Infection Prevention Part 2

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Instructor: Jennifer Barut MSN/IH, RN-BC

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Section 1: Introduction

Course Contributor

This course was written by Jennifer Barut, MSN/IH, RN-BC. Mrs. Barut currently works as a Nursing Professional Development Specialist for Vanderbilt Psychiatric Hospital with Vanderbilt University Medical Center’s Department of Nursing Education and Professional Development. She has worked in psychiatric nursing for the past 11 years in acute inpatient psychiatric care, psychiatric home health, and as psychiatric nursing faculty. Mrs. Barut is board-certified in psychiatric nursing and is on the American Psychiatric Nurse’s Association’s Recovery Council steering committee. Her current position involves multiple roles including CE planner, provision of training for psychiatric nursing staff and organization of monthly Psychiatric Nursing Grand Rounds, Psychiatric Nurse Intern Coordinator, and Psychiatric Nurse Residency Coordinator. Mrs. Barut has conducted numerous presentations regarding the care of individuals diagnosed with mental illness.

About This Course

This course is part two of an infection prevention series. Hospital-acquired infections (HAIs) are a serious public issue and it is vital for health care workers to understand how to prevent infection. Approximately 1.7 million Americans will have a HAI every
year with 100,000 deaths resulting from those infections. 37 states require reporting of HAI's, either publically or to state agencies. Using a blend of experiential exercises, detailed examples, and step-by-step instructions, this course will empower you with in-depth knowledge about infection control and prevention in health care settings. From the basics of how diseases are transmitted to specific guidelines on how to prevent illnesses such as H1N1, Hepatitis B and C, Tuberculosis, and HIV. This course is designed for any health care worker and will provide you with the knowledge you need to be armed against the most powerful and deadliest diseases of your time. The information in this course is appropriate for any health care worker who would like to learn more about how to prevent the spread of diseases, so even if you are familiar with good hygiene, by the end of this course, you will gain a whole new understanding of how to effectively prevent and treat diseases in health care settings.

**Learning Objectives**

After viewing this course, you should be able to:

1. Describe various infectious illnesses and diseases and how they are transmitted from one person to another.
2. Describe measures to prevent the transmission of various infectious illnesses and diseases such as Hepatitis, HIV, Tuberculosis and MRSA.
3. Practice specific prevention strategies based on the infectious organism.

**Section 2: Blood-borne Pathogens: Hepatitis and HIV/AIDS**

**Cheryl’s Fear**

Cheryl is a licensed practice nurse who works in an outpatient mental health clinic. She really enjoys her job, and loves interacting with the individuals served by the clinic. Even though Cheryl frequently has to give her clients’ injections of medications and draw blood she can’t stand receiving an injection herself and is fearful of needles. When the clinic sponsors an annual blood drive, Cheryl makes herself scarce. In order to avoid an injection, Cheryl refused the Hepatitis B vaccination that the clinic offers free of charge to all employees. Just the thought of a needle coming near her causes her to become sick to her stomach.

One busy day at the clinic, Cheryl experienced a needlestick injury. It was just a minor prick and she hardly even bled. The client, Joe, whose blood she was exposed to was healthy and there was no report of disease documented in his chart. Since it was a busy day, Cheryl decided not to report it and didn’t go to occupational health. A couple months later, Joe came back for his next appointment and reported that he was just
Cheryl was diagnosed with hepatitis B by her primary care provider. Cheryl became increasingly worried that she could have contracted the viral infection. Cheryl’s supervisor was pretty upset with her for not reporting the needlestick and instructed her to head to occupational health as soon as possible. When Cheryl finally gets her blood test results back, the news was not good: Positive for Hepatitis B.

**What should Cheryl have done differently?**

Cheryl should have realized that healthcare workers have a higher risk of exposure to blood-borne pathogens like hepatitis B and that she could have decreased her risk through preventative measure such as the hepatitis B vaccination and using safe injection practices.

**Blood-Borne Pathogens**

As we explore infection prevention, it’s critical that we understand how diseases are actually spread. In this section, you will learn about common infectious diseases caused by blood-borne pathogens, common symptoms of these diseases, how they are transmitted, and how they may be prevented.

**Types of Hepatitis**

The term hepatitis refers to an inflammation of the liver that makes it stop working well. It also refers to a group of viral infections that affect the liver. The two most common forms of hepatitis are: hepatitis B (HBV) and hepatitis C (HCV). An estimated 4.4 million Americans are living with chronic hepatitis; most do not know they are infected. About 80,000 new infections occur each year.

**Hepatitis B**

Hepatitis B can result in acute liver failure and death; however, many HBV infections are either asymptomatic or never reported. Here are some stats about HBV:

- Only approximately half of newly acquired HBV infections are symptomatic, and approximately 1% of reported cases result in acute liver failure and death.
- 800,000 - 1.4 million people in the United States have chronic HBV infection
- Among persons with chronic HBV infection, the risk for premature death from cirrhosis or liver cancer is 15 - 25%.
- The rate of new HBV infections has declined by over 80% since 1991, due to vaccinations and other prevention strategies implemented nationally.

HBV is transmitted through blood and bodily fluids by the following methods:

- Sex with an infected partner
Injection drug use that involves sharing needles, syringes, or drug-preparation equipment
- Birth to an infected mother
- Contact with blood or open sores of an infected person
- Needle sticks or sharp instrument exposures
- Sharing items such as razors or toothbrushes with an infected person

**Hepatitis C**

HCV infection is the most common chronic blood-borne infection. It is most commonly transmitted through blood and less commonly through bodily fluids. Here are some facts about HCV:
- 60 - 70% of persons newly infected with HCV typically are usually asymptomatic or have a mild clinical illness.
- Chronic HCV infection develops in 70 - 85% of HCV-infected persons, which is equally over 3 million people with chronic disease annually.
- 60 - 70% of chronically infected persons have evidence of active liver disease.

The majority of infected people might not be aware of their infection because they are not clinically ill. However, infected persons serve as a source of transmission to others and are at risk for chronic liver disease or other HCV-related complications years or decades after initial infection.

HCV is most often transmitted through repeated sharing of needles or equipment for injection drug use. While it is possible, it is not common for HCV to be transmitted through sexual contact, living with an infected member, or childbirth.

**Hepatitis Symptoms**

The symptoms of HBV and HCV are the same. 30 - 50% of new cases of HBV and 20 - 30% of new cases of HCV will show symptoms soon after infection. Others may remain asymptomatic or develop symptoms years after initial infection.

When symptoms are present, they include:
- Jaundice
- Fatigue
- Abdominal pain
- Loss of appetite
- Nausea and vomiting
- Fever
- Joint pain
- Dark urine
- Clay-colored bowel movements
Who Is at Risk?

The hepatitis viruses are transmitted through blood and bodily fluids, creating increased risk for people who are likely to be in contact with the blood and bodily fluids of an infected person.

Persons at higher risk include:
- Infants born to infected mothers
- Sex partners of infected persons
- Sexually active persons who have multiple sex partners
- Men who have sex with men
- Injection drug users
- Those living with persons who have chronic HBV infection
- Health care workers
- Hemodialysis patients
- Travelers to countries with intermediate or high prevalence of HBV infection

Hepatitis Prevention

Avoiding blood exposure through infection prevention strategies is the best way for you to prevent transmission of HBV and HCV.

How can you do this?
Standard Precautions!

Do you recall the components of standard precautions?
- Use safe injection practices
- Use appropriate sharps disposal boxes
- Use protective personal equipment when indicated
- Perform hand hygiene
- Know and follow your facilities’ infection prevention plan

The best treatment is prevention!

Vaccinations for Hepatitis

There is no vaccination available for HCV, but a vaccination is available for hepatitis B. HBV vaccination is recommended for all those at risk for HBV. The HBV vaccination is a series of three injections. It does not contain a live virus.

The HBV vaccine is recommended for all children at birth, and for all unvaccinated
children and teenagers less than 19 years old. In many states, this vaccination is mandatory.

Pregnant women should also be vaccinated for HBV, especially if they have been exposed to blood or body fluids. No evidence exists of risk to the fetus from vaccinating pregnant women with inactivated viruses or bacterial vaccines or toxoids. Live vaccines administered to pregnant women pose a theoretical risk to the fetus; therefore, live, attenuated viruses and live bacterial vaccines generally are contraindicated during pregnancy.

**Vaccinations for Health Care Workers**

The Occupational Safety and Health Administration (OSHA) requires that the hepatitis B vaccine be offered to health care workers who have a reasonable expectation of being exposed to blood on the job.

The employer must provide all health care workers with the vaccine at no cost if they are not immune to the virus. Vaccination ideally should occur during the health care worker’s training period. Additional testing 1 - 2 months after the vaccine series is complete may occur to make sure that vaccination has provided immunity to HBV infection.

The HBV vaccine is also recommended post-exposure if the newly infected person has not previously received the vaccination. Post-exposure vaccination may decrease the incidence of chronic disease.

**HBV and HCV Post-Exposure Precautions**

What should you do after an exposure to hepatitis B or hepatitis C?

**HBV:** Because post-exposure treatment is highly effective in preventing HBV infection, the Center for Disease Control and Prevention does not recommend routine follow-up after treatment. If you receive the hepatitis B vaccine, you should be tested 1 - 2 months after completing the vaccine series to determine if you have responded to the vaccine and are protected against HBV infection.

**HCV:** You should be tested for the HCV antibody and liver enzyme levels as soon as possible after exposure to obtain a baseline and then again at 4 - 6 months after the initial exposure.

After exposure, if you have any symptoms suggesting hepatitis (e.g. yellow eyes or skin, loss of appetite, nausea, vomiting, fever, stomach or joint pain, extreme tiredness) you should report these findings to your health care provider.

Now let’s learn about the last blood-borne pathogen in this section: HIV
HIV/AIDS Overview

AIDS was first reported in the United States in 1981 and has since become a major worldwide epidemic. AIDS is caused by HIV (human immunodeficiency virus).

According to statistics gathered in 2009:
- It is estimated that over one million Americans have HIV with twenty percent of those individuals not knowing they are infected.
- The annual rate of infection is estimated at 50,000 Americans each year.
- The highest risk group for becoming infected with HIV and AIDS are men who have sex with men (MSM). This category accounted for 61% of overall diagnoses.

Heterosexual people who were infected through sexual contact accounted for 28% of those living with the virus. Injection drug users accounted for 18% of cases. The race most severely affected by HIV/AIDS is African Americans, representing 46% of cases, followed by Hispanics/Latinos at 17% of individuals living with HIV.

Do you know the difference between HIV and AIDS? The next few pages are going to outline the difference between the two illnesses.

What Is HIV?

Human immunodeficiency virus (HIV) is the virus that causes AIDS. HIV kills specific white blood cells (T cells or CD4 cells), which are an important part of our immune systems. HIV invades these cells and creates copies of itself to destroy our healthy white blood cells.

Without treatment, HIV gradually destroys the body's defenses against disease (it takes an average of 8 - 10 years), leaving the person vulnerable to many infections and cancers.

While some people will have common symptoms with HIV, such as rapid weight loss, fatigue, and memory loss, there are no definitive symptoms that indicate someone is positive for HIV. The only way to tell if you have HIV is to be tested.

Treatment with antiretroviral drugs can slow or stop the harmful effects of retroviruses like HIV. Many people with HIV are living longer and healthier lives and causing a prolonged time interval before development of AIDS.

What Is AIDS?
Over time, HIV destroys cells of the immune system so that the body can no longer fight infection. When the immune system is destroyed, the person is said to have acquired immune deficiency syndrome (AIDS). AIDS is a syndrome, rather than a disease, because it is a complex illness that involves a wide range of complications and symptoms.

AIDS is the final stage of HIV infection. By the time a person is given an AIDS diagnosis by a doctor, HIV has seriously damaged the body's immune system through the destruction of CD4 cells. This puts the person at risk for opportunistic infections.

Opportunistic infections are caused by microbes such as viruses or bacteria that usually do not make healthy people sick but are life-threatening to people diagnosed with AIDS. Extensively weakened immune systems can cause AIDS patients to die from an opportunistic infection as simple as a common cold.

AIDS is diagnosed when the individual has one or more opportunistic infections, certain cancers, or when CD4 cells are less than 200 cells per cubic millimeter of blood. The person with AIDS will need medical intervention to avoid death.

**Transmission of HIV**

HIV can be transmitted when blood, semen (including pre-seminal fluid), vaginal fluids, or breast milk from an infected person enters the body of an uninfected person. In order to cause infection, these fluids must get into the bloodstream or come into contact with a mucous membrane, non-intact skin, or damaged tissue, or by being injected directly into the bloodstream.

HIV is most often transmitted by:

- Unprotected sex. All unprotected sex contains risk, but unprotected anal sex carries a higher risk of transmission than vaginal sex.
- Sharing of needles, syringes, water, or other equipment used for injection drug use.
- Birth to an infected mother. Transmission can occur during pregnancy, birth, or breast-feeding.
- Before donated blood and organs were screened for, HIV was transmitted through transfusions of contaminated blood or blood components. This risk is now extremely small due to the rigorous testing of blood and donated organs/tissues.
- Individuals who have sexually transmitted disease (STD) are more susceptible to becoming infected with HIV during sex with infected partners.

Anyone infected with HIV can transmit it, whether or not they appear sick, have an AIDS diagnosis, or are successfully treating their infection with antiretroviral drugs.
Contaminated Needles

Sharing needles or drug injection equipment can transmit HIV and other viruses like hepatitis. After use, small amounts of blood can remain in the used needles, syringes, cookers, cottons, and water. This remaining blood can enter the body of the next user if any of these items are shared. If the previous patient’s blood is HIV-infected, transmission can easily occur.

This includes: safe disposal of sharps, wearing gloves, and wearing other personal protective equipment as needed.

There is a very small but real risk of health care workers getting HIV from infected persons as a result of a needle-stick injury or when blood gets into an open cut, mucous membrane, or in their eyes, mouth, or nose. The risk for health care workers is greatly reduced when standard/universal precautions are carefully followed.

Saliva

Can HIV be transmitted through saliva?
Although researchers have found HIV in the saliva of infected people, there is no evidence that the virus is spread by contact with saliva. Laboratory studies reveal that saliva has natural properties that limit the power of HIV to infect, and the amount of virus in saliva appears to be very low.

Can HIV be spread by kissing or oral sex?
There is a remote possibility that a person could contract HIV through the exchange of saliva during open-mouthed kissing if the infected person’s gums or mucous membranes were bleeding. While less common than oral and anal sex, instances of HIV transmission through oral intercourse have been reported.

HIV is NOT Spread By . . .

There is no evidence that HIV is spread through sweat, tears, urine, or feces.

HIV is not spread by casual contact. HIV is a fragile virus outside the body. It quickly becomes inactive when exposed to air, soap, and common disinfectants such as bleach.

There is no risk of getting HIV from:
  - Donating blood
  - Mosquito bites
  - Toilet seats
  - Shaking hands or hugging
  - Sharing eating utensils or drinking containers
- Food or objects handled by people with HIV or AIDS
- Spending time in the same house, business, or public place with people who have HIV or AIDS

**Progression of HIV**

HIV disease has a well-documented progression, or stages of illness.

**Acute Infection**
This occurs typically in the first 2 - 4 weeks and up to three months after infection and is described as the “worst flu ever.” During this period, the virus is being rapidly produced in the person’s body. Flu-like symptoms are experienced as the body attempts to fight the virus. Not all people who have HIV will experience these symptoms.

**Clinical Latency**
After the acute infection period, the person infected with HIV will enter a period of clinical latency, also called asymptomatic HIV infection or chronic HIV infection. During this period, HIV reproduces at a very slow rate. The person may have no apparent symptoms or signs of opportunistic infections. This period may last for as long as eight years. During the latter part of this phase, CD4 count begins to drop and the person may have HIV symptoms which include:

- Fever without a known cause
- Headache
- Constant tiredness
- Night sweats
- Weight loss
- Abdominal issues
- Muscle aches

Without treatment, life expectancy at this stage is three years or less if the person has a dangerous opportunistic infection.

**Opportunistic Infection**

Infections from viruses, bacteria, parasites, or fungi that rarely cause problems in healthy people can be life threatening for people with HIV/AIDS whose immune systems are extremely weakened. These are called opportunistic infections (OIs) and also include certain cancers. Opportunistic infections are the most common cause of death for people with HIV/AIDS.

As the immune system becomes more impaired, a variety of complications start to take over. For many people, the first signs of infection are enlarged lymph nodes or "swollen glands" that may be enlarged for more than three months.
Opportunistic infections common in people with AIDS include:

- Yeast infections
- Tuberculosis
- Hepatitis viruses
- Cryptosporidiosis
- Cervical cancers
- Lymphomas
- Herpes simples
- Candidiasis or yeast infections
- Cytomegalovirus
- Pneumonia
- Encephalitis

**HIV/AIDS Treatment**

In the 1980s, individuals infected with HIV/AIDS had a very short life-expectancy. Now, there are medications that prolong life and health of people with HIV/AIDS. The medications are called “antiretroviral” and the regimen to treat HIV/AIDS is called antiretroviral therapy (ART). These medications prevent the virus from duplicating and allow the immune system to recover and produce more CD4 cells.

ART involves taking three or more antiretroviral medications from at least two different drug classes every day. When a person begins ART depends on the person’s health and physician recommendations. Once the person begins ART, s/he will need to take the medications for the remainder of his or her life.

Usually, ART is begun:

- When CD4 levels fall below 500
- If the person becomes pregnant
- If the person needs treatment for hepatitis B
- If the person develops HIV-related kidney problems

**HIV/AIDS Treatment Side Effects**

All of the antiretroviral drugs for treatment of HIV have been associated with side effects. The most common side effects include upset stomach, nausea, vomiting, diarrhea, tiredness, or headache.

The few serious side effects that have been reported in health care personnel using a combination of antiviral drugs after exposure have included kidney stones, hepatitis, and suppressed blood cell production. Certain antiretrovirals called protease inhibitors (e.g. indinavir and nelfinavir) may interact with other medicines and cause serious side effects and should not be taken in combination with certain other drugs, such as non-sedating antihistamines.
If you need to take antiretroviral drugs for an HIV exposure, it is important to tell the health care provider managing your exposure about any medications you are currently taking.

**Transmission Review**

Let's test your recall of what you just learned.

How are HBV, HCV or HIV transmitted?

A. Unprotected sex

True (That’s right! Unprotected sex with someone infected with hepatitis or HIV can transmit the virus. Remember, this method of transmission is common for HBV and HIV and is possible but unlikely for HCV.)

False (Incorrect. Actually, unprotected sex with someone infected with HBV, HCV, or HIV can transmit the virus.)

B. Exposure to needles contaminated with infected blood through injection drug use or needle-stick injuries.

True (That’s right! Injection drug use or needle-stick injury can expose you or others to HBV, HCV, or HIV if the needle is contaminated with infected blood. Use caution with used needles and always dispose of them in the proper sharps container.)

FALSE (Incorrect. Injection drug use or needle-stick injury can expose you or others to these infectious viruses if the needle is contaminated with infected blood. Use caution with used needles and always dispose in the proper sharps container.)

C. Sharing my nail clippers, razors, toothbrush, or earrings with a person with HBV.

True (That’s right! Don’t share personal hygiene items. Sharing clippers, razors, a toothbrush, or earrings is one way for HBV to spread if those items are contaminated with infected blood. The best treatment is prevention.)

False (Incorrect. Sharing clippers, razors, a toothbrush, or earrings is one way for the hepatitis virus HBV to spread if those items are contaminated with infected blood. The best treatment is prevention.)

D. Not wearing protective personal equipment when indicated.

True (Correct. That’s right! Protective personal equipment is specifically designed to minimize or eliminate the risks of transmitting infectious diseases like the blood-borne pathogens HBV, HCV, or HIV. Failing to wear PPE when needed can expose you blood and body fluids that can transmit HBV or HCV.)

False (Incorrect. Protective personal equipment is specifically designed to minimize or
eliminate the risks of transmitting viruses like hepatitis. Failing to wear PPE when needed can expose you blood and body fluids that can transmit HBV or HCV.)

Meet Jerry

Jerry is a heterosexual male who has had multiple sexual partners in his lifetime. Jerry got tested and found out he has HIV. Jerry always used a condom during sexual intercourse, so he is uncertain how he contracted the virus.

When the doctor asked him about his other recreational activities, the likely method that Jerry was infected with the virus was discovered. Which of the following possibilities do you think is the most likely cause?

A. Jerry revealed that even though he has never shared needles, he has shared drug injection equipment. (Correct. Sharing needles or drug injection equipment can transmit HIV and other viruses like hepatitis. After use, small amounts of blood can remain in the used needles or syringes. This remaining blood can enter the body of the next user when any of these items are shared. If this blood is HIV infected, transmission can easily occur.)
B. Jerry revealed that he may have kissed someone who is HIV positive. (Incorrect. The risk of HIV infection through kissing is extremely low).
C. Jerry revealed that he recently received a blood transfusion. (Incorrect. Rigorous testing of blood products makes getting HIV from such transfusions extremely unlikely)
D. Jerry revealed that he may have shared eating utensils with someone who is HIV positive. (Incorrect. HIV is a fragile virus outside the body. It quickly becomes inactive when exposed to air, soap, and common disinfectants such as bleach. There is no risk of getting HIV from sharing eating utensils or drinking containers, or from food or objects handled by people with HIV or AIDS.)

Section Summary

You now have a more in-depth knowledge of the blood-borne pathogens HBV, HCV, and HIV/AIDS. You know that all of these infectious agents are transmitted via blood and bodily fluids. Health care workers are at particular risk for exposure to HBV, HCV, and HIV and can protect themselves through standard precautions including the use of personal protective equipment.

Now let’s learn more about another serious infectious agent that is transmitted via air particles: tuberculosis.

Section 3: Tuberculosis (TB)

What Is TB?
Tuberculosis (TB) is a disease caused by bacteria called Mycobacterium tuberculosis. The bacteria usually attacks the lungs, but TB bacteria can attack any part of the body such as the kidney, spine, and brain. This section will focus on TB of the lungs, or pulmonary TB. If not treated properly, TB disease can be fatal.

Did You Know?
Did you know that Tuberculosis disease was once the leading cause of death in the United States?

While TB is no longer a leading cause of death in the U.S., it remains a major problem and is one of the world’s deadliest diseases:

- One-third of the world’s population is currently infected with TB.
- In 2010, nearly 9 million people around the world became sick with TB and there were approximately 1.5 million TB-related deaths worldwide.
- Over 11,000 of these individuals live in the U.S.
- TB is a leading killer of people who are HIV infected.

How Is TB spread?

TB is spread through airborne transmission from one person to another. The bacteria enters the air when a person with active TB disease of the lungs or throat coughs or sneezes. People nearby may breathe in bacteria and become infected.

TB in the lungs or throat can be infectious. This means that the bacteria can be spread to other people. Tuberculosis in other parts of the body, such as the kidney or spine, is usually not infectious.

TB Flash Card Review

Based on what you just learned, which of the following activities could spread TB from a client or other individual to a health-care worker?

**Tuberculosis Can Be Spread By:**
Performing oral care
Being in proximity of a client who is coughing or sneezing
Giving a client a bed bath

**Tuberculosis is Not Spread By:**
Shaking a client’s hand
Drinking out of the same cup as a coworker
 Changing bed linens
People with active TB disease are most likely to spread it to people they spend time with every day. This includes family members, friends, and coworkers.

**Latent TB Infection vs. TB Disease**

**Latent TB Infection**
Not everyone infected with TB bacteria becomes sick because their body is able to fight the infection to prevent active disease. Latent TB infection is the state in which the bacteria becomes dormant. People who have latent TB infection do not feel sick, do not have any symptoms, and cannot spread TB to others. They will have a positive TB skin test and may go on to develop the active disease in the future, especially if they do not receive treatment.

**TB Disease**
If the bacteria begins to multiply in the body and becomes active, the person with latent TB infection will develop TB disease. People with active TB disease are sick and have TB symptoms. During the stage of active disease, the person can easily spread the disease to others.

Some people with latent TB infection will never develop the disease. Others will develop active TB disease soon after becoming infected, especially when her/his immune system is too weak to fight the TB bacteria. Other people may get sick later, when their immune system becomes weak for another reason. People who have weakened immune systems are more likely to develop active disease, including: infants, young children and the elderly; persons with HIV/AIDS, diabetes, or other chronic diseases; and people who inject illegal drugs.

**Symptoms of TB**

Once a person develops active TB disease, s/he may experience the following symptoms:

- Chronic cough that lasts three weeks or longer
- Pain in the chest
- Coughing up blood or sputum (phlegm from deep inside the lungs)
- Weakness or fatigue
- Weight loss
- Lack of appetite
- Chills
- Fever
- Sweating at night

**Transmission Precautions**
An effective tuberculosis infection-control program requires early identification, isolation, and effective treatment of people who have active TB.

**Airborne Transmission-Based Precautions**

Airborne precautions prevent transmission of infectious agents that remain infectious over long distances when suspended in the air. This includes tuberculosis.

Any patient in a hospital setting with confirmed or suspected TB should be placed in an airborne infection isolation room that has currently recommended ventilation characteristics. This is to prevent the escape of the TB bacteria from the isolation room, thus preventing the spread of transmission to other patient's. In rare circumstances, placing more than one person with TB in the same room may be acceptable.

In settings where airborne precautions cannot be implemented due to limited engineering resources (e.g. physician offices), the following precautions should be taken: masking the patient, placing the patient in a private room with the door closed (e.g. office examination room), and staff should wear a respirator when interacting with the client. This will reduce the likelihood of airborne transmission until the patient is either transferred to a facility with an isolation room or returned to the home environment. Always follow your facility's infection control plan.

**Treatment of Latent TB Infection**

Treatment of latent TB infection greatly reduces the likelihood that the person will develop active TB disease. This is particularly important for people with weakened immune systems who are at greater risk of developing the disease. It also is a preventative strategy to prevent spread of the disease from persons with active infection. When deciding whether or not to begin treatment, the person will need to weigh the risks versus benefits of treatment. A candidate for treatment will also need to be committed to the full course of treatment. The course of treatment for latent TB infection is shorter, so a full work-up needs to be completed to ensure the person does not have active disease (which requires a longer regimen for effectiveness).

The medications for treatment of Latent TB infection are:

- Isoniazid
- Rifampetine
- Rifampin

Can you guess who should be high priority for treatment of latent TB infection?

- Persons with HIV/AIDS
- Recent contacts of a TB case
- Persons with fibrotic changes on chest radiograph consistent with old TB
- Organ transplant recipients
• Persons who are immune-suppressed for other reasons (e.g. persons taking immunosuppressive medications like prednisone)
• Recent immigrants from countries with high incidence of TB
• Health care workers and others working in high-risk settings
• Injection drug users
• Children under four years old, or children and adolescents who have contact with individuals with TB.

**Treatment of TB Disease**

TB disease is treated through a medication regimen that lasts 6 - 9 months. Of the 10 drugs currently approved for treating TB, the first-line of anti-TB agents that are prescribed include:

- Isoniazid
- Rifampin
- Ethambutol
- Pyrazinamide

It is very important that people who have TB disease complete the full course of the medication regimen and take the medication exactly as prescribed. Stopping the medication early can cause the active disease to return. If the medication regimen is not taken completely and as prescribed, the bacteria may become resistant to medications. Multiple-drug resistant TB is more difficult and more expensive to treat.

**Multiple-Drug Resistant TB**

What is Multiple-drug resistant tuberculosis (MDR TB)?

Multiple-drug resistant TB (MDR TB) is TB that is resistant to more than one of the first-line anti-TB drugs and at least isoniazid and rifampicin.

Treatment of drug-resistant TB is complicated; if not managed appropriately, life-threatening results are possible. It is particularly important that persons with MDR TB be monitored closely to ensure they adhere to the prescribed medication regimen. Retreatment of clients who have MDR TB should be carried out in programs with comprehensive support systems in place to monitor the person’s illness and medication regimen.

Drug resistance is proven by drug-susceptibility testing. However, since this testing can take weeks, treatment based on expert advice should be initiated as soon as drug-resistant TB disease is suspected. Regimens of multiple drugs, which generally are poorly tolerated and more toxic than traditional regimens, must be administered for 18 - 36 months.

**Testing for Health Care Workers**
Health care workers and persons exposed to TB need to have a tuberculin skin test (TST) or a chest x-ray. Positive test results indicate the person is infected with TB, but may not have active TB disease. S/he may be given preventive therapy to prevent bacteria from multiplying, even though the person is not sick at the time of treatment.

**Positive skin test:** This means the person’s body was infected with TB bacteria. Additional tests are needed to determine if the person has latent TB infection or TB disease.

**Negative skin test:** This means the person’s body did not react to the test. Latent TB infection or TB disease is not likely.

If a person has had a positive TST previously, but did not have active TB disease, a chest x-ray is necessary for all future testing to determine presence of disease.

TST testing (or chest x-ray) can determine whether medication is necessary to prevent active TB. Your facility may require you to have a routine TST or chest x-ray at specified intervals or upon exposure to a patient with TB.

Most health care facilities require that every employee be tested at least annually. However, testing may be more or less frequent depending on the risk of exposure to patients with tuberculosis.

**Meet Sharon**

Sharon has been working in health care for 15 years and has had a TB skin test every year. Every year, she has always had a negative result but this year, her TB skin test was positive. Sharon had a follow-up chest X-ray that was normal and did not indicate TB disease.

Based on these results, it is determined that Sharon most likely has:

A. Active TB disease
   (Incorrect. TB bacteria become active if the immune system can't stop them from growing. When the active bacteria multiply in the body and weaken the person’s immune system, it can result in active TB disease. In Sharon’s case, since the chest x-ray did not indicate TB disease, she probably has latent TB infection.)

B. Latent TB infection
   (Correct. Many people who have latent TB infection will have a positive skin test reaction, even when they do not have active TB disease. If Sharon isn’t treated or if her immune system is weakened for any reason, the bacteria may become active and cause TB disease.)

C. Hepatitis B
(Incorrect. TB bacteria become active if the immune system can't stop them from growing. When the active bacteria multiply in the body and weaken the person’s immune system, it can result in active TB disease. In Sharon’s case, since the chest X-ray did not indicate TB disease, she probably has latent TB infection.)

D. MDR TB
(Incorrect. Multiple-drug resistant TB is TB that is resistant to more than one anti-TB drugs and at least isoniazid and rifampicin. MDR TB usually occurs when a person is treated and doesn’t take the medication appropriately. In Sharon’s case, because her chest X-ray was normal, she probably has the latent form of the disease.)

Section Summary

Tuberculosis is an airborne infectious agent that can infect the lungs (or other parts of the body) and cause serious disease. You have learned that a person can have latent TB infection and may not develop active TB disease. People with weakened immune systems from disease or other conditions are more likely to develop active TB disease. As a health care worker, you are tested frequently for this disease, typically annually. You also have learned about TB treatment with anti-TB drugs such as isoniazid and rifampicin, and how important it is for individuals to complete the full course of treatment. Failure to do so can result in multiple-drug resistant TB which is much more difficult to treat.

In the next section, you will learn about some other infectious organisms that, similar to MDR TB, have developed resistance to treatment.

Section 4: Multiple-Drug Resistant Organisms

Antimicrobial (Drug) Resistance

Antimicrobial resistance is a serious public health issue. Antimicrobial drugs, including antibiotics, have been in use for over seven decades for the treatment of infectious diseases. Unfortunately, over time and with widespread use of these antibiotics, some bacteria have adapted and become resistant to the effects of these drugs. Additionally, antimicrobial resistance has developed as a result of overuse and inappropriate use of antibiotics (e.g. unnecessary prescribing of antibiotics or failure of individuals to complete the prescribed full course of antibiotics).

Antimicrobial resistance occurs when bacteria change or adapt in a way that allows them to survive in the presence of antibiotics designed to kill them. In some cases, bacteria become so resistant that no available antibiotics are effective against them. Over the past decade, almost every type of bacteria has become stronger and less...
responsive to antibiotic treatment when it is really needed.

MRSA and VRE are examples of bacteria that have developed significant resistance that can result in potentially deadly consequences.

**Multiple-Drug Resistant Organisms (MDROs)**

When we discussed tuberculosis, we talked about multiple-drug resistant TB, and explained how partial treatment resulted in the bacteria developing resistance to the medications designed to treat TB. In this section we’re going to look at additional organisms that have developed the ability to resist standard medication treatments.

**What Are MDROs?**

Methicillin-resistant Staphylococcus aureus (MRSA), vancomycin-resistant Enterococcus (VRE) and certain gram-negative bacilli (GNB) are infectious bacteria that have developed resistance to medications typically used to treat infection. A primary reason for concern about these MDROs is that options for treating individuals with these infections are often extremely limited and have more side effects. Additionally, MDRO infections are associated with increased lengths of stay, costs, and mortality.

Although transmission of MDROs is most frequently documented in acute care facilities, all health care settings are affected by the emergence and transmission of antimicrobial-resistant microbes.

Here are some facts about the increased prevalence of these dangerous organisms.

- In the 1990s, MRSA accounted for 20 - 50% of Staphylococcus aureus infections from hospitalized patients. By 2003, this number increased to 59%.
- In the early 1990s, VRE accounted for less than 1% of enterococcus infections in intensive care units. By 2003, this number increased to 28.5%.

**Expensive Results of Antimicrobial Resistance**

People infected with antibiotic-resistant organisms like MRSA are more likely to have longer and more expensive hospital stays, and may be more likely to die as a result of the infection. When the drug of choice for treating their infection doesn’t work, they require treatment with second- or third-choice medications that may be less effective, more toxic, and more expensive.

MRSA infection can cause patients to suffer more, and pay more for treatment. The American society as a whole suffers more and pays more too because of the increased burden and expense in the health care system.

The Centers for Disease Control and Prevention has a plan to address MDROs that
includes preventive practices and several comprehensive strategies including a “Campaign to Reduce Antimicrobial Resistance in Health Care Settings.” These campaigns include a multifaceted, evidence-based approach with four parallel strategies: infection prevention; accurate and prompt diagnosis and treatment; prudent use of antimicrobials; and prevention of transmission.

**Infection Prevention Plan**

Once MDROs are introduced into a health care setting, transmission and persistence of the resistant strain is determined by the availability of vulnerable patients, increased potential for transmission from larger numbers of colonized or infected clients, and the impact of implementation and adherence to infection prevention efforts. Make sure you know your facility’s infection prevention plan and specific strategies for addressing MDRO infections.

In general, facilities employ the following prevention strategies to prevent and identify MDRO infections:

- Screening for MRSA on admission (acute care facilities in several states are required by law to perform screening on admission)
- Placing behavioral health patients with known infection and/or colonization on contact precautions only if they are unable to keep the area of infection covered and/or are unable to perform hand hygiene
- Cohorting patients (placing patients who have a current infection with another patient with the same infection)
- Use of PPE and frequent hand hygiene
- Covering the affected area
- Education of patients and families regarding MDRO prevention

**MRSA: A Growing Problem**

As mentioned previously, MRSA is a growing problem. The good news is that treatment is available that can help. Recent studies indicate that hospital-acquired MRSA infections are trending downward. However, MRSA that is contracted in the community is on the rise. These community acquired MRSA infections typically present as infections of the skin and often occur in otherwise healthy people.

According to a study by the American Medical Association, in 2005, there were 94,360 cases of systemic MRSA infection, and these resulted in greater than 18,000 deaths.

MRSA occurs most frequently among patients who undergo invasive medical procedures or who have weakened immune systems and are being treated in hospitals and health care facilities such as nursing homes and dialysis centers. MRSA infections are predominantly skin infections, but in health care settings can create systemic problems (e.g. including severe and potentially life-threatening infections, such as
bloodstream infections, surgical site infections, or pneumonia).

**Persons at Risk for MRSA**

- Immunocompromised individuals, including elderly persons who are more susceptible to infection
- Invasive procedures ranging from intravenous catheter insertion to surgical procedures to life-support treatment
- Failure in infection-control measures, especially poor hand-hygiene

In addition to health care-associated infections, MRSA in the community is also increasing and generally presents as skin infections that may look like pimples or boils. They also can be swollen, painful, and have draining pus.

**How MRSA Spreads in Health Care Settings**

In the case of MRSA, patients who already have an MRSA infection or who carry the bacteria on their bodies but do not have symptoms (this is called colonization) are the most common sources of transmission.

The main method of transmission to other clients is through human hands, especially health care workers' hands. Hands may become contaminated with MRSA bacteria by contact with infected or colonized patients. If appropriate hand hygiene such as washing with soap and water or using an alcohol-based hand sanitizer is not performed, the bacteria can spread when the health care worker touches other clients.

**Signs and Symptoms of MRSA Infection**

How will you know if someone has an MRSA skin infection? What are the signs and symptom? The signs and symptoms will vary by the type and stage of the infection.

Most Staph skin infections, including MRSA, appear as a bump or infected area on the skin that may be:

- Red
- Swollen
- Painful
- Warm to the touch
- Full of pus or other drainage
- Accompanied by a fever

**MRSA Prevention**
Standard precautions are used with every person in any health care setting to prevent the spread of infectious disease. Standard precautions include hand hygiene, the appropriate use of personal protective equipment including gloves, gowns, eye protection and masks, and the appropriate handling of equipment and laundry.

When working with people with MRSA, standard precautions may not be adequate in some situations; for instance, if the consumer is unable to follow direction and/or is incontinent of urine or feces. In these instances, health care workers should implement contact precautions, which include:

- Placing the consumer in a single room (or placing individuals who are infected or colonized with MRSA in the same room)
- Practicing proper hand-hygiene before and after contact with the consumer or her/his environment
- Wearing gowns and gloves when coming into contact with the individual or her/his environment
- Designating patient care equipment (e.g. blood pressure cuff, sphygmomanometer, IV poles) to be used only with the individual with MRSA

Now that you know the basics about this MDRO, let’s continue and learn about another MRDO, Vancomycin-resistant Enterococcus (VRE).

**VRE**

Vancomycin-resistant Enterococcus (VRE) is bacteria that is normally present in the human intestines, the female genital tract, and are often found in the environment. This bacterium can sometimes cause infections in the urinary tract, in the blood stream, or wounds associated with catheters or surgical procedures. Vancomycin is an antibiotic that is used to treat infections caused by enterococci. Just like MRSA, the enterococci bacteria can become resistant to medications that treat the infection, particularly Vancomycin. These drug-resistant enterococci are called VRE. Most VRE infections occur in hospitals.

People infected with VRE may be colonized (carry the bacteria but not sick) or have active infection. Additionally, just like with MRSA, VRE is most commonly transmitted in the hospital from the hands of health care workers to the clients in their care. Prevention strategies for VRE are similar to those described previously in MRSA.

**Who Is at Risk for VRE?**

There is potential for any person in the hospital to contract VRE since the primary mode of transmission is through person to person contact, especially the hands of health care workers. Certain individuals and treatment situations carry an increased risk for VRE infection:
- Individuals who have been treated with Vancomycin for long periods of time
- Individuals who are hospitalized for a long period of time, particularly if they are on antibiotics during the admission
- Individuals in intensive care, burn, or transplant units, particularly when they have weakened immune systems
- Individuals who have had recent surgery of the abdomen or chest cavity
- Individuals who have colonized VRE

**Treatment of MRSA and VRE**

**Active infection MRSA**
Incision and drainage constitutes the primary therapy for MRSA skin infections. Antibiotic therapy, if indicated, will be guided by culture and sensitivity testing to ensure effective treatment.

**Active infection: VRE**
Most VRE infections can be treated with antibiotics other than Vancomycin. Laboratory testing of the VRE can determine which antibiotics will be effective. For people with VRE infections in their bladder and have urinary catheters, removal of the catheter when it is no longer needed can also help get rid of the infection.

**A Quick Note about MDR**
The focus of this section is on MRSA and VRE, but a quick note about other multiple-drug resistant organisms is important, as these types of MDROs are also growing. Multiple-drug resistant gram-negative bacteria cause infections including pneumonia, bloodstream infections, wound or surgical site infections, and meningitis in health care settings. Gram-negative infections include those caused by Klebsiella, Acinetobacter, Pseudomonas aeruginosa, and E. coli. These bacteria are resistant to multiple drugs and are increasingly resistant to most available antibiotics. These bacteria have built-in abilities to find new ways to be resistant and can pass along genetic materials that allow other bacteria to become drug-resistant as well.

**General Infection Prevention Plan**
Health care facilities, both inpatient and outpatient, should have an infection control plan in place. Your facility may employ the following prevention strategies to prevent and identify MDRO infections:

- Screening for MRSA on admission
- Ensuring the client keeps the area of infection covered.
• Maintaining standard precautions for behavioral health care clients with known MRSA infection and/or colonization unless they are unable to keep the infected area covered or who are unable to perform hand hygiene.
• Cohorting individuals with infection.
• Use of PPE and frequent hand hygiene.
• Routine disinfecting of all environmental surfaces and frequent cleaning of high trafficked areas or objects more commonly touched (doorknobs, bathroom surfaces, sinks, and countertops) using a facility approved disinfectant proven to kill MDROs.
• Educating clients and families regarding the prevention of MDRO transmission.

**Teaching Consumers How to Prevent Transmission of MDROs**

Health care workers are not the only people who need to be taught how to prevent the transmission of MRDOs. This becomes more important as MRSA infections acquired in the community continue to rise. The entire household of a person with a MRDO needs to be educated about what they can do to prevent the spread of MDROs to friends, family, and other people in the community.

Can you think of the most important prevention strategies to teach people and their families with MDRO infections?

If you guessed hand hygiene, you are right on the mark! While you may know the basics of hand hygiene, many in the community do not. These individuals need to be taught how to keep their hands clean, including these specific tips:

• Always wash hands thoroughly after using the bathroom and before preparing food.
• Clean hands after contact with persons who have a MDRO.
• Wash hands thoroughly, including wrists and between the fingers, with soap and water or use alcohol-based hand rubs.
• Environmental surfaces and objects in the home may become contaminated with MDROs and will need to be disinfected frequently using a cleaner indicated to kill these organisms. Some of these areas/items may include (bathrooms, kitchens, countertops, doorknobs, remote controls, or other frequent use items).
• Wear gloves if hands may come in contact with body fluids that may contain bacteria, such as stool or bandages from infected wounds.
• Always wash hands after removing gloves.

People infected with an MDRO need to know that they must communicate the diagnosis to all health care providers so that appropriate precautions can be implemented to prevent the spread of infection.

**Meet Mel**
Mel is a 75-year-old man who resides at a long-term care facility. Everyone says he is the friendliest man they know. He believes that the best way to get to know someone is to stop and shake their hand, and so he greets every person he meets with a smile and a handshake. He extends this warm and friendly greeting to all the residents, visitors, physicians, and all of the health care workers. Everyone at the facility loves to see Mel wheeling around in his wheelchair because he is such a pleasure to be around.

Unfortunately, Mel recently contracted MRSA. He had developed two large boils on his left arm that are quite painful to the touch.

Recalling what you just learned in this section, what is the likely culprit of how Mel contracted MRSA?

A. He may have caught it from his friend Joe who is confined to his bed in a neighboring room. Mel wheels past Joe's room every day and says hello as he is on his way to breakfast. (Incorrect. Mel does not have any physical contact with his neighbor, so this is not likely. The main method of MRSA transmission is from person to person by direct contact, especially through human hands when adequate hand hygiene is not performed.)

B. He may have caught it from using the bathroom facilities in his room. (This is a possibility, but what we didn’t tell you is that Mel is the only one who uses the bathroom in his single-occupancy room, so this is unlikely. Try again)

C. He may have caught it during B-I-N-G-O night when he sat next to his friend Margaret who was coughing and didn’t do a good job of covering her cough. He could have caught it by breathing in the infectious agent (Incorrect. Remember, MRSA is transmitted through contact; the most common means of transmission is from human hands, especially health care workers hands.)

D. He may have caught it from one of the nursing staff or the doctor himself, whose hands he loves to shake whenever he sees them. (Correct! The main method of MRSA transmission is through human hands, especially health care workers’ hands. Hands may become contaminated with MRSA bacteria by contact with persons who are infected or colonized with the bacteria. If appropriate hand hygiene such as washing with soap and water or using an alcohol-based hand sanitizer is not performed, the bacteria can be spread when the health care worker touches other clients.)

Section Summary

In this section, you learned about infectious organisms that are resistant to the medications designed to treat them. These organisms, called multiple-drug resistant organisms, are a significant public health care concern. Infections from MDROs, including MRSA and VRE, are not only more difficult to treat, but result in increased health care costs due to the need for longer courses of treatment and costlier medications. Fortunately, MDROs are a growing problem that can be prevented if effective infection prevention strategies are in place.
Section 5: Conclusion

Key Points to Remember

This course has provided you with a lot of great information about infectious diseases. Let’s review some key points!

Do you recall what is the most effective practice to reduce the transmission of infectious agents?
- If you said hand hygiene, you are right! Hand hygiene is the single most important practice to reduce the transmission of infections in the health care setting.

When someone is HIV positive, does that mean that they are sick?
- Not necessarily. A person is said to be HIV positive when the virus is present in the body, or latent HIV infection. This stage may continue for years without a person feeling sick or knowing about it.

When is AIDS diagnosed?
- Did you remember that the diagnosis of AIDS is made when the CD4 count drops to 200 or when the person infected with HIV develops one or more opportunistic infections?

Can you list three blood-borne pathogens?
- I hope you remembered that hepatitis B, hepatitis C, and HIV/AIDS are blood-borne pathogens!

Can blood-borne pathogens be prevented?
- Hepatitis B virus is largely preventable through vaccination. For HBV, HCV, and HIV, however, preventing occupational exposures to blood can prevent occupational infections with HBV, HCV, and HIV.

What is the name of the infection prevention precautions that are applicable in every health care setting?
- Standard Precautions!

What is antimicrobial resistance?
- Antimicrobial resistance occurs when bacteria change or adapt in a way that allows them to survive in the presence of antibiotics designed to kill them.

Summary

You are now equipped with knowledge about several different infectious organisms, how they are transmitted, and how you can break the chain of infection through
prevention strategies such as transmission based precautions that include Standard Precautions, Contact Precautions, Airborne Precautions, and Droplet Precautions.

In addition to learning about how infectious organisms are transmitted and how to prevent their transmission, you learned about the specific organisms themselves. You learned detailed information about the blood-borne pathogens hepatitis B and HIV/AIDS. You learned that tuberculosis is an airborne bacterium that infects a person’s lungs and can cause serious illness. Lastly, you were provided information about the growing problem of multidrug-resistant organisms or MDROs, in particular MRSA and VRE.

Through simple understanding and implementation of appropriate prevention strategies, you as a health care worker can help to prevent the transmission of infectious organisms and in doing so prevent illness, disease and even death.

References

AIDS.gov www.aids.gov
The Center for Disease Control www.cdc.gov
Infectious Diseases Society of America www.idsociety.org
The Joint Commission www.jointcommission.org
Medscape www.medscape.com
Occupational Safety and Health Administration www.osha.gov
The World Health Organization www.who.int/