



## Seattle / King County EMS

Emergency Medical Services Division  
Public Health – Seattle / King County  
401 5th Avenue, Suite 1200  
Seattle, Washington 98104-2333  
(206) 296-4693

January 2010

# CBT/OTEP 621 **Infectious Disease**

Print version of EMS Online Course  
[www.emsonline.net](http://www.emsonline.net)

## Introduction

The world is a changing place. New threats to our health and well-being that can quickly travel around the world appear every year. Global warming, habitat destruction, even the widespread use of pesticides and herbicides are eliminating species and favoring others.

The result? Diseases like malaria, a mosquito-borne illness, are moving northward into areas where they have never been found before. Association of some animals, such as scavenger crows, rats and others, with human populations increases the chances of disease transmission from one species to another. “New” diseases such as SARS and Legionaire’s disease are appearing. Some diseases such as Staph aureus and TB are becoming resistant to treatment and more common.

Given this worldwide concern about infectious diseases, how can you—as an EMS provider—recognize infectious disease, treat your patients properly and keep yourself safe? This course deals with these topics.

### Before You Begin

This is a continuing education and recertification course for EMTs. It covers fundamental EMT-Basic concepts and terminology as well as advanced material. We highly recommend completing the case studies and practice exam before completing the exam.

We also recommend that you review an EMT textbook chapter covering cardiovascular emergencies as a refresher before taking the exam; for example: Chapter 2 – Well-being of the EMT in *Emergency Care and Transportation of the Sick and Injured*, 9th edition (AAOS).

### Practical Skills

There is a practical skills assessment for this course in which you must demonstrate proper donning and doffing of PPE. In addition, you should demonstrate knowledge of the material by being vigilant in use of universal precautions, use of personal protective equipment and body substance isolation precautions on every call.

A checklist is provided that documents annual review of your agency’s exposure control plan.

### Objectives

After completing CBT 621 you will be able to:

1. Identify the types of PPE and how and when they should be applied.
2. Identify the characteristics infectious diseases that are a threat to EMS providers. (HEPC, HBV)
3. Identify appropriate measures for protecting yourself against infectious diseases obtaining 3 of 3 test items correct.
4. Identify the appropriate actions to take for exposure to an infectious disease.
5. Distinguish between the infectious diseases EMS providers can encounter.

## Terms

**antibodies** — Proteins made by the immune system that have a memory for an invading virus and help recognize and destroy future invasions by that virus.

**antibiotic** — Medicine or drug that is effective in killing bacteria or inhibiting their growth.

**bacteria** — A single-celled, microscopic organism that can cause damage to the body's cells. They multiply very quickly by dividing.

**epidemic** — An outbreak of a contagious disease that spreads among many individuals in an area or a population at the same time.

**pandemic** — An outbreak of a contagious disease that affects an entire population over a wide geographical area. A pandemic affects a far higher number of people and a much larger region than an epidemic.

**parasite** — An organism that grows, feeds, and is sheltered on or in a different organism while contributing nothing to the survival of its host.

**pathogen** — An agent that causes disease such as a bacterium, virus or fungus.

**vaccine** — A preparation of a weakened or disabled virus that stimulates antibody production and provides immunity when injected into the body.

**virus** — A very small agent made of genetic information (RNA or DNA) surrounded by a protein coat. It cannot reproduce on its own but must take over a living cell to multiply.

## New Terms

**body substance isolation (BSI)** — An infection control practice that assumes all body substances including blood, urine, saliva, feces, tears, etc., are potentially infectious.

**MRSA** — Methicillin-resistant *Staphylococcus aureus* is a type of staphylococcus or "staph" bacteria that is resistant to many antibiotics.

**personal protective equipment (PPE)** - Specialized clothing or equipment worn for protection against health and safety hazards.

**universal precautions** - Infection control measures that reduce the risk of transmission of pathogens through exposure to blood or specific body fluids.

## Personal Protective Equipment (PPE)

Infectious diseases are becoming more prevalent in the daily activities of all EMS providers. Nowadays, you need to treat every scene that has a potentially infectious patient as a biological hazmat. To help avoid infection from fluids and airborne particles, you need to wear personal protective equipment or PPE, decontaminate equipment and surfaces after use and wash your hands frequently.

### Types of PPE

Personal protective equipment is any type of specialized clothing, barrier product or breathing device used to protect workers from serious injuries or illnesses while doing their jobs.

PPE includes fit-tested masks (such as N95 and N100 masks), eye protection (such as glasses, face shields and goggles), gowns (or suits) and gloves. You must wear full PPE with any patient who is potentially infectious, especially those with a fever or cough.

### Donning PPE

Put on your PPE before you enter the patient area. The sequence for donning PPE is MEGG:

1. **M**ask
2. **E**ye protection
3. **G**own
4. **G**loves

If there is a potential for splash of blood, vomit or other fluids, the minimum PPE should include eye protection, gown and gloves.

### Doffing PPE

Remove your PPE once you have completed a call and left the patient area. Be careful not to contaminate yourself while taking it off. To remove PPE, reverse the order that you put it on:

1. **G**loves
2. **G**own - handwashing min 20 sec
3. **E**ye protection
4. **M**ask - handwashing min 20 sec

## Handwashing is Vital

Washing your hands is the single **most effective way** to prevent the spread of disease. Wash your hands with soap and water for at least 20 seconds or with waterless alcohol gel hand cleaner after all patient contact, even if you wore gloves.

## Equipment Decontamination

Decontaminating equipment is an important step in protecting yourself and others from infectious diseases. "Cleaning" means removing visible contamination such as blood. "Disinfecting" means wiping a clean surface with a disinfecting solution. You should clean first and then disinfect.

After completing a call involving an infectious patient, you must decontaminate everything you touched including:

- All equipment that was exposed or cross-contaminated
- Outside of kits
- Stethoscopes
- Radios
- AEDs, etc.

After you transport a patient, decontaminate the inside of your rig before putting it back in service. Be sure to decontaminate the steering wheel, door handles, radio handset, clipboard, headsets, gurney, etc. When you return to your station carry out a more thorough decontamination as needed or as directed by department policy.

**Wear new gloves while decontaminating equipment.  
Wear clean eye protection and mask if there is splash risk or vapors.**

## HIV

AIDS is caused by the Human Immunodeficiency Virus (HIV). HIV attacks the cells of the immune system and, as the immune system fails, the person becomes susceptible to "opportunistic" diseases and infections.

### Transmission

- unprotected sex with an infected partner
- infected blood given during a transfusion (extremely rare)
- sharing of needles by IV drug users
- an infected mother to her baby
- occupational transmission usually by a needlestick of infected blood

## Prehospital Presentation

Unlike many diseases, which present in a predictable way, HIV/AIDS varies in its presentation depending on which opportunistic disease or infection is acquired. You may encounter:

- dehydration and hypotension secondary to diarrheal diseases
- seizures or altered mental status secondary to a nervous system infection
- dyspnea secondary to a respiratory infection (pneumonia, tuberculosis, etc.)
- medication reactions
- end of life issues

## Occupational Risk

The occupational risk of acquiring AIDS is VERY LOW.

## Prevention

The CDC statistics support the claim that HIV is transmitted most effectively through blood. Prevention should therefore be focused on preventing significant blood exposures, specifically needlesticks. If a significant exposure does occur, post-exposure prophylaxis (PEP) may be recommended.

## Hepatitis B and C

Hepatitis B is caused by the hepatitis B virus (HBV), which damages the liver. Vaccination against HBV has been available since 1982. The disease is spread by contact with the blood of a person infected with the disease, or by sexual transmission.

Hepatitis C is caused by the hepatitis C virus (HCV) that is found in the blood of persons who have this disease. HCV is spread by contact with the blood of an infected person. It is the most common chronic bloodborne viral infection in the United States. It can cause cirrhosis of the liver and liver cancer.

## Transmission

- Blood and other bodily fluids
- Sharing needles with an infected person
- Sex with an infected person
- From a woman to her baby during birth

## Prehospital Presentation

Because most of the signs and symptoms of Hepatitis B are mild, it is unlikely that you will be called to respond to an acute illness caused by this virus. However you may on occasion see a patient with end stage liver cancer or other complications from the disease.

Hepatitis C infection generally produces no signs or symptoms during its early stages and may produce none for years. If encountered, symptoms may include fatigue, nausea, vomiting, poor appetite, muscle and joint pain or low-grade fever.

## Occupational Risk

The occupational risk for acquiring HBV from an unvaccinated person is significant. The risk for a vaccinated person is very low.

After a needlestick or sharps exposure to HCV positive blood, about 2 healthcare workers out of 100 become infected with HCV.

## Prevention

The best way to prevent an occupational exposure to HBV, in addition to taking care to protect yourself from blood exposure, is to be vaccinated against the disease.

There is no effective vaccine for hepatitis C. The only way to protect yourself is to avoid exposure to infected blood.

## TB

Tuberculosis (TB) is a disease caused by small bacteria that travels from the small airways to the cells of the lungs. Less than 10% of people infected with TB will develop active disease; in the others, the bacteria hides, causing no disease until the host (patient) becomes immunocompromised or otherwise debilitated.

## Transmission

- via small airborne particles expelled by cough, sneezing, or speaking
- particles are inhaled into small airways
- prolonged exposure in confined space confers highest risk

## Prehospital Presentation

A person with active disease may have the following signs and symptoms:

- cough, often productive of blood-tinged sputum
- fatigue and weakness
- night sweats
- low-grade fever
- loss of appetite and weight loss

## Occupational Risk

Occupational risk is low but has been very difficult to quantify.

## Prevention

You can minimize your chance of acquiring TB by maintaining a high index of suspicion among patients who are at risk of having TB, and then taking precautions if patients present with suspicious signs and symptoms.

## SARS

In February 2003, a new and virulent respiratory infection was reported in Asia. Over the next few months, before effective steps could be taken to contain the disease, it had spread to over 20 countries through North America, South America, Europe, and Asia – a testament to the effect of global commerce, enterprise and travel.

The SARS outbreak of 2003 was contained by the summer. However before it disappeared, it sickened over 8,000 people worldwide, of whom 700 died. In the United States, there were 192 possible cases (of these, only 33 were considered "probable"), and there were no deaths. However, worldwide, the disease was unusual and frightening in that it had a relatively high case fatality rate among young, healthy people.

### Transmission

Droplets spewed from the cough or sneeze of an infected person:

- close person-to-person contact
- touching an object and then touching the mouth, nose or eyes

### Prehospital Presentation

- fever, headache
- malaise, body aches and diarrhea
- cough and possible respiratory symptoms
- most patients develop pneumonia and may require ventilatory assistance and supplemental oxygen

### Occupational Risk

Currently minimal risk due to lack of recent cases – follow local and CDC guidelines for identification of high-risk patients if the disease returns.

### Prevention

Use standard precautions: wash hands, wash surfaces and use contact precautions: gown, gloves, and protective eyewear.

### Information about SARS

SARS is caused by a corona virus. This family of viruses has also been implicated in the common cold (note: there are multiple causes of the "common cold"). It is possible that the corona virus causing SARS has a reservoir in animals. A virus appearing identical to human SARS has recently been discovered in the civet, a small carnivore related to the mongoose. The civet is a culinary delicacy in parts of Asia and thousands are kept in captivity prior to being eaten.

Treatment is largely supportive and symptomatic, and is similar to the treatment that would be given to a person with serious pneumonia. Antiviral drugs were tested but were not found to be very effective.

We can't predict if or when SARS will return, whether it will make its way to North America, and if it does, what form the disease will take. Epidemiologists will be

continuing to monitor the global disease situation. Updates and guidelines will be provided through our local health department, the CDC and the WHO.

## Influenza

The flu, more commonly known as influenza, is caused by the influenza virus, which attacks the respiratory system. Flu occurs seasonally, generally from November to April in the northern hemisphere. The structure of the virus changes slightly but frequently over time; this accounts for the appearance of different strains each year.

The natural reservoir of Type A influenza (the strain that has the potential to cause pandemics) is wild birds, but the virus can also affect pigs and horses. The virus can mutate in these hosts. In the 1918-1919 flu pandemic, the strain was unusually virulent – not only was it very infectious but it also had a high mortality rate. That event is considered to have been the worst epidemic in recorded history, and is the main reason that we should not underestimate the flu.

### Transmission

- coughed droplets
- touching contaminated surfaces (less common)

### Prehospital Presentation

Sudden onset of:

- high fever
- malaise
- headache
- dry cough
- body aches

### Occupational Risk

Occupational risk varies.

### Prevention

- Handwashing, clean surfaces
- Place mask on patient or ask patient to cover mouth when coughing
- Best prevention is the flu vaccine, which must be taken yearly

## Norovirus

The Norwalk virus is a highly contagious virus responsible for outbreaks of gastrointestinal disease on cruise ships. Norovirus is the general name given to viruses of this type. In fact, noroviruses are responsible for many cases of severe but short-lived illnesses causing vomiting, diarrhea, and stomach cramps. If you have ever had a "stomach flu" or "food poisoning," it is likely that you were infected with a Norovirus.

## Transmission

Transmission of noroviruses occurs via the fecal-oral route. For example, a food handler does not wash his hands after using the bathroom; you then ingest food that has been contaminated with small amounts of fecal matter.

A person with a Norovirus is considered contagious from the time he or she starts feeling ill to as long as two weeks after recovery.

## Prehospital Presentation

- nausea and vomiting
- diarrhea
- stomach cramps
- low-grade, transient fever (less than half of cases)
- general feeling of malaise, headache, body aches

These symptoms begin suddenly, may last one to three days, and usually resolve on their own. Because the disease is caused by a virus, antibiotics are useless.

## Occupational Risk

Most cases of noroviruses are community-acquired, usually in situations where large numbers of people share the same food or living space (cruise ships, college dorms). However there have been several outbreaks of noroviruses among staff at hospitals and nursing homes.

## Prevention

Norovirus is highly contagious. The virus spreads through infected feces or vomit that is accidentally ingested. While there is no evidence of infection via the respiratory route, it is possible for small droplets of vomitus to become aerosolized and come in contact with the mucous membranes.

Therefore, if you treat a person with vomiting and diarrhea, wear gloves, wash your hands thoroughly, and consider the use of protective eyewear and mask. In addition, surfaces contacted by the patient must be thoroughly disinfected.

If you become sick, wait two days after the last of your symptoms before returning to work.

## West Nile Virus

West Nile disease was first identified in Africa in the 1930s, and gradually spread across Asia and Europe before arriving on the west coast of the US in 2002. The virus causing the disease, West Nile Virus (WNV), infects certain types of birds (ravens, crows, and jays), mosquitoes, horses, and other animals. Humans are an incidental, rather than primary, host.

## Transmission

- WNV is transmitted through the bite of an infected mosquito.
- WNV is NOT transmitted person-to-person except in the rare case of a blood transfusion from an infected person.

## Prehospital Presentation

Most people (about 80%) who are infected with WNV have a sub-clinical infection—they may not even know they are infected because they do not feel sick, although studies of their blood will show evidence of the infection. About 20% of people infected with WNV will have mild, self-limiting symptoms such as:

- fever
- headache
- fatigue
- rarely, a rash and swollen lymph nodes

Less than 1% of the people infected with WNV will develop severe illness, usually a meningitis or encephalitis. These people may present with high fever, headache or altered LOC possibly culminating in coma.

It is important to place this information in perspective. Even in states reporting cases of WNV, the disease is extremely rare compared to other causes of encephalitis and meningitis.

## Occupational Risk

- There is no occupational risk involved in caring for a person with WNV disease.

## Prevention

- Since WNV disease is not transmitted person-to-person, no specific disease prevention precautions are necessary at work.

## MRSA

Methicillin-resistant *Staphylococcus aureus* (MRSA) is a type of staph bacteria that is resistant to common antibiotics such as oxacillin, penicillin and amoxicillin. MRSA was traditionally associated with hospitals but there now is an epidemic of community-acquired MRSA. It multiplies very rapidly and can cause many different types of infection ranging from skin infections to septicemia and toxic shock syndrome. *Staphylococcus aureus* is one source of “flesh eating” bacterial infection.

## Transmission

- Found commonly on human skin, in the nose and throat and, less commonly, in the colon and in urine
- Can infect other tissues when skin or mucosal lining have been breached

## Occupational Exposure

- Can be spread through contact with pus from an infected wound, skin-to-skin contact with an infected person, and contact with objects such as towels, sheets or clothing used by an infected person.

## Prehospital Presentation

- Staph infection, including MRSA, generally start as small red bumps that resemble pimples, boils or spider bites.
- Can quickly turn into deep, painful abscesses
- Can also burrow deep into the body, causing potentially life-threatening infections in bones, joints, surgical wounds, the bloodstream, heart valves and lungs.

## Prevention

The best defense against MRSA is to wash your hands often, especially after contact with other people. Thorough washing with soap and water or alcohol hand disinfecting gels is effective against MRSA.

Wear a gown when caring for patients with a known or suspected MRSA infection of the skin.

In some cases MRSA is a respiratory infection. If a patient has a known or suspected MRSA skin infection and has a cough, or has MRSA respiratory infection, wear a fitted mask. As always, when you see patients with a cough, particularly with a fever, you should wear a fitted mask and put a surgical or procedure mask on the patient if they can tolerate it.

## Risk

It is worth noting that the attention given to a disease in the popular press may be distinctly out of proportion to the risk it presents to you as an EMS provider. An early example of this was the AIDS epidemic. In the last 25 years, an estimated 57 health care workers in the United States have contracted HIV from a documented occupational exposure.

Yet, in spite of this relatively low risk, we take many precautions to protect ourselves from this virus. It is ironic, that prior to the development of the Hepatitis B vaccine, thousands of health care workers EVERY YEAR contracted Hepatitis B from an occupational exposure, and it is estimated that as many as 200 per year died!

It was known that Hepatitis B was a blood borne disease, yet in spite of this knowledge, widespread glove use and other precautions against blood borne diseases did not occur until HIV came on the scene.

## Why is an assessment of risk important to an EMS Provider?

Viewing EVERYTHING as equally risky blunts our appreciation for those things that are truly dangerous. For example, many health care providers wear gloves at all times, and

go to great lengths to avoid getting blood on their skin. Yet blood on intact skin poses a small risk, compared to the hazard of getting a needlestick (.3% or 1 in 300).

## Masks

If you suspect you may encounter an airborne disease such as tuberculosis, don a fit-tested mask before entering the scene. Also, place a mask on the patient, if tolerated. Fitted masks, as provided by your department, provide the highest level of protection.

To be effective, a mask must be fit tested to your face. You must apply the mask as soon as a hazard is known or suspected. In addition, you must remove and dispose of the mask without contaminating yourself.

Emergency medical dispatchers in some jurisdictions may provide you with premise information if they know that a patient or location is an infectious disease risk.

### Types of Masks

A mask protects you from inhaling pathogens transmitted by the droplet route, for example, influenza, TB, chickenpox and meningococcal diseases. Like an SCBA, each type of mask must be fit tested to your face. This will determine the best type of mask for you to wear.

Disposable masks are for single use only and should be discarded after 4 - 6 hours of use. Do not re-use, share or hang masks around your neck. Change a mask that has been splashed and is wet.

## Eye Protection

Wear eye protection on all calls. Reportable exposures happen more often as EMTs encounter situations where body fluids are splashed and spattered.

You must prepare for **unanticipated splashes** such as:

- vomiting
- blood flicked from bloody hand
- a violent patient spitting
- blood flicked from a glucometer strip
- splashing fluids
- respiratory infection
- violent cough or sneeze

## Gloves

Wear medical gloves on all calls. Most bodily fluids, such as vomit or urine, while aesthetically unappealing, do not typically carry blood borne viruses. Others, such as feces, may harbor bacteria, viruses or parasites that could make you sick. These are not

transmitted through the skin or via inhalation, but through the so-called fecal-oral route. Therefore...wash your hands before and after using sterile gloves!

You should wear nitrile gloves if you are sensitive to latex or if you are treating a latex-sensitive patient. Usually a patient knows and will inform you about latex sensitivity. Also, nitrile gloves provide more protection from chemicals.

We should also address the issue of wearing both 'turnout' or other protective outer gloves and latex or nitrile gloves during extrication or rescue.

While working in a rescue or extrication environment where the risk of both cut and body substance exposure are present, consider wearing latex or nitrile inner gloves and other protective outer gloves.

**Wear gloves and eye protection for all patients.**

### The Limits of Gloves

Be exceedingly careful around needles! Needlesticks represent by far the greatest risk of occupational blood borne disease transmission. Also, be aware that the use of gloves improves the ability of bacteria to thrive on your hands, since it provides a warm, protected environment. Wash your hands after all patient contact.

Gloves are for use during patient contact. Remove gloves when you are done with patient contact, before getting into your rig, talking on the radio or driving. This will reduce the chances of contaminating other items.

Remember that gloves will not protect you from sharp objects such as needles. You still need to remain vigilant of sharps while on the scene.

### Sharps

**Be exceedingly careful around needles!** Needlesticks represent by far the greatest risk of occupational blood borne transmission.

You may be occasionally expected to handle sharps such as scalpels in an OB kit, Epi-pens, needles, and lancets for glucometry.

You should NOT be asked to handle sharps or manipulate sharps if you were not trained to do so (for example, transferring blood to blood tubes).

Many "exposures" among EMS providers involve cases in which EMS providers inadvertently stuck themselves with used needles!

Therefore...be CAUTIOUS, be AWARE, and be DELIBERATE, when you are working around sharps. Keep an eye on the paramedics and needles, and watch where you put your hands.

### Needlestick

For needlestick exposures, wash the area well with soap and water. Do NOT use bleach or other harsh chemicals. These may damage the skin, making it more likely for the virus to enter the body.

Report the exposure immediately to your officer for testing and possible post-exposure prophylaxis (see your department's guidelines).

### Skin/Mucus

#### **For exposures to non-intact skin you should:**

- wash with soap and water
- report the exposure immediately to your officer for testing and possible post-exposure prophylaxis (see your department's guidelines)

Blood on intact skin is not considered a significant exposure. Non-intact skin includes abrasions and cuts.

#### **For exposures to mucus membranes you should:**

- flush liberally with water
- report the exposure immediately to your officer for testing and possible post-exposure prophylaxis (see your department's guidelines)

### Airborne

For airborne exposures, report possible exposure to your company officer. In some cases the hospital may notify exposed responders if the patient is diagnosed with an airborne disease (e.g., TB or bacterial meningitis).

Some diseases (bacterial meningitis) may require automatic and immediate post-exposure prophylaxis, while others (tuberculosis) may require post-exposure testing and then treatment only if you become positive.

## PEP for HIV

You must immediately report any possible exposure to a bloodborne disease to your company officer. Your department's SOPs will give guidance which may include taking post-exposure prophylaxis (PEP).

A health care worker who has a significant exposure to HIV may take post-exposure prophylaxis—medications that are taken AFTER an exposure to reduce the chance of acquiring the disease. Post-exposure prophylaxis reduces the already very low risk of acquiring the disease, although it does not guarantee that no disease transmission will occur.

The medications taken for PEP are TOXIC. Most people who take them experience significant side effects ranging from fatigue to nausea and vomiting; in fact, as many as 30% of health care workers who start PEP stop taking the drugs because of the side effects. PEP also carries with it a chance of serious permanent consequences such as liver damage. This is not a decision to be taken lightly!

If PEP is started, it should be **started SOON!** Animal studies suggest that PEP is most effective if started IMMEDIATELY after exposure, if at all possible within two hours.

Part of the plan for PEP includes testing of the source blood. If the patient is determined to be HIV-negative, the PEP medications can be stopped.

## Summary

To help avoid infection from fluids and airborne particles, **wear personal protective equipment (PPE)**, **decontaminate equipment** and surfaces after use and **wash your hands** frequently.

The sequence for **donning PPE** is MEGG:

1. Mask
2. Eye protection
3. Gown
4. Gloves

The PPE doffing procedure is the reverse on the donning procedure.

Handwashing is the **most effective method** of preventing infectious disease.

To decontaminate equipment, clean visible contamination first, then disinfect the surface.

The **occupational risk** of acquiring AIDS is VERY LOW.

Avoiding a needlestick and sharps exposure is the best precaution against **Hepatitis C (HVC)**.

**Remove gloves** when you are done with patient contact, before getting into your rig, talking on the radio or driving.

The best defense against MRSA is to wash your hands often.

Wear gloves and eye protection on all calls.

**Needlesticks** represent by far the greatest risk of occupational blood borne transmission.

If post-exposure prophylaxis (PEP) is to be started, it should be **started IMMEDIATELY** after exposure, if at all possible within two hours.