Bloodborne Pathogens: Protecting Against Transmission
OSHA’s Bloodborne Pathogens Standard

COURSE OBJECTIVE: The purpose of this course is to prepare healthcare providers to comply with OSHA’s Bloodborne Pathogens Standard and CDC directives regarding risks and precautions associated with exposure to blood and other potentially infectious materials.

LEARNING OBJECTIVES
Upon completion of this course, you will be able to:

- Identify blood and other potentially infectious materials (OPIM).
- Describe the employer requirements of OSHA’s Bloodborne Pathogens Standard.
- Describe the chain of infection as it applies to bloodborne diseases.
- Identify bloodborne diseases of concern to healthcare providers in the United States.
- Discuss how Standard Precautions protect against bloodborne pathogens (BBP).
- Discuss types of personal protective equipment (PPE), work practices, and engineering controls that reduce risk of exposure to bloodborne pathogens.
- Explain principles underlying enhanced precautions to be used when caring for patients known or suspected to be infected with the Ebola virus.
- Identify warning labels used in cases of known or suspected BBP risk.
- Describe employer and employee actions to be taken in case of a BBP exposure.

Ensuring the safety of providers within the healthcare setting is of utmost importance. A multifaceted approach is needed to reduce the risk of occupational exposure to bloodborne pathogens. The Centers for Disease Control and Prevention (CDC) estimates that 5.6 million workers in the healthcare industry and related occupations are at risk of occupational exposure to bloodborne
pathogens, including human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV), and others (OSHA, 2014).

For example, the CDC estimates that around 385,000 needlesticks and other sharps-related injuries are sustained by hospital-based healthcare personnel on an annual basis (CDC, 2013a). Such exposures can occur in other healthcare settings, such as nursing homes, clinics, emergency departments, and homes. Sharps injuries are primarily associated with occupational transmission of hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV), but they may also be involved in the transmission of other pathogens.

Occupational exposure to bloodborne pathogens from needlesticks and other sharps injuries is a serious problem, however these injuries are often preventable. This course reviews the standards, precautions, and actions needed to reduce healthcare provider risk of exposure to bloodborne pathogens.

OSHA BLOODBORNE PATHOGENS STANDARD

The Occupational Safety and Health Administration (OSHA), part of the U.S. Department of Labor, first published the Occupational Exposure to Bloodborne Pathogens Standard in 1991 in Title 29 of the Code of Federal Regulations 1910.1030. In 2001, in response to the Needlestick Safety and Prevention Act, OSHA revised the Bloodborne Pathogens Standard. The Bloodborne Pathogens Standard is updated regularly, with the most recent update from January 2011 (see “Resources” at the end of this course). The standard details what employers must do to protect workers whose jobs put them at risk for exposure to blood and other potentially infectious materials (OPIM). OSHA regularly inspects healthcare agencies for compliance and may fine employers if infractions are identified.

BLOOD AND OTHER POTENTIALLY INFECTIOUS MATERIALS (OPIM)

All occupational exposures to blood or other potentially infectious materials place healthcare providers at risk for infection with bloodborne pathogens.

OSHA defines blood as:

- Human blood
- Human blood components
- Products made from human blood

Other potentially infectious materials (OPIM) include:

- Semen
- Vaginal secretions
- Cerebrospinal fluid
• Synovial fluid
• Pleural fluid
• Pericardial fluid
• Peritoneal fluid
• Amniotic fluid
• Saliva in dental procedures
• Any body fluid that is visibly contaminated with blood
• Any unfixed tissue or organ (other than intact skin) from a human (living or dead)
• Hepatitis B (HBV)– and human immunodeficiency virus (HIV)–containing cell or tissue cultures, organ cultures, and HBV- or HIV-containing culture medium or other solutions
• Blood, organs, or other tissues from experimental animals infected with HBV or HIV


In general, OSHA’s Bloodborne Pathogens Standard (OSHA, 2011b) requires employers to do the following:

1. Establish a **written exposure control plan** to eliminate or minimize employee exposure to bloodborne pathogens
   • The employer must prepare an exposure determination that contains a list of job classifications in which workers have occupational exposure, along with a list of the tasks and procedures performed by those workers that result in their exposure.

2. **Update the exposure control plan annually** to reflect changes in tasks, procedures, and positions that affect occupational exposure, and also technological changes implemented to eliminate or reduce occupational exposure
   • Employers must annually document in the plan that they have considered and begun using appropriate, commercially available, and effective safer medical devices designed to eliminate or minimize occupational exposure.
   • Employers must also document that they have solicited input from frontline workers in identifying, evaluating, and selecting effective engineering and work practice controls.

3. Implement the use of **universal precautions**
   • Universal precautions means treating all human blood and other potentially infectious materials (OPIM) as if known to be infectious for bloodborne pathogens.

4. Identify and use **engineering controls**
   • These are devices that isolate or remove the bloodborne pathogens hazard from the workplace. They include sharps disposal containers, self-sheathing needles, and safer medical devices, such as sharps with engineered sharps-injury protection and needleless systems.
5. Identify and ensure the use of **work practice controls**
   
   • These are practices that reduce the possibility of exposure by changing the way a task is performed, such as appropriate practices for handling and disposing of contaminated sharps, handling specimens, handling laundry, and cleaning contaminated surfaces and items.

6. Provide **personal protective equipment (PPE)**, such as gloves, gowns, eye protection, and masks
   
   • Employers must clean, repair, and replace this equipment as needed. Provision, maintenance, repair, and replacement are at no cost to the worker.

7. Make available **hepatitis B vaccinations** to all workers with occupational exposure
   
   • This vaccination must be offered after the worker has received the required bloodborne pathogens (BBP) training and within 10 days of initial assignment to a job with occupational exposure.

8. Make available **post-exposure evaluation and follow-up** to any occupationally exposed worker after an exposure incident
   
   • An exposure incident is a specific eye, mouth, other mucous membrane, nonintact skin, or parenteral contact with blood or OPIM.
   
   • This evaluation and follow-up must be at no cost to the worker and includes documenting the route(s) of exposure and the circumstance under which the exposure incident occurred; identifying and testing the source individual for HBV and HIV infectivity; collecting and testing the exposed worker’s blood, if the worker consents; offering post-exposure prophylaxis; offering counseling; and evaluating reported illnesses.
   
   • The healthcare professional will provide a limited written opinion to the employer and all diagnoses must remain confidential.

9. Use **labels and signs to communicate hazards**
   
   • Warning labels must be affixed to containers of regulated waste; containers of contaminated reusable sharps; refrigerators and freezers containing blood or OPIM; other containers used to store, transport, or ship blood or OPIM; contaminated equipment that is being shipped or serviced; and bags or containers of contaminated laundry.
   
   • Facilities may use red bags or red containers instead of labels.
   
   • In HIV and HBV research laboratories and production facilities, signs must be posted at all access doors when OPIM or infected animals are present in the work area or containment module.
10. Provide **information and training** to employees that covers all elements of the standard, including, but not limited to:

- Information on bloodborne pathogens and diseases, methods used to control occupational exposure, hepatitis B vaccine, and medical evaluation and post-exposure follow-up procedures.

- Employers must offer this training on initial assignment, at least annually thereafter, and when new or modified tasks or procedures affect a worker’s occupational exposure.

- HIV and HBV laboratory and production facility workers must receive specialized initial training in addition to the training provided to all workers with occupational exposure. Workers must have the opportunity to ask the trainer questions. Training must be presented at an educational level and in a language that workers understand.

11. Maintain employee **training and medical records** including a sharps injury log

**CHAIN OF INFECTION**

The process of transmission of an infectious agent can be best explained by the epidemiologic model called the chain of infection. An infectious disease results from specific interactions between the agent, host, and environment. Transmission occurs when the infectious agent leaves the reservoir or host through a portal of exit, travels by some mode of transmission, and enters through a portal of entry to infect a susceptible host (CDC, 2012a).

![Chain of infection](image-url)
• A reservoir of an infectious agent is the habitat where the agent normally lives and grows. Reservoirs may be humans, animals, or the environment. In the case of bloodborne infectious diseases, humans are generally the reservoirs.

• The portal of exit is the path by which the infectious agent leaves its host. Bloodborne pathogens can exit the host by crossing the placenta from mother to baby, or through cuts, open wounds, or needles.

• Means of transmission is the mode by which the infectious agent is transmitted from its natural reservoir to a susceptible host. Transmission can occur by a mode that is direct (e.g., OPIM exposure from the reservoir patient directly to exposed nonintact skin or mucous membrane of the host) or indirect (e.g., needlestick).

• The portal of entry refers to the way in which the infectious agent enters the host. The portal of entry must provide access to tissues in a way that allows the infectious agent to multiply and thrive.

• The final link is the vulnerable host. Susceptibility of a host depends on many factors, including immunity and the individual’s ability to resist infection (CDC, 2012).

By breaking any link of the chain of infection, healthcare professionals can prevent the occurrence of new infection. Infection prevention measures are designed to break the links and thereby prevent new infections. The chain of infection is the foundation of infection prevention.

THE PATHOGENS

Bloodborne pathogens are microorganisms present in human blood or OPIM that can cause disease when individuals are exposed to the blood. Many are relatively rare, such as malaria, syphilis, and Ebola. Others are common, such as the hepatitis virus and the human immunodeficiency virus, which causes acquired immune deficiency.

Two bloodborne pathogens are specifically addressed by OSHA standards because they are the most common and pose the greatest threat to employees who may be exposed. They are hepatitis B and HIV.

Hepatitis

Hepatitis means inflammation of the liver. Several strains of the hepatitis virus have been identified; hepatitis A, hepatitis B, and hepatitis C are the most common. (Hepatitis A is not a bloodborne pathogen and will not be discussed here.)

The liver is an organ located at the top of the abdomen, just below the diaphragm. The liver performs several vital functions that serve to detoxify the blood cells, inactivate many chemical compounds, store glucose as glycogen, synthesize triglycerides and cholesterol, and produce
plasma proteins. Diseases that inflame or damage the liver adversely affect the body’s ability to perform these vital functions, leading to acute or chronic illness and sometimes death.

**HEPATITIS B VIRUS (HBV)**

Hepatitis B is an infection of the liver caused by the hepatitis B virus. Acute hepatitis B refers to the first six months after someone is exposed to HBV. The illness can range in severity from very mild with few or no symptoms to a serious condition requiring hospitalization. Some people are able to fight the infection and clear the virus. For others, the infection leads to a chronic illness. Chronic hepatitis B refers to the illness that occurs when HBV remains in a person’s body. Over time, the infection can cause serious health problems.

In the United States, approximately 1.4 million people have chronic hepatitis B. Unfortunately, many people do not know they are infected. An estimated 18,760 people became infected with HBV in 2012 (CDC, 2014a). The number of new cases of hepatitis B has decreased 82% since 1991. The decline has been greatest among children born since 1991, when routine HBV vaccination of children was implemented (CDC, 2014b).

Approximately 15%–25% of people with chronic hepatitis B develop serious liver problems, including liver damage, cirrhosis, liver failure, and liver cancer. Every year, approximately 3,000 people in the United States and more than 786,000 people worldwide die from hepatitis B-related liver disease (CDC, 2014b).

**Transmission**

HBV is transmitted through activities that involve percutaneous (i.e., puncture through the skin) or mucosal contact with infectious blood or body fluids (e.g., semen or saliva), including:

- 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
- Needlesticks or sharp instrument exposures
- Sharing items such as razors or toothbrushes with an infected person

Hepatitis B is not spread through breastfeeding, sharing eating utensils, hugging, kissing, holding hands, coughing, or sneezing. Unlike some forms of hepatitis, HBV is not spread by contaminated food or water.

HBV is very resilient and can survive in dried blood for up to seven days (CDC, 2014b). For this reason, the virus is a concern for medical personnel such as nurses, laboratory technicians, and paramedics, as well as custodians, laundry personnel, and other employees who may come in contact with blood or other potentially infectious materials.
**Diagnosis and Treatment**

People who are infected with HBV often show no symptoms for a period of time. After exposure it can take up to nine months before symptoms become noticeable. The symptoms of hepatitis B are often much like a mild flu. Initially there is fatigue, possible stomach pain, fever, loss of appetite, and nausea. As the disease continues to develop, jaundice (a distinct yellowing of the skin and eyes) and darkened urine usually occurs.

Hepatitis B is diagnosed with specific blood tests that are not part of blood work typically done during regular physical exams. The hepatitis B surface antigen (HBsAg), a protein on the surface of HBV, can be detected in high levels in serum during acute or chronic HBV infection. The presence of HBsAg indicates that the person is infectious. The body normally produces antibodies to HBsAg as part of the normal immune response to infection. HBsAg is the antigen used to make hepatitis B vaccine.

HBsAg will be detected in an infected person’s blood from 1 to 9 weeks after exposure to the virus. About half will no longer be infectious by 7 weeks after onset of symptoms, and all persons who do not remain chronically infected will be HBsAg-negative by 15 weeks after onset of symptoms (CDC, 2014b). There is no cure for HBV, but there are medications available to treat long-lasting HBV infection. Adefovir dipivoxil, interferon alfa-2b, pegylated interferon alfa-2a, lamivudine, entecavir, and telbivudine are six medications used for the treatment of persons with chronic hepatitis B (CDC, 2014b). Many people who contract the disease develop antibodies that help them fight the infection and protect them from getting it again. It is important to note that infection with HBV will not prevent someone from getting another type of hepatitis.

**Vaccine**

The hepatitis B vaccine is the best protection from the disease. All employees who may possibly be exposed to blood or other potentially infectious materials as part of their job duties are eligible to be vaccinated against HBV. The OSHA Bloodborne Pathogens Standard requires employers to offer the vaccination series to all workers who have occupational exposure.

Examples of workers who may have occupational exposure include, but are not limited to, healthcare workers, emergency responders, morticians, first-aid personnel, correctional officers, and laundry workers in hospitals and commercial laundries that service healthcare or public safety institutions. The vaccine and vaccination must be offered at no cost to the employee and at a reasonable time and place (OSHA, 2011c).

The hepatitis B vaccine is a noninfectious, yeast-based vaccine that is usually given in a series of three intramuscular injections in the arm. It is prepared from recombinant yeast cultures rather than human blood or plasma. Thus, there is no chance of developing HBV from the vaccine.
The vaccination consists of a series of three injections. The second injection should be given one month after the first, and the third injection six months after the initial dose. To ensure immunity, it is important to receive all three injections. The vaccine causes no harm to those who are already immune or to those who may be HBV carriers.

Although employees may opt to have their blood tested for antibodies to determine the need for the vaccine, their employers may not make such screening a condition of receiving vaccination, nor are employers required to provide screening. For employees at risk for exposure, an antibody titer can be drawn 1 to 2 months after the vaccination series is completed to determine vaccine effectiveness. If a second vaccine series is indicated, it must be offered free of charge (OSHA, 2011c).

Employees who decide to decline vaccination must complete a mandatory declination form. An employee may opt to take the vaccine at any time even after initially declining it.

HEPATITIS C VIRUS (HCV)

Hepatitis C is a serious infection of the liver caused by the hepatitis C virus (HCV), a bloodborne pathogen. An estimated 3.2 million people in the United States have chronic hepatitis C. Most are unaware of their infection. HCV infection is the most common bloodborne chronic infection in the United States (CDC, 2014c).

Transmission of the virus occurs when blood or body fluids from an infected person enter the body of a person who is not infected. Today, most people become infected with HCV by sharing needles or other equipment to inject drugs. Before widespread screening of the blood supply began in 1992, HCV was also commonly spread through blood transfusions and organ transplants (CDC, 2014c).

Hepatitis C is a progressive disease that varies from person to person. It is characterized as either acute or chronic. Acute hepatitis C is a short-term illness that occurs within the first six months after someone is exposed to HCV. The acute infection can range in severity from a very mild illness with few or no symptoms to a serious condition requiring hospitalization. For reasons that are not known, some of those infected recover from the virus without treatment and show no signs of further disease.

Approximately 75%–85% of people who become infected with HCV develop chronic infection. Chronic hepatitis C is a long-term illness that occurs when HCV remains in a person’s body. Over time, it can lead to serious liver problems, including liver damage, cirrhosis, liver failure, or liver cancer (CDC, 2014c).

Many people with hepatitis C do not have symptoms and do not know they are infected. Symptoms for both acute and chronic hepatitis C can include fever, fatigue, loss of appetite, nausea, vomiting, abdominal pain, dark urine, grey-colored stools, joint pain, and jaundice.
Treatment is not always effective for HCV, and all infected persons are not candidates for treatment. The therapy for chronic hepatitis C has evolved steadily since alpha interferon was first approved for use in the United States to treat this disease more than 15 years ago. For patients infected with HCV, treatment has previously consisted of pegylated interferon combined with oral doses of ribavirin, a regimen that has improved health outcomes for many infected persons. Approximately 40% of HCV-infected patients receiving this therapy clear their infection.

New direct-acting agents against HCV (telaprevir, boceprevir) were approved by the FDA in 2011. These agents, when given in combination with current therapy, have increased virologic cure rates to 80%. Two new oral drugs (sofosbuvir and simeprevir) were approved in 2013, with results showing effective viral suppression in 90% of patients (CDC, 2014a).

Although there is currently no vaccine to prevent hepatitis C, research is being conducted to develop one. At this time, there is no recommendation for the use of antiviral agents upon exposure to HCV. Adherence to Universal Precautions and Body Substance Isolation (BSI) is the most effective way for healthcare workers to prevent exposure to the virus. Body Substance Isolation is an infection prevention method that defines all body fluids and substances as infectious. BSI incorporates not only the fluids and materials covered by the standard but expands coverage to include all body substances. BSI is an acceptable alternative to Universal Precautions, providing that facilities utilizing BSI adhere to all other provisions of OSHA’s Bloodborne Pathogens Standard (OSHA, 2011a).

Human Immunodeficiency Virus (HIV)

As noted earlier, the human immunodeficiency virus (HIV) causes acquired immune deficiency syndrome (AIDS). HIV attacks the body’s immune system, weakening it so that it cannot fight other deadly diseases. Though a person has been infected with HIV, it may be many years before AIDS develops. AIDS is a fatal disease, and while treatment for it is improving, there is no known cure.

The CDC estimates that more than 1.1 million people are living with HIV in the United States. One in five (16%) of those people living with HIV are unaware of their infection. An estimated 49,000 Americans become infected with HIV each year (CDC, 2013b).

HIV is spread by sexual contact with an infected person; by sharing needles and/or syringes with someone who is infected; and less commonly, through transfusions of infected blood or blood clotting factors. Babies born to HIV-infected women may become infected before or during birth or through breastfeeding after birth. HIV is not spread through contaminated food or by casual contact.

In the healthcare setting, personnel have been infected with HIV after being stuck with needles containing HIV-infected blood or, less frequently, after infected blood gets into a worker’s open cut or a mucous membrane such as the eye, mouth, or nostril. Through December 2001, there were 57 documented cases of occupational HIV transmission to healthcare workers in the United States, and no new confirmed cases have been reported since 1999 (CDC, 2013c).

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The **symptoms** of HIV infection vary but often include weakness, mild viral illness within six weeks, fever, sore throat, nausea, headaches, diarrhea, a white coating on the tongue, weight loss, and swollen lymph glands.

HIV/AIDS infection occurs in three broad stages. In the first stage, the person is actually infected with HIV. After the initial infection, the infected individual may show few, or no, signs of illness for many years. During the second stage, the individual may suffer swollen lymph glands or other lesser diseases that begin to take advantage of the body’s weakened immune system. The second stage is believed to lead eventually to AIDS. In the third and final stage, that of AIDS itself, the body becomes completely unable to fight off life-threatening diseases and infections.

The HIV virus is fragile and does not survive long outside the human body. It is primarily of concern to healthcare employees providing first aid or medical care in situations involving contact with fresh blood or OPIM. It is estimated that the chances of contracting HIV in a workplace environment are minimal. However, because it is such a devastating disease, all precautions must be taken to avoid exposure. There is no vaccine to prevent HIV infection. Adherence to Universal Precautions is the most effective means of protection.

A plan for post-exposure management of healthcare personnel is an important element of workplace safety. The CDC has issued guidelines for the management of healthcare worker exposures to HIV and recommendations for **post-exposure prophylaxis (PEP)**. The guidelines outline a number of considerations in determining whether healthcare workers should receive PEP and in choosing the type of PEP regimen. For most HIV exposures that warrant post-exposure prophylaxis, a basic 4-week, 2-drug regimen is recommended (CDC, 2013c) (see “Resources” at end of course for PEP recommendations).

The PEP regime can be modified at any time. If there is any doubt about the age of the facility PEP reference, the person making the decision to begin PEP should obtain expert advice by consulting in the following order, depending on the situation and available resources:

- The facility infection preventionist or designated infection prevention consultant
- The PEP line, listed in the “Resources”
- The CDC website, listed in the “Resources”

**Ebola Virus (EBV)**

Ebola, also known as Ebola hemorrhagic fever, is a rare and deadly disease caused by one of the Ebola virus (EBV) strains. EBV was originally discovered in Africa in 1976 near the Ebola River in the Republic of Congo. The natural host of the EBV is thought to be animal-borne, specifically tied to bats. Since the discovery of EBV, periodic outbreaks have occurred. In 2014, a large and serious epidemic outbreak occurred, with spread of the disease from Africa to other countries, including the United States (CDC, 2014d).
Transmission of EBV to healthcare workers is a serious concern, underscoring the importance of following strict infection control procedures and wearing appropriate personal protective equipment when caring for patients with this deadly virus. Recommendations for PPE use when caring for patients with EBV are evolving and call for enhanced precautions (see below under “Prevention” and under “Resources” at the end of the course).

**Transmission** of EBV occurs through direct contact through broken skin or mucous membranes with the following:

- Blood or body fluids (e.g., OPIM)
- Environmental exposure to objects contaminated with EBV (e.g., clothes, bedding, needles, or equipment)

Healthcare workers caring for patients with EBV and family and friends who have had close contact with patients are at the highest risk of contracting the virus due to contact with infected blood or body fluids and environmental exposure. When caring for a patient identified to have EBV, healthcare workers should use the highest level of personal protective equipment possible (covering all areas of the body) to prevent exposure to EBV.

Medical equipment used to provide care should either be disposable or be adequately sterilized to prevent further transmission in the healthcare setting. Recommendations may also include strict patient isolation, limiting the number of providers and visitors, limits on procedures (e.g., use of sharps, laboratory tests, and aerosol generating procedures), and other environmental control methods to decrease potential exposures (CDC, 2014e). (See also under “Prevention” below.)

**Symptoms** of EBV may appear anywhere from 2 to 21 days after exposure, with the average being 8 to 10 days. Symptoms of EBV include:

- Fever (greater than 101.5 °F or 38.6 °C)
- Severe headache
- Muscle pain
- Weakness
- Diarrhea
- Vomiting
- Abdominal pain
- Unexplained hemorrhage (bleeding or bruising)

Recovery from Ebola depends on good supportive clinical care as well as the patient’s immune response. The following medical interventions may significantly improve the chances of survival:

- Providing intravenous fluids (IV) and balancing electrolytes
- Maintaining oxygen status and blood pressure
- Treating other infections that may occur
Experimental vaccines and treatments for Ebola are under development, but they have not yet been fully tested for safety or effectiveness. No FDA-approved vaccine or medicine (e.g., antiviral drug) is currently available for Ebola (CDC, 2014d). Recent EBV cases have been treated with whole blood or plasma transfusions from EBV survivors who have developed antibodies to EBV. This technique is called convalescent plasma therapy. The concept behind this treatment is that the antibodies from another survivor’s blood will assist the patient in fighting off the disease. Donor blood transfusions must match the patient’s blood type and be screened for other pathogens (Medscape, 2014).

People who recover from Ebola infection develop antibodies that last for at least 10 years. Once a patient has recovered from EBV, they can no longer spread the virus. However, EBV has been found in semen for up to three months; therefore, abstinence from sexual contact (including oral sex) is recommended (CDC, 2014d).

**MODES OF TRANSMISSION**

Bloodborne pathogens such as HBV, HCV, HIV, and EBV can be transmitted through contact with infected blood and OPIM such as semen and vaginal secretions, cerebrospinal fluid, pleural and peritoneal fluid, amniotic fluid, saliva in dental procedures, and any body fluid that is visibly contaminated with blood.

Transmission of a bloodborne pathogen can occur through:

- Sexual contact without a condom
- Sharing of hypodermic needles
- From mothers to their babies at or before birth
- Accidental puncture from contaminated needles, broken glass, or other sharps
- Contact between broken/damaged skin and infected body fluids
- Contact between mucous membranes and infected body fluids

Unbroken skin forms an impervious barrier against bloodborne pathogens. However, infectious blood and body fluids can enter one’s system through open sores, cuts, and abrasions; acne; any damaged or broken skin; or mucous membranes of the eyes, nose, or mouth if splashed with contaminated fluid.

Healthcare personnel are at high risk to exposure to bloodborne pathogens due to routine exposure to blood and OPIM. Thus, it is important to know the ways exposure and transmission are most likely to occur in a work situation. Any time there is blood-to-blood contact with infected blood or body fluids, there is a risk. In most situations, transmission likely occurs because of accidental puncture from contaminated needles or other sharps, contact between broken skin and infected body fluids, or contact between mucous membranes and infected body fluids.
PREVENTION

Exposure Control Plan

Employers are required to develop and share an exposure control plan (ECP). The plan is in place to protect employees from health hazards associated with bloodborne pathogens and provide appropriate treatment and counseling if an exposure incident occurs. Employees should know where their facility’s exposure control plan is located and what it includes.

The exposure control plan includes detailed information about the ways an employer provides a safe and healthful work environment, including:

- Who is responsible for implementing the plan
- Determination of employee exposure incidents
- Methods of exposure control, such as Standard Precautions, environmental engineering and work practice controls, personal protective equipment (PPE), and housekeeping methods
- Hepatitis B vaccination programs
- Post-exposure evaluation and follow-up, as well as the procedures for evaluating the circumstances surrounding an exposure incident
- Communication of hazards to employees
- Training and recordkeeping

Employers are required to implement these preventive measures to reduce or eliminate the risk of exposure to bloodborne pathogens.

Universal and Standard Precautions

*Universal Precautions* is the term used to describe a prevention strategy in which all blood and OPIM are treated as if they are actually infectious, regardless of the perceived status of the source individual. In other words, **whether or not one thinks the blood/body fluid is infected with bloodborne pathogens, treat it as if it is.** This approach is used in all situations where exposure to blood or potentially infectious materials is possible. In addition, it means that certain engineering and work practice controls are always utilized in situations where exposure may occur.

OSHA’s Bloodborne Pathogens Standard allows for healthcare facilities to use acceptable alternatives to Universal Precautions. The CDC revised the infection control practice from Universal Precautions to Standard Precautions in 1996. Standard Precautions combine the major features of Universal Precautions and Body Substance Isolation (BSI). Standard Precautions incorporate not only the fluids and materials covered by the Bloodborne Pathogens Standard but expand coverage to include any and all body fluids and substances (OSHA, 2011a).
STANDARD PRECAUTIONS

Standard Precautions is an infection control strategy to prevent transmission of infectious agents and is recommended for all patient care delivery settings. It is based on the concept that all blood, body fluids, secretions, excretions (except sweat), non-intact skin, and mucous membranes may contain transmissible infectious agents.

Standard Precautions includes proper hand hygiene and use of gloves, gown, mask, eye protection, face shield, and safe injection practices. Equipment or items used in the patient environment that may be contaminated with infectious body fluids are also handled in a manner to prevent transmission of infection, including cleaning, disinfecting, and sterilizing before use on another patient.

Application of Standard Precautions is determined by the type of care interaction anticipated. For some interactions (e.g., venipuncture), only gloves may be needed; during other interactions (e.g., intubation or tracheostomy care), use of gloves, gown, face shield, or mask and goggles are needed.

CDC, 2009a.

Personal Protective Equipment (PPE)

Wearing gloves, gowns, masks, eye, and face/neck protection can significantly reduce health risks for employees exposed to blood and OPIM. Employers are required to provide, clean, and maintain appropriate PPE and clothing free of charge to employees. Latex-free PPE must be made available on request.

PPE must be readily accessible to employees and available in appropriate sizes. It is important to know which type of PPE is available at work and where it is stored. To protect oneself, a healthcare provider must have a barrier between them and any potentially infectious material.

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Face shield | One-piece face protection; worn while performing invasive techniques, including IV therapy, suctioning, and intubations, or any time there is an opportunity for blood or body fluids to be splashed, sprayed, or splattered; not to be used for TB protection

Goggles | Eye protection that includes shielding front, sides, and top; goggles/safety glasses with side and top shields as well as full-face shielding are all acceptable; prescription glasses are acceptable if side shields are added

Mask (surgical) | Disposable; to be placed over the mouth and nose; worn when splashing of blood or body fluids is likely; worn with eye protection

Head coverings | Cap that covers hair; worn when splashing of blood or body fluids is possible

Booties | Outerwear used to cover shoes/boots when exposed to blood and body fluids

Turnout gear | Fire-resistant coat and pants; may provide protection during extrication

Steel-toed shoes/boots | Protective footwear

Hard hats | Protective head covering; worn during extrication

Body armor | Bulletproof vest; worn for protection in potentially hostile situations

### Gloves: The First Defense

Wearing gloves is advised when contact with blood, OPIM, or contaminated surfaces is anticipated. Gloves should be made of latex or other water-impervious materials. If the glove material is thin or flimsy, double gloving can provide an additional layer of protection. Those employees allergic to latex gloves must be provided with latex-free (e.g., vinyl or nitrile) gloves.

Cuts or sores on one’s hands should be covered with a bandage or similar protection as an additional precaution before donning gloves. Always inspect gloves for tears or punctures before putting them on. If a glove is damaged, don’t use it.

Careful procedure is recommended when taking contaminated gloves off. Make sure not to touch the outside of the gloves to bare skin, and be sure to dispose of the gloves in a proper container so that no one else will come in contact with them.

### PPE Rules to Follow

- Know how to use the equipment.
- Always wear PPE in exposure situations.
- Remove and replace PPE that is torn, punctured, or has lost its ability to function.
- Remove clothing that becomes contaminated with blood or OPIM as soon as possible.
- Remove PPE before leaving the work area.
• Handle contaminated laundry as little as possible.
• Place contaminated PPE in appropriately labeled bags or containers until disposed of, decontaminated, or laundered.
• Know where these bags or containers are located in the work area.

The key principle for healthcare workers to remember when removing personal protective equipment is to avoid contact with blood, body fluids, secretions, excretions, and other contaminants. When hands become contaminated, they should be washed or decontaminated as soon as possible.

**HOW TO REMOVE PPE**

• Using gloved hands, untie the gown string and remove shoe covers.
• Remove gloves (fingers under cuff of second glove to avoid contact between skin and outside of gloves) and discard in an appropriate manner. The phrase “rubber to rubber, skin to skin” is useful to recall the correct sequence and permissible contact.
• Wash hands.
• Remove gown without contaminating clothing underneath.
• Touch only the inside of the gown while removing. Place in appropriate disposal bag.
• Remove goggles, mask, and cap and place in an appropriate container.
• Remove boots (if worn) and place in an appropriate container.
• Wash hands up to the wrists thoroughly.

**ENHANCED PRECAUTIONS AGAINST EBOLA VIRUS TRANSMISSION**

In response to concerns raised by nurses during the 2014 Ebola outbreak, the American Nurses Association (ANA, 2014) made several suggestions to the CDC regarding additional precautions to be used by healthcare workers caring for Ebola patients in the United States. Among their requests were clear, specific PPE standards for both points of entry and after admission of patients suspected to have Ebola; training on effective, evidence-based use of PPE; and more rapid dissemination of any changes to procedures, guidelines, and recommended care.

The CDC subsequently developed new recommendations entitled “Guidance on Personal Protective Equipment to Be Used by Healthcare Workers During Management of Patients with Ebola Virus Disease in U.S. Hospitals, Including Procedures for Putting On (Donning) and Removing (Doffing)” (see “Resources” at the end of this course). This guidance emphasizes the importance of training, practice, competence, and observation of healthcare workers.

• Prior to working with patients with Ebola, all healthcare workers involved in the care of such patients must have received repeated training and have demonstrated competency in performing all Ebola-related infection control practices and procedures, and
specifically in donning/doffing proper PPE. A stepwise process should be developed and used during training and daily practice.

- The facility should designate areas for PPE donning and doffing. It is critical that physical barriers (e.g., plastic enclosures) be used where necessary, along with visible signage, to separate distinct areas and ensure a one-way flow of care moving from clean areas (e.g., areas where PPE is donned and unused equipment is stored) to the patient room and to the PPE removal area (areas where PPE is removed and discarded).

- While working in PPE, healthcare workers caring for patients with Ebola should have no skin exposed. PPE must remain in place and be worn correctly for the duration of exposure to potential contamination. PPE should not be adjusted during patient care.

- The overall safe care of patients with Ebola in a facility must be overseen by an onsite manager at all times, and each step of every PPE donning/doffing procedure must be supervised by a trained observer, who will read aloud to the healthcare worker each step in the procedure checklist and visually confirm and document that the step has been completed correctly in order to ensure proper completion of established PPE protocols.

- Healthcare workers are to perform frequent disinfection of gloved hands using an alcohol-based hand rub (ABHR), particularly after handling body fluids. Double gloving provides an extra layer of safety during direct patient care and during the PPE removal process.

- If healthcare facilities decide to add additional PPE or modify this PPE guidance, they must consider the risk/benefit of any modification and train healthcare workers on correct donning and doffing in the modified procedures.

Source: CDC, 2014f.

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**Work Practice Controls**

Work practice controls refer to the processes and procedures used to ensure that work is conducted in a safe and healthy manner. Work practice controls are an essential component of a safe work environment.

Work practices to learn and follow include:

- Proper and timely handwashing
- Minimizing splashing or spraying of any potentially infectious material
- Proper decontamination and sterilization of equipment and supplies
- Cleanup, care, and maintenance of supplies and equipment
- Proper disposal of used supplies and equipment
- Keeping all food and drink away from areas where blood or OPIM are present
• Avoiding eating, drinking, smoking, applying cosmetics or lip balm, or handling contact lenses where there is a risk of contamination

DECONTAMINATION

To minimize exposure to bloodborne pathogens, effective decontamination is essential. Use either a 1:10 household bleach solution, Lysol, or another EPA-registered disinfectant. Check the label of all disinfectants to be sure they meet this requirement.

When cleaning up a blood spill, carefully cover the spill with rags or paper towels. Pour disinfectant solution over the rags or towels and let it sit for 10 minutes, or follow the manufacturer’s recommendations.

PREPARING A 1:10 SOLUTION OF HOUSEHOLD BLEACH

A 1:10 solution of household bleach includes 1 part bleach and 9 parts water. The key is using the same volume as a “part”—i.e., a measuring tablespoon or a measuring cup.

• Working in a well-ventilated area, measure 9 parts water into a closable container that will hold the total volume of solution.
• Measure 1 part of household bleach into the same container.
• Close and label the container with the name of the solution (one which everyone in the household can read and understand), the date and time prepared, and an identifier for the person preparing the solution.
• Prepare only as much solution as needed for 24 hours.
• When using, pour solution from the container.
• Do not return used solution to the container.
• Discard any unused solution within 24 hours, rinse the container, and prepare new solution as needed.

Source: CDC, 2009b.

HANDWASHING

Handwashing is the most important—and easiest—practice used to prevent transmission of bloodborne pathogens. Hands or other exposed skin should be thoroughly washed as soon as possible following a known or possible exposure incident. Hands should also be washed immediately or as soon as feasible after removing gloves or other PPE.

Use soft antibacterial soap, if possible. Avoid harsh abrasive soaps, as these may open fragile scabs or other sores. Because handwashing is so important, it is wise to be familiar with the nearest handwashing facilities. Public restrooms, janitor closets, and so forth may be used for handwashing if they are normally supplied with soap and clean paper towels.

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When one is working in an area without access to such facilities, an antiseptic cleanser or antiseptic hand wipes (“hand sanitizers”) may be used in conjunction with clean cloth/paper towels. If these alternative methods are used, hands should be washed with soap and running water as soon as feasible (OSHA, 2011d).

**HAND CLEANSING TECHNIQUE**

The following steps constitute the techniques outlined in the WHO guidelines for hand hygiene with **soap and water**. Caregivers are advised to follow the manufacturer’s recommendations about the product they are using.

**Duration of the entire procedure: 40–60 seconds.**

1. Wet hands with water.
2. Apply the amount of soap product necessary to cover all hand surfaces.
3. Rub hands palm to palm.
4. Rub right palm over left dorsum with interlaced fingers, and vice versa.
5. Rub palm to palm with fingers interlaced.
6. Rub backs of fingers to opposing palms with fingers interlocked.
7. Rub left thumb rotationally while clasped in right palm, and vice versa.
8. Rub clasped fingers of right hand rotationally in left palm, backwards and forwards, and vice versa.
9. Rinse hands with water. Avoid using hot water in order to decrease the risk of dermatitis.
10. Dry hands thoroughly with a single-use towel.
11. Use towel to turn off faucet.

The same technique is used when decontaminating hands with an **alcohol-based hand rub** (ABHR), however no water is used. Similarly, towels are not used for drying, as hands will quickly dry on their own. When using alcohol-based hand rubs, the CDC recommends healthcare personnel rub their hands until the alcohol evaporates and the hands are dry.

Source: CDC, 2012b. See also the WHO Guidelines on Hand Hygiene in Health Care, pages 155–156, for illustrations of this recommended hand hygiene technique (WHO, 2009).

**Engineering Controls**

Engineering controls isolate or remove bloodborne pathogens hazards from the workplace. They include any physical device or equipment used or installed to prevent occupational hazard exposure, illness, or injury. Examples of engineering controls include sharps disposal containers, self-sheathing needles, and safer medical devices, such as needleless systems.
Employers must select and implement appropriate engineering controls to reduce or eliminate employee exposure. It is important for workers to learn and use the engineering controls available in the work environment.

**SHARPS HANDLING**

Sharps are anything that can puncture the skin, such as needles, blades, scissors, or broken glass. A needlestick or a cut from a contaminated sharp can lead to infection from a bloodborne pathogen. Proper handling and disposal of sharps greatly reduces this risk. Sharps containers should be closable, puncture-resistant, and leak-proof on the sides and the bottom. They must be labeled or color-coded.

**HOW TO HANDLE SHARPS**

- Discard needle/syringe units without attempting to recap the needle whenever possible.
- If a needle must be recapped, **never** use both hands. Use the single-hand “scoop” method.
- Never break or shear needles.
- To move or pick up needles, use a mechanical device or tool, such as forceps, pliers, or broom and dustpan.
- Dispose of needles in labeled sharps containers only.
- When transporting sharps containers, close the containers immediately before removal or replacement to prevent spillage or protrusion of contents during handling or transport.
- Fill a sharps container up to the fill line, or two thirds full. Do not overfill the container.

**WARNING LABELS**

Warning labels need to be affixed to containers of regulated waste; refrigerators and freezers containing blood or OPIM; and other containers used to store, transport, or ship blood or OPIM. These labels are fluorescent orange, red, or orange-red. Bags used to dispose of regulated waste must be red or orange-red, and they too must have the biohazard symbol in a contrasting color readily visible upon them.
Regulated waste refers to:

- Any liquid or semi-liquid blood or other OPIM
- Contaminated items that would release blood or OPIM in a liquid or semi-liquid state if compressed
- Items that are caked with dried blood or OPIM and are capable of releasing these materials during handling
- Contaminated sharps

**EXPOSURE INCIDENTS**

If a needlestick or other sharps injury occurs and a healthcare worker is exposed to the blood or OPIM, he or she should immediately follow these steps:

- Wash needlesticks and cuts with soap and water.
- Flush splashes to the nose, mouth, or skin with water.
- If the eyes were involved in the exposure, irrigate eyes with clean water, saline, or sterile irrigation solution for 10 minutes.
- Report the incident to a supervisor—including how, when, where, and who—and describing the exposure event in as much detail as possible.
- Immediately seek medical treatment.

**Post-Exposure Follow-Up**

Employers must provide a written report explaining how a bloodborne pathogen might have entered the healthcare worker’s body and a description of risk during the exposure. The employer must identify the source individual (the patient involved in the exposure) unless the source individual is unknown or state or local law prohibits disclosure. If the source person is known, many states require that the person be tested for HBV and HIV and notified of the results. The healthcare worker’s blood must also be collected and tested after they have agreed to the test.

Medical care as the result of an exposure is provided by the employer at no charge to the healthcare worker. All test records are confidential. The healthcare worker must be given a copy of the healthcare professional’s written opinion with 15 days after the medical evaluation is finished. Post-exposure prophylaxis may be administered if medically necessary, as recommended by the U.S. Public Health Service. The healthcare worker should also be offered counseling that includes recommendations for transmission and prevention of HIV.
CASE

Robert is a nurse working in the emergency department. He is in the trauma bay when a patient arrives who has been in a car accident. The patient is actively bleeding out from the abdomen. Robert has a gown, gloves, mask, and goggles on as he cares for the patient. Robert applies pressure to the wound prior to stabilizing the patient. His gown and gloves become covered in blood as he works with the patient.

Later, as he is taking off the gloves, Robert notices that there is a hole in his left-hand glove and that his hands have been exposed to the patient’s blood. He also remembers that the day prior, he cut his left hand at home while he was chopping vegetables in his kitchen and forgot to cover the cut prior to starting his shift. The ED is so busy that he goes on with his shift and does not report the exposure.

The next day, the ED supervisor reports that the patient was found to be positive for HIV and asks the team to report any concerns. Robert is now faced with the possibility that he was exposed to HIV-positive blood. He immediately reports the blood exposure incident from the previous day. His supervisor takes all of the information and together they work closely with the infection control nurse to implement testing, post-exposure prophylaxis, and surveillance. As Robert starts his medical care, he also receives counseling to understand his risk for developing HIV as a result of the exposure.

The supervisor reinforces to Robert that it was important for him to report the exposure as soon as it happened. The supervisor also debriefs the remainder of the team to do the same any time an exposure occurs. The supervisor stresses the importance of protecting employee health and well-being as well as reviews the reporting requirements of the OSHA Bloodborne Pathogens Standard.

CONCLUSION

Protection of healthcare workers against bloodborne pathogens is of vital importance. Healthcare workers need to have an understanding of how bloodborne pathogens are transmitted as well as the standards and precautions recommended to prevent exposure. Standard Precautions, PPE, safe work practices, and environmental engineering together can break the chain of infection, reduce the risk of exposure, and ensure a safe working environment.
QUESTIONS PATIENTS MAY ASK ABOUT BLOODBORNE PATHOGENS

Q: If I accidentally get a patient’s blood on my hands, do I need to treat the incident as an exposure?

A: Yes. Wash the area with soap and water and report the occurrence to your supervisor as soon as possible. Your supervisor will determine the type of follow-up needed.

Q: How great is my risk for hepatitis B infection?

A: One out of 20 people living in the United States will become infected with the HBV at some time during their lives. Your risk is higher if you have a job that involves contact with human blood.

Q: How do I know if I have hepatitis?

A: A blood test is the only way to diagnose hepatitis.

Q: When should I get the hepatitis B vaccine?

A: The vaccination must be offered within 10 days of initial assignment to a job where exposure to blood or other potentially infectious materials can be anticipated.

Q: If I decline to take the vaccination, can I change my mind later?

A: Yes, you can decide to begin the vaccination series at any time.

Q: If I think I’ve been infected with HIV, how soon can I find out?

A: You will usually develop antibodies against the HIV virus within 6 to 12 weeks after becoming infected. Tests will not reveal whether you had been infected before that time.

Q: If dried blood were to get wet, could the HIV virus become active again?

A: No. Once a virus is no longer active, it cannot be “reconstituted” by adding water.
Q: Can I catch HIV from being in the same room or vehicle with someone who has the infection if they cough or sneeze?

A: No. HIV cannot be transmitted through sneezing or coughing (you cannot catch it like the common cold), or by shaking hands, hugging, sharing the water fountain, or sharing the rest room or work equipment.

Q: If the chances of being exposed to a patient with a contagious disease are low, why do I need to take precautions all the time?

A: It is not always possible to predict when an exposure will occur. Bloodborne pathogens are not visible, and you don’t know whether the patient you are working with is infected. Following Standard Precautions is the most effective way to safeguard against exposure to bloodborne pathogens.

Q: Can I refuse to do a job that will expose me to potential infection?

A: No. Standard Precautions do not allow you to refuse to take an assignment. However, your employer is required to provide you with the appropriate personal protective equipment and training to minimize your risk.

RESOURCES

Ebola Resources Guide
(American Association of Occupational Health Nurses)

Ebola Virus Disease (CDC)
http://www.cdc.gov/vhf/ebola/index.html

Guidance on Personal Protective Equipment To Be Used by Healthcare Workers During Management of Patients with Ebola Virus Disease in U.S. Hospitals, Including Procedures for Putting On (Donning) and Removing (Doffing). (CDC)
http://www.cdc.gov/vhf/ebola/hcp/procedures-for-ppe.html

HIV/AIDS (CDC)
http://www.cdc.gov/hiv/

National Healthcare Safety Network (CDC)
http://www.cdc.gov/nhsn/

OSHA Bloodborne Pathogens Standard

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PEPline Poster (CDC)
http://www.cdc.gov/niosh/topics/bbp/PEPline_poster.pdf

Updated U.S. Public Health Service Guidelines for the Management of Occupational Exposures to Human Immunodeficiency Virus and Recommendations for Postexposure Prophylaxis (Chicago Journals: Infection Control and Hospital Epidemiology)
http://www.jstor.org/stable/10.1086/672271

Viral Hepatitis (CDC)
http://www.cdc.gov/hepatitis/index.htm

REFERENCES


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TEST

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1. A circulating nurse in surgery is at most risk for exposure to bloodborne pathogens when working with which other potentially infectious material (OPIM)?
   a. A tissue biopsy from a patient with active hepatitis B
   b. The preservative used to fix a tissue sample
   c. A cancerous tumor from a patient with breast cancer
   d. The cleaning agent used to disinfect hard surfaces in the operating room

2. The OSHA Bloodborne Pathogens Standard requires employers to establish an exposure control plan, provide personal protective equipment, train employees, and:
   a. Implement engineering controls to reduce risk of exposure.
   b. Solicit employee input regarding the types of warning labels to be used on new products.
   c. Offer employees prescreening for hepatitis B titer before administering the vaccine.
   d. Establish a method of identifying the cost of exposure control practices.

3. Which is an incorrect statement describing the chain of infection as it applies to bloodborne diseases?
   a. The reservoir can be a patient who currently has and/or has had the disease in the past.
   b. Transmission may occur by direct or indirect means.
   c. Any amount of transmitted blood or OPIM can cause an infection in any host.
   d. The host’s immunity and general ability to resist infection can influence susceptibility.

4. A nurse is administering an intramuscular injection to a patient with HIV. What is the potential means of HIV transmission that the nurse should be aware of in this clinical scenario?
   a. Having exposure to the patient’s skin
   b. Receiving a needlestick injury
   c. Touching the patient’s blood with a gloved hand
   d. Forgetting to wear a surgical gown

5. Which two diseases are considered the most common bloodborne pathogens for healthcare workers?
   a. Syphilis and tuberculosis
   b. Hepatitis A and influenza
   c. Hepatitis A and pneumonia
   d. Hepatitis B and HIV
6. A definitive diagnosis of hepatitis B can be made from 1 to 9 weeks after exposure to the hepatitis B virus using which method?
   a. Testing a stool specimen
   b. Evaluating patient symptoms
   c. Collecting a saliva specimen
   d. Conducting a blood test

7. Which bloodborne virus is known for its resiliency and ability to survive outside of the human body on wet or dry surfaces for up to seven days?
   a. Hepatitis B virus
   b. Influenza A virus
   c. Human immunodeficiency virus
   d. Hepatitis A virus

8. Which exposure incident poses the greatest risk for a bloodborne pathogen infection?
   a. A nurse sustains a needlestick while drawing insulin to administer to a patient with diabetes and a blood glucose level of 326 mg/dL.
   b. A lab worker is splashed in the eye with urine from a patient who is diagnosed with a hepatitis A infection.
   c. An emergency medical technician with an open sore on the hand wears a torn glove to apply a pressure dressing to a laceration on a patient with a hepatitis C infection.
   d. A housekeeper’s intact skin comes into contact with a patient’s feces while cleaning the hospital bathroom.

9. A nurse accepts a position working on a medical surgical unit of a hospital. During orientation the nurse learns that he will need which vaccine as dictated by the OSHA Bloodborne Pathogens Exposure Control Plan?
   a. Hepatitis A vaccine
   b. Hepatitis B vaccine
   c. Pneumococcal vaccine
   d. Hepatitis C vaccine

10. Which is a true statement about Standard Precautions?
    a. The use of Standard Precautions is limited to settings where exposure to blood may be expected.
    b. Before implementing Standard Precautions, it is advisable to determine if the patient is contagious.
    c. Standard Precautions are implemented regardless of the perceived status of the source individual.
    d. Engineering and work practice controls are not required if Standard Precautions are implemented.
11. What is the single most important practice to prevent transmission of bloodborne pathogens?
   a. The isolation of infected patients
   b. Hand hygiene
   c. Prompt and thorough reporting
   d. The use of gloves

12. Three types of personal protective equipment that offer protection to a nurse who is working with a patient diagnosed with active hepatitis B infection include:
   a. Hard hats, surgical scrubs, and gloves.
   b. Gloves, mask, and hand wash.
   c. Gloves, goggles, and gowns.
   d. Particulate respirator masks, eye protection, and hand wash.

13. Which is a true statement regarding PPE guidance when working with patients infected with Ebola virus?
   a. PPE donning/doffing must be supervised by a trained observer each time.
   b. PPE donning/doffing procedures and protocols are the same as for all other bloodborne pathogens.
   c. PPE guidelines do not recommend the use of double gloves.
   d. PPE guidelines do not recommend frequent disinfection of gloved hands using an alcohol-based hand rub.

14. Which is an example of an engineering control used to protect a nurse who works in an infusion center?
   a. Prohibiting food storage in a medication refrigerator
   b. Reviewing patient records to identify proper documentation of clinical data
   c. Using self-sheathing needles to prepare and administer medications
   d. Handwashing after possible exposure to infectious material

15. Containers used to store, transport, and dispose of regulated waste must be identified with warning labels colored:
   a. Orange, red, or orange-red.
   b. Black, brown, or gray.
   c. Yellow or gold.
   d. Blue or blue-green.
16. A nurse is providing pain medication via intramuscular injection to a post-operative patient when an accidental needlestick to the nurse’s hand occurs. The most appropriate response is for the nurse to:

a. Not report the exposure incident because the patient does not have a suspected diagnosis.

b. Report the exposure incident immediately to the supervisor.

c. Finish the shift and report the exposure incident the following day.

d. Report the exposure incident only if the patient has tested positive for potential bloodborne pathogens.