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Contact Hours: **2**

Bloodborne Pathogens Training

OSHA's Bloodborne Pathogens Standard

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LEARNING OUTCOME AND OBJECTIVES: Upon completion of this continuing education course, you will have the knowledge 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. Specific learning objectives to address potential knowledge gaps include:

- State the OSHA definition for blood and other potentially infectious materials.
- Summarize 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.
- Discuss types of personal protective equipment, work practices, and engineering controls that reduce risk of exposure to bloodborne pathogens.
- Summarize employer and employee actions to be taken in case of an occupational exposure to a bloodborne pathogen.

INTRODUCTION

Bloodborne pathogens are microorganisms that may be present in human blood and can cause disease. There are a number of bloodborne pathogens, and those of primary concern are the human immunodeficiency virus (HIV), hepatitis B virus (HBV), and hepatitis C virus (HCV).

Exposure to blood and other body fluids that may contain blood occurs in the general population as well as in a wide variety of occupations that include healthcare workers, emergency response

and public safety personnel, those working in maintenance, and those working in the waste handling industry. Individuals in these occupations can be exposed to blood through needlestick and other sharps injuries as well as through contacts with mucous membranes and skin.

Recognizing the risk for those working in these occupations has resulted in efforts to ensure their safety in the workplace, and guidance is contained in the Occupational Safety and Health Administration (OSHA) Bloodborne Pathogens Standard. Occupational exposure to bloodborne pathogens is often preventable.

Exposure Incidence

The U.S. Exposure Prevention Information Network (EPINet) Sharps Injury and Blood and Body Fluid Exposure Surveillance Research Group collects data annually from healthcare facilities around the United States. Participating hospitals vary in size, geographic location, and teaching status. The exposure patterns, however, are very similar, suggesting a high degree of standardization among medical devices and procedures.

In 2019 there were a total of 1,324 **needlestick** and **sharp object injury** records reviewed. Of this total:

- Nurses incurred 483 exposures.
- The next highest number (368) occurred among attending physicians, interns, residents, and fellows.
- A total of 547 occurred in the operating and recovery rooms, and 341 in patient rooms or wards.
- A contaminated sharp object was involved in 1,137 injuries. A total of 202 of these occurred while giving an injection and 220 while suturing.
- The highest number of injury-causing devices were suture needles (303) followed by disposable syringes (252).
- “Safety design” needles or medical devices were involved in 217 injuries, and safety mechanisms were not activated in 146 of those.

In that same year, there were 639 **blood and body fluid exposure** records reviewed. Of this total:

- Nurses incurred 352 exposures.
- The greatest number of exposures (272) occurred in patient rooms or wards.
- The majority of exposures were to blood or blood products (277).
- The barrier most commonly worn was a single pair of gloves (201).
- A total of 128 were the result of direct patient contact.
- The greatest number of exposures (310) was to the eyes (conjunctivae). (ISC, 2019)



OSHA BLOODBORNE PATHOGENS STANDARD

The Occupational Safety and Health Administration, 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 continues to be updated regularly, with the most recent update from April 2012 (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. OSHA regularly inspects healthcare agencies for compliance and may fine employers if infractions are identified.

BLOOD AND OTHER POTENTIALLY INFECTIOUS MATERIALS

All occupational exposures to blood or other potentially infectious materials place workers 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
- All body fluids in situations where it is difficult or impossible to differentiate between body fluids



- Any unfixed tissue or organ (other than intact skin) from a human (living or dead)
- HBV- and 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
- Human breast milk (implicated in transmitting HIV and HBV from mother to infant and being an exposure risk for healthcare workers frequently exposed to breast milk)

(OSHA, 2012; CDC, 2020; CDC, 2015)

In general, OSHA's Bloodborne Pathogens Standard (OSHA, 2012) requires employers to do the following:

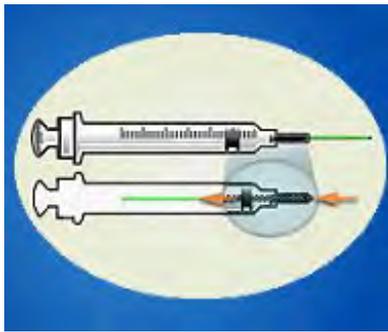
1. **Establish a written exposure control plan** designed to eliminate or minimize employee exposure to bloodborne pathogens. Employers must:
 - Prepare an exposure determination that contains a list of job classifications in which **all** workers have occupational exposure and a list of job classifications in which **some** workers have occupational exposure, along with a list of the tasks and procedures performed by those workers that could result in exposure
 - Ensure that a copy of the exposure control plan is accessible to employees
2. **Update the exposure control plan at least 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
 - 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 as if known to be infectious for bloodborne pathogens.
 - Under circumstances in which differentiation between body fluid types is difficult or impossible, all body fluids shall be considered potentially infectious materials.



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.
- Engineering controls shall be examined and maintained or replaced on a regular schedule to ensure their effectiveness.

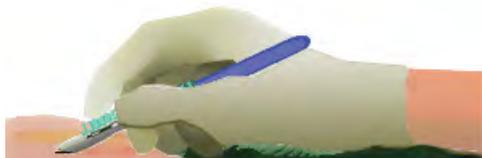
ENGINEERING CONTROL DEVICE EXAMPLES



Syringe with retractable needle.



Self-resheathing needle.



Resheathing disposable scalpel.





Phlebotomy needle with hinged shield as an add-on safety feature.

(OSHA, 2020)

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.
- Employers shall provide handwashing facilities that are readily accessible to employees. When this is not feasible, appropriate antiseptic hand cleanser in conjunction with clean cloth/paper towels or antiseptic towelettes shall be available.
- Employers should ensure that employees wash their hands immediately or as soon as feasible after removal of gloves or other personal protective equipment.

6. 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.

WARNING LABELS

Warning 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 (OSHA, 2012).





7. **Provide personal protective equipment (PPE)**, such as, but not limited to, gloves, gowns, laboratory coats, face shields or masks and eye protection, mouthpieces, resuscitation bags, pocket masks, or other ventilation devices
 - Employers must clean, repair, and replace this equipment as needed. Provision, maintenance, repair, and replacement are at no cost to the worker.
8. **Make available hepatitis B vaccinations** to all workers with occupational exposure
 - Vaccination must be offered after the worker has received the required bloodborne pathogens training and within 10 days of initial assignment to a job with occupational exposure.
9. **Make available postexposure 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.
 - 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 if the source individual consents or the law does not require consent; collecting and testing the exposed worker's blood, if the worker consents; offering postexposure 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.
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

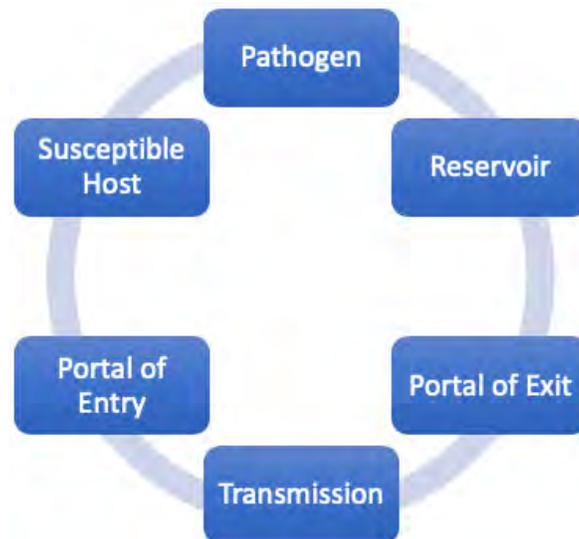
used to control occupational exposure, hepatitis B vaccine, and medical evaluation and postexposure follow-up procedures.

- 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

Epidemiology involves knowing how disease spreads and how it can be controlled. Infection can only spread when conditions are right. This set of conditions is referred to as the *chain of infection*, which consists of six links. When all the links are connected, infection spreads (APIC, 2020).



Chain of infection.

(Source: Wild Iris Medical Education, Inc.)

- **Infectious organisms** (pathogens) can be bacteria, viruses, fungi, or parasites.
- A **reservoir** of an infectious agent is the habitat where the agent normally lives and grows. Reservoirs may be dirty surfaces and equipment, humans, animals/insects, or soil. 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. This can occur through open wounds/skin, the splatter of body fluids, aerosols, or needle or other sharps contamination.
- 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. Portal of entry for bloodborne pathogens can include broken or punctured skin, incisions, mucous membranes, and across the placenta to fetus.
- The final link is the **susceptible host**. Susceptibility of a host depends on many factors, including immunity and the individual's ability to resist infection.
(APIC, 2020)

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.

PATHOGENS

Bloodborne pathogens are microorganisms present in human blood or OPIM that can cause disease in humans. Many are relatively rare, such as malaria, syphilis, Zika virus, and Ebola virus. Others are more common, such as the hepatitis B and C viruses, which cause inflammation of the liver, and the human immunodeficiency virus (HIV), which causes acquired immunodeficiency syndrome (AIDS) (OSHA, 2012).

Hepatitis B Virus (HBV)

Hepatitis B is an infection of the liver caused by the hepatitis B virus. For some people, hepatitis B is an acute or short-term illness that typically lasts for several weeks but can persist for up to six months. For others, however, hepatitis B infection can become a chronic, long-term infection. Disease is more severe among adults over the age of 60 years. Approximately 25% of those who become chronically infected by HBV during childhood and 15% of those after childhood die prematurely from cirrhosis or liver cancer, and most remain asymptomatic until onset of cirrhosis or end-stage liver disease.

The risk for chronic infection varies according to the age at time of infection and is greatest among young children. Approximately 90% of infants and 25%–50% of children aged 1–5 years will remain chronically infected with HBV. By contrast, approximately 95% of adults recover completely from HBV infection and do not become chronically infected.



In 2016, an estimated 862,000 people were living with HBV infection in the United States, and in 2018, a total of 3,322 new cases of acute hepatitis B were reported. The overall incidence rate for 2018 was 1.0 cases per 100,000 population. After adjusting for under-ascertainment (cases that do not seek healthcare) and under-reporting, an estimated 21,600 hepatitis B cases occurred in 2018. During that same year, a total of 1,649 U.S. death certificates indicated HBV as an underlying or contributing case of death; however, this is a conservative estimate (CDC, 2020a).

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 that can break the skin or mucous membranes (such as razors, toothbrushes, or medical equipment [e.g., glucose monitor]) with an infected person

Hepatitis B is **not transmitted** through:

- Breastfeeding
- Sharing eating utensils
- Hugging, kissing, holding hands
- Coughing or sneezing
- Contaminated food or water (unlike some other forms of hepatitis)

HBV is very resilient and can survive outside the body at least seven days and still be capable of causing infection. 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 (CDC, 2020a).

HBV 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. The vaccine and vaccination must be offered at no cost to the employee and at a reasonable time and place (OSHA, 2012).

The vaccination consists of a series of three intramuscular injections. The second injection should be given one month after the first, and the third injection six months after the initial dose. Schedules have been approved for certain vaccines and/or populations. A new formulation, Heplisav-B, is approved for two doses, one month apart. To ensure immunity, it is important to receive all recommended 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.

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 (OSHA, 2012; CDC, 2020a).

POSTEXPOSURE MANAGEMENT

Following an exposure to HBV, prophylaxis can prevent HBV infection and subsequent development of chronic liver infection. The central component of postexposure prophylaxis is hepatitis B vaccine, which provides long-term protection. The vaccine series should be started as soon as possible after exposure, preferably within 24 hours. In certain circumstances, hepatitis B immune globulin is recommended in addition to vaccine to provide short-term passive immunity (CDC, 2020b).

Hepatitis C Virus (HCV)

Hepatitis C is a serious infection of the liver caused by the hepatitis C virus, a bloodborne pathogen. For some people, hepatitis C is a short-term illness, but for more than 50% of those who become infected, it becomes a long-term, chronic infection that can result in serious, even life-threatening health problems such as cirrhosis and liver cancer. People with chronic hepatitis C may have no symptoms, but when symptoms do appear, they are often a sign of advanced liver disease.

It is estimated that 50,300 acute hepatitis C cases occurred in 2018, and a total of 3,621 were reported to the CDC. An estimated 2.4 million people in the United States were living with hepatitis C during 2013–2016.

Because the hepatitis C virus has multiple genotypes and subtypes and mutates rapidly, there is no vaccine (CDC, 2020c).



TRANSMISSION

Hepatitis C transmission occurs mainly through parenteral exposures to infectious blood or body fluids that contain blood. Injection drug use is the most common means of transmission in the United States. Due to screening methods, hepatitis C infection rarely occurs in the United States from transfusion of donated blood, blood products, or from organ transplants. Other methods of transmission include needlesticks in healthcare settings and being born to an HCV-infected mother (CDC, 2020c).

POSTEXPOSURE MANAGEMENT

The risk of HCV transmission after percutaneous exposure is approximately 0.2% when the source patient is HCV-infected. Postexposure prophylaxis with antivirals are not currently available or approved for HCV. Following exposure, initial management includes baseline testing of the source patient and the healthcare worker as soon as possible (preferably within 48 hours) after exposure, with initial follow-up in six weeks and final follow-up in six months.

Personnel who become infected with HCV should be referred to a healthcare provider for initiation and management of antiviral therapy and to receive interventions and education aimed at reducing liver disease progression and the prevention of HCV transmission (CDC, 2020c; NCCC, 2020).

Human Immunodeficiency Virus (HIV)

HIV has existed in the United States since at least the mid- to late-1970s. The virus spreads via blood and other body fluids and attacks the body's immune system, specifically the CD4⁺ T cells. Untreated HIV reduces the number of T cells in the body, which makes it more and more difficult for the body to fight off infections and other diseases. There currently is no effective cure for HIV infection, and once an individual becomes infected with it, they have it for life. Opportunistic infections or cancers take advantage of a very weak immune system and are signs that a person has AIDS (acquired immunodeficiency syndrome).

There was a 7% decrease in the annual number of new HIV diagnoses from 2014 to 2018 in the United States and dependent territories. In 2018, 37,968 people received an HIV diagnosis, and an estimated 1.2 million people were living with HIV. Of these people, about 14% (1 in 7) did not know they were infected (CDC, 2020d).

TRANSMISSION

HIV is transmitted most commonly in the United States through sexual behaviors and sharing of needles, syringes, or equipment used to prepare drugs for injection. Only certain body fluids—blood, semen, pre-seminal fluid, rectal fluids, vaginal fluids, and breast milk—from a person who is infected can transmit HIV. These fluids must come in contact with a mucous membrane or damaged tissue or be directly injected into the bloodstream for transmission to occur.



For healthcare workers, the risk of occupational exposure is very low. The main risk is from being stuck with an HIV-contaminated needle or other sharp object. This risk, however, is small and estimated to be less than 1%. HIV contamination has also been reported by healthcare workers from body fluid splashes to the eye, the risk of which is near zero. Only 58 cases of confirmed occupational HIV transmission to healthcare personnel and an additional 150 possible transmissions have been reported in the United States.

There is no vaccine to prevent HIV infection, but HIV prevention medications such as pre-exposure prophylaxis (PrEP) and post-exposure prophylaxis (PEP) are available. The best way for healthcare workers to protect against infection is by strict adherence to Standard Precautions (CDC, 2020d).

POSTEXPOSURE MANAGEMENT

Occupational exposures require urgent medical evaluation. Baseline HIV testing of the source patient and the exposed worker should be done as soon as possible and periodically for at least six months after exposure.

PEP should be initiated as soon as possible within a maximum of 72 hours after a recent possible exposure to HIV, but the earlier PEP is started, the better. The preferred HIV occupational postexposure prophylaxis regimen is Truvada orally once a day plus Isentress (raltegravir) orally twice a day or Tivicay (dolutegravir) once a day for a duration of 28 days. A first dose of PEP should be offered while evaluation is underway and should not be delayed while awaiting information about the source person or results of the exposed worker's baseline HIV test.

If the source person tests negative for HIV, PEP should be discontinued, and no follow-up HIV testing is clinically indicated for the exposed worker. If positive, the exposed worker should be retested for HIV at six weeks and three months (NCCC, 2020).

Ebola Virus

Ebola virus disease (EVD) (previously known as *Ebola hemorrhagic fever*) is a rare and deadly disease caused by a strain of the Ebola virus. EVD is often fatal if untreated. There are five identified Ebola virus species, four of which are known to cause disease in humans.

EVD was originally discovered in Africa in 1976 near the Ebola River in the Republic of Congo. The natural host of the Ebola virus is thought to be animal-borne, specifically tied to bats. Since the discovery of the Ebola virus, 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, 2019a).

TRANSMISSION

The Ebola virus is transmitted through direct contact (broken skin or mucous membranes) with:



- Blood or body fluids of a person who has Ebola or has died from Ebola (proven to be one of the most dangerous and effective methods of transmission)
- Contaminated objects such as needles and syringes, medical equipment, surfaces, bedding, or clothing
- Infected fruit bats or primates
- Possibly from contact with semen from a man who has recovered from Ebola

The virus can remain in certain body fluids (including semen) of a patient who has recovered from EVD even if they no longer have symptoms of severe illness. There is no evidence that Ebola can be spread through sexual or other contact with vaginal fluids.

Ebola virus can survive on dry surfaces like doorknobs and countertops for several hours and in body fluids like blood for up to several days at room temperature. Ebola can remain in areas of the body where viruses and pathogens are shielded from the immune system, even after being cleared elsewhere in the body. These areas include the testes, interior of the eyes, placenta, and central nervous system, particularly the cerebrospinal fluid (CDC, 2019a).

In December of 2019, the FDA approved the vaccine rVSV-ZEBOV (Ervebo) for prevention only against the *Zaire ebolavirus* species of ebolavirus. The vaccine, supported by a study conducted in Guinea during the 2014–2016 outbreak, was found to be 100% effective (FDA, 2019).

POSTEXPOSURE MANAGEMENT

Asymptomatic healthcare personnel who experience unprotected exposure (not wearing recommended PPE at time of patient contact or through direct contact with blood and body fluids) to a patient with EVD should receive medical evaluation and follow-up care, including fever monitoring twice daily for 21 days after the exposure.

Healthcare personnel who develop sudden onset of signs and symptoms of EVD should seek prompt medical evaluation and testing.

Hospitals should consider policies ensuring twice-daily contact with exposed personnel to discuss potential symptoms and document fever checks (CDC, 2018).

Zika Virus

Zika virus disease is caused by the Zika virus (*Aedes aegypti* and *Aedes albopictus*), which is found worldwide. Although the illness is usually mild, Zika infection during pregnancy can cause serious birth defects such as microcephaly (smaller than normal head) as well as absent or poorly developed brain structures, defects of the eye, hearing deficits, and impaired growth. It is also associated with other complications, including preterm birth and miscarriage. Zika is also a trigger, particularly in adults and older children, of Guillain-Barré syndrome (a rare condition



that can result in near to total paralysis and/or death if severe), as well as neuropathy and myelitis (WHO, 2018).

TRANSMISSION

Zika virus is primarily spread through the bites of infected *Aedes* species mosquitoes. Mosquitoes can become infected when they bite infected persons and can then spread the Zika virus to other persons they subsequently bite. Other modes of transmission include:

- While rare, during pregnancy and through the birthing process
- Sexual contact (Zika virus can stay in semen longer than in other body fluids)
- Blood transfusion
- Bloodborne exposure

POSTEXPOSURE MANAGEMENT

As of 2018, there have been no cases of Zika virus transmission in healthcare settings and no confirmed Zika cases from blood transfusions in the United States. There currently is no vaccine available and no specific medicine to treat Zika.

In the event of an exposure, it is recommended that the worker receive prompt and appropriate medical evaluation and follow-up, complying with OSHA's BBP standard (CDC, 2019b).

EXPOSURE PREVENTION

It is important for all healthcare workers to understand the role they play in protecting themselves, coworkers, patients, and families from exposure to bloodborne pathogens. The employer's exposure control plan provides the following detailed information about how each healthcare worker can take appropriate steps to reduce or eliminate the risk of exposure to bloodborne pathogens as well as other infectious agents.

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 OPIM 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 with 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, 2012).

These precautions are intended to address all modes of transmission by any type of organism. Routes of transmission include:

- **Contact** (direct or indirect):
 - Direct contact is transfer of microorganisms from one infected person to another without a contaminated intermediate object or person (e.g., blood splatter).
 - Indirect contact involves transfer of an infectious agent through a contaminated intermediate object or person (e.g., needlestick, other sharp object). Contaminated hands of healthcare personnel are important contributors to indirect contact transmission.
- **Droplet:** Transmission of infection (e.g., coronavirus, influenza virus) traveling directly from the respiratory tract of infectious individuals to susceptible mucosal surfaces of the recipient, generally over short distances, necessitating facial protection.
- **Airborne:** Transmission by dissemination of either airborne droplet nuclei or small particles containing infectious agents (e.g., *Mycobacterium tuberculosis*) that remain infective over time and distance, requiring the use of special air handling and ventilation systems.
(CDC, 2019c)

Standard Precautions for Bloodborne Pathogens

The Standard Precautions that are to be followed by all healthcare workers when concerned with bloodborne pathogens or other potentially infectious materials include:

1. Performing hand hygiene
2. Using personal protective equipment (PPE) whenever there is an expectation of possible exposure to infectious material
3. Following respiratory hygiene/cough etiquette principles
4. Ensuring appropriate patient placement
5. Properly handling and properly cleaning and disinfecting of patient care equipment and instruments/devices; appropriate cleaning and disinfecting of the environment
6. Handling textiles and laundry carefully
7. Wearing a surgical mask when performing lumbar punctures



8. Ensuring healthcare safety by proper handling of regulated waste, including proper handling of needles and other sharps
(CDC, 2019d)

HAND HYGIENE

Hand hygiene is the first line of defense, the single most important practice in preventing the spread of infectious agents. Hand hygiene in Standard Precautions means cleaning the hands with either soap and water, antiseptic hand wash/rub, or surgical hand antisepsis. Hand hygiene is done to reduce the spread of potentially infectious agents from healthcare workers to patients and from patients to healthcare workers.

The CDC advises healthcare workers who are delivering healthcare to avoid unnecessary touching of surfaces in close proximity to the patient to prevent both contamination of clean hands from environmental surfaces and transmission of pathogens from contaminated hands.

Hand hygiene should be performed:

- Before eating
- Before and after having direct contact with a patient's intact skin
- After contact with blood, body fluids or excretions, mucous membranes, nonintact skin, or wound dressings
- After contact with inanimate objections (including medical equipment) in the immediate vicinity of the patient
- When hands will be moving from a contaminated body site to a clean body site during patient care
- After glove removal
- After using a restroom
(CDC, 2019d)

Recommendations regarding **fingernails** state:

- Healthcare providers should not wear artificial fingernails or extensions when having direct contact with patients at high risk (e.g., those in ICU or ORs). Pathogens can live under artificial fingernails both before and after use of an alcohol-based hand sanitizer and handwashing.
- Keep natural nail tips less than 1/4-inch long.



HAND HYGIENE WITH SOAP AND WATER OR HAND SANITIZER

The CDC guidelines for hand hygiene in healthcare settings recommend:

When using soap and water:

- Wet hands with clean running water (warm or cold) and apply the amount of product recommended by the manufacturer to hands.
- Lather hands by rubbing them together. Lather the back of the hands, between fingers, and under nails.
- Scrub hands for 15 to 20 seconds.
- Rinse hands well under clean running water.
- Dry hands using a disposable towel. Use a clean disposable towel to turn off the faucet.

When using an alcohol-based hand sanitizer:

- Apply the amount of product recommended by the manufacturer to the palm of one hand.
- Rub hands together.
- Rub the product over all the surfaces of the hands and fingers until hands are dry; this should take about 20 seconds.

(CDC, 2020e)

PERSONAL PROTECTIVE EQUIPMENT (PPE)

To protect oneself, healthcare providers must have a protective barrier between them and any potentially infectious material. Personal protective equipment is defined by OSHA as specialized clothing or equipment worn by a healthcare worker for protection against infectious materials.

Employers are required to provide and maintain clean, 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.

Types of PPE used in healthcare settings to protect healthcare workers from exposure to bloodborne pathogens include:

- Gloves
- Gowns, aprons, coveralls, laboratory coats
- Masks, face shields, goggles



- Ventilation devices: mouthpieces, pocket masks, resuscitation devices
- Head coverings
- Boots/shoe covers
- Respirators

Factors that influence the **selection of appropriate PPE** include:

- Type of exposure anticipated
 - Splash/spray versus touch
 - Category of isolation precautions (Contact, Droplet, Airborne)
- Durability and appropriateness for the task
- Fit of the equipment

Gloves

Gloves are the most common type of PPE. They are used for patient care as well as when contacting environmental surfaces. Gloves can be sterile or nonsterile and single use or reusable. Because of allergy concerns, latex products have been eliminated in many facilities, and materials used for gloves are mostly synthetics such as vinyl or nitrile.

Most patient care activities require the use of a single pair of nonsterile gloves. Sterile surgical gloves are worn when performing invasive patient procedures. At times two pairs of gloves may be worn for additional protection during surgical procedures. Environmental service personnel often wear reusable heavy-duty gloves to work with caustic disinfectants.

Proper glove use includes:

- Performing hand hygiene prior to donning gloves and before touching the patient or the patient environment
- Working from clean to dirty
- Limiting touch contamination (e.g., adjusting eyeglasses, touching light switches, etc.) when wearing gloves that have been in contact with a patient
- Changing gloves during use if torn, when heavily soiled, and after use on each patient
- Removing gloves carefully to avoid contamination
- Disposing of gloves in a proper receptacle
- Performing hand hygiene immediately following removal of gloves



- Never wearing the same pair of gloves in the care of more than one patient
- Never washing or reusing disposable gloves
(CDC, 2020f)

Gowns/Aprons

Gowns or aprons can be natural or human-made, reusable or disposable, resistant to fluid penetration, and clean or sterile. Sterile gowns are only required when performing invasive procedures.

Isolation gowns are preferred, but aprons occasionally are used where limited contamination is expected. Gowns should fully cover the torso, fit comfortably over the body, and have long sleeves that fit snugly at the wrist.

A waterproof apron is often worn during surgical or obstetrical procedures when a large volume of blood or body fluids are anticipated.

Proper use of gowns, aprons, and coveralls include:

- Wear a gown that is appropriate to the task to protect skin and prevent soiling or contamination of clothing.
- Wear a gown for direct patient contact if the patient has uncontained secretions or excretions.
- Remove gown and perform hand hygiene before leaving the patient's environment.
- Do not reuse gowns, even for repeated contacts with the same patient.
(CDC, 2019d)

Mouth, Nose, and Eye Protection

Face and eye protection are used during procedures and patient care activities likely to generate splashes or sprays of blood, body fluids, secretions, or excretions. Select PPE according to the need anticipated by the task to be performed.

- **Masks** protect the nose and mouth and should fully cover them to prevent fluid penetration.
- **Goggles** protect the eyes and should fit over and around them snugly. Personal prescription glasses are **not** a substitute for goggles. Some goggles have antifog features that improve clarity.
- **Face shields** protect the face, nose, mouth, and eyes. A face shield should cover the forehead, extend below the chin, and wrap around the sides of the face.
(CDC, 2019d)



Head Coverings

Head coverings such as surgical caps are worn when gross contamination is expected, such as during orthopedic surgery or autopsies (OSHA, 2012).

Boots/Shoe Covers

Theater boots are waterproof boots worn by surgical personnel as a protective measure from contamination with blood and other body fluids. Shoe covers protect the wearer from accidental spills and bodily fluids (OSHA, 2012).

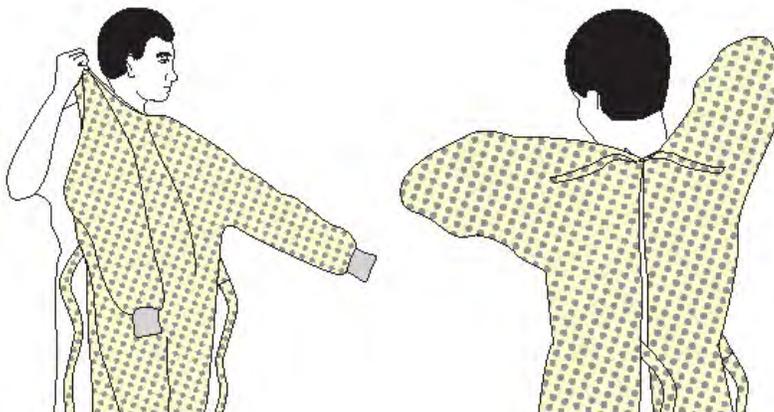
PUTTING ON PPE

There are various ways to put on PPE. Training and practice using the healthcare facility's procedure is critical. The CDC recommends that PPE be put on (donned) in the following sequence:

1. Gown
2. Mask or N95 filtering respirator
3. Face shield or goggles
4. Gloves

How to put on a gown:

1. Select appropriate type and size.
2. Perform hand hygiene using hand sanitizer.
3. Put on with opening in the back.
4. Secure at neck and waist.
5. If gown is too small, use two gowns, with the first tied in front and the second tied in back.



How to put on a respirator:

1. Respirator straps should be placed on the crown of the head (top strap) and base of the neck (bottom strap). Perform a user seal check each time putting on the respirator.

How to put on a mask:

1. Place over nose, mouth, and chin.
2. Fit flexible nose piece over bridge of nose using both hands. Do not bend or tent. Do not pinch the nosepiece with one hand.
3. Ensure facemask extends under the chin.
4. Mask ties should be secured on the crown of the head (top tie) and base of the neck. If the mask has loops, hook them appropriately around the ears.



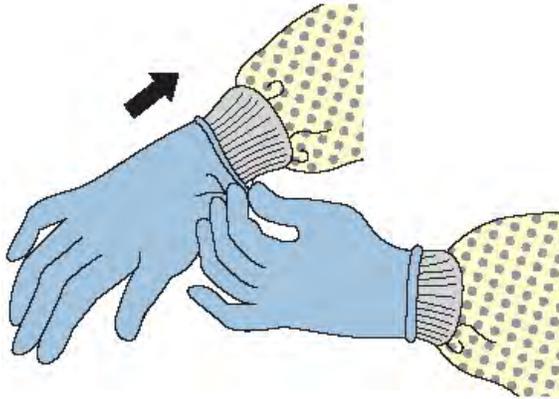
How to put on goggles and face shield:

1. Place over face and eyes.
2. Adjust to fit.



How to put on gloves:

1. Select correct type and size.
2. Insert hands into gloves.
3. Extend gloves over isolation gown cuffs (wrists).



(CDC, 2020g)

REMOVING PPE

More than one doffing method may be acceptable. Training and practice using the healthcare facility's procedure is critical. The following is one example of doffing recommended by the CDC.

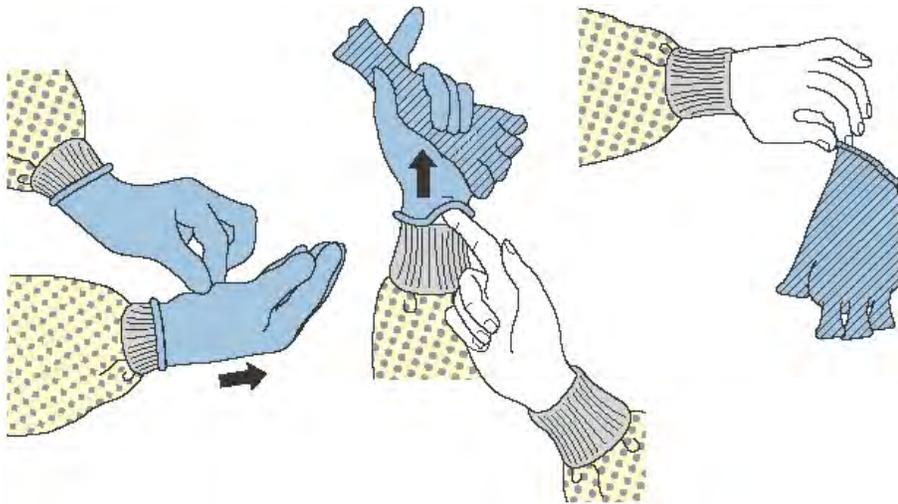
Contaminated PPE should be removed in the following sequence:

1. Gloves
2. Gown
3. Hand hygiene and exit patient room
4. Face shield or goggles
5. Mask or respirator
6. Hand hygiene



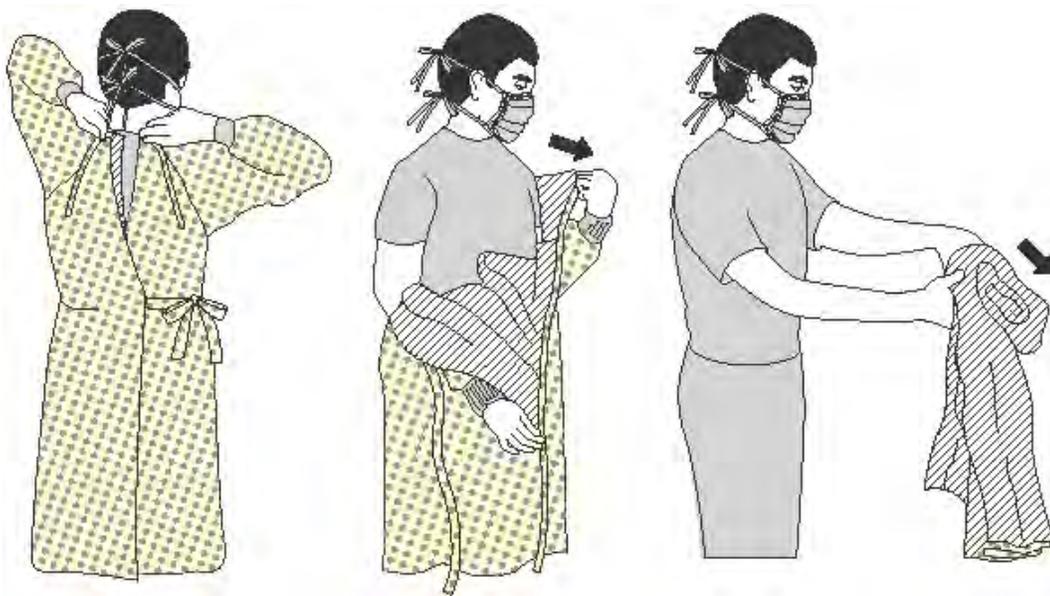
How to remove gloves:

1. Grasp outside edge near wrist.
2. Peel away from hand, turning glove inside out.
3. Hold in opposite gloved hand.
4. Slide ungloved finger under wrist of remaining glove.
5. Peel off from inside, creating a bag for both gloves.
6. Discard.
7. Perform hand hygiene if contamination occurs.



How to remove gown:

1. Consider gown front and sleeves to be contaminated.
2. Unfasten ties. (Some gown ties can be broken rather than untied.)
3. Peel gown away from neck and shoulders, touching inside of gown only.
4. Turn contaminated outside toward the inside.
5. Fold or roll into a bundle and discard.
6. Perform hand hygiene before exiting the patient area.



How to remove goggles or face shield:

1. Consider outside of goggles or face shield to be contaminated.
2. Grasp ear- or headpieces from the back with ungloved hands by lifting head band or ear pieces.
3. Lift away from face.
4. Place in designated receptacle for reprocessing or disposal.
5. Perform hand hygiene if contamination occurs.



How to remove mask or respirator:

1. Consider front of mask or respirator to be contaminated; do not touch.
2. Respirator: Remove the bottom strap of the respirator by touching only the strap and bringing it carefully over the head. Grasp the top strap and bring it carefully over the head. Then pull the respirator away from the face without touching the front of it.
3. Facemask: Carefully untie (or unhook from the ears) and pull away from face without touching the front.
4. Discard.
5. Perform hand hygiene.



(CDC, 2020g)



ENHANCED PRECAUTIONS AGAINST EBOLA VIRUS TRANSMISSION

The CDC provides guidance for healthcare workers who are caring for a person with confirmed Ebola or persons under investigation for Ebola. This guidance recommends:

1. Healthcare workers caring for patient with Ebola or persons under investigation for Ebola are required to receive comprehensive training and have demonstrated competency in performing Ebola-related infection control practices and procedures.
2. Personal protective equipment that covers the clothing and skin and completely protects mucous membranes is required:
 - A disposable **impermeable gown** extending to at least mid-calf or disposable **coverall**, preferably without a hood. Coveralls with or without integrated socks are acceptable.
 - Disposable **apron** covering the torso to level of mid-calf should be used over the gown or coveralls if the patient is vomiting or has diarrhea. An apron should be used routinely if the facility is using a coverall that has an exposed, unprotected zipper in the front.
 - Disposable **examination gloves** with extended cuffs. Two pairs of gloves should be worn so that a heavily soiled outer glove can be removed and replaced safely during care.
 - Disposable **boot covers** that extend to at least mid-calf. Disposable ankle-high **shoe covers** (surgical booties) worn over boot covers may also be considered.
 - An **N-95 respirator** with a disposable surgical hood extending to the shoulders and fully covering the neck. Alternatively, a **PAPR** can be used that includes a full face shield, helmet, or headpiece and disposable hood.
 - Full **face shield**.

When personnel are providing care to patients with Ebola, they must be supervised by an on-site manager at all times, and a trained observer must supervise each step of every PPE donning/doffing procedure to make certain established PPE protocols are completed correctly (CDC, 2018).

CLEANING AND DISINFECTING

All equipment and environmental and working surfaces must be cleaned and decontaminated after contact with blood or other potentially infectious material. Protective gloves and other PPE should be worn as necessary, and an appropriate disinfectant should be used. Such disinfections can be a diluted bleach solution or EPA-registered antimicrobial products such as tuberculocides, sterilants, or products registered against HIV/HBV.



When cleaning up a **blood spill** or **OPIM**, use protective gloves or other PPE as necessary and:

- Confine the spill and immediately wipe up the spill with paper towels or other disposable absorbent material and discard the contaminated materials in an appropriate, labeled infectious waste container.
- Clean up all blood thoroughly using neutral detergent and warm water solution before applying the disinfectant.
- Apply facility-approved intermediate-level disinfecting solution onto all contaminated areas of the surface.
- When using a diluted bleach solution, contact time is the length of time it takes for the solution to dry. (Do not use a diluted bleach solution to clean up a urine spill due to risk of chlorine gas.)
- Allow disinfectant to remain wet on the surface for the recommended contact time, then rinse the area with clean water to remove the disinfectant residue (if required).
- Immediately send all reusable supplies and equipment (e.g., cleaning cloths, mops) for reprocessing (i.e., cleaning and disinfection) after the spill is cleaned up.

Liquid chlorine bleach comes in different concentrations. To make a 0.5% chlorine solution from 3.5% bleach, use 6 parts of water for each part bleach (CDC, 2020h).

HANDLING CONTAMINATED LAUNDRY

Contaminated laundry (i.e., soiled with blood or OPIM or that may contain sharps) should be handled as little as possible with a minimum of agitation. Contaminated laundry is bagged at the location of use into labeled or color-coded bags or containers. Contaminated laundry that is wet is placed and transported in containers or bags that prevent soak-through or leakage. Contaminated laundry should not be rinsed at the location of use.

Avoid uniform contamination by holding soiled laundry away from the body, and do not hold laundry bags close to the body or squeeze them when transporting to avoid punctures from improperly discarded sharps (OSHA, 2012).

HANDLING REGULATED WASTE

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

Regulated waste should be placed in strong, leak-proof plastic bags or a container capable of being autoclaved and should be properly labeled or color-coded (OSHA, 2012).

Sharps Handling

Contaminated sharps are needles, blades (such as scalpels), scissors, and other medical instruments and objects that can puncture the skin. Contaminated sharps must be properly disposed of immediately or as soon as possible into containers that are closable, puncture-resistant, leak-proof on the sides and bottom, and color-coded or labeled with a biohazard symbol.

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 or other sharp devices, use a mechanical device or tool, such as forceps, pliers, or broom and dustpan.
 - Dispose of needles in labeled sharps containers only; sharps containers must be accessible and maintained upright. 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.
- (OSHA, 2012)

POSTEXPOSURE MEASURES AND FOLLOW-UP

Emergency Steps Following an Accidental Exposure

If an occupational exposure to blood or other body fluids occurs, the following steps should immediately be taken:

1. First wash needlestick injuries and open wounds with soap and water.
2. Flush splashes to nose, mouth, or skin with water.
3. If eyes were exposed, irrigate eyes with clean water, saline, or sterile irrigant.



4. Report the incident to the supervisor.
5. Immediately seek medical treatment.
(CDC, 2016)

Employer Follow-Up

Following an exposure incident, the employer is required to:

- Perform a timely evaluation of the circumstances surrounding the exposure incident to find ways of preventing such a situation from occurring again
- Identify the source individual (unless the employer can establish that identification is not possible or prohibited by state or local law) and determine the source's HBV and HIV infectivity status
- If the status of the source individual is not already known, test the source's blood as soon as possible, provided the source individual consents
- If the source individual does not consent to testing, establish that legally required consent cannot be obtained
- If state or local law allows testing without the source person's consent, test the individual's blood, if it is available
- Make results of the tests available to the exposed worker and inform the worker of the laws and regulations concerning disclosure of the source's identity and infectivity status
- Provide a timely written report of the above information

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 within 15 days after the medical evaluation is finished. Postexposure 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 (OSHA, 2012).

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. Following OSHA's Bloodborne Pathogens Standard, including the use of Standard Precautions, can break the chain of infection, reduce the risk of exposure, and ensure a safe working environment.



RESOURCES

How to safely put on personal protective equipment (video) (CDC)

<https://www.youtube.com/watch?v=H4jQUBAIBrI>

How to safely take off personal protective equipment (video) (CDC)

<https://www.youtube.com/watch?v=PQxOc13DxvQ>

OSHA Bloodborne Pathogens Standard

http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10051

Personal protective equipment (OSHA)

https://www.osha.gov/OshDoc/data_BloodborneFacts/bbfact03.pdf

Postexposure prophylaxis for HIV (CDC)

<https://www.cdc.gov/hiv/risk/pep/index.html>

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TEST

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1. A circulating nurse in surgery is at **highest** risk for exposure to a bloodborne pathogen 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 link in the chain of infection describes the habitat where the infectious agent normally lives and grows?
 - a. Vulnerable host
 - b. Reservoir
 - c. Portal of entry
 - d. Portal of exit

4. Which is a **correct** statement about the hepatitis B vaccine?
 - a. Employers must make screening a condition of receiving vaccination.
 - b. To ensure immunity, it is important to receive all recommended injections.
 - c. An employee may not take the vaccine later after initially declining it.
 - d. Hepatitis B vaccine is not a good protection against the disease.

5. Which is a **true** statement about hepatitis C?
 - a. The most common means of transmission in the United States is through injection drug use.
 - b. Prior infection protects against future infection with the same or different genotype of virus.
 - c. Most people with hepatitis C are well aware of their illness.
 - d. Hepatitis C is the least common bloodborne disease in the United States.



6. The **most effective** means of protection against HIV infection for healthcare workers is:
 - a. Appropriate handwashing and surface decontamination.
 - b. Use of needleless devices.
 - c. HIV vaccine.
 - d. Adherence to Standard Precautions.

7. 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.

8. Contaminated personal protective equipment should be removed in the following order:
 - a. Face shield or goggles, mask or respirator, gloves, gown.
 - b. Gown, gloves, face shield or goggles, mask or respirator.
 - c. Gloves, gown, face shield or goggles, mask or respirator.
 - d. Mask or respirator, gloves, gown, face shield or goggles.

9. Which is a correct work practice when handling sharps?
 - a. Always recap needle/syringe units before disposal.
 - b. Use a one-hand scoop technique if a needle must be recapped.
 - c. Break or shear off needles before disposing of used sharps.
 - d. Fill used sharps containers only halfway before replacing them with new containers.

10. Which are the appropriate actions to take in the event of an accidental needlestick injury?
 - a. Cleanse the injury with alcohol wipes and immediately seek medical treatment.
 - b. Report the incident immediately to the supervisor and then wash the injury.
 - c. Wash the needlestick injury with soap and water and report the incident to the supervisor.
 - d. First irrigate the injury with sterile irrigant, followed by soap and water.

