



Chapter 6: Infectious Disease Control for Funeral Directors and Embalmers

3 CE Hours

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Learning objectives

- Describe five CDC universal precautions for infection prevention and control for airborne, droplet, and contact transmission of pathogens.
- List five steps for personal protective equipment (PPE) compliance from the CDC guidelines for infection prevention and control procedures in the funeral home setting.
- Explain how pathogenic organisms may be spread in funeral home settings and identify factors that influence exposure and transmission.
- Identify five types of infectious disease that require the use of barriers, personal protective equipment, and control strategies to protect personnel from pathogens according to CDC and WHO guidelines.
- Define epidemiologically important organisms and discuss four types, including modes of transmission.
- List and discuss OSHA guidelines and strategies, including cleaning, sterilization, chemical disinfection, and barriers to protect personnel and the public from infectious disease.
- Describe CDC guidelines for barriers, protective equipment, and control procedures for personnel to prevent exposure to infectious material during the embalming process.
- Define CDC and OSHA guidelines for handling, cleaning, disinfection, sterilization and waste disposal procedures to during post mortem procedures to prevent disease transmission.
- Discuss the professional funeral director and embalmer's responsibility for maintaining a safe environment for personnel, the public, and the environment.
- Identify strategies and procedures for preventing transmission and controlling Ebola and HIV/AIDS virus during all post-mortem procedures.
- Select five myths concerning infectious disease contamination from embalming and burial and discuss facts from PAHO and WHO research studies that dispel them.

Introduction

Funeral directors in the 1980s faced new concerns related to containment of infectious disease pathogens due to the number of casualties from the HIV/AIDS virus.

Funeral directors and staff were asked to deliver post-mortem services for premature deaths of HIV/AIDS victims of all ages. In addition to assisting grieving families, funeral service professionals had to address serious health risks and fears surrounding embalming, funeral services, and burial of victims with the contagious disease. The demand for infection control for postmortem care of HIV/AIDS victims resulted in a detailed review and modernization of procedures for the first time in over a century. Misinformation, fear, and hysteria led to myths of environmental contamination, which spread throughout the funeral industry. Many directors and embalmers refused to offer services to HIV/AIDS victims during this time.

To address these concerns the Centers for Disease Control (CDC), the World Health Organization (WHO), and the Occupational Health and Safety Administration (OSHA) developed detailed, extensive, uniform procedures to contain infectious pathogens in the healthcare field. These precautions were extended and refined for the practice of mortuary science and all areas of funeral services. Guidelines created by the CDC, and adopted by OSHA in 1991, were called "universal precautions" which provided standardized procedures for postmortem services. Robert Mayer, author of embalming textbooks, explained that using universal precaution means an embalmer will "treat all human remains as if they were infected with HIV, hepatitis B (HBV) or other pathogens. In other words, the embalmers should treat all bodies with the same caution that would be applied for extremely hazardous, potentially fatal infections (Mayer, 2012)."

Changes in handling the body were implemented and different postmortem technologies in all levels of thought and practices were developed and deployed by the American funeral industry (Kennedy

and Nisbett, 2015). New procedures for health, safety, and training for funeral personnel helped ease fears and build confidence surrounding postmortem care of victims of infectious disease.

In 2014 mortuary science encountered the Ebola epidemic, leading to a complete transformation in postmortem care to protect personnel and the public from exposure to deadly pathogens. The CDC, OSHA, and the WHO revolutionized infection control and prevention procedures from transport to and from the hospital, to burial or cremation. Some myths have persisted concerning the potential environmental contamination related to the burial of victims of infectious, communicable diseases. Misinformation and anxiety grew due to public fear over media reports of the spread of other diseases such as bovine spongiform encephalopathy (BSE), more commonly known as mad cow disease; the human variant Creutzfeldt-Jakob Disease (CJD); and transmissible spongiform encephalopathy (TSE), also known as prion diseases. This course will address the facts and detail the CDC, WHO, and OSHA standards and guidelines to address procedures to contain these diseases during all phases of mortuary practice.

The National Funeral Directors Association (NFDA) is the guiding funeral service association, with 19,700 individual members and serving over 10,000 funeral homes in the United States and forty-three countries around the world. The NFDA provides information, education, and advocates for members to enhance quality funeral services, including high ethical standards and meaningful service to families (NFDA, 2015). The NFDA offers resources and materials to assist members to comply with federal, state, and county laws along with conducting and funding research on topics of health, safety, environmental, and consumer concerns.

John Erik Troyer is a leading author and researcher addressing the social and technological control of the dead body, including legal, scientific, and medical protocols and aesthetics. Troyer cautions

that people addressing the issues of infectious disease in mortuary services funeral directors, “Need a dose of humility and effective approaches at household, community, societal and global levels. At the household level, we need to promote family-centered interactions and interventions. Cultural practices such as embalming, burial, and caregiving are family-based as well as community-based activities.”

Professionals in the funeral industry must have knowledge concerning different types of infectious disease, modes of transmission, and virulence that make them dangerous and difficult to contain. The global nature of travel today leads to the rapid spread of contagious disease throughout the world. Certain diseases are not endemic to the United States; however, they can easily cross borders before they are observed or diagnosed. Individuals can carry colonies of disease and be non-symptomatic for weeks or even months as they spread disease to those they contact at home, work, or throughout their community.

This course includes information on infectious diseases that rise to the level of serious public health concern. Major health organizations

of the federal, state, and county epidemiology departments would be aware of the presence of individuals with serious infectious disease from the moment they were identified at the point of entry to the U.S. These agencies have jurisdiction in these cases, though in many states, if the person dies, the body would be released to the local funeral home. At this point, the director could refuse the case or the local health agency would assist them if they chose to proceed. As of 2015, fifty-five hospitals across the U.S. were equipped to handle these cases. Funeral home directors can visit the CDC website to determine the locations near them.

This course provides specific references for downloading guidelines and training resources from the CDC, OSHA, and the WHO for further information. Individual states may have additional regulations and guidelines that must be reviewed on the state government website. Information is included for the control of infectious disease encountered during mortuary services to ensure the safety of personnel, funeral attendees, the general public, and the environment.

Transmission of infectious agents in healthcare settings

The CDC, WHO, and OSHA organizations include mortuary, funeral homes, cemetery, and crematory settings under the classification of healthcare when issuing regulations and guidelines for universal precautions. Some documents contain specific information for practitioners dealing with postmortem procedures for preparation

at the hospital, cleaning, sterilization, transport, embalming, waste disposal, viewing, burial, or cremation. Some highly contagious, drug-resistant diseases require specific regulations for postmortem care, and current regulations are included in this course.

Definitions

- **Alkaline hydrolysis** – an alternative to flame cremation that uses water and alkaline under high temperatures and pressure.
- **Colonization** – development of a bacterial infection, though the infected person may or may not have signs or symptoms of infection.
- **Diathesis** – predisposition or susceptibility to suffer from disease.
- **Enveloped virus** – the outermost shells made of proteins and surrounded by lipids and are less virulent.
- **Non-enveloped virus** – contain a capsid coat made of protein, are more virulent and can retain infectivity even after drying.
- **Fomites** – objects or materials, such as dishes, utensils, or clothing, that may carry infection and lead to transmission of disease.
- **Flora** – microorganisms such bacteria or fungi that live in or on the body.
- **Immunity** – the host’s ability to resist the pathogens that cause disease.

Factors related to immunity include the following:

- The immune state at the time of exposure to an infectious agent.
 - Interaction between pathogens.
 - Virulence factors of the pathogen.
 - Host factors, such as age, and underlying disease, such as diabetes, HIV/AIDS, malignancy, transplants, or other chronic illness.
 - Medications that alter normal flora such as antimicrobial agents, gastric acid suppressors, corticosteroids, anti-rejection drugs, antineoplastic agents, and immunosuppressive drugs.
- **Infection** – invasion and multiplication of pathogenic microorganisms in the body. Pathogens invade the body and may

lead to infection or disease that disrupts the functioning of the body. Pathogenic microorganisms are found, particularly in the respiratory and gastrointestinal tracts, but may live anywhere in or on the body.

- **Infectious agents** – four main classes including bacteria, viruses, fungi, and parasites transmitted primarily from human sources but also inanimate environmental sources as well.
- **Lumina** – the inner open space or cavity of a tubular organ or cell, such as in a blood vessel or an intestine.
- **Pathogens** – agents that cause infection or disease including microorganisms such as a bacterium, protozoan, prions, or virus. These agents cause communicable diseases that spread easily through contact with others.
- **Percutaneous exposure** – caused by an injury, such as a needle stick or cut with a sharp object that allows contact of mucous membrane or nonintact skin with blood, saliva, tissue, or other body fluids that are potentially infectious. Injury can also occur through exposed skin that is chapped, abraded, or broken due to dermatitis or other skin conditions.
- **Prions** – small infectious disease agents carrying protein that are the smallest infectious particles. They are not bacterial, fungal, or viral and have no genetic material. Prions cause degenerative brain diseases, including mad cow disease, Creutzfeldt-Jakob disease (CJD), and inherited forms of dementia such as Gertsmann-Straeussler-Scheinker (GSS) disease.
- **Susceptible host** – an individual without adequate immunity to withstand exposure or contact with a particular infectious agent.
- **Virulence** – the ability of an agent of infection to produce disease. The virulence of a microorganism is a measure of the severity of the disease it causes.

CDC guidelines: Types of infectious disease and transmission

Infection transmitted between an infectious agent and a host may cause disease to develop and progress causing illness or death. In some cases, the host may be temporarily or permanently colonized but show no symptoms of the infection or disease. It is possible for infection

to develop from colonization and rapidly progress to disease after exposure or after an extended period of colonization.

Exposure to a variety of infectious disease agents may occur when handling any deceased body. The body may remain infectious, and

microbes may continue to colonize after death and be dispersed through contact. If infectious disease was present at the time of death, mortuary personnel, family, and the public may be at risk for infection,

and burial practices involving touching and washing the body should be avoided, depending upon the type of infection present.

Sources of infection after death

The four main sources of infection that may be present in human remains include the following:

- Blood and body fluids, including saliva, lung, and gastrointestinal fluids.
- Waste products, such as feces and urine.

Transmission

Transmission of infectious agents within a healthcare setting requires three elements:

- A source or reservoir of infectious agents.
- A susceptible host with a portal of entry to receive the infectious agent.
- A mode of transmission for the infectious agent.

Individual microorganisms normally have a specific mode of transmission and route to enter the body, but some types of infection can spread in multiple ways, such as:

- Contaminated hands, fingers, or objects placed into the mouth, nose, or eyes.
- Instruments or equipment that are inadequately cleaned between patients before disinfection or sterilization or that have manufacturing defects that interfere with the effectiveness of reprocessing may transmit bacterial and viral pathogens.
- Clothing, uniforms, laboratory coats, or personal protective equipment (PPE), may become contaminated with potential pathogens after contact with colonized or infectious agents, including Methicillin-resistant *Staphylococcus aureus* (MRSA), Vancomycin-resistant enterococcus (VRE), and *C. difficile*. Soiled garments have the potential to transmit infectious agents.
- Inhalation of small droplets of microorganisms can occur without PPE.
- Blood and body fluids may splash into the eye, nose, or mouth for contact with other mucous membranes.
- Breaks in the skin may lead to direct contact with microorganism or contaminated objects.
- Pathogens may enter through any puncture or injury to the skin such as a contaminated needles or sharp objects.

According to OSHA guidelines in 2015, the routes of infectious disease transmission in mortuary settings include contact, droplet, and airborne.

- **Contact transmission** can be classified as direct or indirect contact. Direct contact transmission involves transfer of infectious agents to a susceptible individual through physical contact with an infected individual such as direct skin-to-skin contact. Indirect contact transmission occurs when infectious agents transfer to a susceptible individual when the individual makes physical contact with contaminated items and surfaces, such as doorknobs, instruments, equipment, or examination tables. Two examples of contact transmissible infectious agents include MRSA and VRE.
- **Droplets** containing infectious agents can spread during certain postmortem preparation, including transport and embalming procedures. Transmission occurs when droplets come into direct contact with the mucosal surfaces of the eyes, nose, or mouth of a susceptible individual. The distance droplets travel depends on the velocity and means by which respiratory droplets are propelled from the source, the density of respiratory secretions, environmental factors such as temperature and humidity, and the

- Aerosols of infectious material might be released when moving or opening the body.
- Microbes may be present on the skin and spread through direct contact.

ability of the pathogen to remain infectious over that distance.

A distance of three feet around the patient is an example of “a short distance from a patient” but should not be used as the sole criterion for deciding when a mask should be donned to protect from droplet exposure. Due to the variables that affect droplet transmission, staff should wear a mask when they are within six to ten feet of the body upon entry into the room, especially when exposure to emerging or highly virulent pathogens is possible. Observations of particle dynamics have shown that a range of droplet sizes, including those with diameters of thirty μm , micrometer or one millionth of a meter, or greater can remain suspended in the air.

- **Airborne transmission** occurs through very small particles or droplet nuclei that contain infectious agents and remain suspended in the air for extended periods of time. When the susceptible individual inhales the pathogen, it enters the respiratory tract and can cause infection. Airborne transmission only occurs with infectious agents that are capable of surviving and remaining infectious for relatively long periods of time in airborne particles or droplet nuclei. Airborne microorganisms may be dispersed over long distances by air currents and may be inhaled by susceptible individuals who have not had face-to-face contact with or been in the same room as the infectious individual. Preventing the spread of pathogens by airborne routes requires the use of special air handling and ventilation systems, such as an Airborne Infection Isolation Room (AIIR, to contain and safely remove the infectious agent.

OSHA standards and directives for protection against transmission of infectious agents must be included in training for all personnel. These include OSHA’s Bloodborne Pathogens standard (29 CFR 1910.1030) which provides protection of workers from exposures to blood and body fluids that may contain bloodborne infectious agents. OSHA’s Personal Protective Equipment standard (29 CFR 1910.132) and Respiratory Protection standard (29 CFR 1910.134) which provide protection for workers when exposed to contact, droplet, and airborne transmissible infectious agents; and OSHA’s TB compliance directive, which protects workers against exposure to tuberculosis (TB) through enforcement of existing applicable OSHA standards and the General Duty Clause of the OSH Act. In some cases where a specific OSHA standard doesn’t apply, the General Duty Clause (Sec. 5(a)(1) of the Occupational Safety and Health Act requires employers to furnish to each employee a place of employment free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees; each employer shall comply with occupational safety and health standards under this Act. In addition, each employee shall comply with occupational safety and health standards and all rules, regulations, and orders issued pursuant to this Act, which are applicable to his own actions and conduct.

Epidemiologically important organisms

Infectious agents of particular interest for healthcare settings are called epidemiologically important organisms and are targeted for advanced methods of infection control. An “epidemiologically important organism” is identified by the following characteristics:

- Increased potential for transmission within healthcare facilities based on published reports and the occurrence of temporal or geographic clusters of > two patients. A single case of healthcare-associated invasive disease caused by certain pathogens is generally considered a trigger for investigation and enhanced control measures because of the risk of additional cases and severity of illness associated with these infections.
- Antimicrobial resistance to first-line therapies.
- Common and uncommon microorganisms with unusual patterns of resistance.

- Difficulty to treat because of resistance to multiple classes of antimicrobial agents.
- Association with serious clinical disease, increased morbidity, and mortality.
- A newly discovered or reemerging pathogen.

These epidemiologically important organisms include *C. difficile*; bioterrorism agents like anthrax, prions, SARS-CoV, monkey pox, noroviruses; and hemorrhagic fever viruses which include Ebola, Marburg, Lassa, Crimean-Congo hemorrhagic fever viruses and other multi-drug resistant organisms. The CDC updated its research on modes of transmission and effective preventive measures in 2015, and these are included in this course.

Multidrug-resistant organisms (MDROs)

MDROs are microorganisms, mainly bacteria, that are resistant to one or more classes of antimicrobial agents. These pathogens are usually resistant to all but a few commercially available antimicrobial agents, so MDROs are considered to be epidemiologically important and deserve special attention in mortuary facilities. MDROs are transmitted by the same routes as other infectious agents. Preventing the emergence and transmission of these pathogens requires a comprehensive approach that includes administrative involvement, education and training of personnel, comprehensive surveillance for targeted MDROs, application of infection control precautions, and environmental measures such as cleaning and disinfection of the environment and equipment.

MDROs include:

- Clostridium Difficile (*C. diff*).
- Carbapenem-resistant Enterobacteriaceae (CRE).

- Neisseria gonorrhoeae.
- Multidrug-resistant Acinetobacter.
- Drug-resistant Campylobacter.
- Fluconazole-resistant Candida.
- Extended Spectrum beta-lactamases (ESBL).
- Vancomycin-resistant enterococci (VRE).
- Multidrug-resistant Pseudomonas aeruginosa.
- Drug-resistant non-typhoidal Salmonella.
- Drug-resistant Salmonella Serotype Typhi.
- Drug-resistant Shigella.
- Methicillin-resistant Staphylococcus aureus (MRSA).
- Drug-resistant Streptococcus pneumoniae.
- Drug-resistant Tuberculosis.
- Vancomycin-resistant Staphylococcus aureus.
- Erythromycin-resistant Group A Streptococcus.
- Clindamycin-resistant Group B Streptococcus.

Agents of bioterrorism

The CDC has designated agents that cause anthrax, smallpox, plague, tularemia, viral hemorrhagic fevers, and botulism as Category A, high priority, because these agents can be easily dispersed environmentally, through food, water, air, and/or transmitted from person to person; can cause high mortality and have the potential for major public health impact; might cause public panic and social disruption. These agents identified by the CDC include the following:

- Arenaviruses.
- Botulism (Clostridium botulinum toxin).
- Brucella species (brucellosis).
- Brucellosis (Brucella species).
- Burkholderia mallei (glanders).
- Burkholderia pseudomallei (melioidosis).
- Chlamydia psittaci (psittacosis).
- Cholera (Vibrio cholerae).
- Clostridium botulinum toxin (botulism).
- Clostridium perfringens (Epsilon toxin).
- Coxiella burnetii (Q fever).
- Ebola virus hemorrhagic fever.
- E. coli O157:H7 (Escherichia coli).
- Emerging infectious diseases such as Nipah virus and hantavirus.
- Epsilon toxin of Clostridium perfringens.
- Escherichia coli O157:H7 (E. coli).
- Food safety threats (e.g., Salmonella species, Escherichia coli O157:H7, Shigella).
- Francisella tularensis (tularemia).

- Glanders (Burkholderia mallei).
- Lassa fever.
- Marburg virus hemorrhagic fever.
- Melioidosis (Burkholderia pseudomallei).
- Psittacosis (Chlamydia psittaci).
- Q fever (Coxiella burnetii).
- Ricin toxin from Ricinus communis (castor beans).
- Rickettsia prowazekii (typhus fever).
- Salmonella species (salmonellosis).
- Salmonella Typhi (typhoid fever).
- Salmonellosis (Salmonella species).
- Shigella (shigellosis).
- Staphylococcal enterotoxin B.
- Typhoid fever (Salmonella Typhi).
- Typhus fever (Rickettsia prowazekii).
- Vibrio cholerae (cholera).
- Viral encephalitis (alphaviruses such as Venezuelan equine encephalitis, eastern equine encephalitis, western equine encephalitis).
- Viral hemorrhagic fevers (filoviruses including Ebola, Marburg, and arenaviruses such as Lassa, Machupo).
- Water safety threats including Vibrio cholerae, Cryptosporidium parvum.

Prions

The CDC defines transmissible spongiform encephalopathies (TSEs) as a family of rare, progressive neurodegenerative disorders that affect both humans and animals. They are distinguished by long incubation periods, characteristic spongiform changes associated with neuronal loss, and a failure to induce inflammatory response.

The causative agents of TSEs are believed to be prions. The term “prions” refers to abnormal pathogenic agents that are transmissible and are able to induce abnormal folding of specific normal cellular proteins called prion proteins that are found most abundantly in the brain. The functions of these normal prion proteins are still not

completely understood, but the abnormal folding of the prion proteins leads to brain damage and the characteristic signs and symptoms of the disease. Prion diseases are usually rapidly progressive and always fatal.

Prion diseases in animals include scrapie in sheep and goats; bovine spongiform encephalopathy (BSE), or “mad cow disease” in cattle; and chronic wasting disease in deer and elk. BSE, first recognized in the United Kingdom (UK) in 1986, was associated with a major epidemic among cattle that had consumed contaminated meat and bone meal.

Identified prion diseases in humans

Creutzfeldt-Jakob disease (CJD) is a rapidly progressive, degenerative, neurologic disorder of humans caused by an infectious, highly transmissible prion. The incubation period between exposure and onset of symptoms varies from two years to many decades, though death occurs within one year of the onset of symptoms. CJD is not related to BSE, or mad cow disease.

Variant CJD (vCJD) is not the same disease as classic CJD. It has different clinical and pathologic characteristics from classic CJD. Each disease also has a particular genetic profile of the prion protein gene. Variant Creutzfeldt-Jakob disease (vCJD) is a prion disease that was first described in 1996 in the United Kingdom. There is now strong scientific evidence that the agent responsible for the outbreak of prion disease in cows, BSE, is the same agent responsible for the outbreak of vCJD in humans. Both CJD and vCJD disorders are fatal brain diseases with unusually long incubation periods measured in years, and are caused by a prion.

Although most cases of CJD have been reported from the UK, cases also have been reported from other parts of Europe, Japan, Canada, and the United States. Standard Precautions are used when caring for clients with suspected or confirmed CJD. This course includes special precautions from the CDC and WHO for tissue handling, contact with a body after autopsy, embalming, and reprocessing surgical instruments to prevent transmission of CJD.

Severe acute respiratory syndrome (SARS)

SARS is a respiratory disease that emerged in China late in 2002 and spread to several countries including Mainland China, Hong Kong, Hanoi, Singapore, and Toronto. There have been cases of laboratory evidence of SARS in the U.S. but no deaths have occurred. SARS outbreaks have occurred in healthcare settings and transmitted to large numbers of healthcare personnel and patients with evidence of droplet, contact transmission, and airborne transmission. The CDC recommends universal precautions, with emphasis on hand hygiene, and contact precautions with emphasis on environmental cleaning, because SARS CoV RNA has been identified on surfaces in the rooms of SARS patients. Airborne precautions, including use of fit-tested NIOSH-approved N95 or higher level respirators, and eye protection are also indicated.

Monkey pox

Monkey pox is a rare viral disease found mostly in rain forest countries of Central and West Africa. The disease is caused by an orthopoxvirus that is similar in appearance to smallpox but causes

a milder disease. Transmission from infected animals and humans occurs primarily through direct contact with lesions and respiratory secretions, but airborne transmission from animals to humans cannot be excluded.

Norovirus

Norovirus, formerly referred to as Norwalk-like viruses, are members of the Calciviridae family. Environmental contamination has been documented as a factor in transmission during outbreaks and of this highly contagious disease. Widespread, persistent, and undetected contamination of the environment and fomites can make outbreaks extremely difficult to control. Clinical observations and detection of norovirus DNA on surfaces five feet above levels normally touched suggest that aerosolized particles may travel distances beyond three feet. Individuals who are responsible for cleaning the environment may be at increased risk of infection. The virus is resistant to many cleaning and disinfection agents and may survive < ten parts per million (ppm or one milligram per liter) chlorine.

Hemorrhagic fever viruses (HFV)

The hemorrhagic fever viruses are a mixed group of viruses that cause serious disease with high fever, skin rash, bleeding diathesis, and high mortality; the disease caused by the virus is referred to as viral hemorrhagic fever (VHF). Commonly known HFVs are Ebola and Marburg viruses (Filoviridae), Lassa virus (Arenaviridae), Crimean-Congo hemorrhagic fever and Rift Valley Fever virus, or Bunyaviridae, and Dengue and Yellow fever viruses, or Flaviviridae.

Person-to-person transmission is mainly due to direct blood and body fluid contact. Percutaneous exposure to contaminated blood carries a high risk for transmission and increased mortality during the embalming process. Large numbers of Ebola viral particles can be found in the skin and the lumina of sweat glands, which indicates transmission could occur from direct contact with intact skin. Evidence to support direct transmission from intact skin is limited, but postmortem handling of infected bodies is an important risk for transmission. There have been situations where transmission occurred among individuals with no direct contact. In these rare cases, there is speculation that airborne transmission could have occurred. Airborne transmission of HFVs in humans has not been scientifically observed, though the possibility of airborne transmission exists and the CDC was not able to completely exclude droplet or indirect contact transmission. In 2015, the CDC updated infection control precautions for HFVs that are transmitted person to person, which are included in this course.

CONTAINING THE EBOLA AND HIV/AIDS VIRUS

World Health Organization 2015 Ebola precautions for funeral directors

The Ebola epidemic spread to American health workers overseas and prompted the CDC and the WHO to develop standards, preparedness regulations, and guidelines to address treatment and prevention in the U.S.

Cleaning should precede application of disinfectants. WHO recommends:

- Do not spray (i.e., fog) occupied or unoccupied clinical areas with disinfectant. This is a potentially dangerous practice that has no proven disease control benefit.

- Wear gloves, gown, and closed shoes when cleaning the environment and handling infectious waste. Cleaning heavily soiled surfaces increases the risk of splashes. On these occasions, staff should wear facial protection in addition to gloves, gown and closed, resistant shoes.
- Soiled linen should be placed in clearly labeled, leak-proof bags or buckets at the site of use, and the container surfaces should be disinfected (using an effective disinfectant) before removal from the site. Linen should be transported directly to the laundry area and laundered promptly with water and detergent. For low-temperature laundering, wash linens with detergent and water, rinse and then soak in 0.05 percent chlorine for approximately thirty minutes. Linen should then be dried according to routine standards and procedures. When handling soiled linen from HF patients, use gloves, gown, closed shoes, and facial protection.
- If safe cleaning and disinfection of heavily soiled linen is not possible or reliable, it may be prudent to burn the linens to avoid any unnecessary risks to individuals handling these items.

For postmortem examinations, HF patient remains should be limited to essential evaluations only, and trained personnel should perform those

evaluations. Personnel examining remains should wear eye protection, mask, gloves, and gowns as recommended for patient care. In addition, WHO recommends that personnel performing autopsies of known or suspected HF patients should wear a particulate respirator and eye protection or face shield, or a powered air-purifying respirator.

WHO also recommends:

- When removing protective equipment, avoid any contact between soiled gloves or equipment and the face (i.e., eyes, nose, or mouth).
- Hand hygiene should be performed immediately following the removal of protective equipment used during postmortem examination and that may have come into contact with potentially contaminated surfaces.
- Place specimens in clearly labeled, non-glass, leak-proof containers and deliver directly to designated specimen handling areas.
- All external surfaces of specimen containers should be thoroughly disinfected prior to transport.
- Tissue or body fluids for disposal should be carefully placed in clearly marked, sealed containers for incineration.

2015 CDC guidance for personnel: Postmortem care in United States hospitals and mortuaries to protect against the spread of Ebola

Human-to-human transmission is the principal feature in Ebola virus outbreaks; the virus is transmitted from symptomatic persons or contaminated corpses or by contact with objects acting as fomites. Contact with corpses during mourning and funeral practices, which can include bathing the body and rinsing family members with the water, or during the removal and transportation of bodies by burial teams has resulted in numerous infections. Studies published by the CDC in 2015 on the Postmortem Viability of the Ebola Virus show it can persist for > seven days on surfaces of bodies, confirming that transmission from deceased persons is possible for an extended period after death. In addition, the study revealed that viral RNA was detectable for ten weeks.

The CDC published the following guidelines in 2015 to protect against the postmortem spread of Ebola infection at the site of death, prior to

transport, during transport, at the mortuary, and during final disposition of remains.

The guide should be followed to train staff in the safe handling of human remains that may contain Ebola virus by properly using PPE and following decontamination measures at every step of the process. Revisions were made on January 20, 2015, to reflect the following:

- The term “hermetically sealed casket” was replaced with a recommendation to use a metal casket based on common practices in the industry.
- Additional details have been added about equipment needed for workers handling remains and step-by-step guidelines for postmortem preparation and transportation of remains.
- Additional resources have been added on PPE, decontamination, infection control, transportation of remains, and burial and cremation practices.

Background

Given the systems currently in place to identify people with Ebola virus disease (EVD), beginning with screening and interception at airports for passengers from countries with known outbreaks, Ebola-related deaths in the United States would likely occur within a hospital setting, and all Ebola cases are immediately reported and monitored by the CDC, and state and local health agencies. The EVD can be detected throughout the bodies of patients who die of the disease. Ebola can be transmitted in postmortem care by laceration and puncture with contaminated instruments, through direct handling of human remains without recommended PPE, through splashes of blood,

urine, saliva, feces, or vomit to unprotected mucosa such as eyes, nose, or mouth during postmortem care.

In addition to federal laws and guidelines that apply to mortuary workers contained in this course, mortuary practices and workers may also be subject to a state, tribal, territorial, and local regulations. Staff should always consult local health department officials for additional guidance on laws that affect mortuary practices. The CDC recommends licensed funeral directors, who have agreed to accept the bagged remains, work in close collaboration with public health officials in their state or local jurisdiction to safely implement each step of the process.

Key points

- EVD can be transmitted in postmortem care settings through unsafe handling of remains.
- Only personnel trained in handling infected human remains and wearing recommended PPE should touch or move any remains that contain Ebola virus.
- Do not wash or clean the body.
- Do not embalm the body.
- Do not perform an autopsy. If an autopsy is necessary, consult the state health department and CDC regarding necessary precautions.
- Do not remove any inserted medical equipment from the body such as intravenous (IV) lines, endotracheal or other tubing, or implanted electronic medical devices.
- Cremate the body. If cremation cannot be done because of safety concerns, the body should be buried in a standard metal casket or other comparable burial method.

Definitions for terms in this guidance

- **Hot zone** – contaminated area that includes the patient treatment room. Only workers wearing PPE that conforms to CDC’s Guidance on Personal Protective Equipment for Healthcare Workers are allowed to be in this area.
- **Cold zone** – non-contaminated area used for planning and staging. Only workers who have not entered the hot zone or who have properly doffed their PPE after being in the hot zone are permitted

in the cold zone. Workers put on clean PPE in the cold zone under the direction of a trained observer.

- **Cremation** – the act of reducing human remains to ash by intense heat.
- **Leak-proof bag** – a body bag that is puncture-resistant and sealed in a manner to contain all contents and prevent leakage of fluids during handling, transport, or shipping.

Equipment list

The following equipment should be used in the hot zone:

A hospital gurney containing three pre-opened cremation-compatible body bags with the following specifications:

- First bag (top layer on gurney): Vinyl or other chlorine-free material, minimum of 6 ml thickness (152 micrometers). To prevent any leakage of fluids, all seams should be factory heat-sealed or welded, not sewn, and the zipper should be on top.
- Second bag (middle layer on gurney): Chlorine-free material impervious to fluids that can be heat-sealed around the body to form a leak-proof body bag. This bag should be specifically designed for the containment and transport of infectious bodies. The material should be pre-cut to provide sufficient material to envelop the body and first bag.
- Third bag (bottom layer on gurney): Laminated vinyl or other chlorine-free material, minimum of 18 ml thickness (457 micrometers), with handles that are not sewn on, such as riveted handles reinforced with handle straps that run under the pouch. To prevent any leakage of fluids, all seams should be factory heat-sealed or welded, not sewn, and the zipper should be on top.
- Thermal sealer for sealing the second bag.
- PPE recommended for personnel entering the room of a patient with EVD as described in CDC’s Guidance on Personal Protective Equipment for Healthcare Workers.
- Scissors for cutting excess material from heat-sealed bag.
- Camera or mobile phone capable of securely transferring photographs electronically via Wi-Fi, e-mail, or text message.

- U.S. Environmental Protection Agency (EPA)-registered hospital disinfectant and wipes with a label-claim for use against a non-enveloped virus.
- Alcohol-based hand rub (ABHR).
- Red biohazard bag for medical waste.
- Zip tie for locking the third bag shut at the zipper.
- Enlarged copy of the Mortuary Guidance Job Aid: Postmortem Preparation in a Hospital Room PDF and tape for posting these step-by-step guidelines to a wall in the hot zone. The guide is included below.

The following equipment should be used in the cold zone:

- Hospital gurney or mortuary stretcher.
- Adhesive-backed pouch that is applied to the decontaminated body bag.
- Single-use (disposable) gloves with extended cuffs and a long-sleeved disposable gown.
- Biohazard spill kit, including: Recommended PPE, absorbent materials such as paper towels, kitty litter or a solidifier, an EPA-registered hospital disinfectant, and biohazard waste bags.
- Infectious substance labels that are applied to the decontaminated body bag, including the following:
 - Black and white “infectious substance” label.
 - United Nations (UN) 2814 label.
 - “Do not open” label.
 - Name and phone number of the hospital administrator.

Postmortem preparation in a hospital room

The following points are important considerations for postmortem preparation of human remains containing Ebola virus:

- Ensure that workers handling the body and the trained observer wear the recommended PPE and follow all of the procedures in the CDC’s “Guidance on Personal Protective Equipment for Healthcare Workers.”
- Follow the cleaning and disinfecting recommendations found in the CDC’s “Guidance for Environmental Infection Control in Hospitals for Ebola Virus.” According to this guidance, PPE

surfaces, equipment, or patient care area surfaces that become visibly soiled should be decontaminated immediately using a U.S. Environmental Protection Agency (EPA)-registered hospital disinfectant with a label claim for use against a nonenveloped virus.

- Place all waste produced during postmortem preparation and decontamination into red biohazard bags in the hot zone, following the CDC Guidelines for Ebola-Associated Waste Management.

Highlights from these websites are included in this course.

CDC step-by-step Mortuary Guidance Job Aid for postmortem preparation

These step-by-step guidelines, listed as the Mortuary Guidance Job Aid, are intended to protect workers involved in the postmortem preparation of the body in a hospital setting. The size and weight of the body being prepared and the ability of the workers to lift the body and assist with managing the body bag will determine the number of workers needed for the process. For the death of an average size adult, for example, a minimum of three healthcare workers or other workers properly trained in handling infectious bodies should assist with the process: two to lift the body and one to hold the body bag open.

CDC recommends posting an enlarged copy of the following step-by-step guidelines in the hot zone. The workers should read the guidelines aloud as they perform each step of the procedure.

- Turn on the thermal sealer to allow it to warm up during the initial preparation of the body. This sealer will be used to seal the second body bag.
- Use the digital camera or mobile phone to take a photograph of the decedent’s face for identification purposes. The photograph should be securely transferred via Wi-Fi, e-mail, or text message to the pre-identified site manager. The camera or mobile phone must be decontaminated before being removed from the hot zone or reused. If not decontaminated, the camera or mobile phone should be discarded along with other medical waste.
- Position the gurney with the three pre-opened body bags next to the hospital bed with the body.
- Pull the bed sheet(s) that are under the body up and around the front of the body. Do not wash or clean the body. Do not remove

any inserted medical equipment such as IV lines or endotracheal or other tubing from the body.

- Remove the first bag from the gurney. Gently roll the body wrapped in sheets while sliding the first bag under the body.
- Complete the transfer of the body wrapped in sheets to the first bag and zip up the bag. Minimize the amount of air trapped in the bag.
- Disinfect gloved hands using ABHR. If any areas of the PPE have visible contamination, disinfect with an EPA-registered disinfectant wipe.
- Disinfect the outside of the first bag with an EPA-registered hospital disinfectant applied according to the manufacturer's recommendations.
- Transfer the first bag with the body in it to the gurney, placing it on top of the second bag material.
- Disinfect gloved hands using ABHR.
- Fold the second bag material around the first bag, and heat-seal approximately 2 inches from the edges while removing as much air from the second bag as possible. Heat-seal the bag a second time approximately 1 inch below the initial seal and then heat-seal diagonally across the corners. Use scissors to trim off any excess material along the seam. Turn off or unplug the thermal sealer to allow it to cool. The thermal sealer must be decontaminated before being removed from the hot zone or reused.
- Disinfect the outside of the second bag with an EPA-registered hospital disinfectant applied according to the manufacturer's recommendations.
- Disinfect gloved hands using ABHR.
- Work the third bag around the second bag, and then zip up the third bag. If possible, zip tie the zipper shut.
- Disinfect gloved hands using ABHR.
- Wheel the gurney to the decontamination area.
- Decontaminate the surface of the body bag with an EPA-registered hospital disinfectant applied according to the manufacturer's

recommendations. Begin by applying the hospital disinfectant to the top of the bag and any exposed areas of the gurney's cot. Roll the bag to one side to decontaminate half of the bottom of the bag and the newly exposed portion of the gurney's cot. Repeat with the other side of the bag and gurney. When performing decontamination, remove any visible soil on surfaces of the bag or gurney with the EPA-registered disinfectant wipe. After the visible soil has been removed, reapply the hospital disinfectant, and allow sufficient contact time as specified by the manufacturer of the disinfectant.

- Disinfect the surfaces of the gurney from the handles to the wheels with an EPA-registered hospital disinfectant applied according to the manufacturer's recommendations.
- Disinfect gloved hands using ABHR.
- Push the gurney gently so that only the gurney and the decontaminated body bag enter the cold zone. The workers in the hot zone should not enter the cold zone. Another set of workers should receive the body in the cold zone and transport the body for disposition (see "Transportation of Human Remains" below).
- Proceed to the PPE removal area and follow the procedures in CDC's Guidance on Personal Protective Equipment for Healthcare Workers. The trained observer should provide instructions on the decontamination and removal of PPE.

At this point, the body bag has been decontaminated, and the potential for further contamination has been eliminated as long as the body is handled carefully. Workers who handle the body bag from this point until the body is cremated or placed into a metal casket should wear single-use (disposable) gloves with extended cuffs and a long-sleeved disposable gown; other PPE is optional. If there is no evidence that the body bag has been compromised by a tear or puncture or liquid coming from the bag, surfaces that contact the body bag should not be considered contaminated, and gloves and disposable gowns used for transport can be disposed of as regular trash.

Transportation of human remains

The following points are important considerations for staff when transporting human remains:

- Ensure that anyone handling the body bag wears single-use (disposable) gloves with extended cuffs and a long-sleeved disposable gown.
- Minimize transportation of remains that contain Ebola virus to the extent possible.
- Coordinate all transportation, including local transport for mortuary care or burial, with relevant local and state authorities in advance.

- Coordinate interstate transport with CDC by calling the Emergency Operations Center at (770) 488-7100.
- Avoid transporting noncremated remains via aircraft.
- Human remains transported for interment, cremation, or medical research at a college, hospital, or laboratory are exempted from the U.S. Department of Transportation's Hazardous Materials Regulations (49 C.F.R., Parts 171-180). See §173.134(b)(14).

Step-by-step guidelines for transportation of remains

These step-by-step guidelines are intended to protect workers involved in the transportation of human remains from the cold zone in the hospital to the place of final disposition. A minimum of two healthcare or mortuary workers should perform this process. A plan should be in place to transport the body safely from the hospital to the hearse or vehicle used to transport the body. For example, the plan should include a pre-identified route through the hospital that is secure and either free of or with limited patient and personnel traffic. The route should take the body directly to a pre-identified hearse or vehicle to transport the body. A hospital or public health official should be designated in advance to accompany the body from the hospital to the place of final disposition to ensure the safety of all those involved in the process. There should be protocols in place so the designated official accompanying the body knows what to do if the body bag is compromised during transport and how to safely decontaminate it. For example, this official should have a biohazard spill kit with all of the equipment needed for any situation in which the body bag is compromised, including: recommended PPE, absorbent materials

such as paper towels, kitty litter or a solidifier, an EPA-registered hospital disinfectant, additional body bags, and biohazard waste bags.

- A new set of workers in the cold zone will receive the decontaminated body bag.
- Place patient identification and any other documents that need to accompany the body, including a printout of the photograph taken before the body was bagged, in an adhesive-backed pouch that is attached to the body bag. This will serve the function of toe tags. This should be done after the bagged body enters the cold zone but before the bagged body is transported to the morgue or out of the hospital.
- Notify the mortuary if the body has any implanted electronic medical devices.
- Affix the following labels to the body bag before it is placed into the hearse or other vehicle used to transport the body:
 - Black and white "infectious substance" label.
 - United Nations (UN) 2814 label.
 - "Do not open" label.
 - Name and phone number of the hospital administrator.

Mortuary care and disposition of remains

The guidance below is primarily intended to protect workers involved with the disposition of human remains either by cremation (recommended) or burial.

- Ensure that anyone handling the body bag wears single-use (disposable) gloves with extended cuffs and a long-sleeved disposable gown.
- Do not open the body bags.
- Do not embalm the body.
- Do not remove any implanted medical devices.
- Cremate the remains. An oversized cremation container may be needed to contain the bagged body for cremation. Cremated remains are no longer infectious and can be handled and provided to the family using normal procedures.
- Consult your authorized state regulator and EPA regulations governing required cremation temperatures. Cremation and cremation temperatures may be subject to state, local, and EPA regulations.
- Bury the remains in instances where cremation cannot be safely performed. For example, some crematoriums may have concerns about cremating bodies containing implanted electronic medical devices. Some of these medical devices can explode, potentially damaging the crematory container or vessel known as a retort. Other medical devices can normally be cremated safely. Where damage to the retort is a concern, the body should be buried in a standard metal casket or other comparable burial method in accordance with state and local burial requirements. The casket containing the bagged remains can be handled without PPE.

CDC and OSHA fact sheet for safe handling, treatment, transport, and disposal of Ebola-contaminated waste

- Workers involved in handling, treatment, transport, and disposal of medical, laboratory, and other waste must be protected from exposure to Ebola virus and from physical and chemical hazards that may be associated with waste management tasks.
- Waste generated from caring for or cleaning up after an Ebola victim may pose a risk to workers if it is not handled safely or treated and disposed of properly.
- Safe handling, treatment, transport, and disposal of waste that is suspected or known to be contaminated with Ebola virus begins at the point of origin where the waste is generated and continues through final disposal. Waste may be generated at the point of origin during activities such as:
 - Using and discarding sharps, dressings, and other supplies while caring for a patient with suspected or confirmed Ebola.
 - Discarding supplies used for clinical laboratory testing of samples from a patient with suspected or confirmed Ebola.
 - Cleaning hospital rooms; ambulances, airplanes, and other vehicles; airport and other transportation facilities; residences; or other areas with suspected or confirmed Ebola-virus contamination.
 - Removing and discarding disposable personal protective equipment (PPE) after working in an environment with suspected or confirmed Ebola-virus contamination.

Waste management steps at point of origin

- Take steps to minimize solid and liquid wastes.
- Identify a complete chain for waste handling, collection, treatment, transport, and disposal before the waste is generated. Ensure that waste, including incinerator ash or other completely treated materials, has a final place for disposition.
- Sharps containers must be closable, puncture-resistant, leak proof, and labeled or color-coded.
- Create a waste management plan and secure necessary contracts and permits ahead of time in order to help avoid potential exposure hazards, security risks, and storage problems. Pre-identify waste management facilities prior to waste generation; waste management facilities may have their own requirements that may need to be considered.
- Place materials in double, leak-proof bags, and store in a rigid, leak-proof container to reduce the risk of worker exposure.
- If waste ultimately will be transported, follow U.S. Department of Transportation (DOT) guidance for packaging from the outset to minimize repackaging or additional handling: phmsa.dot.gov/hazmat/packaging-of-ebola-contaminated-waste.
- Employers should follow manufacturer instructions on product labels and Safety Data Sheets for Environmental Protection Agency (EPA)-registered disinfectants when selecting PPE for their workers. U.S. Dept. of Health and Human Services (HHS).
- Use a puncture-proof container for sharps. See www.cdc.gov/niosh/docs/97-111.
- Mark and label outer packaging according to the Occupational Safety and Health Administration (OSHA) Bloodborne Pathogens standard (29 CFR 1910.1030) and DOT.

General marking requirements for non-bulk packaging (49 CFR 172.301)

- Ensure that the outsides of waste containers are not contaminated. Use a combination of administrative controls and work practices to avoid contaminating a container when placing waste into it.
- Implement protocols for effectively decontaminating the outside of bags that go into containers, and the containers themselves if they come into contact with potentially infectious waste.
- If porous containers, such as corrugated cardboard boxes, become contaminated, they should be placed into another container.
- Disinfect the outsides of waste bags with an EPA-registered disinfectant that meets Centers for Disease Control and Prevention (CDC) criteria (see page 3: “Disinfectants for Ebola virus”) by wiping or spraying the bags with an appropriate disinfectant. Follow manufacturer instructions on product labels for concentration, application method, and contact time for the specific disinfectant.
- If practicable, consider autoclaving waste on-site using an appropriate autoclave before it is packaged and sent out of a facility for disposal. Porous materials may require multiple autoclave cycles to ensure sufficient penetration of heat and steam. This approach may be more effective than just using a longer cycle.

Follow CDC guidelines and DOT Hazardous Materials Regulations (HMR), at www.cdc.gov/vhf/ebola/hcp/medical-waste-management.html and phmsa.dot.gov/hazmat/transporting-infectious-substances.

Use appropriate personal protective equipment

The Occupational Safety and Health Administration (OSHA) Personal Protective Equipment (PPE) standard (29 CFR 1910.132) requires employers to assess the workplace to determine what hazards are present and then choose the appropriate PPE to protect workers. Employers must select PPE that will protect workers against Ebola virus and other hazards to which they may be exposed. Workers with different job tasks, for instance, those who load waste containers onto trucks compared to those who empty containers onto processing lines, may have very different exposures and require different PPE. Workers must wear PPE to help minimize exposure to the virus via mucous membranes and broken skin, or through inhalation of bio-aerosols. Examples of PPE that may be needed during waste handling, treatment, transport, and disposal include:

- Nitrile gloves (consider using double-gloves and/or puncture-resistant gloves for extra protection).
- Goggles or face shields.
- Fluid-resistant or impermeable gowns or coveralls, and aprons.
- Facemasks that cover the nose and mouth.
- Dedicated washable shoes with protective shoe coverings.

- N95 respirators, Powered Air Purifying Respirators (PAPRs), or other respiratory protection devices.
- OSHA's PPE Selection Matrix is intended to help employers select appropriate PPE for protecting workers who may be exposed to Ebola virus on-the-job. The National Institute for Occupational Safety and Health (NIOSH) also provides recommendations for the selection and use of protective clothing and respirators for protection against biological agents: www.cdc.gov/niosh/docs/2009-132.
- Training, practice and observation of workers in correct donning and doffing of PPE are important infection control measures. Workers should put on PPE in a way that minimizes the risk of skin and mucous membrane contact with potentially infectious materials; and remove PPE in a way that avoids self-contamination. This includes decontaminating PPE before and between removal steps: www.cdc.gov/vhf/ebola/hcp/procedures-for-ppe.html. The order of PPE removal may vary depending on the type of PPE a worker uses, the nature of the work tasks being performed, and which devices or garments are contaminated, among other factors.

Collecting and transporting waste

- Under the Bloodborne Pathogens standard, 29 CFR 1910.1030, and other OSHA requirements, employers already must protect workers who collect and transport waste from exposure to infectious agents, such as the hepatitis B virus and human immunodeficiency virus (HIV), in the waste they handle on a daily basis. Although exposure to these other agents may be more likely, employers are also required to protect workers from exposure to the all virus including Ebola.
- Follow stringent packaging protocols, including decontaminating waste containers at the point of origin, as a way to reduce the risk of exposure to Ebola virus and other infectious agents for workers involved in collecting packaged waste.
- Place containers of waste as low as possible on dollies, hand trucks, or carts and in trucks or other transport vehicles to prevent

toppling and spillage. Secure containers, especially stacked ones, within vehicles using suitable straps or tie-downs.

- Employers must take steps to protect workers from exposure to contaminated waste containers and to protect workers when they must handle waste containers that are visibly soiled or otherwise known or suspected of having Ebola-virus contamination.
- Use proper protections, including additional or more protective PPE, if handling waste containers with visible contamination from blood, body fluids, or other potentially infectious or unknown material. Employers may consider additional or more protective PPE for waste collection and transport workers if they determine another more serious hazard(s) exists.
- Follow DOT HMR, at phmsa.dot.gov/hazmat/transporting-infectious-substances.

Processing waste in a treatment/disposal facility

- Under the Bloodborne Pathogens standard, 29 CFR 1910.1030, and other OSHA requirements, employers already must protect workers who process waste in a treatment/disposal facility from exposure to all infectious agents as noted above. Workers who are exposed to waste before it is completely treated and decontaminated, including when opening containers to load waste onto processing lines or into autoclaves or incinerators, may be at higher risk for exposure to Ebola virus and other infectious agents

than workers with job tasks such as handling waste products that have already been treated, such as incinerator ash or waste that already was appropriately autoclaved at its point of origin. Waste that has been properly treated and decontaminated is no longer infectious. Again, containers of waste must be placed as low as possible on dollies, hand trucks, or carts and when stacking to prevent toppling and spillage. Secure stacked containers using suitable shelves, straps, or other equipment.

Disinfectants for Ebola virus

- Use an EPA-registered disinfectant with label claims for use against non-enveloped viruses (e.g., norovirus, rotavirus, adenovirus, poliovirus) to treat contamination/spills and to disinfect non-porous surfaces after bulk spill material has been removed.
- Non-enveloped viruses are typically more difficult to destroy than enveloped viruses, such as Ebola. Stronger disinfectants used to destroy non-enveloped viruses are also capable of inactivating enveloped viruses.
- EPA List L outlines selected registered antimicrobial products that meet the CDC criteria for use against the Ebola virus: www.epa.gov/oppad001/list-l-ebola-virus.html.
- Always follow the manufacturer's instructions (e.g., concentration, application method and contact time) for the specific disinfectant.

- Never mix chemical disinfectants and cleaners together. Certain combinations of chemicals can be deadly or can reduce the effectiveness of the disinfectant.
- Employers must consider increasing levels of PPE for waste processing and treatment/disposal workers if they determine that a more serious hazard exists.
- Follow applicable EPA, state, and local regulations for hospital/medical/infectious waste incinerators: www.epa.gov/ttnatw01/129/hmiwi/rihmiwi.html.
- Workers tasked with processing reusable collection and storage containers, conducting housekeeping within processing facilities, or cleaning transport vehicles may refer to OSHA's "Cleaning and Decontamination of Ebola on Surfaces" Fact Sheet for additional guidance: www.osha.gov/Publications/OSHA_FS-3756.pdf.

Do not shred contaminated waste

- Do not use waste management processes that involve shredding incoming waste materials that have suspected or confirmed Ebola-virus contamination.
- Shredding, particularly with equipment that is not closed and ventilated out of the work area, may result in generation of bio-aerosols (aerosolized droplets containing infectious particles that can be inhaled).
- Shredders may become clogged or jammed by atypical, porous waste materials (e.g., linens, carpet, curtains, or other textiles) that must be discarded when decontamination is not possible.
- If at all possible, do not enter a clogged shredding machine to resolve a jam. If a worker must do so, they should always ensure that the machine is powered off and follow proper lockout/tagout procedures for controlling hazardous energy: www.osha.gov/SLTC/controlhazardousenergy.
- Ensure that the worker has proper PPE to protect against all health and safety hazards that are possible from the waste and the machinery, including bloodborne pathogens and other infectious diseases, and mechanical, electrical, and other physical hazards of the equipment.

Final disposal of treated waste

- Waste that has been properly treated and disinfected using thermal/heat treatment (e.g., microwaves), autoclaving, incineration, or a combination of these or other generally accepted methods is not considered to be infectious.
- Depending on state regulations, such waste can safely be disposed of following the protocols normally used by a facility under the jurisdiction of the state where it is located.
- As with any solid waste, other applicable disposal requirements should be considered (e.g., if non-infectious materials, such as toxic metals, are present in regulated amounts).

Use appropriate respiratory protection

- In instances where workers may be exposed to bio-aerosols (e.g., as a result of using high-pressure air or water for cleaning) suspected or known to contain Ebola virus, additional respiratory protection is needed. In these cases, medically qualified workers must use, at a minimum, a NIOSH-approved, fit-tested N95 respirator. See www.cdc.gov/niosh/nppt/topics/respirators/disp_part/n95list1.html.

Safer waste processing techniques

- Select waste-processing techniques that minimize potential worker exposure to Ebola virus or other pathogens.
- Incinerate entire unopened waste containers in incinerators to eliminate exposures associated with handling and opening containers. Incinerator facilities should be operated in compliance with applicable federal, state, and local regulations.
- If using autoclave or rotoclave equipment, develop, validate, and regularly test protocols using biological and non-biological indicators to ensure that the autoclave temperature and pressure are maintained for long enough time periods to kill all organisms throughout the waste content and that heat/steam can penetrate packaging and any porous materials.
- Weekly (or more frequent) testing with biological or non-biological indicators ensures that autoclave equipment is functioning properly.
- Do not use open burning techniques, which could expose workers and other individuals to harmful air contaminants.
- Do not shred contaminated waste.
- Wearing a respirator for extended periods of time can be uncomfortable. Workers who need respirators for long time periods may find powered air-purifying respirators more tolerable.
- Respirators used for protecting workers against Ebola virus may not be effective for also protecting them from exposure to certain chemicals used for treating and decontaminating waste, or for cleaning and decontaminating equipment. To learn more about the requirements for selecting an appropriate respirator to protect against chemical exposure (elastomeric respirator with appropriate chemical or combination cartridges or a supplied-air respirator), consult OSHA's Respiratory Protection standard, 29 CFR 1910.134, and the manufacturer's Safety Data Sheet (SDS) for the specific chemical(s) that workers are using. See OSHA's Respiratory Protection web page: www.osha.gov/SLTC/respiratoryprotection.

Infection control for all waste workers

- Limit the number of workers who handle waste to essential staff. For example, instruct and train healthcare workers generating waste during care of an Ebola patient to properly package the waste instead of requiring an environmental services or waste collection worker to also handle the waste.
- Whenever gloves are removed or changed, wash hands with soap and water, or use alcohol-based hand rubs if soap and water are unavailable. Always wash with soap and water if hands are visibly soiled.
- Avoid touching the face or other exposed parts of the body while wearing gloves or before washing/sanitizing bare hands.
- Change clothing and shower as soon as possible if work clothing becomes soiled. Discard soiled work clothing with other Ebola-contaminated waste.
- Consider wearing dedicated, washable footwear while on the job.
- Notify a supervisor immediately if exposed to potentially infectious material or waste on the job, including on work clothing or exposed skin or through mucous membranes including eyes, nose, and mouth.

Follow applicable OSHA standards

- Employers must ensure that they comply with OSHA's Bloodborne Pathogens standard, 29 CFR 1910.1030, to protect workers who may come into contact with blood or other potentially infectious materials.
- OSHA's Personal Protective Equipment (PPE) standard, 29 CFR 1910.132, provides additional information about how to select and use appropriate PPE, training, and other requirements.
- Employers must comply with OSHA's Hazard Communication standard, 29 CFR 1910.1200, when their workers use certain chemicals for cleaning and decontamination.
- OSHA's Lockout/Tagout standard, 29 CFR 1910.147, contains requirements on controlling hazardous energy when working with machinery.

Worker training is essential

- Employers must train workers about sources of exposure to Ebola and appropriate precautions.
- Where workers may be exposed to blood or other potentially infectious materials, such as in the waste handling, treatment, transport, and disposal industry, employers must provide the training required by OSHA's Bloodborne Pathogens standard, 29 CFR 1910.1030. This includes information about how to recognize tasks that may involve exposure and the methods to reduce exposure, including engineering controls, work practices, and PPE.
- Employers must train workers required to use PPE on what equipment is necessary, how to put it on and take it off safely and effectively, when and how they must use it, and how to dispose of the equipment. Employers may also be required to follow state regulations that cover potentially infectious medical waste, sometimes referred to as regulated medical waste: www.epa.gov/osw/nonhaz/industrial/medical/programs.htm.

Assistance for employers

OSHA's On-site Consultation Program offers free and confidential advice to small and medium-sized businesses in all states across the country, with priority given to high-hazard worksites. On-site consultation services are separate from enforcement and do not result in penalties or citations. Consultants from state agencies or universities work with employers to identify workplace hazards, provide advice

on compliance with OSHA standards, and assist in establishing safety and health management systems. To locate the nearest OSHA On-site Consultation Program, call 1-800-321-6742 (OSHA) or visit www.osha.gov/consultation and www.cdc.gov/info, or visit the NIOSH website at www.cdc.gov/niosh.

CDC AND WHO 2015 GUIDELINES FOR CONTAINING CREUTZFELDT-JAKOB DISEASE (CJD)

Practitioners at funeral homes, cemeteries, and crematories encounter many potentially fatal and infectious diseases including Creutzfeldt-Jakob Disease (CJD). CJD is a rare brain disease that affects one person per million population each year, and occurs when a normal brain protein spontaneously changes into an infectious abnormal form called "prion" and accumulates in brain cells. Individuals with CJD experience a rapid onset of dementia, and a range of neurological symptoms including walking difficulties, sudden jerky movements, and sometimes, visual disturbances. CJD patients usually die within one year following the onset of symptoms. An autopsy is very important in the diagnosis of CJD because it is the best way to confirm presence of the disease.

CJD is not transmissible from person to person by normal contact or through environmental contamination. For example, it is not spread

by airborne droplets, as are tuberculosis (TB) and influenza, or by blood or sexual contact as are hepatitis and human immunodeficiency virus (HIV). CJD transmission can occur during invasive medical procedures involving the central nervous system due to exposure to contaminated brain tissue. This accounts for less than 1 percent of all CJD cases. The majority of cases occur sporadically, but some individuals can also develop CJD because of an inherited mutation. Standard disinfection procedures and routine embalming solutions are ineffective against prions; however, studies show that chemical solutions and physical processes involving bleach, sodium hydroxide, or autoclaving can inactivate the prion. If the bodies of CJD patients have not been autopsied, then transportation, preparation, disinfection, and final disposition can be safely performed when standard precautions are strictly enforced.

Transporting

Funeral service workers can safely remove the body of a CJD patient from the place of death and transport it to the funeral home preparation room for mortuary procedures using appropriate standard infection control measures, which includes wearing personal protective gear. The WHO recommends placing the body in a leak proof pouch

prior to moving. The bag should be lined with absorbent material to prevent leakage of body fluids. In instances where there is excess fluid, a double bag can be utilized. After transporting, all surfaces (i.e. stretchers, cots) should be disinfected with bleach.

Preparation and dressing

Family members of CJD patients should be advised to avoid superficial contact, such as touching or kissing the patient's face, with

the body of a CJD patient who has been autopsied. However, if the patient has not been autopsied, staff need not discourage such contact.

Embalming bodies who have not been autopsied

Embalmers can embalm bodies of CJD patients who have not been autopsied using standard precautions. However, it may be prudent to place the body on a waterproof sheet to collect bodily fluids and use disposable instruments. They should collect bodily fluids in a suitable

container. Incision sites should be closed with super glue, wiped down with bleach, and the body washed prior to dressing. Cosmetic restorative work may also be undertaken.

Embalming bodies who have been autopsied

Embalming bodies of CJD patients who have been autopsied can also be safely performed. Adherence to standard infection control measures is paramount when embalming an autopsied body of a suspected or clinically diagnosed CJD patient. Autopsies on these individuals are often restricted to removal of the brain; therefore, special precautions should be taken, including placing a plastic sheet with absorbent

wadding and raised edges underneath the head to ensure containment of fluids and prevent any spillage. In instances where sutures do not completely control leaking, the cranial cavity should be packed with absorbent material that has been soaked with bleach and tightly sutured.

Precautions for embalming the bodies of patients with suspected or confirmed CJD

Bodies of autopsied CJD patients

Bodies of autopsied CJD patients should be placed on a waterproof sheet to collect all fluids. It is strongly recommended that disposable instruments, masks, gowns, and puncture-resistant gloves be used whenever possible. The entire body should be washed with bleach, rinsed, and sanitized before dressing. Special care should be taken to limit fluid leakage when performing restorative work on a CJD patient. All fluids should be collected in a suitable container.

Decontaminating heat-sensitive instruments or materials that come in contact with suspected or confirmed CJD patients

All disposable instruments, materials, and wastes that come in contact with high infectivity tissues (brain, spinal cord, and eyes) and low infectivity tissues (cerebrospinal fluid, kidneys, liver, lungs, lymph nodes, spleen, and placenta) of suspected or confirmed transmissible spongiform encephalopathy, or TSE, patients should be disposed of by incineration. Surfaces and heat-sensitive reusable instruments that come in contact with high infectivity and low infectivity tissues should be decontaminated by flooding with or soaking in 2N NaOH or undiluted sodium hypochlorite for one hour and rinsed with water. CDC NOTE: Sodium hypochlorite may be corrosive to some instruments.

Casketing and viewing

Staff should avoid unnecessary manipulation of the body that would force purging of body fluids and risk opening of incision sites. If

warranted, the casket can be lined with a leak-proof sheet. An open casket for viewing should not be prohibited. Family members of CJD patients should be advised to avoid superficial contact, such as touching or kissing the patient's face, with the body of a CJD patient who has been autopsied. However, if the patient has not been autopsied, such contact need not be discouraged.

Terminal disinfection and waste removal

According to WHO infection-control guidelines, flooding with undiluted bleach can disinfect work surfaces. Although the use of disposable instruments is preferred, reusable instruments and tools can be cleaned and disinfected by using CJD sterilization protocols recommended by the Centers for Disease Control and Prevention listed above. All contaminated solid materials should be disposed of as hazardous waste. Disposing of body fluids, tissues, and hazardous chemicals should be handled in accordance with funeral home policy, local, state, and federal regulations.

Final disposition for cremation and burial

There are no special interment, entombment, inurnment, or cremation requirements for patients with CJD. Interment of bodies in closed caskets does not present a significant risk of environmental contamination and cremated remains can be considered sterile, as the infectious agent does not survive incineration-range temperatures.

WHO GUIDELINES FOR TSE

After death

Precautions for handling of the deceased patient

On the death of a patient with confirmed or suspected TSE, the removal of the body from the ward, community setting, or hospice, should be carried out using universal precaution measures. It is recommended that the deceased patient be placed in a sealed body bag prior to moving following universal precautions for bodies with a known infection risk. Where the skull is open or there is cerebrospinal fluid (CSF) leakage, and where sutures do not completely control this leaking, the bag should be lined with materials to absorb any fluid, and moved in a sealed body bag. WHO guidelines for TSE note

drainage from any tissues may retain infectivity and should be handled accordingly.

National and international transport of bodies

If there is a need to transport the deceased patient nationally or internationally, it will be necessary to comply with the International Civil Aviation Organization (ICAO), International Air Transport Association (IATA) Restricted Articles Regulations, and any additional requirements of the individual carriers. It should be noted that the IATA regulations require the embalming of the body.

Undertakers and embalmers

General measures

Mortuary procedures using universal precautions may be performed on the bodies of patients who have died from TSE, to ensure the safety of personnel and avoid contamination of the workplace. Transportation of the unembalmed body to the mortuary should be in a sealable, impermeable plastic pouch. Contact or handling of an intact, unautopsied body does not pose a risk, and staff may undertake cosmetic work without any special precautions. If the body has undergone autopsy, care should be taken to limit contamination of the workplace by any leaking bodily fluids, especially from the cranium, when transferring the body from its transport bag to the mortuary table that has been covered with an impermeable sheet.

Embalming

An intact unautopsied body can be safely managed with only minor adjustments to the usual procedures. Embalming an autopsied or traumatized body is not encouraged, but may be safely performed when the following precautions are observed:

- Disposable masks, gowns, and gloves should be worn, just as pathologists do when performing an autopsy.
- The body should be placed on an impermeable sheet or body pouch so that suture site leakage can be contained, and perfusion

drain sites should be similarly arranged to avoid surface contamination.

- All drainage fluids should be collected into a stainless steel container.
- Perfusion and autopsy incision sites should be closed with cyanoacrylates.
- The entire body should be wiped down with bleach, and special care taken to ensure contact of bleach with perfusion sites and closed autopsy incisions.
- At the conclusion of the perfusion procedure, the container of drainage fluids should be decontaminated by adding sodium hydroxide pellets at the rate of 40g per litre of fluid. The mixture should be stirred after a few minutes and care should be taken to avoid spillage, as the fluid will be hot. It should then be left undisturbed for at least one hour, after which it can be disposed of as for any other mortuary waste.
- Plastic sheets and other disposable items that have come into contact with bodily fluids should be incinerated.
- Mortuary working surfaces that have accidentally become contaminated should be flooded with sodium hydroxide or bleach, left undisturbed for at least one hour, then, using gloves, mopped up with absorbent disposable rags, and the surface swabbed with water sufficient to remove any residual disinfectant solution.

- Non-disposable instruments and tools should be decontaminated using one of the methods from the following Annex III recommendations in order of more to less severe treatments:
 1. Incineration.
 2. Autoclave/chemical methods for heat-resistant instruments.
 3. Chemical methods for surfaces and heat-sensitive instruments.
 4. Autoclave/chemical methods for dry goods.

At the conclusion of the decontamination procedure, the instruments should be washed with water to remove residual disinfectant fluid before drying and reuse. Sodium hydroxide or bleach can be disposed of as uninfected but corrosive waste fluid. Visit the WHO website for guidelines of when and how to use the specific methods above at <http://www.who.int/csr/resources/publications/bse/whocdscsaph2003.pdf>

Funerals and cremations

Relatives of the deceased may wish to view or have some final contact with the body. Superficial contact, such as touching or kissing the face, need not be discouraged, even if an autopsy has been conducted. Interment in closed coffins does not present any significant risk of environmental contamination, and cremated remains can be considered

to be sterile, as the infectious agents do not survive incineration-range temperatures of 1000°C. Transport and interment are subject to national, state, and local guidelines, and transport overseas is governed by international regulations.

Exhumations

Standard procedures are conducted according to local and national guidelines. The body should be considered as having the same infectivity as at the time of burial, and the precautions used for an autopsy should be followed.

Body donation for teaching purposes

Anatomy departments should not accept, for teaching or research purposes, any body or organs from persons confirmed, suspected, or at risk for TSE, unless they have specific training or research programs for TSEs, including access to specialized equipment, procedures, appropriate containment facilities, and training for managing TSE-contaminated tissues. Departments should make inquiries of those responsible for donating the body, and of the medical staff involved in the care of the donor, to ensure the rigorous adherence to this recommendation.

MYTHS SURROUNDING POSTMORTEM PROCEDURES AND INFECTIOUS DISEASE CONTAMINATION

The following information applies to infectious diseases that do not carry specific regulations for burial and cremation, as previously outlined above. Care should be taken to review the federal guidelines in this course as well as laws and regulations of the state and local jurisdictions.

In the past, many personnel in the funeral industry believed that embalming was necessary to protect the public from environmental contaminants and the spread of infectious disease. It was commonly believed that the body must be interred in a sealed casket or vault to protect against contamination of soil and groundwater. Scientific research provides significant evidence to refute these beliefs and the CDC, the WHO and the Pan American Health Organization (PAHO) have published these findings. Numerous research studies, using evidence based, scientific peer-review procedures, have shown no environmental contamination or spread of disease from unembalmed bodies in countries that do not use embalming or burial in sealed caskets or vaults.

There is also a myth that embalming is legally required; however, states do not routinely require embalming for viewing. New Hampshire and some others require embalming, or refrigeration, if the body has not been buried within twenty-four to forty-eight hours. Embalming is mandated when a body crosses state lines from Alabama and Alaska. Five other states, California, Idaho, Kansas, Minnesota, and New Jersey, require embalming when the body leaves those states by common carrier airplane or train (FCA, 2015).

There is the belief by some that a body contains dangerous bacteria that can spread infection. A journal article written by Oliver Morgan, and published by the PAHO, a division of WHO, addresses this topic as follows:

“The microorganisms that are involved in decomposition are not the kind that cause disease, and most viruses and bacteria that do cause disease cannot survive more than a few hours in a dead body. An apparent exception is the human immunodeficiency virus, HIV, which has been shown to live up to 16 days in a corpse under refrigeration.”

Morgan further explains that exposure to a body with HIV, as well as most diseases, is no more dangerous in terms of contamination than exposure to a live person with HIV. The same precautions to prevent contact with bodily fluids from a person with HIV/AIDS would apply to contact with the body post mortem.

Dr. Lakshmanan Sathyavagiswaran, M.D., Chief Medical Examiner of Los Angeles, provides the following clarification:

“There is no reason that an unembalmed human body should be infectious to anyone attending visitation or public services. Persons transporting and handling bodies or cutting into them may be vulnerable in rare instances, with little or no risk if proper precautions are taken. To refuse to present a body unembalmed because of public health risk is unfounded. On rare occasions of certain deaths resulting from contagious disease, our office may encourage placing a facemask on the decedent before and during transportation and containment, and disposing without embalming or viewing. In the event, however, it becomes necessary to hold a body for an extended period of time before public services can be held, arterial embalming is recommended. Riding on an airplane or a bus may be a public health risk; the presence of an unembalmed body is not.”

The United States and Canada are the only countries that normally practice embalming though some religious and ethnic groups, including Jewish, Muslims, Amish, Native Americans, Buddhists, Baha’i, Hindus, and others follow traditional customs for private care of the body by family or religious members. The CDC simply states, “We have not at any point prescribed embalming as a method of protecting public health (Burden, 2006).”

Another unfounded myth is that infectious disease epidemics can occur after national disasters, such as earthquakes or tsunamis, which uncover burial grounds. Both PAHO and the WHO have attempted since 1986 to dispel this myth and produced a video titled, “Myths and Realities of Natural Disasters.” Jean-Luc Poncelet, chief of PAHO’s Emergency Preparedness and Disaster Relief program states the following:

“The notion that dead bodies pose an urgent health threat in the aftermath of a disaster is one of several enduring myths about disasters and relief efforts. Survivors are much more likely to be a source of disease outbreaks.”

One long-held myth is that burial sites will lead to contamination of groundwater, so bodies need to be embalmed and placed in caskets and vaults to prevent this. Decomposition is a natural part of the life cycle of all living things and the human body becomes part of this cycle. When domestic and wild animals die, they are not embalmed or buried in leak-proof containers to protect the environment from contamination, though they may carry disease.

Further support can be found in the fact that states do not mandate embalming or internment in contamination-proof caskets or vaults. Studies conducted in 2006 by Monument Builders of North America (MBNA) showed that even sealed caskets in vaults were subject to failure, which allowed outside elements in and fluids to leak out over time. These results were published in the “Funeral Ethics Organization Newsletter” as follows:

“MBNA found that the Catholic Cemetery Association was documenting an 86 percent failure rate or problems with wood and cloth-covered caskets, 62 percent for nonsealing metal, and 46 percent for ‘protective’ or ‘sealer’ caskets. Though sealed caskets yielded lower failure numbers the report states in bold print, ‘It is highly unlikely that protective sealer metal caskets employ sufficient mechanisms to contain body fluids or gases.’”

Environmental health and safety

The National Funeral Directors Association, or NFDA, has enhanced its efforts to assist funeral directors to address the health and safety of personnel and to educate the public on environmental safety related to the embalming process, preparation, alkaline hydrolysis, crematory equipment, and wastes discharged by funeral homes and crematories. To that end, the NFDA will:

- Encourage the development of environmentally and personally safe embalming chemicals, funeral service products, and preparation room equipment.
- Undertake proactive communications initiatives.

- Assist funeral directors with environmental and safety compliance issues, establishing green funeral homes, and green end-of-life practices.
- Promote laws and practices consistent with these objectives.

OSHA reform: That NFDA continue to support legislation, regulations, and policies that reshape OSHA into an agency that listens to and works with business to craft industry-specific, performance-based, safety and health workplace practices that are based on commonsense and practical reality rather than academic or theoretical concepts or punitive regulations or enforcement (NFDA, 2015).

Conclusion

Funeral directors, embalmers, and personnel will face postmortem care for persons who have died with infectious, contagious diseases. They must receive training to provide services for these individuals and their families using universal precautions to ensure the health and safety of everyone in contact with the deceased as well as the public at large. The severity of many infectious diseases discussed in this course calls for strict adherence to the regulations and guidelines mandated by the

CDC, OSHA, and WHO. Following these guidelines provides staff with training and preparation to meet the changing demands of the profession and promote the health, safety, and confidence of personnel, families, and the community.

In addition to the major health organizations, the NFDA websites provide frequent updates from the major health organizations and resources for current information specific to the funeral profession.

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INFECTIOUS DISEASE CONTROL FOR FUNERAL DIRECTORS AND EMBALMERS

Final Examination Questions

Select the best answer for each question and mark your answers online at Funeral.EliteCME.com.

1. Colonization is development of a bacterial infection, though the infected person may or may not have signs or symptoms of infection.
 True False
2. The four main classes of infectious agents are bacteria, viruses, fungi, and pathogens.
 True False
3. In some cases, the host may be temporarily or permanently colonized but show no symptoms of the infection or disease.
 True False
4. Transmission of infectious agents within a healthcare setting requires one element only and that is the direct exposure to mucous membranes.
 True False
5. Prion diseases are usually rapidly progressive and always fatal.
 True False
6. Human-to-human transmission is the principal feature in Ebola virus outbreaks; virus is transmitted from symptomatic persons but not from contaminated corpses or by contact with objects acting as fomites.
 True False
7. In addition to federal laws and guidelines that apply to mortuary workers contained in this course, mortuary practices and workers may also be subject to a state, tribal, territorial, and local regulations.
 True False
8. Respirators used for protecting workers against Ebola virus may not be effective for also protecting them from exposure to certain chemicals used for treating and decontaminating waste, or for cleaning and decontaminating equipment.
 True False
9. Family members of CJD patients should be advised to avoid superficial contact, such as touching or kissing the patient's face, with the body of a CJD patient who has been autopsied.
 True False
10. Mortuary working surfaces that have accidentally become contaminated should be flooded with sodium hydroxide or bleach, and then left undisturbed for at least one hour.
 True False