Ebola Virus Disease

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Abstract

Ebola is an unfamiliar disease with a high mortality rate. Until recently, it occurred only in rural tropical regions and most health care providers had only read about it in epidemiology classes. With globalization, international travel, and foreign medical missions, it is possible that a patient with Ebola exposure and/or symptoms may present in any emergency department. All health care providers must be familiar with identifying the signs and symptoms of Ebola and capable of initiating an appropriate response. This article presents an overview of Ebola virus disease for health care providers, covering pathophysiology, identification, treatment, and general considerations for hospitals and providers to consider when developing policies and procedures.

Key words: Ebola, Ebola virus, Ebola virus disease, Filoviridae, filovirus, hemorrhagic disease, hemorrhagic fever, hemorrhagic virus

“IT’S A SMALL WORLD and getting smaller” has never been a more true statement, and the health care field is constantly evolving to keep pace with the growing number of emerging diseases resulting from globalization. Technological developments allow health care providers to travel to remote locations and provide state-of-the-art care. Telemedicine facilitates consults with specialists across the world. Persons who once traveled weeks to access even rudimentary health care facilities are quickly transported across continents, to large medical centers, in a matter of hours. Worldwide travel is common, and persons move freely about sharing their culture, stories, and any illness they may have contracted with those they meet along the way. One such illness is Ebola virus disease (EVD). Once found only in remote areas, with infrequent occurrences, EVD has been growing in incidence and prevalence (Centers for Disease Control and Prevention [CDC], 2015u).

Ebola has, in fact, found its way to the United States, and health care workers have contracted the disease within the hospital setting (CDC, 2015o; Shoichet, Levs & Yan, 2014; Wade, 2014). As of January 14, 2015, a total of four laboratory-confirmed cases have occurred in the United States and seven persons have been treated for EVD in the United States. Three health care workers who contracted Ebola while in Africa were transported to the United States for treatment. One non-U.S. citizen, with known exposure to Ebola, traveled to the United States and subsequently developed symptoms, and two nurses caring for this individual contracted the disease within the United States. Finally, one physician who had cared for Ebola patients in

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West Africa received a diagnosis of Ebola after returning home and developing symptoms. Hundreds of others have been placed under quarantine or surveillance (CDC, 2015a; Levs & Yan, 2014; Shoichet et al., 2014; Wade, 2014), and countless others may be yet unidentified and unaware of their exposure. Ebola guidelines from the CDC and the World Health Organization (WHO) initially focused on identifying and treating patients with Ebola in austere environments with limited health care resources and patient contact (CDC, 2015g; WHO, 2015a, 2015b, 2015c). Now CDC guidelines on patient triage within the United States focus on identifying individuals who may have been exposed (CDC, 2015g, 2015s).

Emergency department (ED) nurses serve on the front lines of health care and will most likely be the first contact patients have with a health care provider. Would you recognize Ebola if a patient walked into your ED? Would you know what to do? Are your ED and hospital prepared?

The purpose of this article is to provide an overview of EVD for health care providers. It covers the pathophysiology, identification, treatment, and general considerations when caring for patients with Ebola. In addition, it provides recommendations for hospitals and providers to consider when developing policies and procedures for care of patients exposed to and diagnosed with EVD. Because prevention and treatment guidance is constantly evolving, this article provides additional resources to reference for emerging practice guidance.

PATHOPHYSIOLOGY

The Ebola virus that causes a hemorrhagic disease is a member of the Filoviridae family that is endemic in rural tropical regions (CDC, 2015r; Turner, 2014). The first species of these hemorrhagic diseases was identified in 1976, and five species have subsequently been isolated (CDC, 2015i, 2015p, 2015r; Michelow et al., 2011; Turner, 2014). Four of the identified filovirus species (Zaire, Sudan, Taiforest, and Bundibugyo) are endogenous to the African continent and can be transmitted from nonhuman primates and other mammals to humans. The fifth species (Reston) is endogenous to the Philippines and found in pigs. Presently, there are no known cases of cross-species infection of humans (CDC, 2015i, 2015r; Feldman & Geisbert, 2011; Michelow et al., 2011; Turner, 2014).

Filoviruses produce a glycoprotein that causes immune suppression, inflammation, and finally multiorgan failure (CDC, 2015f). When the virus enters the host, it spreads via the lymphatic system causing lymphopenia and lymph node necrosis, dendritic cell function dysregulation, cytokine storms, and adrenal necrosis. This chain of events undermines the immune response, allowing the virus to travel, unchecked, throughout the body. Once the virus metastasizes to the liver and the spleen, it becomes necrotic, leading to abnormal clotting, decreased platelet production, and increased bleeding (CDC, 2015f; Michelow et al., 2011; Turner, 2014). Approximately 30%–50% of infected persons develop hemorrhagic symptoms late in the disease (Dixon & Schafer, 2014).

TRANSMISSION

Ebola has, historically, been a self-limiting disease due to the fact that it usually kills the host quickly. Infected victims and their families/tribes were isolated, and unable to travel long distances, the disease might kill the village inhabitants but not be carried to other locations (Turner, 2014). Because of the resurgent nature of outbreaks, scientists believe that the reservoir must be a carrier that remains asymptomatic until a stressor causes disease symptoms to manifest (CDC, 2015i). Once symptomatic, the carrier becomes infectious and contact with infected tissue and/or body fluids or ingestion of contaminated raw flesh transmits the virus to others (CDC, 2015e, 2015i, 2015k, 2015l; Dixon & Schafer, 2014; Feldman & Geisbert, 2011; Turner, 2014).
The true reservoir for Ebola remains unknown. A common, yet unproven, belief is that fruit bats serve as a reservoir for Ebola (CDC, 2014b; Ebihara et al., 2013; Turner, 2014). Mammals appear to be the primary transmission vector. Ebola has been and can be transmitted to or by bats, apes, monkeys, antelope, porcupine, hamsters, mice, guinea pigs, and humans (Ebihara et al., 2013; Feldman & Geisbert, 2011; Turner, 2014). It is reasonable to assume that cats, dogs, and other mammals could contract the disease and serve as vectors as well. Insects, such as mosquitoes, although known to transmit other diseases, are not known transmission vectors for the Ebola virus (CDC, 2015c).

The most common route of infection is direct contact with infected tissue and bodily fluids. Ebola can be transmitted through blood, urine, saliva, feces, vomit, sweat, breast milk, and semen, usually via mucous membranes or broken skin (CDC, 2015c, 2015i, 2015j, 2015k, 2015l; Dixon & Schafer, 2014; Feldman & Geisbert, 2011; Turner, 2014). Air transmission of Ebola is not common, but it is possible (Turner, 2014). Ebola remains virulent in infected cadavers and is sometimes transmitted during burial preparations (Turner, 2014; WHO, 2015a, 2015b, 2015c). It can live on nonporous inorganic objects for a week and is known to survive in semen up to 3 months postrecovery (CDC, 2015c, 2015j; Dixon & Schafer, 2014; Turner, 2014).

Even though human-to-human transmission does not occur prior to the onset of symptoms, Ebola is extremely virulent (CDC, 2015i). It has a small inoculum and up to a 90% mortality rate (see Table 1; Dixon & Schafer, 2014; Feldman & Geisbert, 2011). Ebola can spread quickly among families and in health care facilities and other environments that promote frequent and extended contact with infected persons or matter (CDC, 2014b). Any contact with infectious persons or substances places an individual at risk for EVD. All infected/contaminated tissue, fluids, and objects must be considered hazardous. The higher the level of contact/exposure, the greater the chance of contracting EVD (see Table 2; Emory Healthcare, 2014).

**SYMPTOMS**

Ebola progresses through a series of four phases after exposure: incubation, nonspecific symptoms, disease-specific symptoms, and recovery. Ebola has an incubation period of 2–21 days postexposure. Individuals are not considered infectious during the incubation stage and may not know they have been infected (CDC, 2015f, 2015g, 2015o; WHO, 2015a, 2015b, 2015c).

Phase II begins when the patient manifests symptoms and usually occurs 8–10 days postexposure (CDC, 2015f, 2015g; WHO, 2015a, 2015b, 2015c). Individuals exposed through injection may experience onset of symptoms earlier (6.3 days) than those infected through direct/indirect contact (9.5 days; Feldman & Geisbert, 2011). Initial symptoms are vague and nonspecific, mimicking other illness, and an earlier onset of symptoms is associated with higher mortality (Stephenson, 2014). Initial EVD symptoms begin abruptly and can include fever (perceived or actual) and generalized nonspecific complaints typically associated with the common cold (see Table 3; CDC, 2015j, 2015f, 2015g, 2015o, 2015r; Dixon & Schafer, 2014; Feldman & Geisbert, 2011).

Phase III begins approximately 5–6 days after the onset of symptoms. During this phase, disease-specific symptoms manifest and progressively worsen and multiorgan failure and subsequent death occur unless the immune system is able to overcome the virus (CDC, 2015d, 2015f; Goozner, 2014; Michelow et al., 2011). Individuals unable to fight off the virus typically develop severe symptoms.
Table 2. Ebola exposure risk stratification

| Risk category         | Type of exposure                                                                 |
|-----------------------|----------------------------------------------------------------------------------|
| High risk             | Direct contact with infected blood/body fluids (no PPE)                         |
|                       | Needlestick (symptomatic patient)                                               |
|                       | Direct contact with infected tissue/fluids postmortem (no PPE)                  |
|                       | Living in household of/providing care to the symptomatic person                |
| Some or moderate risk | Direct contact with infected blood/body fluids (with PPE)                      |
|                       | Direct contact with infected tissue/fluids postmortem (with PPE)                |
|                       | Close contact with the symptomatic person (prolonged period, no PPE, 3-ft. proximity) |
| Low risk              | No known exposure, but traveling in an endogenous region/location               |
|                       | Brief direct contact with someone in early disease stages                       |
|                       | Direct contact with the symptomatic person while wearing PPE                    |
|                       | Sharing public transportation with the symptomatic person                       |
| No known risk         | Contact with the asymptomatic person who was exposed to Ebola                   |
|                       | Contact with the asymptomatic person who later develops symptoms               |
|                       | Contact with the asymptomatic person 21 days after his or her exposure          |

Note. PPE = personal protective equipment.

earlier and die between Days 6 and 16 of complications (CDC, 2015f).

Phase IV, recovery, can be extremely prolonged, and a full recovery to a predisease state is not guaranteed. The severity of an organ injury and the ability of the tissue to regenerate and function will impact whether a full recovery occurs. Patients who recover from EVD are believed to have immunity to Ebola. However, it is unknown if this is a lifelong immunity (CDC, 2015f).

Table 3. Ebola signs and symptoms

| Early signs and symptoms | Late signs and symptoms |
|--------------------------|-------------------------|
| Temperature (subjective or confirmed) | Rash        |
| Headache                 | Red eyes               |
| Myalgia                  | Hiccups                |
| Weakness                 | Cough                  |
| Fatigue                  | Sore throat            |
| Decreased appetite       | Chest pain             |
| Diarrhea                 | Dysphagia              |
| Nausea                   | Dyspnea                |
| Vomiting                 | Increased              |
| Abdominal/stomach pain   | Hemorrhage             |
|                          | (30%–55%)              |

IDENTIFICATION

Identification of symptoms should occur early and outside of the health care facility to limit the number of exposures and facilitate early treatment initiation. Adopting a method to identify infected persons prior to hospital arrival would be ideal. Emory University Hospital has developed a symptom hotline for symptomatic patients to triage patients prior to them leaving their homes (Emory Healthcare, 2015). Hospitals and health care facilities should consider utilizing a telephone triage process with screening guidelines to assist in identifying patients at risk and routing them to preidentified locations for care. Advertising these prehospital triage resources and conducting an educational campaign may also assist in directing patients to the...
appropriate setting and limiting infected persons physically coming to the ED.

Unfortunately, initial Ebola identification is usually a diagnosis of exclusion because early symptoms readily mimic those of the common cold, cholera, plague, meningitis, typhoid, malaria, influenza, and pneumonia (CDC, 2015f, 2015g; Turner, 2014). People go to the doctor or ED when they feel sick, and prehospital triage efforts may not identify or keep every high-risk patient from potentially walking in the door. The case of Thomas Eric Duncan proved that people will travel after exposure and may not realize that they are infectious (CDC, 2014a). Even educated persons, familiar with the disease, may misinterpret initial symptoms (CDC, 2015a; Levs & Yan, 2014; Wade, 2014).

Health care providers must be mindful of the complications associated with failure to suspect and recognize Ebola and err on the side of caution, always adopting a conservative posture. Travel to locations with endemic Ebola can no longer be the singular discriminating factor in suspecting Ebola. Triage personnel must continue to ask patients if they have recently traveled overseas or to West Africa or been in contact with anyone sick who has recently traveled to these areas per CDC triage recommendations. However, they must also use their clinical judgment to identify patients with a potential Ebola infection. Physical examination and laboratory testing can confirm the diagnosis once precautions are in place.

**DIAGNOSIS**

Ebola testing to confirm diagnosis is only effective after the viral load has reached a level to where symptoms are present. Although the viral load may not be detectable until the patient has been symptomatic for several days, laboratory tests (white blood cell count, liver function, amylase, and coagulation studies) associated with affected organs may show changes. Therefore, supportive treatment of symptoms usually starts before confirmation of the disease. To guide symptomatic treatment, clinicians should order and monitor the following laboratory studies: complete blood cell count, chemistry, amylase, liver function tests, complete urinalysis, and coagulation studies (CDC, 2015f).

In patients with suspected EVD, antigen-capture enzyme-linked immunosorbent assay (ELISA) testing can confirm Ebola infection within the first few days of symptoms. Additional diagnostic tests include IgM ELISA, polymerase chain reaction (PCR), and virus isolation (CDC, 2015c). Because Ebola can mimic symptoms of other diseases found in tropical regions, clinicians may consider testing for malaria or typhoid in addition to EVD. However, these tests are not required (Arizona Bureau of State Laboratory Services, 2015).

In patients whose symptoms have progressed, tests will show development of IgM and IgG antibodies. Patients continue to test positive in immunoglobulin assays after they have recovered from Ebola (CDC, 2015v). This continued level of immunoglobulin is believed to provide immunity to further Ebola exposures and the basis for some Ebola treatments currently under investigation (CDC, 2015t).

Testing can also occur posthumously. If a patient is suspected to have died of Ebola, immunohistochemical testing, PCR testing, and virus isolation can all confirm the diagnosis (CDC, 2015c).

**TRIAGE**

The CDC has developed resources for use during triage of patients (see Figure 1; CDC, 2015j). This checklist provides the pertinent questions to ask all patients and focuses on three key factors: identify, isolate, and inform. Identify if the patient has been exposed while traveling or by contact with an infected individual. Identify how long it has been since the contact and if the patient currently has symptoms (CDC, 2015j).

If symptoms are present, isolate the patient (CDC, 2015j). Mask and glove both yourself and the patient, implement Ebola personal protective equipment (PPE) wear and droplet
precautions, and keep the door closed (University of Nebraska Medical Center, 2014b). Furthermore, the patient should not leave the triage room until a private negative-pressure room (with a private bathroom and an anteroom), appropriate protective equipment, and transportation are coordinated. Keeping the patient in the triage room limits both exposure to other patients and contamination. In addition, ensure all personnel coming in contact with the patient wear the appropriate level of PPE (CDC, 2015j; University of Nebraska Medical Center, 2014b). Finally, inform hospital infection control personnel to notify the health department, which will then notify the CDC (CDC, 2015j).

**TREATMENT**

Supportive care remains the “gold standard” for EVD treatment (see Table 4; Feldman & Geisbert, 2011). Although current Food and Drug Administration (FDA)-approved antivirals are ineffective against the Ebola virus and no FDA-approved treatment or vaccine exists, several potential medications and treatments are under consideration (Butler, 2014; CDC, 2015k; Goozner, 2014; Michelow et al., 2011; Turner, 2014; WHO, 2015a, 2015d). It is believed that a mannose-binding lectin (MBL), which causes immunity in mice, may be an effective vaccine. Laboratory testing has shown that MBL assists the immune response and manages symptoms. Combined with symptomatic treatments (antibodies, coagulation modulators, fluids, and electrolytes), MBL may mitigate viral effects and increase the chance of survival (Michelow et al., 2011).

Three patients, recently treated for Ebola, received an experimental medication (Zmapp) that has yet to go through randomized controlled human trials. Two patients

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**Figure 1.** [http://stacks.cdc.gov/gsearch?terms=ebola&start=0](http://stacks.cdc.gov/gsearch?terms=ebola&start=0) has many downloadable resources available to help inform staff and patients. This particular image provides a quick reference and could easily be posted in triage rooms.
Table 4. Elements of supportive care

| Elements of supportive treatment | Treatment adjuncts |
|----------------------------------|--------------------|
| Blood pressure maintenance       | Intravenous fluids |
| Oxygenation                      | Oxygen             |
| Pain control                     | Opioids            |
| Nutritional support              | Parenteral feedings |
| Electrolyte balance              | Electrolyte replace as appropriate |
| Nausea/vomiting control          | Antiemetics        |
| Chronic conditions               | Administration of chronic medications as appropriate |
| Secondary bacterial infections   | Antibiotics as appropriate for the organism |
| Psychological and emotional support | Patients will be isolated and under great stress and could benefit from the ability to talk to a professional about their condition |

As of January 12, 2015, the results of the Liberian and Guinean studies are very promising (WHO, 2015d). In anticipation of approval for use, Emory University Hospital Center in collaboration with the FDA is working to gather convalescent blood plasma for storage and use to treat newly diagnosed patients with Ebola (Johnson, 2014).
Phase I clinical efficacy trials for two vaccines (chimpanzee adenovirus serotype 3 and recombinant vesicular stomatitis virus) began in 2014. These vaccines are scheduled for testing in West Africa in early 2015. If vaccine tests are as successful as anticipated, vaccination programs will soon begin to immunize individuals at high risk of contracting the disease. Researchers hope to have this vaccine available some time in 2015 (Goozner, 2014; WHO, 2015a).

**PROVIDER PROTECTION**

If a patient is suspected to have EVD, providers should avoid direct contact, cluster care activities, and limit the number of patient interactions. A fit-tested N95 mask or similar device should be worn during all aspects of care. Ebola is not considered to be transmissible by the airborne route, but procedures can cause aerosolization of infected tissue and fluids and providers must ensure they are not exposed. Additional practices should include the use of dedicated and disposable equipment that remains in the patient’s room, limiting number of procedures, monitoring and tracking of all contacts at every level, and isolation from other patients (CDC, 2015h).

Patients remain contagious as long as the Ebola virus is detectable within the blood and body fluids. Use of PPE and all other infection control precautions should continue until the patient no longer tests positive for the Ebola virus (WHO, 2015c).

The CDC guidelines for provider protection when caring for suspected and confirmed patients with Ebola have always included universal precautions (CDC, 2015f, 2015k, 2015q, 2015r; WHO, 2015a, 2015b, 2015c). When two nurses contracted the disease following the care of a patient with Ebola, the CDC guidelines were updated to include head-to-toe barrier protection, partner-assisted donning and doffing of protective equipment, and improved monitoring of personal protection gear utilization. This upgraded level of protection also includes inclusion of an N95 mask or respirator and provides a comprehensive barrier to exposure (CDC, 2015h). Facilities must determine which equipment they choose to utilize to ensure head-to-toe barrier protection for their health care personnel. A list of recommended PPE (see Table 5), per best practices at the University of Nebraska Medical Center, is included in this article for quick review and links to the Nebraska Medical Center and CDC guidelines for PPE are included in Table 6.

General guidelines to follow when donning and doffing PPE focus on ensuring that the caregiver will not come into contact with any infected substance. Always work with a partner to ensure that the equipment is properly donned and removed. Double glove, one set under the gown cuff and one above. Tape all sites where two different items of PPE come together. Use a third layer of gloves when conducting patient care, and change third layer of gloves as often as needed. Disinfect and remove your PPE exactly as directed. Do not rip or tear any of the items during removal, and always don and doff equipment with a partner to observe and assist (University of Nebraska Medical Center, 2014a).

Health care providers and workers should practice donning and doffing protective equipment and become familiar with

**Table 5. Personal protective equipment**

| PPE equipment and supplies |
|----------------------------|
| Surgical gown              |
| Surgical cap/hair cover    |
| Face shield                |
| Standard patient gloves    |
| Doffing pads (fluid repellent) |
| Surgical boot covers       |
| N95 respirator             |
| Long-cuff nitrile gloves   |
| Trash receptacle           |
| Hand sanitizer             |
| Bleach wipes               |
| Duct tape                  |
| Surgical masks             |

*Note. PPE = personal protective equipment. This list of PPE equipment is from the University of Nebraska Medical Center Best Practices (2014c).*
Table 6. Resource links

| Link                                      | Information                                                                                                                                 |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| www.cdc.gov                               | Centers for Disease Control and Prevention website with a comprehensive warehouse of information and links about the Ebola virus. It is regularly updated and provides the most up-to-date information available. PDF versions of the Ebola Triage Protocol (identify, isolate, inform) can be accessed and downloaded from this site. |
| www.nebraskamed.com/biocontainment-unit/ebola | Provides:  
- Free online courses for clinicians  
- Free online courses for the general public  
- Treatment and triage algorithms  
- Best practice guidelines  
- PPE donning and doffing guidelines  
- Webinars on:  
  - Care of the possible patient with Ebola in the ED  
  - Infection control considerations  
  - Transport  
  - Laboratory testing and sample transport  
  - Clinical care  
  - Medical waste management  
- Videos on:  
  - Donning and doffing PPE  
  - Media relation considerations |
| www.osha.gov/SLTC/ebola                   | Provides:  
- Background information  
- Hazard recognition  
- Medical information  
- Information on decontamination of Ebola-exposed surfaces |
| www.epa.gov/oppad001/list-l-ebola-virus.html | Provides a fairly comprehensive and up-to-date list of disinfectants effective against the Ebola virus Indicates whether the disinfectant is approved for home and/or health care facility use |
| www.emoryhealthcare.org/ebolaprep        | Provides best practices for triage, diagnosis, and treatment  
Additionally provides drafts of Ebola policies, protocols, and procedures for download |
| http://www.cdc.gov/vhf/ebola/hcp/procedures-for-ppe.html | Provides guidance on PPE and step-by-step directions |

Note. ED = emergency department; PPE = personal protective equipment.

performing their regular duties, to include specimen collection, while wearing the equipment. Health care providers should refer to the CDC website frequently to remain up to date with new protective measures and protocols. Frequent hand washing regardless of patient chief complaint is always advised (CDC, 2015h).
SPECIMEN COLLECTION AND HANDLING AND WASTE DISPOSAL

Procedures and specimen collection should be limited (Stephenson, 2014). Clustering care, specimen collection, and procedures can minimize the likelihood of exposure. Staff should follow PPE guidelines both for the procedure being performed and for the care of EVD patients. If the guidelines are not in agreement, the higher level of PPE should be adopted. All laboratory tubes/containers and equipment should be single use and plastic. Specimen collection containers should be triple packed in watertight packaging with the outside disinfected per CDC infection control guidance and under no circumstances should a specimen be left unattended or sent through a pneumatic tube system. Any laboratory waste should be considered a hazardous substance and incinerated (CDC, 2015m).

Transport and incineration practices may need to be evaluated and modified for facilities disposing of Ebola-laden medical waste. Transportation of Category A infectious substances, such as Ebola, is considered hazardous material and require special permits (CDC, 2015b; Department of Transportation, 2014). Emory University Hospital found that its contracted medical waste disposal carrier would not accept or transport medical waste that may be contaminated with Ebola (CDC, 2014c). According to the CDC, the only two standardized methods for inactivating Ebola-laden waste are autoclaving and on-site incineration. Once inactivated, the waste is no longer considered infectious regulated medical waste and can be transported according to local and states laws (CDC, 2015b).

DISINFECTION

The Ebola virus can live on inorganic nonporous surfaces for up to 6 days (CDC, 2015l). Every effort should be made to expediently disinfect and decontaminate any equipment or surface that cannot be incinerated. A delay in disinfection could result in unintended exposure and spread of the Ebola virus. Surfaces infected with the Ebola virus can be disinfected with any disinfectant that is Environmental Protection Agency (EPA) approved for nonenveloped viruses (such as CaviCide, and Simple Green d Pro-5). If the product specifications indicate that the product works to kill rota-, noro-, and polio viruses, then it will work for the Ebola virus. A current list of disinfectants approved for hospital and home use can be found at www.epa.gov (EPA, 2015). In the absence of an EPA-approved disinfectant, a 10% bleach solution (9 parts water, 1 part bleach) can be used (Occupational Safety and Health Administration, 2015).

Personnel conducting decontamination activities should wear PPE and use disposable equipment. All nonporous surfaces should be cleaned with an approved cleaner known to kill nonenveloped viruses. All disposable equipment and debris/waste should be placed into rigid watertight containers, which are then incinerated. Small durable (nondisposable) equipment can be disinfected and contained in a separate rigid, watertight container and autoclaved. Autoclaving is an effective means to deactivate the virus (CDC, 2015l).

Normal sewage processing procedures in the United States are believed to be sufficient to inactivate the Ebola virus, and the CDC advises that a patient may use regular bathroom accommodations without fear of spreading the virus (CDC, 2015l). Local sewage management and watershed offices may disagree and require additional steps to disinfect human waste prior to introduction into the sewage system. Emory University Hospital currently disinfects liquid waste with bleach before flushing into the sewer system (Emory Healthcare, 2014). Once the patient is discharged, the bathroom facility and the patient room and all durable equipment should undergo a thorough cleaning in accordance with the facility and CDC infection control guidelines.

BURIAL PRACTICES

The only way to ensure no potential spread of Ebola after death is cremation. Decedased patients remain infectious and exposure to the
tissue or fluids facilitates disease transmission. Corpses should not be embalmed and should not be buried near any water sources. Preparation and handling of corpses should be limited and remains cremated as soon as possible. Family members will need support and education when making decisions. They may not understand why they are not able to hold, touch, and bury their loved ones after death. Cremation may be incongruent with religious and cultural beliefs and practices (Kinsman, 2012; WHO, 2015a, 2015b, 2015c).

**EXPOSURE**

If a provider is exposed during care of a patient with suspected or confirmed Ebola, he or she should initiate the hospital

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**Table 7. Considerations for Ebola policy development**

| Considerations for Ebola policy development |
|--------------------------------------------|
| Patient education and outreach through information sessions and printed material |
| Staff education |
| Central provider resource for information (must be regularly updated) |
| Equipment and PPE training (initial and continuing competency training) |
| Mock disaster/simulation training |
| Communication plans (internal and external numbers and systems) |
| Specific provider roles and responsibilities |
| Patient transport (internal and external) |
| Patient rooms (to include an anteroom, a bathroom) |
| Waste disposal and temporary storage until transport |
| Decontamination of waste—dedicated equipment and space |
| Decontamination of all equipment |
| Tracking of all contacts |
| Alternate triage or ED operations until decontamination can occur (if needed) |
| Treatment team (a well-trained core team) |
| Triage protocols |
| Exposure protocols |
| Protocol checklists/cognitive aids |
| Contact information (health department, CDC) |
| Equipment (single-use, disposable, durable) |
| Policy updates |
| Media interactions—HIPPA and confidentiality considerations |
| Training schedules and tracking |
| Laboratory |
| Radiology |
| Morgue and disposal of remains |
| Behavioral health counseling (staff and patients) |
| Identification of potential exposures (waiting room etc.) |
| Work schedule/quarantine during incubation period for exposed staff and compensation |
| EMS personnel and equipment training, decontamination and tracking |
| Staffing considerations—increased numbers and workload, rotations, special treatment staff, illness |
| Space utilization and designation of contaminated and clean areas |
| Infection control measures |

**Note.** CDC = Centers for Disease Control and Prevention; ED = emergency department; EMS = emergency medical services. This list of considerations for policy development is by no means all inclusive. Every aspect of health care, no matter how small, should be considered, practiced, and modified as needed. An example policy draft from the Emory University can be accessed at [www.ena.org](http://www.ena.org) and [www.emoryhealthcare.org/ebolaprep](http://www.emoryhealthcare.org/ebolaprep).
protocols for decontamination and reporting. Care and monitoring of exposed caregivers should follow the same CDC triage protocols as those defined for patients presenting to the ED in addition to general hospital blood-borne pathogen needlestick/exposure protocols. Exposed providers should be monitored for EVD for 21 days postexposure and continue to be monitored for HIV, hepatitis, and other blood-borne pathogens in accordance with the hospital and CDC needlestick/exposure guidelines. Health care officials should also be notified in accordance with the CDC triage protocols (CDC, 2015j).

READINESS

The best method of protection is to ensure the clinician, the facility, and the patient population are educated and prepared to deal with Ebola. Health care facilities should have a comprehensive plan that addresses all components of care from initial patient contact to discharge (CDC, 2015n; Emory Healthcare, 2014). Providers must be familiar with policies, protocols, and procedures for identification and care of patients with Ebola before needing them. Simulated scenarios allow providers to develop the skills and competencies necessary to be prepared. Simulation additionally tests current plans, identifies areas for improvement, and promotes plan modification and contingency planning. Table 7 includes a list of considerations that should be included when planning for care of patients with Ebola.

CONCLUSION

Ebola is both an unfamiliar and high-risk disease. It initially presents like many other illnesses but progresses quickly and has a high mortality rate. There is no guaranteed cure, and treatments and vaccines are still under investigation. Until recently, it occurred only in rural tropical regions and most health care providers had only learned about it in epidemiology classes. With globalization, patients with Ebola could present to any ED anywhere in the world. Early and rapid identification of Ebola signs and symptoms is essential to minimize patient mortality rates and virus transmission.

Ebola treatment and prevention are constantly evolving. Advanced practice nurses must be prepared to lead the health care team to ensure Ebola protocols and procedures are in place, vetted, and rehearsed prior to their need for implementation. When health care providers are ready and prepared for EVD and other emerging diseases, they can ensure that lifesaving treatments are administered in a timely manner, the chance of survival is optimized, and the spread of disease is minimized.

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