

GUIDE TO INFECTION CONTROL IN THE HEALTHCARE SETTING

Ebola Virus Disease

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KEY ISSUES

The 2014 Ebola epidemic was the largest in history with 28,616 cases and 11,310 deaths recorded up to September 2016. There was widespread person-to-person transmission in multiple countries in West Africa, particularly affecting Guinea, Liberia, and Sierra Leone, but also Nigeria. Several countries in Europe and the United States received patients and healthcare workers who became infected with Ebola and were transported home for care.

KNOWN FACTS

- Ebola virus disease, previously known as Ebola hemorrhagic fever, is an uncommon and deadly disease caused by infection with a virus of the family Filoviridae, genus *Ebolavirus*. There are four identified Ebola virus species (Zaire, Sudan, Bundibugyo, and Tai Forest Ebola viruses) that cause disease in humans, Zaire being the most common and virulent and responsible for most of the outbreaks.
- Ebola viruses are found in several West African countries. The first Ebola virus was discovered in 1976 near the Ebola River in what is now the Democratic Republic of the Congo. A second outbreak in Sudan occurred simultaneously. Since then, over 20 outbreaks have appeared sporadically in Africa but most of them were confined in rural forested areas.
- Fruit bats are thought to be the host and carriers of Ebola virus and the virus affects both human and non-human primates such as chimpanzees and gorillas. The virus is present in the bat saliva which contaminates fruit. Transfer occurs when humans and apes forage for fallen fruit from the forest floor or eat poorly cooked "bush meat".
- Once acquired, Ebola virus spreads through direct contact with the blood or body fluids (including but not limited to feces, saliva, sweat,

urine, vomit, and semen) from a person who is sick with Ebola. The virus in blood and body fluids can enter another person's body through broken skin or unprotected mucous membranes in, for example, the eyes, nose, or mouth.

- After the onset of symptoms, as the disease progresses high grade viremia occurs.
- People with Ebola symptoms become more infectious with progressive symptoms. As a result, exposure to the virus is more likely when someone is bleeding, has diarrhoea or vomiting also known as "wet" cases.
- The incubation period for the disease, from exposure to when signs or symptoms appear, is 2 to 21 days, but the average is 8 to 10 days.
- Signs of Ebola include fever and symptoms such as severe headache, fatigue, muscle pain, vomiting, diarrhea, abdominal (stomach) pain, or unexplained hemorrhage (bleeding or bruising in less than 40% of cases).
- Death occurs from excessive loss of fluid, dehydration leading to total organ failure. The corpse contains a high viral load and is highly infectious post mortem. During this epidemic, a combined 50% mortality rate was recorded.
- Ebola poses minimal risk to travelers or the general public who have not cared for or been in close contact (within 3 feet or 1 meter) with someone sick with Ebola for a prolonged period.
- Ebola is not airborne but droplets containing the virus could be contaminate the patient's environment.
- Ebola vaccine zVSV-ZEBOV is highly effective in preventing transmission amongst contact of Ebola cases.
- Several secondary clusters have been recorded following unprotected sex with Ebola survivors. Consequently, it is recommended that men or women who have recovered from Ebola abstain from sex (including oral sex) for as long as the Ebola virus is detectable in semen or vaginal fluids. During sex, the use of condoms is strongly recommended.

- Ebola virus has been detected in breast milk, however it is not known if the virus can spread from mothers to their infants through breastfeeding-wet nursing is strongly discouraged.
- Because healthcare workers have accounted for up to 25% of Ebola cases in prior outbreaks with mortality varying between 48% and 28% personal protective equipment (PPE) must be redesigned to be more comfortable and easy to put on and take off.
- Ideal PPE for healthcare workers must
 - be impervious to fluid;
 - cover all skin and all underclothing;
 - be easy to don;
 - be easy to remove while minimizing the risk for self contamination;
 - provide maximal comfort for healthcare workers; and
 - be easy to dispose of while minimizing contamination of healthcare workers.

SUGGESTED PRACTICE FOR THE MANAGEMENT OF EBOLA VIRUS DISEASE IN HEALTHCARE SETTINGS

General Principles

- All healthcare workers dealing with Ebola are adequately trained and are confident to deal with such patients.
- Identify and isolate the Ebola patient in a single patient room with a closed door and a private bathroom as soon as possible.
- Limit the number of healthcare workers who come into contact with the Ebola patient (e.g., avoid short shifts), and restrict non-essential personnel and visitors from the patient care area.

- Monitor the patient care area at all times, and log, at a minimum, entry and exit of all healthcare workers who enter the room of an Ebola patient.
- Ensure the PPE is appropriate and comfortable.
- Ensure that a trained observer (or buddy) watches closely each donning and each doffing procedure, and provides supervisory assurance that donning and doffing protocols are followed.
- Ensure that healthcare workers have sufficient time to don and doff PPE correctly without disturbances.
- Ensure that practical precautions are taken during patient care, such as keeping hands away from the face, limiting touch of surfaces and body fluids, preventing needle stick and sharps injuries, and performing frequent disinfection of gloved hands using an alcohol-based handrub (ABHR), particularly after handling body fluids.
- Dedicated medical equipment (preferably disposable) should be used to provide patient care.
- All non-dedicated, non-disposable medical equipment used for patient care should be cleaned and disinfected according to the manufacturer's instructions.
- The mainstay of therapy is intra venous rehydration and maintaining a metabolically corrected fluid balance

Personal Protective Equipment for Healthcare Worker:

Guidelines available from WHO:

<http://who.int/csr/resources/publications/ebola/personal-protective-equipment/en/>

- N95 respirator: Single-use (disposable) N95 respirator in combination with single-use (disposable) surgical hood extending to shoulders and single-use (disposable) full face shield.

- Single-use (disposable) fluid-resistant or impermeable (non-woven) gown that extends to at least mid-calf or coverall without integrated hood.
- Single-use (disposable) nitrile examination gloves with extended cuffs. Two pairs of gloves should be worn one under and the other one over, the gown sleeve. At a minimum, outer gloves should have extended cuffs.
- Single-use (disposable), fluid-resistant, or impermeable boot covers that extend to at least mid-calf. The boots should allow for ease of movement and not present a slip hazard to the worker. The boots should be able to be removed easily without touching if possible.
- Single-use (disposable), fluid-resistant or impermeable apron that covers the torso to the level of the mid-calf should be used if Ebola patients have vomiting or diarrhea. An apron provides additional protection against exposure of the front of the body to body fluids or excrement and should be used if there are no fluid resistant gowns.

Personal Protective Equipment for Trained Observer

A trained observer should not enter the room of a patient with Ebola, but will be in the PPE removal area to observe and assist with removal of specific components of PPE, according to the prescribed steps (WHO guidelines). The observer should not participate in any Ebola patient care activities while conducting observations.

Donning and Doffing

- Refer to the CDC (<http://www.cdc.gov/vhf/ebola/hcp/procedures-for-ppe.html>) and WHO websites (http://who.int/csr/resources/publications/ebola/filovirus_infection_control/en/) for further information.

- Facilities should ensure that space and layout allow for clear separation between clean and potentially contaminated areas. It is critical that a one-way flow of care moving from clean areas (e.g., area where PPE is donned and unused equipment is stored) to the patient room and to the PPE removal area.
- There should be an area outside the Ebola patient room (e.g., a nearby vacant patient room, a marked area in the hallway outside the patient room) where clean PPE is stored and where healthcare workers can don PPE before entering the patient's room.

Disinfection

- Regular cleaning of all surfaces and maintaining a dry environment is essential.
- Disinfect immediately any visibly contaminated PPE surfaces, equipment, or patient care area surfaces using a registered disinfectant wipe.
- Perform regular cleaning and disinfection of patient care area surfaces, even absent visible contamination.
- This should be performed only by nurses or physicians as part of patient care activities in order to limit the number of additional healthcare workers who enter the room.

Healthcare Waste Management

- All healthcare waste arising from an Ebola case should be treated as clinical or infectious waste. The PPE and other medical devices which are to be disposed of must be double bagged, sealed, labelled, and sent to the appropriate end disposal method such as incineration or autoclave and shredding.

- Sharps containers must be carefully handled. The box should be sealed, labelled, and disposed of by a healthcare worker wearing heavy duty gloves, an apron, boots, and face cover.
- Feces and urine should be disposed of in the toilet or sluice area and the bedpan or urinal cleaned and disinfected by placing the bedpan washer disinfector directly in an automated bedpan washer disinfector heated to 176 F (80 C) x 3 min.
- Healthcare workers must be careful when handling the bedpan and should wear face cover, body cover, boots and gloves prior to handling the bedpans.
- Linen must be separated and clearly labelled before being disposed of. It should either be disposable or washable at high temperatures (194 F (90 C) for 1 minute).
- Linen must be handled wearing face cover, body cover, boots, and gloves prior to handling.

SUGGESTED PRACTICE IN UNDER-RESOURCED SETTINGS

- Ensure good hand hygiene practices are followed and hand washing stations are readily available.
- If available alcohol based handrub should be widely available and readily visible.
- If an isolation room with en suite facilities is not available, a separate space should be cordoned off and designated for cases of Ebola. Cohort isolation might be necessary.
- Strict contact precautions applied when any contact with the patient.
- Wear PPE providing protection to eyes, nose and mucous membrane using a face cover, body cover with fluid resistant gown, boots, double gloves one below and the other one over the sleeve of the gown.

- Disinfect immediately any visibly contaminated PPE surfaces, equipment, or patient care area surfaces using a registered disinfectant wipe. DO NOT SPRAY WITH A DISINFECTANT such as 0.5% chlorine.
- Reuse of gloves between patients is not acceptable infection prevention and control (IPC) practice and must be avoided because they may contribute to increase Ebola transmission between infected and uninfected (suspected) patients.
- There is no evidence that spraying humans with 0.05% or 0.5% chlorine will reduce Ebola transmission. The side effects of exposure to chlorine far outweigh any perceived benefit and this practice and chlorine exposure of humans is banned in high income countries.
- All healthcare waste arising from an Ebola case or clinical area must be double bagged and incinerated.
- Feces and urine should be disposed of in the toilet or sluice area and the bedpan or urinal cleaned and disinfected by thorough cleaning and disinfection with heat or a suitable chemical.
- All healthcare waste arising from an Ebola case should be treated as clinical or infectious waste. The PPE and other medical devices which are to be disposed off must be double bagged, sealed, labelled and sent to the appropriate end disposal method such as incineration or autoclave and shredding.
- Safe burial should be encouraged and the families should be involved when cultural or religious rites are administered

SUMMARY

Ebola virus disease is an infection with high mortality. Ebola virus is spread through direct contact with the blood or body fluids (including but not limited to feces, saliva, sweat, urine, vomit, and semen) of a person who is sick with Ebola. The cornerstone of infection prevention for Ebola is prompt

recognition of the disease; deployment of well trained staff to manage patients; isolation patients; and meticulous and correct use of personal protective equipment. The donning and doffing of personal protective equipment should be done by trained personnel and should be overseen by a trained observer. The ideal PPE for healthcare workers must be impervious to fluid, cover all skin and all underclothing, be easy to don and doff while minimizing the risk for self-contamination, provide maximal comfort for healthcare workers, and be easy to dispose of while minimizing contamination of healthcare workers. Facilities should ensure that space and layout allow for clear separation between clean and potentially contaminated areas. It is critical that a one-way flow of care moving from clean areas to the patient room and to the PPE removal area. Visibly contaminated PPE surfaces, equipment, or patient care area surfaces should be promptly disinfected using a registered disinfectant. Disinfection should be performed by nurses or physicians as part of patient care activities in order to limit the number of additional healthcare workers who enter the room.

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