SMCC Ebola Backgrounder Part 1 - Preparing for Ebola

The number of cases of Ebola in West Africa continues to increase. The World Health Organization expects 5,000 to 10,000 new cases per week by December 2014. The recent infection of two health care workers in the United States underlines the fact that hospitals will be the front lines of the infection. Fortunately, our health system has many measures in place to deal with a possible spread. Here are some facts about the Ebola virus, how it spreads and what hospitals can do to prepare for an outbreak.

What is Ebola?

Ebola is a human disease caused by an ebolavirus. Ebolaviruses were discovered following the first outbreaks of the disease in 1976 and named after the locations where the outbreaks occurred; Ebola is the name of a river in the Democratic Republic of the Congo. So far, scientists have named five species of ebolavirus, four of which cause the Ebola virus disease in humans. Ebola viruses can also be carried by other mammals, such as chimpanzees, gorillas and bats. Outbreaks are believed to be caused when the virus jumps from these animals into humans.

The symptoms include fever, sore throat, muscle pain and headaches. This can progress to vomiting, diarrhea, rash and shutdown of the liver or kidneys. Some patients begin to bleed internally or externally, and death can be caused by loss of fluids or low blood pressure. The fatality rate can vary between 25 and 90 per cent. It is estimated that the current outbreak, caused by a strain of the Zaire species of ebolavirus has a fatality rate of 70 per cent. A different strain of the same species is currently causing a much smaller outbreak in the Democratic Republic of the Congo.

At the present time there is no cure for Ebola. The standard treatment is to support patients with rehydration therapy and manage the symptoms until the body's immune system can fight off the disease on its own.

Why is this outbreak so much worse than the others?

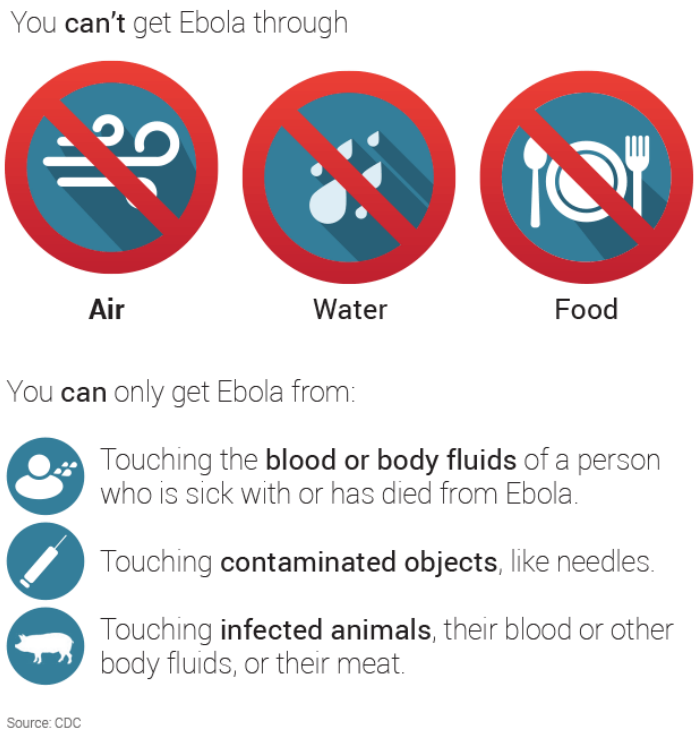
There have been at least 20 Ebola outbreaks since it was first identified in 1976. The vast majority of these have been in rural African villages and have died out quickly. The total number of Ebola deaths before 2013 was less than 2000; the current outbreak alone has killed more than double that number.

It's important to note that the difference is not likely to be due to any changes in the virus itself. Although this strain, like all other strains, has genetic mutations that distinguish it from those that have caused previous outbreaks, experience has shown its transmissibility and effects to be very similar to what has been seen before. Rather, is a change in the conditions — *where* the virus made its latest crossover into humans — that is most likely responsible for the size of the current outbreak.

Previous outbreaks had occurred in remote forested areas with little health care infrastructure. Infected individuals were isolated geographically and died rapidly, causing the outbreaks to end spontaneously.

In this case, while the outbreak started in a forested region, it took months to be identified (this was the first outbreak to occur in West Africa, so officials there were not necessarily on the lookout for it.) By that time the virus had reached crowded urban centres like Conakry in Guinea, Monrovia in Liberia and Freetown in Sierra Leone. In these cities containment measures — e.g. tracking down every affected individual — were not possible because of the large population, lack of healthcare infrastructure and numerous untraceable contacts. Thus it's the urbanization of Ebola that has caused the outbreak to become the largest on record.

How does Ebola spread?



Source: US Centres for Disease Control (CDC) http://www.cdc.gov/vhf/ebola/pdf/infographic.pdf

The Ebola virus only spreads through direct contact with bodily fluids: vomit, blood, saliva or semen. These fluids must move from an infected patient into the bloodstream of a new host. For example, a healthcare worker could become infected by touching his or her mouth, nose, eye or break in the skin with a contaminated gloved hand while caring for a patient.

Patients who carry the Ebola virus do not spread it to others until the virus load — that is, the number of virus particles in the body — has become high enough that the patient begins to show symptoms. This begins to happen between 2 and 21 days after infection. Based on data from a previous outbreak in Uganda, it is estimated that each millilitre of a patient's blood can carry up to a billion virus particles during the peak of infection. It only takes a handful of these particles to infect a new patient.

Unlike other infectious diseases (e.g. influenza) the Ebola virus particles do not remain suspended in the air after a person coughs or sneezes. This means that the virus cannot be transmitted through air. It is technically possible, if a symptomatic patient with Ebola coughs or sneezes in one's face, that saliva or mucus could come into contact with that person's eyes, nose or mouth, and these fluids could transmit the disease. However experience shows that this is a rare mode of transmission, as coughing and sneezing are not common Ebola symptoms. According to the World Health Organization, the likelihood of the virus mutating to become transmissible by air is extremely remote.

Ebola has been detected on the skin of some infected patients. However this could be due to micro-contamination of the skin with blood or other body fluids. The US Centres for Disease Control (CDC) states that "The risk of EVD transmission from direct skin contact with an EVD patient is lower than the risk from exposure to blood or body fluids and may be more likely in severe illness (when the Ebola virus RNA levels are highest)."

There have been few scientific studies looking at the ability of Ebola to survive outside of a host. According to a review of the literature from the Public Health Agency of Canada, Ebola virus can survive if dried onto some surfaces for a few hours at most. However, in infected fluids like blood at room temperature and ambient conditions, it can survive for several days. If refrigerated at 4 degrees C, as in a sample being stored in tissue culture vessel in a laboratory setting, the virus can remain viable for up to 50 days. This last point is only relevant to storing virus samples in laboratories; it doesn't reflect the situation found in nature.

Virus particles may be present in semen for up to 3 months following infection, and those who recover from Ebola are advised to abstain from sex or use condoms for 3 months. However according to the CDC, sexual transmission of Ebola has not been definitively established.

There is no evidence that mosquitoes or other insects can transmit Ebola virus. Only mammals (for example, humans, bats, monkeys and apes) have shown the ability to spread and become infected with Ebola virus.

What are the barriers that can be used to prevent Ebola from spreading?

Chemical disinfectants are among the most important tools in preventing the spread of Ebola. These include household bleach (sodium hypochlorite), alcohol-based products and acids. The chemicals destroy the protein and lipid outer coat of the virus, preventing it from spreading. Alcohol-based hand sanitizers also work to destroy the virus. These decontaminating fluids are used to treat all surfaces that have come in contact with fluids from an Ebola patient, as well as clothing.

Personal protective equipment (PPE) refers to gloves, gowns with hoods, goggles, and other equipment that is impermeable to the fluids that carry Ebola. Organizations like the CDC and the Public Health Agency of Canada (PHAC)have published detailed instructions on how to put on and remove personal protective equipment so as to minimize the risk of contamination. Contaminated PPE is placed in an infectious waste container and incinerated.

Following the hospital transmission of Ebola from a patient to two nurses in Dallas, the CDC updated its guidance on the use of PPE among healthcare workers. The changes include:

- A recommendation that all healthcare workers undergo rigorous training in putting on and taking off PPE in a systematic manner
- A recommendation that all workers be supervised by a trained monitor who watches each worker putting PPE on and taking it off and can spot mistakes
- No skin exposure when PPE is worn

What are the protocols that need to be followed in hospitals?

Recently, both the Public Health Agency of Canada (PHAC) and the US Centres for Disease Control (CDC) updated their guidelines on how hospitals should treat patients suspected or confirmed as carrying Ebola. The recommendation is to put such patients in isolation (see below) and to use contact precautions such as 2 pairs of gloves, full impermeable gowns, a face shield, a hood and an N-95 air-purifying respirator (APR). N-95 devices are designed to filter airborne particles or droplets greater than 0.3 micrometres in size with 95% efficiency or greater.

The reason for the respirators is this: although the Ebola virus is not airborne, some procedures - for example, intubating an Ebola patient - could lead to the creation of aerosols, that is, airborne droplets of bodily fluids that could carry the disease. Thus, guidelines recommend that healthcare workers in contact with Ebola patients use a respirator even before procedures that could lead to the creation of an aerosol are performed. This is so that they would not have to stop treatment in order to don the air filter if an aerosol-creating procedure needs to be performed.

What does it mean for a patient to be “in isolation”?

Isolation means in a single room separated from all other patients with a solid door and containing its own bathroom. Healthcare workers entering isolation rooms must put on PPE before then enter these rooms and remove them again after they leave. These procedures should be carried out under the supervision of a fellow caregiver or trained observer, and the PPE must be disposed of as with any contaminated material.

Sometimes isolation rooms use negative air pressure, which involves using fans to continually suck air into from the room and through a filter with venting to the roof. This ensures that no air from the room can travel to other areas of the hospital. Although Ebola is not airborne, some procedures (e.g. intubating an Ebola patient) could lead to the creation of aerosols, that is, airborne droplets of bodily fluids that could carry the disease. Therefore the PHAC recommendations are to place potential Ebola patients in these rooms from the start so that later on, if procedures like intubation are required, the patient does not need to be moved.

How do you test to see whether a patient truly has Ebola or not?

If a patient is showing Ebola-like symptoms, a sample of their blood can be taken to a testing laboratory. PHAC has issued guidelines about how such samples should be handled. These recommend a minimum Containment Level 2 laboratory. There is only one laboratory that has the appropriate safety protocols (Containment Level 4) to actually culture the virus, which is the National Microbiology Laboratory in Winnipeg. However, some provincial laboratories are gearing up to have the initial testing carried out locally followed by confirmation at the Winnipeg lab.

The Ebola virus is little more than a collection of 7 genes in a protein coat. Thus, tests for Ebola usually begin by looking for these genes. The genes are made of RNA. A process called reverse-transcriptase polymerase chain reaction (RT-PCR) is used to convert the RNA into DNA and then make enough copies of the DNA sequence to be detected.

Other tests for Ebola use antibodies designed to attach to the surface of the virus. Some of these antibodies are designed to glow when excited by certain types of light, allowing them to be detected. Tests that use these antibodies are called enzyme-linked immunosorbent assays (ELISA). These tests can be used to detect the virus particles themselves, or to detect human antibodies that have been created to fight the virus. These human antibodies would only be present after the disease has progressed.

Both RT-PCR and ELISA tests can be performed quickly, usually with results within 24 hours. They are the tests recommended by the CDC for early detection.

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Websites for further reading

Public Health Agency of Canada - Ebola virus disease

Centers for Disease Control and Prevention - Ebola Virus Disease
World Health Organization - Ebola
Public Health Ontario - Ebola FAQ