The 2014 Ebola outbreak is the most severe outbreak of Ebola Virus Disease (EVD) since the discovery of ebolaviruses in 1976. As of 22 October 2014, the WHO, CDC and local governments together have reported a worldwide total of 9,964 suspected cases and 4,881 deaths (5,488 cases and 2,945 deaths having been laboratory confirmed). Many experts believe that the official numbers substantially understate the magnitude of the outbreak with true figures numbering 2.5 times as many cases as have been reported.

Understanding Ebola: A Visual Guide
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Ebola is caused by infection with one of the three Filoviridae virus, genus Ebolavirus. They are transmitted to humans and non-human primates through contact with infected bodily fluids. 

The illustrations above describe the spread of cases and deaths during the 2014 outbreak: 

1. Case-Patients, having contact with case-patients, 
2. Care to Ebola case-patients without using PPE. 
3. Laboratory contamination of nontoxic needle. 
4. Laboratory infection by nontoxic needle. 
5. Occupational exposure to Ebola virus. 
6. Laboratory exposure to Ebola virus. 
7. Personal contact and by use of contaminated objects. 
8. Primates to humans. 

The Ebola virus has caused outbreaks in various parts of the world: 

- 2014 West Africa: Guinea, Liberia, Sierra Leone, Nigeria, Senegal, DRC, United States, Spain, Mali. 
- 2009 Democratic Republic of the Congo (formerly Zaire). 
- 1976 Democratic Republic of the Congo (formerly Zaire). 
- 1976 Sudan. 
- 1976 Ivory Coast. 

The virus is spread through contact with infected bodily fluids. 

Since then the numbers of cases and deaths have risen at an alarming rate. 

There has been a sharp rise in cases of cases and deaths during the 2014 outbreak: 

- 2004 
- 2005 
- 2006 
- 2007 
- 2008 
- 2009 
- 2010 
- 2011 
- 2012 
- 2013 
- 2014 

Some experts predict that if we don’t get control of the virus, the number of infections could mushroom to nearly 55,000.
Ebola is introduced into the human population through contact with an infected animal. Ebola is spread through close and direct physical contact with infected bodily fluids, the most infectious being blood, faeces and vomit. The Ebola virus has also been detected in breast milk, urine and semen.

It is not entirely clear how an Ebola outbreak starts. The initial infection is believed to occur after an Ebola virus is transmitted to a human by contact with an infected animal’s body fluids. Evidence strongly implicates bats as the reservoir hosts for ebolaviruses. Bats drop partially eaten fruits and pulp, then land mammals such as gorillas and duikers feed on these fallen fruits. This chain of events forms a possible indirect means of transmission from the natural host to animal populations.

Ebola then spreads in the community through human-to-human transmission, with infection resulting from direct contact (through broken skin or mucous membrane) with the blood, secretions, or other bodily fluids, or with the organs of infected people, and indirect contact with environments contaminated with such fluids. The virus can survive in liquid or dried material for a number of days.

The following are the most common methods of EVD transmission between people:

- Contact with infected saliva / sweat
- Contact with infected stool or urine
- Contact with infected blood
- Contact with an infected dead body
- Contact with infected medical items
- Contact with infected breast milk
- Unprotected sex with an infected person
- unprotected sex with an infected person

The virus spreads to cell types throughout the body by binding glycoprotein to receptors on cell surfaces. Infected cells detach from blood vessels, causing massive hemorrhage. Loss of blood leads to kidney and liver failure.
Ebola is a severe acute viral illness often characterized by the sudden onset of fever, intense weakness, joint and muscle pain, sore throat and headache. These symptoms are then followed by more severe complications, along with decreased function of the liver and kidneys. Around this time, affected people may begin to bleed both within the body and externally. The incubation period is 2 to 21 days. Humans are not infectious until they develop symptoms. It is unclear why some patients can survive and others die from this disease, but patients who die usually have a poor immune response to the virus.

Typical time frame and symptoms development:

- The virus may enter through the mouth, eyes, nose, a break in the skin or through sexual intercourse. The most common incubation period is about 10 days.
- The patient shows sudden flu-like symptoms, which are similar for common diseases such as:
  - Fever
  - Headache
  - Skin rash
  - Hiccups
    - Hiccups are a very bad sign
    - Joint and Muscle pain
- One average, the patient is hospitalized 5 days after showing symptoms. New symptoms include:
  - Diarrhea
  - Loss of appetite
  - Chest pain
  - coughing
  - Eye inflammation
- The body’s immune response and damage to the vascular system cause blood to leak from the veins. Around 18% of patients begin to show unexplained bleeding such as:
  - Blooding in stool
  - Vomiting blood
  - Coughing up blood
  - Bleeding gums
- About 70.8% of infected patients die, usually from multi-organ failure or shock. On average, death occurs 8 days after the onset of symptoms and 4 days after hospitalization.

<table>
<thead>
<tr>
<th>Period</th>
<th>0%</th>
<th>10 days after infection</th>
<th>10-15 days</th>
<th>15-17 days</th>
<th>18 days: death</th>
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<tbody>
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<tr>
<td>Fever</td>
<td>40% - 90%</td>
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<td>Headache</td>
<td>90% - 100%</td>
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<td>Skin Rash</td>
<td>5% - 20%</td>
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<td>Hiccups</td>
<td>15%</td>
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<tr>
<td>Diarrhea</td>
<td>81%</td>
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<td>Sore Throat</td>
<td>63%</td>
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<td>Coughing</td>
<td>20%-40%</td>
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<td>Vomiting</td>
<td>59%</td>
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<td>Hematemesis</td>
<td>10%-40%</td>
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<td>Stomach Pain</td>
<td>60% - 80%</td>
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<tr>
<td>Internal and External Bleeding</td>
<td>71% - 78%</td>
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Ebola diagnosis requires ruling out other diseases, which may include malaria, typhoid fever, shigellosis, cholera, leptospirosis, plague, rickettsiosis, relapsing fever, meningitis, hepatitis, and other viral hemorrhagic fevers. Once these have been ruled out, Ebola virus infections can be diagnosed definitively in a laboratory through several types of tests:

- Antibody-capture enzyme-linked immunosorbent assay (ELISA)
- Antigen-capture detection tests
- Serum neutralisation test
- Reverse transcriptase polymerase chain reaction (RT-PCR) assay
- Electron microscopy
- Virus isolation by cell culture

To confirm the diagnosis, blood test samples are tested for viral antibodies, viral RNA, or the virus itself.

There is no licensed vaccine or specific treatment available for Ebola. The goal of an Ebola vaccine is to induce an effective immune response to the Ebola virus which would lead to protection from subsequent infection. A number of potential Ebola vaccines have been tested in animals but none have been adequately tested in humans. Tests of new Ebola drugs could take place as early as November 2014.

The course of treatment for infected patients involves supportive therapy: providing relief of symptoms while the body fights the infection. Intravenous fluids, antibiotics, and oxygen are usually employed. Treatment may also include the use of medications to control fever, help the blood clot, and maintain blood pressure. Even with such supportive care, death occurs in 70.8% of cases.

- Intravenous (IV) fluids to maintain fluids and electrolytes (sodium, potassium, and chloride)
- Oxygen and devices that help with breathing
- Medications to control fever, help the blood clot, and maintain blood pressure
- Antibiotics to prevent secondary infections from bacteria
- Good nursing care.

*In August, it was reported that healthcare workers represented nearly 10 percent of the cases and fatalities, significantly impairing the ability to respond to the outbreak in an area which already faces a severe shortage of doctors. According to the WHO, the high proportion of infected medical staff can be explained by lack of the number of medical staff needed to manage such a large outbreak, shortages of protective equipment, or improperly using what is available, and "the compassion that causes medical staff to work in isolation wards far beyond the number of hours recommended as safe." By 29 September, the WHO reported 377 workers had been infected and 216 had died.

Current bed capacity for patients in countries with active cases as of 8 Oct 2014:

- Guinea: 160 beds, 210 required
- Liberia: 620 beds, 2,930 required
- Sierra Leone: 304 beds, 1,148 required

ZMapp, a monoclonal antibody vaccine. The limited supply of the drug has been used to treat a small number of individuals infected with the Ebola virus. Although some of these have recovered the outcome is not considered statistically significant. ZMapp has proved highly effective in a trial involving rhesus macaque monkeys.

The NIH along with the Wellcome Trust and Britain’s Medical Research Council and Department for International Development have begun human trials of a monovalent vaccine at the University of Oxford. The first healthy patient received a monovalent vaccine containing antigenic material from just the Zaire strain on 17 September. In parallel studies, human trials began on this same monovalent vaccine on healthcare workers in Mali in early October, and are due to start in Maryland, USA in October and potentially in Gambia.

The NIH in collaboration with the U.S. Department of Defense, have begun human safety trials of a recombinant vesicular stomatitis virus Ebola vaccine (VSV-EOBV) in Maryland in October. There are also plans to expand safety trials to sites in Europe and sub-Saharan Africa. This vaccine has been developed by the Public Health Agency of Canada (PHAC) and NewLink Genetics. Initial results about safety and dose ranges are expected by the end of 2014.
Good outbreak control relies on a coordinated set of interventions including case management, surveillance and contact tracing, reliable laboratory services, safe burials, and social mobilization. Community engagement is key to successfully controlling outbreaks. Raising awareness of risk factors for Ebola infection and protective measures that individuals can take is an effective way to reduce human transmission. Risk reduction messaging should focus on several factors:

- Avoid physical contact with people showing symptoms of the Ebola virus.
- Wash your hands regularly with clean water and soap.
- Keep away from fruit bats, monkeys, dead animals, and bush meat.
- Thoroughly cook all animal products before consumption.
- Inform health authorities immediately in case of contact with expected or confirmed Ebola case.
- Travel to areas where there is an Ebola outbreak only in case of urgent need.

Contact tracing involves finding everyone who comes in direct contact with a sick Ebola patient. Contacts are watched for signs of illness for 21 days from the last day they came in contact with the Ebola patient. If the contact develops a fever or other Ebola symptoms, he or she is immediately isolated, tested, treated, and the cycle starts again—all of the new patient’s contacts are found and watched for 21 days, and so on.
There are major concerns that the EVD outbreak could spread, particularly to Europe and the United States. The main concern centres around air travel, which is thought to be the primary potential route for the virus to spread across international and continental borders.

Air traffic connections from West African countries to the rest of the world. Guinea, Liberia, and Sierra Leone are not well connected outside the region. Nigeria, in contrast, being the most populous country in West Africa with more than 166 million people, is well connected to the rest of the world. For historical reasons, all these countries have the strongest ties with European countries.

The figure shows that travel from Sierra Leone, Guinea, and Liberia within the continent of Africa is much more prevalent than travel elsewhere.

Severe travel restrictions to and from the affected areas (80% airline traffic reduction) generates only a 3-4 weeks delay in the international spreading.
References