



World Health Organization

## AN INSIGHT INTO EBOLA VIRUS

The outbreak of Ebola virus disease in West Africa continues to escalate, with 2615 cases and 1427 deaths reported from Guinea, Liberia, Nigeria, and Sierra Leone. Extensive contact tracing and monitoring, implemented with support from the US Centers for Disease Control and Prevention (CDC), has kept the number of additional cases small. Elsewhere, the outbreak is expected to continue for some time. WHO's operational response plan extends over the next several months. Staff at the outbreak sites see evidence that the numbers of reported cases and deaths vastly underestimate the magnitude of the outbreak. WHO is coordinating a massive scaling up of the international response, marshalling support from individual countries, disease control agencies, agencies within the United Nations system, and others.

The World Food Programme is using its well-developed logistics to deliver food to the more than one million people locked down in the quarantine zones, where the borders of Guinea, Liberia, and Sierra Leone intersect. Several countries have agreed to support the provision of priority food staples for this population. Practical on-the-ground intelligence is the backbone of a coordinated response. WHO is mapping the outbreak, in great detail, to pinpoint areas of ongoing transmission and locate treatment facilities and supplies. Good logistical support depends on knowing which facilities need disinfectants or personal protective equipment, where new isolation facilities need to be built, and where the need for more health-care workers is most intense. CDC is equipping the hardest-hit countries with computer hardware and software that will soon allow real-time reporting of cases and analysis of trends. This also strengthens the framework for a scaled-up response.



Figure 1: Ebola Virus

Today, WHO Director-General Dr Margaret Chan held discussions with a group of ambassadors from Geneva's United Nations missions. The meeting aimed to identify the most urgent needs within countries and match them with rapid international support. These steps align with recognition of the extraordinary measures needed, on a massive scale, to contain the outbreak in settings characterized by extreme poverty, dysfunctional health systems, a severe shortage of doctors, and rampant fear.

### Ebola virus disease

#### Key Facts:

- Ebola virus disease (EVD), formerly known as Ebola haemorrhagic fever, is a severe, often fatal illness in humans.
- EVD outbreaks have a case fatality rate of up to 90%.
- EVD outbreaks occur primarily in remote villages in Central and West Africa, near tropical rainforests.
- The virus is transmitted to people from wild animals and spreads in the human population through human-to-human transmission.
- Fruit bats of the Pteropodidae family are considered to be the natural host of the Ebola virus.
- Severely ill patients require intensive supportive care. No licensed specific treatment or vaccine is available for use in people or animals.

Ebola first appeared in 1976 in 2 simultaneous outbreaks, in Nzara, South Sudan, and in Yambuku, Democratic Republic of Congo. The latter was in a village situated near the Ebola River, from which the disease takes its name.

Genus Ebolavirus is 1 of 3 members of the Filoviridae family (filovirus), along with genus Marburgvirus and genus Cuevavirus. Genus Ebolavirus comprises 5 distinct species:

1. Bundibugyo ebolavirus (BDBV)
2. Zaire ebolavirus (EBOV)
3. Reston ebolavirus (RESTV)
4. Sudan ebolavirus (SUDV)
5. Taï Forest ebolavirus (TAFV).

### **Transmission**

Ebola is introduced into the human population through close contact with the blood, secretions, organs or other bodily fluids of infected animals. In Africa, infection has been documented through the handling of infected chimpanzees, gorillas, fruit bats, monkeys, forest antelope and porcupines found ill or dead or in the rainforest.

Ebola then spreads in the community through human-to-human transmission, with infection resulting from direct contact (through broken skin or mucous membranes) with the blood, secretions, organs or other bodily fluids of infected people, and indirect contact with environments contaminated with such fluids. Burial ceremonies in which mourners have direct contact with the body of the deceased person can also play a role in the transmission of Ebola. Men who have recovered from the disease can still transmit the virus through their semen for up to 7 weeks after recovery from illness. Health-care workers have frequently been infected while treating patients with suspected or confirmed EVD. This has occurred through close contact with patients when infection control precautions are not strictly practiced. Among workers in contact with monkeys or pigs infected with Reston ebolavirus, several infections have been documented in people who were clinically asymptomatic. Thus, RESTV appears less capable of causing disease in humans than other Ebola species.

However, the only available evidence available comes from healthy adult males. It would be premature to extrapolate the health effects of the virus to all population groups, such as immuno-compromised persons, persons with underlying medical conditions, pregnant women and children. More studies of RESTV are needed before definitive conclusions can be drawn about the pathogenicity and virulence of this virus in humans.

### **Signs and symptoms**

EVD is a severe acute viral illness often characterized by the sudden onset of fever, intense weakness, muscle pain, headache and sore throat. This is followed by vomiting, diarrhoea, rash, impaired kidney and liver function, and in some cases, both internal and external bleeding. Laboratory findings include low white blood cell and platelet counts and elevated liver enzymes. People are infectious as long as their blood and secretions contain the virus. Ebola virus was isolated from semen 61 days after onset of illness in a man who was infected in a laboratory. The incubation period, that is, the time interval from infection with the virus to onset of symptoms, is 2 to 21 days.

### **Diagnosis**

Other diseases that should be ruled out before a diagnosis of EVD can be made include: malaria, typhoid fever, shigellosis, cholera, leptospirosis, plague, rickettsiosis, relapsing fever, meningitis, hepatitis and other viral haemorrhagic fevers.

Ebola virus infections can be diagnosed definitively in a laboratory through several types of tests:

- antibody-capture enzyme-linked immunosorbent assay (ELISA)
- antigen detection tests

- serum neutralization test
- reverse transcriptase polymerase chain reaction (RT-PCR) assay
- electron microscopy
- virus isolation by cell culture.

Samples from patients are an extreme biohazard risk; testing should be conducted under maximum biological containment conditions.

**Vaccine and treatment**

No licensed vaccine for EVD is available. Several vaccines are being tested, but none are available for clinical use. Severely ill patients require intensive supportive care. Patients are frequently dehydrated and require oral rehydration with solutions containing electrolytes or intravenous fluids. No specific treatment is available. New drug therapies are being evaluated.

**Prevention and control**

No animal vaccine against EVD is available. Routine cleaning and disinfection of pig or monkey farms (with sodium hypochlorite or other detergents) should be effective in inactivating the virus. If an outbreak is suspected, the premises should be quarantined immediately. Culling of infected animals, with close supervision of burial or incineration of carcasses, may be necessary to reduce the risk of animal-to-human transmission. Restricting or banning the movement of animals from infected farms to other areas can reduce the spread of the disease. As EVD outbreaks in pigs and monkeys have preceded human infections, the establishment of an active animal health surveillance system to detect new cases is essential in providing early warning for veterinary and human public health authorities.



Figure 2: 2014 Ebola Outbreak in West Africa- Outbreak Distribution Map

**WHO response**

WHO provides expertise and documentation to support disease investigation and control. Recommendations for infection control while providing care to patients with suspected or confirmed Ebola haemorrhagic fever are provided in: Interim infection control recommendations for care of patients with suspected or confirmed Filovirus (Ebola, Marburg) haemorrhagic fever, March 2008. This document is currently being updated.

WHO has created an aide-memoire on standard precautions in health care (currently being updated). Standard precautions are meant to reduce the risk of transmission of bloodborne and other pathogens. If universally applied, the precautions would help prevent most transmission through exposure to blood and body fluids. Standard precautions are recommended in the care and treatment of all patients regardless of their perceived or confirmed infectious status. They include the basic level of infection

control-hand hygiene, use of personal protective equipment to avoid direct contact with blood and body fluids, prevention of needle stick and injuries from other sharp instruments, and a set of environmental controls.

### **Reducing the risk of Ebola infection in people**

In the absence of effective treatment and a human vaccine, raising awareness of the risk factors for Ebola infection and the protective measures individuals can take is the only way to reduce human infection and death.

In Africa, during EVD outbreaks, educational public health messages for risk reduction should focus on several factors:

- Reducing the risk of wildlife-to-human transmission from contact with infected fruit bats or monkeys/apes and the consumption of their raw meat. Animals should be handled with gloves and other appropriate protective clothing. Animal products (blood and meat) should be thoroughly cooked before consumption.
- Reducing the risk of human-to-human transmission in the community arising from direct or close contact with infected patients, particularly with their bodily fluids. Close physical contact with Ebola patients should be avoided. Gloves and appropriate personal protective equipment should be worn when taking care of ill patients at home. Regular hand washing is required after visiting patients in hospital, as well as after taking care of patients at home.
- Communities affected by Ebola should inform the population about the nature of the disease and about outbreak containment measures, including burial of the dead. People who have died from Ebola should be promptly and safely buried.

Pig farms in Africa can play a role in the amplification of infection because of the presence of fruit bats on these farms. Appropriate biosecurity measures should be in place to limit transmission. For RESTV, educational public health messages should focus on reducing the risk of pig-to-human transmission as a result of unsafe animal husbandry and slaughtering practices, and unsafe consumption of fresh blood, raw milk or animal tissue. Gloves and other appropriate protective clothing should be worn when handling sick animals or their tissues and when slaughtering animals. In regions where RESTV has been reported in pigs, all animal products (blood, meat and milk) should be thoroughly cooked before eating.

### **Controlling infection in health-care settings**

Human-to-human transmission of the Ebola virus is primarily associated with direct or indirect contact with blood and body fluids. Transmission to health-care workers has been reported when appropriate infection control measures have not been observed.

It is not always possible to identify patients with EBV early because initial symptoms may be non-specific. For this reason, it is important that health-care workers apply standard precautions consistently with all patients – regardless of their diagnosis – in all work practices at all times. These include basic hand hygiene, respiratory hygiene, the use of personal protective equipment (according to the risk of splashes or other contact with infected materials), safe injection practices and safe burial practices.

Health-care workers caring for patients with suspected or confirmed Ebola virus should apply, in addition to standard precautions, other infection control measures to avoid any exposure to the patient's blood and body fluids and direct unprotected contact with the possibly contaminated environment. When in close contact (within 1 metre) of patients with EBV, health-care workers should wear face protection (a face shield or a medical mask and goggles), a clean, non-sterile long-sleeved gown, and gloves (sterile gloves for some procedures). Laboratory workers are also at risk. Samples taken from suspected human and animal Ebola cases for diagnosis should be handled by trained staff and processed in suitably



equipped laboratories.

### **Health workers protection:**

Health workers treating patients with suspected or confirmed illness are at higher risk of infection than other groups. During an outbreak a number of important actions will reduce or stop the spread of the virus and protect health workers and others in the health-care setting. These actions are called “standard and other additional precautions” and are evidence-based recommendations known to prevent the spread of infections. The following questions and answers describe the precautions in detail.

#### ***Should patients with suspected or confirmed Ebola virus be separated from other patients?***

Isolating patients with suspected or confirmed Ebola virus disease in single isolation rooms is recommended. Where isolation rooms are not available, it is important to assign designated areas, separate from other patients, for suspected and confirmed cases. In these designated areas, suspect and confirmed cases should also be separate. Access to these areas should be restricted, needed equipment should be dedicated strictly to suspected and confirmed EVD treatment areas, and clinical and non-clinical personnel should be exclusively assigned to isolation rooms and dedicated areas.

#### ***Are visitors allowed in areas where patients suspected or confirmed Ebola virus disease are admitted?***

Stopping visitor access to patients infected with EVD is preferred. If this is not possible, access should be given only to those individuals who are necessary for the patient’s well-being and care, such as a child’s parent.

#### ***Is protective equipment required when caring for these patients?***

- In addition to standard health-care precautions, health-care workers should strictly apply recommended infection control measures to avoid exposure to infected blood, fluids, or contaminated environments or objects – such as a patient’s soiled linen or used needles.
- All visitors and health-care workers should rigorously use what is known as personal protective equipment (PPE). PPE should include at least: gloves, an impermeable gown, boots/closed shoes with overshoes, a mask, and eye protection for splashes (goggles or face shields).

#### ***Is hand hygiene important?***

- Hand hygiene is essential and should be performed:
- before donning gloves and wearing PPE on entry to the isolation room/area;
- before any clean or aseptic procedures is being performed on a patient;
- after any exposure risk or actual exposure with a patient’s blood or body fluids;
- after touching (even potentially) contaminated surfaces, items, or equipment in the patient’s surroundings; and
- after removal of PPE, upon leaving the isolation area.

It is important to note that neglecting to perform hand hygiene after removing PPE will reduce or negate any benefits of the PPE. Either an alcohol-based hand rub or soap and running water can be used for hand hygiene, applying the correct technique recommended by WHO. It is important to always perform hand hygiene with soap and running water when hands are visibly soiled. Alcohol-based hand rubs should be made available at every point of care (at the entrance and within the isolation rooms and areas); running water, soap, and single use towels should also be always available.

#### ***What other precautions are necessary in the health-care setting?***

Other key precautions are safe injection and phlebotomy procedures, including safe management of sharps, regular and rigorous environmental cleaning, decontamination of surfaces and equipment, and management of soiled linen and of waste.

In addition, it is important to ensure safe processing of laboratory samples from suspected or confirmed

patients with EDV and safe handling of dead bodies or human remains for post-mortem examination and burial preparation. Any health-care workers and other professionals undertaking these tasks in connection with suspected or confirmed patients with Ebola virus disease should wear appropriate PPE and follow precautions and procedures recommended by WHO.

### ***Traveling during Ebola outbreak?***

During an outbreak, WHO reviews the public health situation regularly and recommends any travel or trade restrictions, if necessary, and may inform national authorities to implement it. WHO is currently reviewing its recommendations for travel and expects to issue advice in the coming days.

While travellers should always be vigilant with regard to their health and those around them, the risk of infection for travellers is very low since person-to-person transmission results from direct contact with the body fluids or secretions of an infected patient.

### ***Is it safe to travel with persons who have Ebola?***

As with any illness or disease, it is always possible that a person who has been exposed to Ebola virus may choose to travel. If the individual has not developed symptoms, they cannot transmit EVD to those around them. If the individual does have symptoms, they should seek immediate medical attention at the first sign they are feeling unwell. This may require either notifying the flight crew or ship crew or, upon arrival at a destination, seeking immediate medical attention. Travellers who show initial symptoms of EVD should be isolated to prevent further transmission. Although the risk to fellow travellers in such a situation is very low, contact tracing is recommended under these circumstances.

### ***Is it safe to travel to West Africa on business or to visit family and friends?***

The risk of a tourist or businessman/woman becoming infected with Ebola virus during a visit to the affected areas and developing disease after returning is extremely low, even if the visit included travel to the local areas from which primary cases have been reported. Transmission requires direct contact with blood, secretions, organs or other body fluids of infected living or dead persons or animal, all of which are unlikely exposures for the average traveller. In any event, tourists are advised to avoid all such contacts. If you are visiting family or friends in the affected areas, the risk is similarly low, unless you have direct physical contact with a person who is ill or who has died. If this is the case, it is important to notify public health authorities and engage in contact tracing. Contact tracing is used to confirm you have not been exposed to EVD and to prevent further spread of the disease through monitoring.

### ***WHO's general travel advice***

- Travelers should avoid all contact with infected patients.
- Health workers traveling to affected areas should strictly follow WHO-recommended infection control guidance.
- Anyone who has stayed in areas where cases were recently reported should be aware of the symptoms of infection and seek medical attention at the first sign of illness.
- Clinicians caring for travelers returning from affected areas with compatible symptoms are advised to consider the possibility of Ebola virus disease.
- For additional travel advice, please read the Travel and transport risk assessment: Recommendations for public health authorities and transport sector at <http://who.int/ith/updates/20140421/en/>.

### **BARRIERS TO RAPID CONTAINMENT OF THE EBOLA OUTBREAK**

The outbreak of Ebola virus disease in west Africa continues to evolve in alarming ways, with no immediate end in sight. Many barriers stand in the way of rapid containment. The most severely affected countries, Guinea, Liberia, and Sierra Leone, have only recently returned to political stability following years of civil

war and conflict, which left health systems largely destroyed or severely disabled.

### **LACK OF CAPACITY MAKES INFECTION CONTROL DIFFICULT**

This lack of capacity makes standard containment measures, such as early detection and isolation of cases, contact tracing and monitoring, and rigorous procedures for infection control, difficult to implement. Though no vaccine and no proven curative treatment exist, implementation of these measures has successfully brought previous Ebola outbreaks under control. The recent surge in the number of cases has stretched all capacities to the breaking point. Supplies of personal protective equipment and disinfectants are inadequate. The outbreak continues to outstrip diagnostic capacity, delaying the confirmation or exclusion of cases and impeding contact tracing.

Diagnostic capacity is especially important as the early symptoms of Ebola virus disease mimic those of many other diseases commonly seen in this region, including malaria, typhoid fever, and Lassa fever. Some treatment facilities are overflowing; all beds are occupied and patients are being turned away. Many facilities lack reliable supplies of electricity and running water. Aid organizations, including Médecins Sans Frontières (Doctors without Borders), which has provided the mainstay of clinical care, are exhausted.

### **MANAGERIAL FRAMEWORK FOR EBOLA**

Last week, the WHO Director-General, Dr Margaret Chan, announced a new managerial framework designed to ensure that WHO's emergency response is fully staffed, drawing on personnel in all WHO regional and country offices, for an around-the-clock response.

The Ebola virus is one of the world's most virulent pathogens. Personal protective equipment is essential, but in short supply. It is also hot and cumbersome, severely limiting the number of hours that medical and nursing staff can work on an isolation ward. On present estimates, a facility treating 70 patients needs a minimum of 250 health-care staff.

### **FEAR IS HARD TO OVERCOME**

Six months into the outbreak, fear is proving to be the most difficult barrier to overcome. Fear causes contacts of cases to escape from the surveillance system, families to hide symptomatic loved ones or take them to traditional healers, and patients to flee treatment centres. Fear, and the hostility it can feed, have threatened the security of national and international response teams. Health-care staff fear for their lives. To date, more than 170 health-care workers have been infected and at least 81 have died.

Outbreak control is further compromised when fear causes airlines to refuse to transport personal protective equipment and courier services to refuse to transport properly and securely packaged patient samples to a WHO-approved laboratory. Fear has spread well beyond west Africa, leading some to suggest that imported cases, also in wealthy countries, could ignite widespread infections in the general population. In countries with well-developed health systems, such a scenario is highly unlikely, given the epidemiology of the Ebola virus and experiences in past outbreaks.

**Source:** <http://www.who.int/mediacentre/factsheets/fs103/en>