A Review on Transmission of Ebola Virus Disease

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ABSTRACT

Objectives

Ebola Virus Disease is a severe illness that starts with a sudden onset of fever, intense weakness, muscle pain, headache and sore throat. This is followed by vomiting, diarrhea, rash, impaired kidney and liver function, and both external and internal bleeding, according to the WHO. Ebola is not spread through the air or by water, or in general, by food. However, in Africa, Ebola may be spread as a result of handling bush meat and contact with infected bats. Ebola virus can be transmitted by direct contact with blood, body fluids, or skin of EVD patients or Persons who have died of EVD.

Study Design and Methods

Systematic meta-review 2014, design basis on WHO and CDC Reports. In 2014, the biggest outbreak of a filovirus-induced hemorrhagic fever that has been documented so far occurred from March to July 2014 in Guinea, Sierra Leone, Liberia and Nigeria. As of 29 October 2014, the WHO has reported a total of 13567 suspected cases and 4922 deaths, with a reported case fatality rate (CFR) of about 71%.

Results

Ebola virus is generally considered as a potential biological weapon, it is urgent to develop effective antiviral drugs and vaccines. There is no known cure for Ebola, a hemorrhagic fever that has overwhelmed rudimentary health care systems in West Africa, but an experimental treatment, called ZMapp, is currently being assessed and has been used on the two Americans being treated in Atlanta. Both patients seem to be showing signs of improvement.

Conclusion

Experimental vaccines and treatments for Ebola are under development, but they have not yet been fully tested for safety or effectiveness. In addition, although monoclonal antibodies to the glycoprotein of Ebola virus showed protective and therapeutic properties in mice, they failed to protect Non-human primates (NHP).

Keywords: Ebola Virus Disease, Etiology, Transmission, Clinical Features, Control Measures.

INTRODUCTION

The largest Ebola virus disease (EVD) outbreak to date is ongoing in West Africa, particularly in Guinea, Sierra Leone and Liberia, with a total of 13,567 reported cases including 4,922 deaths as of 29 October 2014.¹ A total of 20 EVD cases (19 laboratory confirmed, one probable) have been reported in Nigeria, with no new cases reported since 5 September 2014. All 20 cases stemmed from a single importation from a traveler returning from Liberia on 20 July 2014.² Ebola virus causes severe viral hemorrhagic fever with a high fatality rate. Five Ebola virus species within the genus Ebola virus are known, including four that cause Ebola virus disease (EVD) in humans (a fifth species has only caused disease in nonhuman primates).³ The 2014 outbreak of EVD in West Africa, caused by Ebola virus (Zaire Ebola virus species), is the largest outbreak of EVD in history. Ebola virus can be transmitted by direct contact with blood, body fluids, or skin of EVD patients or persons who have died of EVD.³ As of October 23, 2014, 450 healthcare personnel are known to have become infected with Ebola, of whom 244 died.⁵ Several U.S. healthcare personnel working in West Africa have also become infected with EVD and have returned to the United States for evaluation and treatment. In addition, people in several states who have had recent travel to West Africa and have developed fever...
and other symptoms have been evaluated at U.S. hospitals for possible EVD. As of October 29, 2014, there have been two imported cases, including one death, and two locally acquired cases in healthcare workers reported in the United States.\(^6\) Ebola hemorrhagic fever (EHF) is an acute viral syndrome that presents with fever and an ensuing bleeding diathesis that is marked by high mortality in human and nonhuman primates. It is caused by Ebola virus, a lipid-enveloped, negatively stranded RNA virus that belongs to the viral family Filoviridae.\(^7\)

Infections with Ebola viruses originating from Africa cause a severe disease in humans called Ebola virus disease. There are five species of the genus Ebola virus (Filoviridae family): Zaire ebolavirus (ZEBOV), Sudan ebolavirus (SEBOV), Cote d’Ivoire ebolavirus (CEBOV), Bundibugyo ebolavirus (BEOBV) and Reston ebolavirus (REBOV). Cote d’Ivoire ebolavirus has been associated with only one human case.\(^8,9,10\) Reston ebolavirus has only caused disease in non-human primates (NHP) and was found in swine suffering from porcine reproductive and respiratory disease syndrome.\(^11\) Zaire, Sudan and Bundibugyo Ebola viruses are responsible for most of the EHF outbreaks,\(^12,13\) but ZEBOV constitutes a particularly serious threat to both human and NHPs in sub-Saharan Africa. Ebola haemorrhagic fever has been associated with large human outbreaks, with case fatality rates for ZEBOV as high as 90%. The case fatality rate of EBOV in NHP is unknown but some ecological data suggest that EBOV has contributed to declines of up to 98% of local great ape populations in Gabon and the Republic of Congo.\(^14\)

In 1976, the first reported cases of Ebola fever surfaced during 2 simultaneous outbreaks in southern Sudan and the Democratic Republic of Congo (formerly Zaire). Fatality rates reached 53% and 88%, respectively.\(^15,16\) From that time until January 2003, 10 significant Ebola fever outbreaks have occurred in Africa involving more than 1600 cases of infection and 1100 fatalities. In addition, there have been a small number of subclinical infections in the United States and the Philippines from the Reston strain of the virus, which is harmless to humans but lethal for monkeys.\(^17\)

Despite concerted investigative efforts, the natural reservoir of the virus is unknown. As a result, little is understood about how Ebola virus is transmitted or how it replicates in its host. However, based on evidence from similar viruses, it is theorized that the virus is zoonotic and therefore is maintained by an unidentified animal host.\(^17,18,19\) The fact that outbreaks of EHF have coincided with the end of the African rainy season may provide a clue to the natural ecology of Ebola virus and to the host, which may be influenced by this weather cycle.\(^20\)

Ebola haemorrhagic fever in Sudan 2004: The epicenter of this small outbreak of 17 cases and seven deaths (CFR of 41.2%) was the town of Yambio, near to the two previous Ebola sites (Nzara and Maridi).\(^21\) In the Ebola outbreak (2008), Kaluamba was affected again, with 37 cases and 16 deaths (CFR of 43.8%).

Ebola haemorrhagic fever in the DRC (2007–2008, 2008–2009): A further outbreak occurred in 2007, in the Mweka health zone, West Kasai Province, involving 264 cases and 187 deaths with a case fatality rate (CFR) of 71%. Kampungu city was the epicenter of the outbreak with 47% of cases, followed by the city of Kaluamba (42% of cases). The index case was the chief of the village and a hunter. The outbreak was apparently associated with a massive fruit bat migration through this region.\(^22\)

Ebola haemorrhagic fever (EHF) in Uganda (2011, 2007 and 2000): An outbreak of SEBOV occurred in Gulu in 2000 and spread to the cities of Mbarara and Masindi, with a total of 425 cases and 224 deaths (CFR of 52%).\(^23\) This was the largest epidemic caused by SEBOV. The outbreak was recognised from a cluster of human cases and was amplified by nosocomial transmission. Uganda was again affected in 2007 when a new Ebola species, BEBOV, killed 30 people out of 116 cases (CFR of 26%).\(^13\)

**MATERIALS AND METHODS**

**Study Design, Setting and Study Population**

**Etiology**

Ebola virus belongs to the family Filoviridae in the order Mononegavirales which includes Rhabdoviridae and Paramyxoviridae. Structurally, filovirus virions (complete viral particles) may appear in several shapes, biological features called pleomorphism. These shapes include long, sometimes branched filaments, as well as shorter filaments shaped like a "6", a "U", or a circle. Viral
filaments may measure up to 14,000 nanometers in length, have a uniform diameter of 80 nanometers, and are enveloped in a lipid (fatty) membrane. Each virion contains one molecule of single-stranded, negative-sense RNA. New viral particles are created by budding from the surface of their hosts’ cells; however, filovirus replication strategy is not completely understood.

The virus was first recognized in 1976 when two unrelated EHF outbreaks occurred 800 km apart in northern Zaire (Yambuku) and southern Sudan (Nzara or Maridi). It was given the name ‘Ebola’ after the small river near the Catholic mission of Yambuku, the epicenter of the 1976 EHF outbreak. Ebola virus is not restricted to Africa. A new species, REBOV, was described in cynomolgus monkeys (Macaca fascicularis) imported from the Philippines (Manila) to a quarantine facility in Reston, USA in 1989. Subsequently, REBOV has been re-isolated from cynomolgus monkeys and domestic pigs in the Philippines.

Pathogenesis and Transmission

Ebola viruses are bio safety level-4 pathogens and require special containment measures and barrier protection, particularly for healthcare workers. The viruses can survive in liquid or dried material for many days. They are inactivated by gamma irradiation, heating for 60 minutes at 60 °C or boiling for five minutes, and are sensitive to sodium hypochlorite (bleach) and other disinfectants. Freezing or refrigeration will not inactivate Ebola viruses.

The incubation period (the period between infection and first symptoms) is usually four to ten days but can be as short as two days and as long as 21 days. The case–fatality ratio for Zaire ebolavirus infections is estimated to be between 44% and 90%. Ebola viruses are highly transmissible by direct contact with infected blood, secretions, tissues, organs and other bodily fluids from dead or living infected persons. Transmission via inanimate objects contaminated with infected bodily fluids is possible. The principal mode of transmission in human outbreaks is person-to-person transmission through direct contact with a symptomatic or dead EVD case. Airborne transmission has not been documented.

The infection generally involves necrosis of the liver, spleen, kidney, lymph nodes, testes, and ovaries due to viral replication within parenchymal cells. More significant effects are microvascular damage, changes in vascular permeability and activation of the clotting cascade. Damage to platelets and endothelial cells results in the disruption of fluid balance and homeostasis. In addition, the virus is believed to compromise and suppress immunological function. Although the natural reservoir host of Ebola viruses has not yet been identified, the way in which the virus first appears in a human at the start of an outbreak is unknown. However, scientists believe that the first patient becomes infected through contact with an infected animal, such as a fruit bat or primate (apes and monkeys), which is called a spillover event. Person-to-person transmission follows and can lead to large numbers of affected people. In some past Ebola outbreaks, primates were also affected by Ebola, and multiple spillover events occurred when people touched or ate infected primates. When an infection does occur in humans, the virus can be spread in several ways to others. Ebola is spread through direct contact (through broken skin or mucous membranes in, for example, the eyes, nose, or mouth) with:

- Blood or body fluids (including but not limited to urine, saliva, sweat, feces, vomit, breast milk, and semen) of a person who is sick with Ebola
- Objects (like needles and syringes) that have been contaminated with the virus
- Infected fruit bats or primates (apes and monkeys)

Ebola is not spread through the air or by water, or in general, by food. However, in Africa, Ebola may be spread as a result of handling bush meat (wild animals hunted for food) and contact with infected bats. There is no evidence that mosquitoes or other insects can transmit Ebola virus. Only a few species of mammals (for example, humans, bats, monkeys, and apes) (Figure 2) have shown the ability to become infected with and spread Ebola virus.

The main routes of infection are through mucous membranes, the conjunctiva, and small skin breaks. Case reports of hospital personnel acquiring the disease that are not attributable to the percutaneous route suggest that rubbing one’s eye after caring for a patient with acute illness transmits enough inoculum to produce clinical infection. Aerosol dissemination of Ebola virus has not been established as a mode of transmission in humans. However, in nonhuman primates, this mode of transmission has been associated with disease.
Data Collection and Evaluation

Epidemiological Update (Situation in West Africa)

Since December 2013 and as of 29 October 2014, the World Health Organization (WHO) has reported a total of 13,567 suspected cases and 4,922 deaths, have been reported by WHO. (Figure.1) (Table.1).

The distribution of EVD cases by affected countries is as follows:

- Guinea: 1 472 cases and 843 deaths as of 12 October 2014;
- Liberia: 4 249 cases and 2 458 deaths as of 11 October 2014;
- Sierra Leone: 3 252 cases and 1 183 deaths as of 12 October 2014;
- Nigeria: 20 cases and 8 deaths, with last confirmed case in Lagos on 5 September 2014 (37 days as of 12 October 2014) and in Rivers State on first September 2014 (41 days as of 12 October);
- Senegal: 1 case, no deaths, confirmed on 28 August 2014 (45 days as of 12 October). All contacts have completed 21 days of follow-up.1

Ethical Consideration

Clinical Features

The onset of the disease is abrupt after an incubation period of 2 to 21 days. The clinical features can be divided into four main phases as follows,

Phase A. Influenza–like syndrome: The onset is abrupt with non-specific symptoms or signs such as high fever, headache and nausea.

Phase B. Acute (day 1–6): Persistent fever not responding to anti malarial drugs or to antibiotics, headache and intense fatigue followed by diarrhea and abdominal pain and vomiting.

Phase C. Pseudo-remission (day 7–8): During this phase the patient feels better and seeks food. Some patients may recover during this phase and survive from the disease and

Phase D. Aggravation (day 9): In many if not most cases, the health status gets worse. The following symptoms may be observed:

- Skin manifestations: petaechiae(not so obvious on black skin), purpura(morbiliform skin rash)
- Respiratory disorders: dyspnea,cough, hiccup, throat and chest pain,
- Cardiovascular distress and hypovolaemic shock.44,45,46

Diagnosis

Early laboratory confirmation of suspected clinical haemorrhagic fever cases is essential to implement appropriate control measures. Definitive diagnosis of suspected cases of EHF is usually made by PCR detection and virus isolation on Vero cells. As a class-4 pathogen, Ebola virus culture requires a maximum containment facility. Additional laboratory diagnostic tests include ELISAs for the detection of Ebola IgG- and IgM-specific antibodies and virus antigens; more specialized molecular testing is also available but is not readily available in the usual clinical setting. In Africa, laboratory confirmation of Ebola cases has been challenging and early recognition of the first outbreaks were severely hampered as a result. Because the disease was poorly known or rare, laboratory investigations were oriented towards the more common, endemic pathogens in the area (Table.2).

Since 1994, the incidence of Ebola outbreaks increased and, as a consequence, the awareness of the disease has improved and facilities capable of diagnosing EHV were established in Africa. National Public Health laboratories in endemic countries like Uganda (UVRI), Kenya (KEMRI) and Gabon (CIRMF) have already developed capacities to diagnose EHF by ELISA and RT-PCR. South Africa is the only African country with a maximum containment, enclosed suit laboratory where all class-4 viral pathogens can be handled safely. After the last Ebola outbreak in Kaluamba, DRC (2008–2009), the Ebola diagnostic technologies of ELISAs for the detection of antigens and IgM antibody, and RT-PCR have been transferred to the INRB in Kinshasa.47,48,49
Statistical Analysis

Most of the time, outbreaks of Ebola haemorrhagic fevers are managed by a core structure called the International Committee on Scientific and Technical Coordination, under the aegis of the World Health Organization. This committee is in charge of implementing control measure activities on a daily basis and has the following working subgroups:

- The patient management team is involved in the isolation of clinical cases in a quarantine ward, training of medical and relief personnel on the proper use of protective equipment (gloves, masks etc.), and providing medical care based on symptomatic therapy to maintain the vital respiratory and cardio-vascular.
- Co-ordination committee, which is responsible for all epidemic response activities, chair daily meetings and write reports for public health authorities and health partners.
- The epidemiological surveillance team is in charge of active and passive case finding, contact tracing and rumor-verification of suspect cases or deaths in the community.
- The hygiene and sanitation team is in charge of disinfection and burial of all Ebola and non-Ebola dead bodies under safe conditions. Local Red Cross volunteers usually perform these activities.
- Social mobilization and health education are critical for controlling an Ebola outbreak since resistance from the community to freely provide information on patients, deaths and contacts are commonplace. Ebola haemorrhagic fever outbreaks have many socio-cultural aspects that need to be studied deeply as communities can reject the anti-epidemic control measures imposed by the international scientific and technical committee. Sometimes the anti-epidemic control measures needed to be adapted to the local culture, for example, funeral practices as in the 2003 Ebola outbreak in Republic of the Congo.
- The laboratory and research team is in charge of collecting, storing and shipping of clinical samples for diagnostic confirmation.
- The logistic support team is in charge of providing any administrative, logistic and technical support to the other teams, such as coordination of secretariat, transport and communication.
- Psychosocial support for the affected families has been neglected during previous outbreaks, but this issue has become more and more important due to stigmatization of survivors and their families by the community.\(^\text{50,51}\)

Treatment

No proven Ebola virus-specific treatment presently exists; however there are measures that can be taken that will improve a patient's chances of survival. Ebola symptoms may begin as early as two days or as long as 21 days after one is exposed to the virus. They usually begin with a sudden influenza-like stage characterized by feeling tired, fever, and pain in the muscles and joints. No specific treatments or vaccines are presently available for EVD. However, early supportive treatment can improve the chances of recovery (WHO. March 2014). Potential new Ebola therapies and vaccines were reviewed during two WHO meetings on 4–5 and 29-30 September 2014 and further assessed by scientific review.\(^\text{52,53}\) Several of these potential drugs have in the past month been used in experimental treatment of individual EVD cases. During the first WHO consultation meeting, there was consensus that the use of whole blood therapies and convalescent blood serums needs to be considered as a matter of priority.\(^\text{54}\)

ZMapp is a combination of monoclonal antibodies. The limited supply of the drug has been used to treat 7 individuals infected with the Ebola virus.\(^\text{55}\) Although some of them have recovered, the outcome is not considered to be statistically significant.\(^\text{56}\) ZMapp has proved highly effective in a trial involving rhesus macaque monkeys.\(^\text{57}\) Texas A&M University stated on 8 October that it was preparing to mass-produce the drug, in its Center for Innovation in Advanced Development and Manufacturing, pending final approval.\(^\text{58}\)

Symptoms of Ebola are treated as they appear. The following basic interventions, when used early, can significantly improve the chances of survival:

- Providing intravenous fluids (IV)and balancing electrolytes (body salts)
- Maintaining oxygen status and blood pressure
- Treating other infections if they occur
Experimental vaccines and treatments for Ebola are under development, but they have not yet been fully tested for safety or effectiveness. Managing Ebola patients in the African setting was a major challenge because there was no specific vaccine available. Only supportive care could be administered, to sustain cardiac and renal functions with prudent use of perfusion. Oral rehydration was recommended but sometimes not realistic because of throat pain and vomiting. The main objective was to provide optimal care to the patient with maximum protection of the medical and nursing staff.

In a clinical experiment conducted late in the 1995 Ebola outbreak in Kikwit, human convalescent blood was used for passive immunization to treat patients that had been infected naturally with ZEBOV; 7 out of 8 patients who received blood transfusion from convalescent Ebola patients’ survived.\(^{59}\) In addition, although monoclonal antibodies to the glycoprotein of Ebola virus showed protective and therapeutic properties in mice, they failed to protect Non-human primates (NHP).\(^{60,61}\)

Ebola virus is generally considered as a potential biological weapon, it is urgent to develop effective antiviral drugs and vaccines. The Ideal is to develop a candidate vaccine able to confer interspecies cross-protection against SEBOV, BEBOV, ZEBOV and Other unknown Ebola virus species.

**RESULTS**

The corner-stone for controlling an outbreak of Ebola haemorrhagic fever is to interrupt the viral transmission chain. In order to reduce transmission, several strict public health measures need to be implemented as quickly as possible, including isolation of patients, barrier precautions and identification and tracking of all contacts. Most of the time, outbreaks are managed by a core structure called the International Committee on Scientific and Technical Coordination, under the aegis of the World Health Organization (WHO).

Experimental vaccines and treatments for Ebola are under development, but they have not yet been fully tested for safety or effectiveness. Potential new Ebola therapies and vaccines were reviewed during two WHO meetings on 4–5 and 29-30 September 2014 and further assessed by scientific review.

**Table 1.** Major Ebola virus outbreaks by country.\(^1\)

<table>
<thead>
<tr>
<th>Country</th>
<th>Cases</th>
<th>Deaths</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liberia</td>
<td>6,535</td>
<td>2,413</td>
<td>31 Oct. 2014</td>
</tr>
<tr>
<td>Sierra Leone</td>
<td>5,338</td>
<td>1,510</td>
<td>27 Oct. 2014</td>
</tr>
<tr>
<td>Guinea</td>
<td>1,667</td>
<td>1,018</td>
<td>31 Oct. 2014</td>
</tr>
<tr>
<td>Nigeria</td>
<td>20</td>
<td>8</td>
<td>20 Oct. 2014</td>
</tr>
<tr>
<td>United States</td>
<td>4</td>
<td>1</td>
<td>31 Oct. 2014</td>
</tr>
<tr>
<td>Mali</td>
<td>1</td>
<td>1</td>
<td>31 Oct. 2014</td>
</tr>
<tr>
<td>Senegal</td>
<td>1</td>
<td>0</td>
<td>17 Oct. 2014</td>
</tr>
<tr>
<td>Spain</td>
<td>1</td>
<td>0</td>
<td>31 Oct. 2014</td>
</tr>
<tr>
<td>Total</td>
<td>13,567</td>
<td>4,951</td>
<td>31 Oct. 2014</td>
</tr>
</tbody>
</table>

**Figure 1.** Distribution of cases of EVD by week of reporting in Guinea, Sierra Leone, Liberia and Nigeria (as of week 41/2014).\(^1\)
There is no known cure for Ebola, a hemorrhagic fever that has overwhelmed rudimentary health care systems in West Africa. An experimental treatment, ZMapp, has not yet been tested in people, although animal tests are promising. The drug is a combination of three antibodies created in plants, which block or neutralize the virus. The treatment was been made available to a few healthcare workers who were infected while treating Ebola patients. Some of them have recovered although some did not and subsequently died but an experimental treatment, ZMapp is currently being assessed and has been used on the two Americans being treated in Atlanta. Both patients seem to be showing signs of improvement.

**Figure 2. Hypothesis of Ebola virus transmission at the human animal interface**

**Table 2. Laboratory tests used in diagnosis**

<table>
<thead>
<tr>
<th>Timeline of Infection</th>
<th>Diagnostic tests available</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within a few days after symptoms begin</td>
<td>• Antigen-capture enzyme-linked immunosorbent assay (ELISA) testing IgM&lt;br&gt;• Polymerase chain reaction (PCR)&lt;br&gt;• Virus isolation</td>
</tr>
<tr>
<td>Later in disease course or after recovery</td>
<td>• IgM and IgG antibodies</td>
</tr>
<tr>
<td>Retrospectively in deceased patients</td>
<td>• Immunohistochemistry testing&lt;br&gt;• PCR&lt;br&gt;• Virus Isolation</td>
</tr>
</tbody>
</table>

**Table 3. Levels of risk of transmission of Ebola viruses**

<table>
<thead>
<tr>
<th>Type of contact</th>
<th>Type of contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Risk</td>
<td>Casual contact with a feverish but ambulant and self-caring patient, e.g. sharing a seating area or public transportation; receptionist tasks.</td>
</tr>
<tr>
<td>High Risk</td>
<td>Direct contact with any material soiled by bodily fluids from a probable or confirmed case; &lt;br&gt;• Percutaneous injury (e.g. with needle) or mucosal exposure to bodily fluids, tissues or laboratory specimens of a probable or confirmed case.&lt;br&gt;• Participation in funeral rites with direct exposure to human remains in or from an affected area without appropriate personal protective equipment.&lt;br&gt;• Direct contact with bush meat or bats, rodents, primates, living or dead in/from affected areas.</td>
</tr>
</tbody>
</table>

**DISCUSSION**

Ebola virus disease (EVD), formally known as Ebola haemorrhagic fever, has been causing worldwide concern as it infects people in countries out of West Africa, including the United States.
Newspapers around the world have made the epidemic front page news and top headlines, and global health experts, such as the CDC, have declared the 2014 Ebola epidemic as the largest in history. The World Health Organization said EVD has a fatality rate of up to 90 percent and that the virus is transmitted to people from wild animals and then spread from human to human. We have analyzed epidemiological data of what appears to be a limited outbreak of EVD in Liberia, Sierra Leone, Nigeria and Guinea based on data available as of 27 October 2014 (WHO). The swift control of the outbreak was likely facilitated by the early detection of the index entering Nigeria from a country where disease is widespread, in combination with intense contact tracing efforts of all contacts of this index case and the subsequent isolation of infected secondary cases. The initial outbreak in Guinea remained undetected for several weeks. This detection delay facilitated the transnational spread of the virus to Sierra Leone and Liberia. The recent importation of an EVD case in the United States from Liberia proves that no country is immune to the risk of EVD in a globally connected world, but that rapid case identification and forceful interventions can stop transmission.

CONCLUSION
Ebola haemorrhagic fever epidemics constitute a significant public health concern in Africa and an effective vaccine is needed urgently. In addition, although monoclonal antibodies to the glycoprotein of Ebola virus showed protective and therapeutic properties in mice, they failed to protect Non-human primates. Managing Ebola patients in the African setting was a major challenge because there was no specific vaccine available. Such a vaccine would primarily benefit doctors, nurses and field epidemiologists working in endemic countries. The second target group would be the scientists working with Ebola virus as well as veterinarians and those involved in wildlife conservation in endemic areas. Since its discovery in 1976, much is known about Ebola virology, physiopathology, clinical features and epidemiology, but the missing link certainly remains the virus reservoir in nature. The current research focused on bats as putative ZEBOV reservoirs has to be reinforced and extended to the reservoirs of other Ebola species. The early detection and isolation of a patient with Ebola virus Disease decreases the risk of transmission in the community.

LIMITATIONS
The limitations of such culturalist discourses of epidemiology and call for greater attention to the more salient features of Ebola epidemics in Africa. The evolving epidemic of EVD over the last weeks increases the likelihood that EU residents and travellers to the EVD-affected countries will be exposed to infected or ill persons. You can only catch EBOLA by touching someone who is sick or dead, their body fluids, or things they have touched. Pay strict attention to hygiene.

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REFERENCES


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