

Ebola Virus Disease: An Emerging Global Public Health Concern

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Abstract: Ebola virus disease (EVD) formerly known as, Ebola haemorrhagic fever (EHF) is one of the most severe viral HF's often characterized by the sudden onset of fever, intense weakness, muscle pain, headache, sore throat, vomiting, diarrhoea, rash, impaired kidney and liver function, and in some cases, both internal and external bleeding. The 2014 Ebola outbreak is the largest Ebola outbreak in history and the first Ebola outbreak in West Africa affecting multiple countries in West Africa e.g. Guinea, Liberia, and Sierra Leone. The current outbreak threatens to spread more and cross the boundaries of West Africa to establish itself in realms of different continents. India is also vulnerable due to its susceptible ecosystem and unprepared health system. Our healthcare systems as well as communities are clearly not sensitised to the extent of the danger this possess, It's time to take action before it is far too late.

Keywords: Ebola Virus Disease, Outbreak, West Africa, Laboratory Diagnosis, Vaccine, Prevention.

I. INTRODUCTION

The Filovirus infection (Latin filo - 'thread') Ebola virus disease (EVD) is perhaps the most severe and feared of all viral HF's today. EVD is a severe acute viral illness often characterized by the sudden onset of fever, intense weakness, muscle pain, headache, sore throat, 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 [1-3]. Formerly known as, Ebola haemorrhagic fever (EHF) Incubation period ranges between 2 – 21 days. The case fatality rate (CFR) varies from 50 – 90% [1, 4-7]. EVD outbreaks occur primarily in remote villages in Central and West Africa, near tropical rainforests [1, 6]. All cases of human illness or death from Ebola have occurred in Africa (with the exception of several laboratory contamination cases: one in England and two in Russia). No cases have been reported in the India till date [8].

Agent: Order-Mononegavirales, Family- Filoviridae, Genus-Ebola like viruses, Species-5 distinct species; Bundi Bugyo Ebola Virus (BDBV), Zaire Ebola Virus (EBOV), Reston Ebola Virus (RESTV), Sudan Ebola Virus (SUDV), Tai Forest Ebola Virus (TAFV). BDBV, EBOV, and SUDV have been associated with large EVD outbreaks in Africa, whereas RESTV and TAFV have not. The RESTV species, found in Philippines and the People's Republic of China, can infect humans, but no illness or death in humans from this species has been reported to date [1, 6].

Host: Fruit bats of the *Pteropodidae* family are considered to be a likely natural host of the Ebola Virus, with outbreaks amongst other species such as chimpanzees, gorillas, monkeys, forest antelope from time to time [1, 6]. There are locations throughout the world where the Fruit Bat is able to successfully thrive. They tend to live in forests, grassland and sheets. Most of them live in warmer climates where they can take advantage of various fruits that will grow throughout the year [9]. Geographical distribution of fruit bats and Ebola virus outbreak in animal and human coincide (Fig.1) and is Africa, Asia, Australia and Middle East region [10].

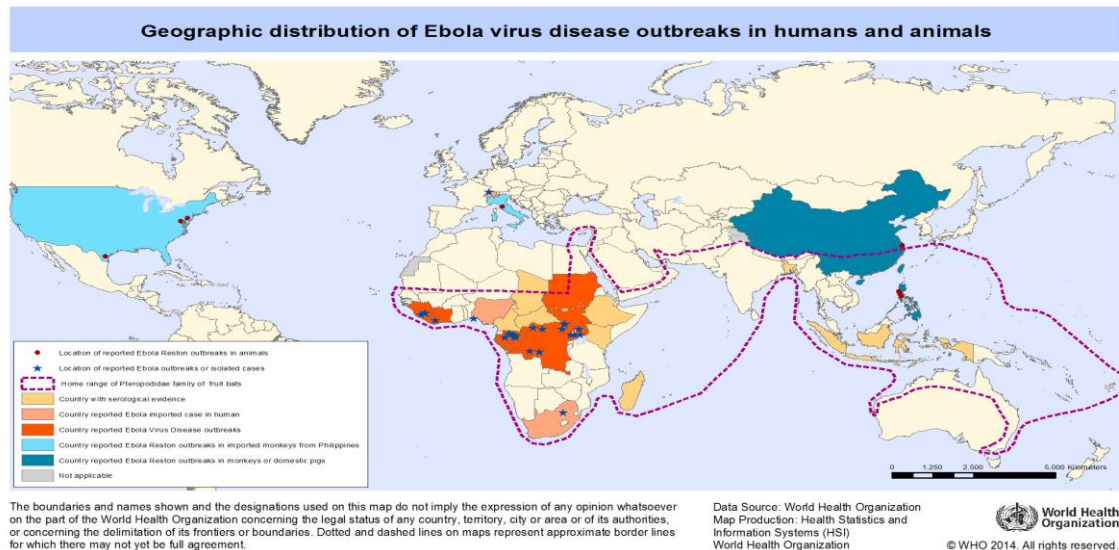


Figure - 1

The link between human infection by the Ebola virus and their proximity to primates is clear now (Figure.2). Outbreaks occurred in countries that house 80 percent of the world's remaining wild gorilla and chimpanzee populations. The outbreaks coincided with the outbreaks in wild animals. The same distinct viral strains were isolated in animal carcasses and in the bodies of those who handled those carcasses. These outbreaks were preceded by an abnormally large death in wild Gorilla populations [11]. Ebola is introduced into the human population through close contact with the blood, secretions, organs or other bodily fluids of infected animals [7, 12, and 13]. 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 [14-18]. 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 [1, 7]. Ebola virus is not easily transmitted via the airborne route [2, 16]. Ebola is not transmitted by water and food [2].

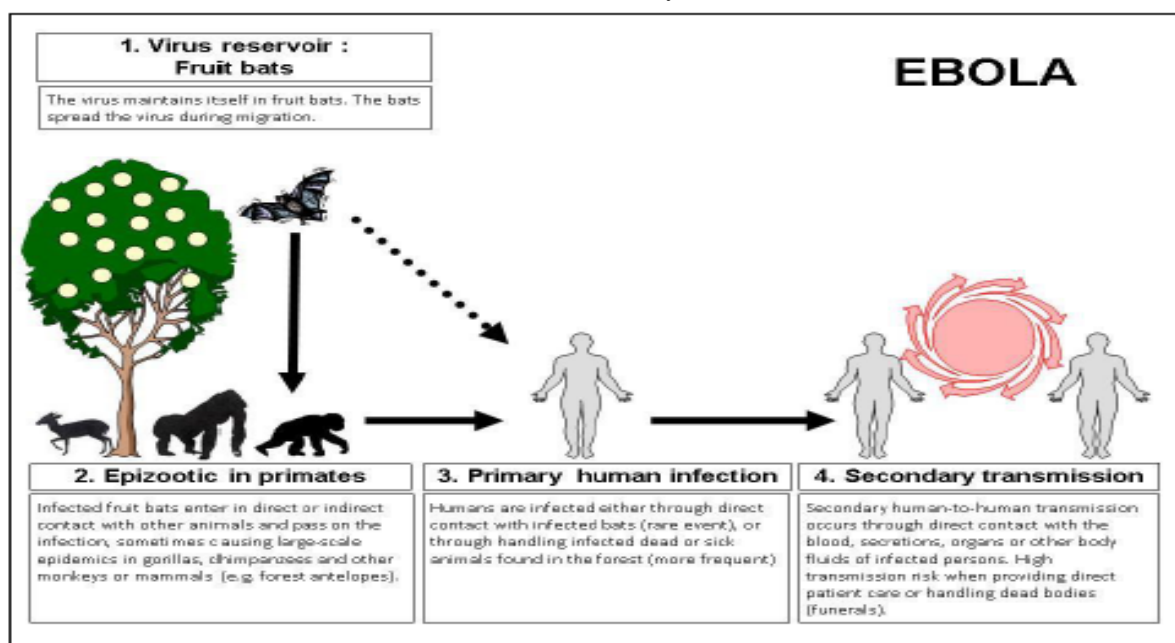


Figure 2: Hypothesis of Ebola virus transmission at the human-animal interface [19].

Transmission: Levels of risk of transmission of Ebola virus according to type of contact with an infected patient.

Very low or no recognised risk: Casual contact with a feverish, ambulant, self-caring patient. Examples: sharing a sitting area or public transportation; receptionist tasks.

Low risk: Close face-to-face contact with a feverish and ambulant patient. Example: physical examination, measuring temperature and blood pressures.

Moderate risk: Close face-to-face contact without appropriate personal protective equipment (including eye protection) with a patient who is coughing or vomiting, has nosebleeds or who has diarrhoea.

High risk: Percutaneous, needle stick or mucosal exposure to virus-contaminated blood, bodily fluids, tissues or laboratory specimens in severely ill or known positive patients [20].

Ebola first appeared in 1976 in two simultaneous outbreaks, in Nzara, 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 [21]. List of Ebola outbreaks is presented in Table 1.

Table 1: Cases of Ebola Hemorrhagic Fever in Africa, 1976 – 2014 [22]

Country	Town	Cases	Deaths	Case Fatality	Species	Year
Dem. Rep. of Congo	Yambuku	318	280	88%	Zaire ebolavirus	1976
South Sudan	Nzara	284	151	53%	Sudan ebolavirus	1976
Dem. Rep. of Congo	Tandala	1	1	100%	Zaire ebolavirus	1977
South Sudan	Nzara	34	22	65%	Sudan ebolavirus	1979
Gabon	Mekouka	52	31	59.6%	Zaire ebolavirus	1994
Ivory Coast	Tai Forest	1	0	0	Tai Forest ebolavirus	1994
Dem. Rep. of Congo	Kikwit	315	250	81%	Zaire ebolavirus	1995
Gabon	Mayibout	37	21	57%	Zaire ebolavirus	1996
Gabon	Booue	60	45	74%	Zaire ebolavirus	1996
South Africa	Johannesburg	2	1	50%	Zaire ebolavirus	1996
Uganda	Gulu	425	224	52.7%	Zaire ebolavirus	2000
Gabon	Libreville	65	53	82%	Zaire ebolavirus	2001
Republic of Congo	Not specified	57	43	75%	Zaire ebolavirus	2001
Republic of Congo	Mbomo	143	128	89%	Zaire ebolavirus	2002
Republic of Congo	Mbomo	35	29	83%	Zaire ebolavirus	2003
South Sudan	Yambio	17	7	41%	Zaire ebolavirus	2004
Dem. Rep. of Congo	Luebo	264	187	71%	Zaire ebolavirus	2007
Uganda	Bundibugyo	149	37	25%	Bundibugyo ebolavirus	2007
Dem. Rep. of Congo	Luebo	32	15	47%	Zaire ebolavirus	2008
Uganda	Luwero District	1	1	100%	Sudan ebolavirus	2011
Uganda	Kibaale District	11*	4*	36.4%	Sudan ebolavirus	2012
Dem. Rep. of Congo	Isiro Health Zone	36*	13*	36.1%	Bundibugyo ebolavirus	2012
Uganda	Luwero District	6*	3*	50%	Sudan ebolavirus	2012
Multiple countries[†]	multiple	3487*	2917*	51%	Zaire ebolavirus	2014

*Numbers reflect laboratory confirmed cases only.

[†] Guinea, Liberia, Nigeria, Sierra Leone and Senegal

Current Epidemic: The 2014 Ebola outbreak is the largest Ebola outbreak in history and the first Ebola outbreak in West Africa. This outbreak is the first Ebola epidemic the world has ever known —affecting multiple countries in West Africa eg. Guinea, Liberia, and Sierra Leone. A small number of cases in Lagos and Port Harcourt, Nigeria, have been associated with a man from Liberia who traveled to Lagos and died from Ebola, but the virus does not appear to have been widely

spread in Nigeria. The case in Senegal is related to a man who traveled there from Guinea. Nigeria and Senegal have not reported any new cases since September 5, 2014, and August 29, 2014, respectively. In Senegal, all contacts have now completed their 21-day follow up, with no further cases of Ebola reported.

Total Cases (Updated September 25, 2014)

Total Case Count: 6263

Total Deaths: 2917

Laboratory Confirmed Cases: 3487

World Health Organization (WHO), and other domestic and international partners and has activated its Emergency Operations Center to help coordinate technical assistance and control activities with partners. CDC has also deployed teams of public health experts to West Africa and will continue to send experts to the affected countries.

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

Within a few days after symptoms begin: Antigen-capture enzyme-linked immunosorbent assay (ELISA) testing, IgM ELISA, Polymerase chain reaction (PCR), Virus isolation

Later in disease course or after recovery: IgM and IgG antibodies

Retrospectively in deceased patients: Immuno-histo-chemistry testing, PCR [15, 23].

Treatment: No specific vaccine or medicine (e.g., antiviral drug) has been proven to be effective against Ebola. Ribavirin is not efficacious and should not be used for Ebola HF (Medbox). ZMapp, being developed by Mapp Biopharmaceutical Inc., is an experimental treatment, for use with individuals infected with Ebola virus. It has not yet been tested in humans for safety or effectiveness. The product is a combination of three different monoclonal antibodies that bind to the protein of the Ebola virus [24]. The following basic interventions, when used early, can significantly improve the chances of survival: Fluid and electrolyte balance, Management of complication symptomatically, Maintaining Oxygen status and Blood Pressure, Treat for any complicating infection and co-morbid condition [2, 25].

Prevention and Control: There is no Food and Drug Administration (FDA) approved vaccine available for Ebola Virus Disease [1, 2, 23]. A number of experimental approaches for filovirus infection have shown promise; the vesicular stomatitis virus vectored vaccine for viral HFs has shown protective immunity in animal models. In addition, a DNA plasmid vaccine for Ebola HF has been shown to be safe and immunogenic in a Phase I trial. National Institute of Health (NIH) will begin initial human testing of an investigational vaccine to prevent EVD in early September and is working with a company to develop an antiviral drug to treat Ebola.

U.S. Department of Defense has funded two companies that are developing drug therapies for Ebola and is working with another company to develop an Ebola vaccine [22].

Reducing the risk of Ebola infection in people [1, 7]:

- 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.
- 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 body 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 and should be disposed after use as per bio safety guidelines. Regular hand washing is required after visiting patients in hospital, as well as after taking care of patients at home.
- Those who are travelling to an area affected by an Ebola outbreak, make sure to do the following [26]:
- Practice careful hygiene. Avoid contact with blood and body fluids.

- Do not handle items that may have come in contact with an infected person's blood or body fluids.
- Avoid funeral or burial rituals that require handling the body of someone who has died from Ebola.
- Avoid contact with bats and nonhuman primates or blood, fluids, and raw meat prepared from these animals.
- Avoid hospitals where Ebola patients are being treated.
- After you return, monitor your health for 21 days and seek medical care immediately if you develop symptoms of Ebola.
- Healthcare workers who may be exposed to people with Ebola should follow these steps [7, 26]:
- 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).
- Practice proper infection control and sterilization measures.
- Isolate patients with Ebola from other patients.
- Avoid direct contact with the bodies of people who have died from Ebola.

Disposal of waste material and dead Body [2]:

- Specimen collected, waste material should be packed in triple packaging system which consist of primary receptacle (sealable specimen bag) wrapped with absorbent material, secondary receptacle (watertight, leak proof) and an outer package.
- Person handling the dead body must be heavily protected.
- Burial is the preferred method of disposal.
- Cultural and religious procedures may be addressed too.
- Local health authority must ensure burial ground for safe disposal. Like away from drinking/ ground water resources, habitat etc.
- Burial depth should be at least 1.5 meter above ground water level with at least 1 meter covering of soil.
- If coffins not available, corpus should be wrapped in plastic sheeting to keep the remains separate from soil.
- Individual burial grave preferred.

Why India must be prepared...???

In India, we are crowding wildlife into ever-smaller areas, due to rapidly increasing human population which is disturbing the balance of the ecosystem, which may act in favour of spread of the epidemic once the deadly virus is introduced in our ecosystem. Though threat of Ebola virus reaching Indian shores is still very distant, it's time to put measures in place to face the situation if the virus reaches India. A total of 44,700 Indians are living in different countries affected by Ebola. If it all it happens in India, it would be through people travelling back from the African countries where its outbreak has been reported. While several airports of the developed world has put machineries to screen the travellers and goods, it seems to be quite a feat to be putting such machinery in place at Indian airports. And while the installation is one issue, the implementation would be another greater challenge, considering the apparent laxity and unpreparedness of our immigration and customs personnel. This only means that it could be highly possible for a person who has contracted the virus to pass into the country, totally unnoticed. To make matters worse, most healthcare facilities in our country are not equipped with appropriate space and infrastructure to quarantine patients. This could well imply that the disease would start spreading in the very places where it's ought to be controlled that is "the hospitals". In view of outbreak of the Ebola virus disease in 4 countries of West Africa, namely, Guinea, Liberia, Sierra Leone and Nigeria, it is recommended that non-essential travel to these countries be deferred till such time that the Ebola virus disease outbreak situation is brought under control. Our healthcare systems are clearly not sensitised to the extent of the danger this poses.

Not only that, but the Government must be well prepared with the preventive measures to tackle any public health emergency situation due to EVD. Good outbreak control relies on applying a package of interventions, like case management, surveillance and contact tracing, a good laboratory service, safe burials and social mobilisation, which also requires extensive Community participation. Therefore, awareness regarding the spread, consequences and preventive measures must be spread in the general population until it actually comes knocking at our doorstep. And then it could be far too late.

II. CONCLUSION

Ebola virus disease is a deadly disease caused by Filovirus and transmitted by fruit bats. Though in past also there have been many small outbreaks with Ebola, the current epidemic in West Africa is unprecedented in scale mainly because of the attributes of the affected populations, the condition of the health systems, and failure of control efforts to halt the spread of infection. The clinical course of infection and the transmissibility of the virus in the current epidemic are similar to those in previous Ebola outbreaks. Indian subcontinent also presents favourable ecological system for spread of the virus. Also, increasing human encroachment in wildlife may act in favour of spread of the epidemic once the deadly virus is introduced in our ecosystem; therefore it's time to put measures in place to face the situation if the virus reaches India. Also, awareness regarding the spread, consequences and preventive measures must be spread in the general population.

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