



# Epidemiology of Ebola virus disease and its Public Health Importance in Africa

Mahendra Pal,<sup>1</sup> Mati Roba Bulcha<sup>2</sup> and Iyasu Ejeta<sup>3</sup>

1. Narayan Consultancy on Veterinary Public Health and Microbiology- Anand-388001, Gujarat, India

2. Yemalog Walal Woreda Livestock and Fishery Development and Resource Office, Kellem Wollega zone, Oromia, Ethiopia.

3. Meta Robi Livestock and Fishery Development and Resource Office, Oromia, Ethiopia.

Corresponding Author: Prof.Dr.Mahendra Pal, Founder Director of Narayan Consultancy on Veterinary Public Health and Microbiology, Aangan, Jagnath Ganesh Dairy Road, Anand-388001, Gujarat, India Email:palmahendra2@gmail.com

## ABSTRACT

*The existence of Ebola Virus Disease (EVD) has been known to humans for more than four decades; however, many aspects of its history are not well recognized. Ebola virus mostly thrives in the West and sub-Sahara of Africa until today with great outbreaks and high mortality rates. Ebola is established as a major threat to public health and conservation as they cause periodic human and nonhuman primate outbreaks with high death rates. This disease is highly contagious and tends to break out to other individuals that come in direct contact with the affected patients. In hospital, transmission of infection occurs through unsterilized needles and syringes. Clinical spectrum of disease includes high fever, frontal headache, myalgia, nausea, vomiting, diarrhea, malaise, pharyngitis, pleuritic chest pain, and visceral hemorrhages from nose, gums, and vagina. Death occurs due to severe blood loss and shock. Virological, immunological, and molecular techniques are employed to confirm the diagnosis of the disease. Currently, no antiviral drug is available to treat the patient. Preventive strategies include immediate isolation of patient and strict containment nursing practice, wearing of personal protective equipment, through washing of hands with soap and water after percutaneous or mucocutaneous exposure, proper handling of infected materials of the patients, and decontamination of all discharges, secretions etc.*

**KEYWORDS:** Ebola Virus Disease, Public health, West Africa

## INTRODUCTION

In several countries around the world, zoonoses, including emerging and re-emerging zoonoses, are still a leading cause of high morbidity and mortality [1,2]. In the last 25 years, 38 new pathogens have appeared, with 75% of them having their origins in animals [3]. There are many emerging viral zoonoses, such as bird flu, Ebola haemorrhagic fever, Hendra virus disease, monkey pox, Nipha virus disease, Rift Valley fever, severe acute respiratory syndrome, swine flu, and West Nile fever, which are significant from public health and economic point of view [2, 3]. Among these zoonoses, Ebola virus disease (EVD) is highly fatal for humans as well as non-human primates [2]. The first EVD outbreak was recorded in 1976, and before the outbreaks in 2014, there were only 2345 human cases and 1546 deaths [4]. Up until 2014, Outbreaks of Ebola virus disease were mostly spread across the central African area [ 5 ]. A recent report of 21 July 2019, a total of 2592 EVD cases, including 2498 confirmed and 94 probable cases, were reported in DRC [6]. About 217 viruses and prions are identified those pathogenic to humans. Out of these viruses, Ebola virus is one of the causes of Ebola virus disease (EVD), previously known as Ebola hemorrhagic fever a highly fatal of humans and non-human primates [7]. Ebola virus is categorized under the family Filoviridae and Five species to the Ebolavirus genus [8].

The Ebola virus disease, formerly known as Viral Haemorrhagic Fever (VHF), is an acute disease characterized by multisystem involvement and a potential to disrupt the vascular system, resulting in some bleeding manifestations and hemorrhagic fever [9]. The term viral hemorrhagic fever refers to a variety of viral diseases characterized by bleeding and fever in humans [10 ].

Ebola virus mostly thrives in the West and sub-Sahara of Africa until today with large outbreaks and high mortality rates [11]. Despite such severity of Ebola outbreaks, there is no effective vaccine or therapeutic drug is commercially available for clinical use. Public awareness toward EVD in those countries with an outbreak or without an outbreak is not significant as the severity of this disease [4]. The purpose of this review paper is to provide a brief and concise history of EVD with the main focus on the epidemiology, and risk factors for the disease, mode of transmission, and current knowledge regarding the prevention and control of EVD.



## **2. LITERATURE REVIEW**

### **2.1. Historical Background**

Ebola virus disease first emerged in 1976 in two simultaneous outbreaks, one in Nzara, South Sudan, and the other in Yambuku, Democratic Republic of Congo. The latter occurred in a village near the Ebola River, which is where the disease gets its name [12]. Since it triggers high-fatality outbreaks in humans and nonhuman primates daily, Ebola is considered a major threat to public health and wildlife [9]. Researchers have recognized the Marburg virus's importance as a lethal pathogen that causes hemorrhagic fever since it first appeared in humans in 1967, but their roots, natural history, and ecology have remained elusive for decades [13].

Ebola virus disease outbreaks were notorious before 2014 for their unpredictability, with outbreaks occurring after periods of apparent epidemiological quiet and very rarely reoccurring in the same place [14]. The World Health Organization declared the outbreak an international public health emergency on August 8, 2014, and called for increased multinational assistance to stop it [15]. The DRC reported a total of 2592 EVD cases in a recent report dated July 21, 2019, with 2498 confirmed cases and 94 probable cases. A total of 1743 deaths have been recorded, with 1649 deaths among EVD confirmed cases, indicating that an active outbreak is present in Africa [6].

### **2.2. Etiology**

Ebola virus, the cause of Ebola virus disease, is classified as a member of the Filoviridae family [9]. Five Ebola virus species have been described, four of which are contagious for humans and are found in Africa: Zaire Ebola virus (ZEBOV), Sudan Ebola virus (SEBOV), Bundibugyo Ebola virus (BEBOV), and Tai Forest virus (TAFV); and one Reston Ebola virus (REBOV), which is found in the Philippines and is associated with nonhuman primates and pigs [16].

### **2.3. Epidemiology of Ebola virus disease in Africa**

Epidemiology is the study of the distribution and determinants of health-related states or events that include disease and the application of this study to the control of diseases and other health-related problems [17]. Ebola epidemiology specifically in West Africa is described as the study of the spread of the Ebola Virus disease from one region in Africa to another through surveillance and other methods and finding solutions to this situation [18].

Ebola virus outbreaks are most common in tropical regions of Sub-Saharan Africa (9 Pal et al., 2014). Between 1976 and 2013, the World Health Organization (WHO) recorded 1,716 confirmed cases in Sudan, Zaire, Uganda, Gabon, and Congo [19]. In Sub-Saharan Africa, outbreaks are becoming more common, with major ongoing outbreaks in wild (endangered) non-human primate species. Animal carcasses in the forest are considered as an important Ebola sources for human beings [20].

### **2.4. Clinical signs and symptoms**

It takes 2 to 21 days for the disease to develop. The affected patients experience fever, headache, loss of appetite, vomiting, stomach pain, vascular dysfunction, diarrhea, and exhaustion [9,21]. The temperature remains above 38.3°C. Vomiting, stomach pain, shortness of breath and chest pain accompany these symptoms. There is severe and fatal bleeding, hemorrhagic diathesis, shock, and multiple organ failure [19]. The severe blood loss and shock is ascribed as the cause of death [2].

### **2.5. Mode of transmission**

This disease is extremely infectious, and it has a proclivity to spread to those who come into contact with the infected patients. In Sub-Saharan Africa, EBOV is transmitted to humans by contact with dead or living infected animals (non-human primates, antelopes, and bats) [9]. Bats are most likely where the virus "resides" [22]. It can then infect humans who come into close contact with or consume bats. Ebola may infect an intermediate species, such as monkeys or gorillas (non-human primates), that eat contaminated partially eaten fruit that bats drop. Humans may find the dead intermediate animal and then eat its meat [23]. Once Ebola virus has infected humans, it can spread from person to person. It is documented that transmission through inanimate objects (bedding, clothing) contaminated with infected bodily fluids is also possible [16].

### **2.6. Diagnosis**

Laboratory help is imperative to confirm an unequivocal diagnosis of Ebola virus disease. The disease can be diagnosed using transmission electron microscopy (TEM), virus culture, immunohistochemistry, reverse transcription PCR (RT-PCR), and antigen and antibody detection ELISA [9, 24]. It is pertinent to mention that isolation of virus from clinical specimens require biosecurity level- 4 facilities in the laboratory [2].

## 2.7. Treatment, prevention and control

In Africa, Ebola virus infections are often linked to exposure to wild animal tissues during butchering. Because the full host range may not be known, all sick and dead wild animals should be avoided (including for use as food) [17]. International health regulations require that nations report acute hemorrhagic fever syndromes immediately to World Health Organizations (WHO) without waiting for the causative agent to be identified to prevent transmission and aid in case management and diagnosis [25].

Ebola disease could be controlled by isolation of infected patients and through quarantine, social distancing, travel restrictions on those suspected of living in Ebola risk communities and having the tendency of spreading the Virus, practicing safe burial of those dead through the Ebola disease, practicing strict infection control methods in hospitals and good use of personal protective equipment [17]. Avoid interaction with bats and nonhuman primates, as well as their blood, fluids, and raw meat. Ebola viruses were discovered in milk 15 days after the illness began and in sperm for much longer. As a result, sexual abstinence for at least three months after healing is advised [26].

## 2.8. Economic Impacts of Ebola Virus Disease

Ebola virus disease has huge impacts of economic loss on those countries outbreak presents due to strict restrictions of peoples traveling in to and out of the country with the disease outbreak that has a major affection on market flow and income from foreign tourists will be lost [27]. The other impact is millions of dollars annually budgeted by WHO, countries, and other organizations to control the disease that can rely on the other development of social service [28].

## 3. Conclusions and Recommendations

This review aimed at exploring the status of Ebola virus disease in Africa that the disease originated. This viral disease is highly contagious and fatal to humans and primates, and uses bats, plants, and arthropods as a reservoir. Ebola virus disease has huge economic impacts in countries of outbreaks present and as Africa continent. Still, active outbreaks are sporadically present in west and sub-Saharan Africa countries that pay significant attention. Based on the above conclusions, the following points should be performed by the responsible individuals, stakeholders, health professionals, communities, government, and international organizations like WHO.

As elaborated in this review, EVD is significant and internationally notifiable by the WHO, in Africa but the distribution of information and awareness creation for the societies and Stakeholders in Africa should equivalent with the disease significance.

- Modified effective drugs and vaccine productions should be encouraged by the WHO.
- More researches and investigations should be conducted toward this highly fatal disease.
- Ebola virus can be used in biological weapons, thus the UN should have to create international rules and policies regarding the disease.
- Further research on the reservoir and molecular epidemiology of disease will be rewarding.

## Acknowledgements

The authors are very thankful to Prof. Dr. R.K. Narayan for his suggestions during the preparation of manuscript and Anubha Priyabandhu for computer help.

## Contribution of authors

All the authors contributed equally. They read the final version, and approved it for the publication.

## Conflict of interest

The authors declare that they do not have conflict of interest.

## Source of financial grant

There was no financial support for this manuscript.

## REFERENCES

1. Pal, M. Importance of zoonoses in public health. *Indian Journal of Animal Sciences*, 75(5):586-591.2005
2. Pal, M. Zoonoses .2nd Ed. Satyam Publishers, Jaipur, India.2007.
3. Pal, M . Public health concerns due to emerging and re-emerging zoonoses. *International Journal of Livestock Research*, 3(1):56-62.2013.
4. Malvy, D., McElroy, A.K., de Clerck, H., Günther, S. and van Griensven, J. Ebola virus disease. *The Lancet*, 393(10174):936-948.2019.
5. Nsio, J., Kapetshi, J., Makiala. S., Raymond. F., Tshapenda, G., Boucher, N., Corbeil, J., Okitandjate, A., Mbuyi ,G., Kiyele, M.,Mondonge, V. Outbreak of Ebola virus disease in northern Democratic Republic of Congo. *The Journal of Infectious Diseases*, 221(5):701-706.2020.2017
6. WHO (World Health Organization). Ebola Virus Disease: Democratic Republic of the Congo External Situation Report 51.2019.

7. Rasheed, A., Ullah, S., Naeem, S., Zubair, M., Ahmad, W., Hussain, Z. Occurrence of HCV genotypes in different age groups of patients from Lahore, Pakistan. *Advancements in Life Sciences*, 1 (2):89–95.2014.
8. Kidd, L. Ebola Virus. *Clinical Small Animal Internal Medicine*, 30:901-902.2020.
9. Pal, M., Dave, P., Mahendra, R. Ebola hemorrhagic fever: An emerging highly contagious and fatal viral zoonosis. *International Journal of Multidisciplinary Research*, 2: 1-2.2014.
10. Lannetta, M., Di Caro, A., Nicastrì, E., Vairo, F., Masanja, H., Kobinger, G., Mirazimi, A., Ntoumi, F., Zumla, A., Ippolito, G. Viral hemorrhagic fevers other than Ebola and Lassa. *Infectious Disease Clinics*, 33(4):977-1002.2019.
11. Perdomo-Celis, F., Salvato, M.S., Medina-Moreno, S., Zapata, J.C. T-cell response to viral hemorrhagic fevers. *Vaccines*, 7(1):11.2019.
12. WHO. (World Health Organization). Facts Sheet on Ebola. Available at <http://www.who.int/news-room/fact-sheets/detail/ebola-virus-disease.2018>
13. Bray, M. Pathogenesis of viral haemorrhagic fever. *Current opinion in immunology*, 17(4): 399-403.2005.
14. Pourrut, X., Kumulungui, B., Wittmann, T., Moussavou, G., Délicat, A., Yaba, P., Nkoghe, D., Gonzalez, J.P., Leroy, E.M. (2005). The natural history of Ebola virus in Africa. *Microbes and infection*, 7(7-8):1005-1014.2005.
15. WHO (World Health Organization). Statement on the meeting of the International Health Regulations Emergency Committee regarding the 2014 Ebola outbreak in West Africa. <http://www.who.int/mediacentre/news/statements/2014/ebola-20140808/en/>. 2014.
16. Jacob, S.T., Crozier, I., Fischer, W.A., Hewlett, A., Kraft, C.S., de La Vega, M.A., Soka, M.J., Wahl, V., Griffiths, A., Bollinger, L., Kuhn, J.H. Ebola virus disease. *Nature Reviews Disease Primers*, .6(1):1-31.2020.
17. Nicastrì, E., Kobinger, G., Vairo, F., Montaldo, C., Mboera, L.E., Ansunama, R., Zumla, A., Ippolito, G. Ebola virus disease: epidemiology, clinical features, management, and prevention. *Infectious Disease Clinics*, 33(4):953-976.2019.
18. WHO (World Health Organization)(2016). Ebola situation report, Available: <http://apps.who.int/ebola/ebola-situation-reports.2016>.
19. Ehsan Mostafavi. The Epidemiology of Ebola virus disease: <https://www.researchgate.net/publication/301892762>. 2016.
20. Polonsky, J.A., Wamala, J.F., de Clerck, H., Van Herp, M., Sprecher, A., Porten, K., Shoemaker, T. (2014). Emerging filoviral disease in Uganda, proposed explanations and research directions. *The American Journal of Tropical Medicine and Hygiene*, 90(5): 790- 793.2014
21. Jain, V., Charlett A.,Brown, C.S. Meta-analysis of predictive symptoms for Ebola virus disease. *Plos Neglected Tropical Diseases*, 14(10):e0008799.2020.
22. Den Boon, S., Marston, B.J., Nyenswah, T.G., Jambai, A., Barry, M., Keita, S., Durski, K., Senesie, S.S., Perkins, D., Shah, A.,Green, H.H. Ebola virus infection associated with transmission from survivors. *Emerging Infectious Diseases*, 25(2):240.2019.
23. Aruna, A., Mbala, P., Minikulu, L., Mukadi, D., Bulemfu, D., Edidi, F., Bulabula, J., Tshapenda, G., Nsio, J., Kitenge, R., Mbuyi, G. Ebola Virus Disease Outbreak—Democratic Republic of the Congo, August 2018–November 2019. *Morbidity and Mortality Weekly Report*, 68(50):1162.2019.
24. Yadav, A.R.,Mohite S.K. An overview on Ebola virus disease. *Research Journal of Pharmaceutical Dosage Forms and Technology*, 12(4):267-270.2020.
25. CFSPPH(Centre for Food Security and Public Health). *Ebolavirus and Marburgvirus Infections*. Iowa State University, Iowa ,USA. 3: 1-11.2014.
26. Lee, H.,Nishiura, H. Sexual transmission and the probability of an end of the Ebola virus disease epidemic. *Journal of Theoretical Biology*, 471:1-2.2019.
27. Redding, D.W., Atkinson, P.M., Cunningham, A.A, Iacono, G.L, Moses, L.M., Wood, J.L., Jones, K.E. (2019). Impacts of environmental and socio-economic factors on emergence and epidemic potential of Ebola in Africa. *Nature Communications*, 10(1):1-11.2019.
28. Maphanga, PM., Henama, U.S. The tourism impact of Ebola in Africa: Lessons on crisis management. *African Journal of Hospitality, Tourism and Leisure*, 8(3):1-3.2019.

**Citation: Mahendra Pal, Mati Roba Bulcha and Iyasu Ejeta, “Epidemiology of Ebola virus disease and its public health importance in Africa”. *American Research Journal of Public Health*, Volume 4, Issue No. 1, 2021, pp. 1–4.**

**Copyright © 2021 Mahendra Pal, Mati Roba Bulcha and Iyasu Ejeta, This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.**