Jagua Publication

Journal of Applied Health Sciences and Medicine 3(1): 1 – 9.

Research Article

Ebola Virus Disease (Evd): Nigeria Perspective

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www.jpub.org

Received: December 10, 2022
Accepted: December 30, 2022
Published: January 8, 2023

How to cite:
Nwalozie R., B. A. Nnokam, and R. A. Ikpeama. 2023. " Ebola Virus Disease (Evd): Nigeria Perspective." *Journal of Applied Health Sciences and Medicine* 3(1): 1 – 9. **https://doi.org/**10.58614/**jahsm**311

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Abstract

The deadly but uncommon Ebola virus disease affects both humans and primates (EVD). The Ebola virus causes a severe form of hemorrhagic fever in which the victim's blood clots abnormally, leading to internal bleeding. After initial contact with the virus, "dry" symptoms such as fever, aches and pains, and exhaustion typically appear, followed by "wet" symptoms such as diarrhoea and vomiting anywhere from two to twenty-one days (on average, eight to ten) laterVirologists believe Laupland and Valiquette are hosting the virus. It is believed that the only way for the Ebola virus to spread is through direct contact between people and blood or other body fluids from a person showing symptoms of the disease. Saliva, mucus, vomit, faeces, tears, perspiration, breast milk, urine, and sperm all contain the Ebola virus. The term "spillover" is used to describe the zoonotic spread of the Ebola virus from infected hosts like the fruit bat or nonhuman primates to other animals. The Ebola virus is a member of the viral family known as Filoviridae in the order of Mononegavirales the Marburg virus is also. Ebola virus infection can be diagnosed through a variety of techniques, including electron microscopy, antigen-capture detection tests, serum neutralisation tests, reverse transcriptase polymerase chain reaction (RT-PCR) assays, antibody-capture enzyme-linked immunosorbent assays (ELISAs), and virus isolation through cell culture. The term "Ebola vaccine" refers to both already available and planned vaccines against the virus. Only Zaire ebolavirus and rVSV-ZEBOV vaccines are effective against this disease. Treatment that is purely supportive, such as relieving patients of their symptoms and giving them water orally or intravenously, does not improve prognosis. This research intends to give Nigerians an up-to-date picture of the spread of EVD in the country in the wake of the recent pandemic in neighbouring Uganda.

Keywords: ebola, disease, primates, haemorrhagic, Laupland, and valiquette, filoviridae.

1 Introduction

The exceedingly rare yet lethal Ebola virus disease (EVD) is transmissible to both humans and primates (WHO 2021; CDC 2022; Nyenke, Konne, and Ikpeama 2022). According to the World Health Organization (WHO), the Ebola virus that causes Ebola virus disease (EVD) stops the blood from clotting, resulting in internal bleeding in the patient. Due to this, the disease was formerly referred to as hemorrhagic fever (WHO 2021)[1]. According to study conducted by Johns Hopkins Medicine (Medicine 2022) internal bleeding in individuals with Ebola virus disease (EVD) is caused by blood spilling from infected microblood vessels. WHO reports that the first two epidemics of Ebola Virus Disease (EVD) occurred simultaneously in 1976 in two distinct locations: Yambuku, in the Democratic Republic of the Congo (DRC), and what is now Nzara, in South Sudan. According to some other stories, the most recent case of the sickness happened in a village that was relatively close to the river that gave the disease its name (WHO 2021). Between 2014 and 2016, West Africa saw the most severe Ebola outbreak since the virus was discovered there in 1976. The virus spread from Guinea

to Sierra Leone and Liberia by crossing each country's land border (WHO 2021). According to the research of Dixon and Schafer (Dixon and Schafer 2014) there were a total of 24 Ebola outbreaks between 1976 and 2012, resulting in 2,387 cases and 1,552 fatalities. This is in contrast to the largest outbreak to date, which occurred between December 2013 and January 2016 in West Africa (CDC 2014, 2019). During this time period, 28, 646 instances were reported, and 11,323 individuals died as a result of the disease. According to Nicholas Ibekwe of the Premium Times ng, Patrick Sawyer, a Liberian-American citizen, was the prime suspect in Nigeria's first incidence of Ebola virus disease (EVD). (Ibekwe 2014a) On July 20, 2014, he flew from Liberia to Lagos, which is the country's most populous metropolis. In addition, it was hypothesised that Sawyer passed away only five days after exhibiting symptoms of illness at the airport (Ibekwe 2014b). As a direct result, the government of Nigeria enhanced controls at all entry points and probed Sawyer's contacts for evidence of sickness. According to the research conducted by Ambe and Kombe (Ambe and Kombe 2019), he was admitted to a hospital in Monrovia on July 17 with a fever and Ebola symptoms before deciding to fly to Lagos against the advice of expert physicians and telling the staff at First Consultants Medical Center that he had not been exposed to anyone with the disease. He asserted that he had no interaction with anyone who had the condition. Sawyer likely knew he had Ebola since he cared for his sister, who died on July 8th. On July 8, Sawyer's sister died of the infection (2014). According to the findings of the inquiry undertaken by (Monica 2014), a Nigerian nurse who had treated Patrick Sawyer died of EVD in August 2014. As of September 2014, the World Health Organization (WHO) recorded 20 cases of EVD, 8 of which were fatal, and 529 contacts who were isolated for 21 days (WHO 2014). The European Centre for Disease Prevention and Control (ECDC) issued a statement on October 9, 2014, recognising Nigeria's contribution to efforts to contain the Ebola outbreak (Fasina *et al.* 2019). On October 20, the WHO ambassador in Nigeria announced Nigeria to be free of Ebola, calling it a "huge success story" (Sola 2014). On that day, no additional active cases were discovered among the follow-up contacts. According to (Reliefweb.net 2022b), as of October 4th, 2022, the Nigeria Center for Disease Control is aware of the current Ebola virus disease (EVD) outbreak in Uganda caused by the Sudan strain of the Ebola virus (EV). This was reported on September 20th, 2022. (NCDC). Even the World Health Organization has acknowledged this outbreak's existence (WHO). South Sudan, Uganda, and the Democratic Republic of the Congo have all seen EVD epidemics, and it is widely believed that the Sudanese strain of the virus is to blame (Reliefweb.net 2022b). In light of the latest EVD outbreak in Uganda, this research aims to update Nigerians on the state of the EVD epidemic.

2 Symptoms

The Centers for Disease Control and Prevention (Reliefweb.net 2022a) and the World Health Organization (WHO 2021) report that the usual onset of symptoms is between eight and ten days following viral infection. In many cases, "dry" symptoms such as fever, aches and pains, and weariness precede "wet" symptoms like diarrhoea and vomiting as the sickness advances. In addition, the World Health Organization states that an EVD patient cannot spread the disease until symptoms appear (WHO 2021). Other symptoms, such as a rash, poor renal function, blood in the stool, and bleeding gums, have also been recorded (WHO 2021).

3 Reservoir

Despite Laupland and Valiquette's (Laupland and Valiquette 2014) claim that the virus may be carried by three different species of fruit bats (Hypsignathus monstrosus, Epomops franqueti, and Myonycteris torquata) without them becoming ill, a study by Chowell and Nishiura (Chowell and Nishiura 2014) revealed that the actual host for However, the Ebola virus has yet to be discovered. Whether or not other animals are contributing to its spread is a mystery as of 2013 (Weingartl,

Nfon, and Kobinger 2013). Possible viral reservoirs include not only birds, plants, arthropods, rodents, and animals, but also other organisms (Sharma and Cappell 2015). The transmission of the Marburg virus was linked to bats between 1975 and 1980, according to research published by (Pourrut *et al.* 2005). Bat roosts may be located in the same cotton plant that housed the earliest cases of the 1976 and 1979 pandemics. Despite the experimental vaccination of 24 plant species and 19 vertebrate species against EBOV, only bats were found to be infected. The lack of clinical symptoms in bats has led to the hypothesis that they serve as a reservoir for EBOV. Six hundred and seventy bats were tested out of a total of 1,030 animals between 2002 and 2003, and results showed that they had immunoglobulin G (IgG) immune defence components, which are consistent with Ebola infection. Bats tested at various stages of the experiment showed IgG molecules and RNA sequences indicative of an Ebola infection in 2.2% to 22.6% of the sampled animals (Leroy *et al.* 2005). The EBOV was not detected in any of the 30,000 mammals, birds, reptiles, amphibians, and arthropods sampled from regions where outbreaks have occurred, with the exception of some genetic traces found in six rodents (belonging to the species Mus setulosus and Praomys) and one shrew (Sylvisorex ollula) collected from the Central African Republic between 1976 and 1998. But further studies have not backed up the idea of using rodents as a reservoir (Groseth, Feldmann, and Strong 2007). Human illnesses were linked to the EBOV markers found in the bodies of chimpanzees and gorillas during outbreaks in 2001 and 2003. With such a high mortality rate from EBOV infection, it's hard to believe that these animals serve as a natural reservoir for the virus (Pourrut *et al.* 2005). Some researchers have linked deforestation to recent pandemics like the Ebola virus outbreak in West Africa. In several instances (Olivero *et al.* 2017), EVD index cases have been discovered in or near areas where trees have been cut down.

4 Transmission

Funk and Kumar (Funk and Kumar 2015) found that close contact with blood or other bodily fluids from an infected person is necessary for the transmission of Ebola. The Ebola virus can live in a variety of bodily fluids, including saliva, mucus, vomit, faeces, tears, perspiration, breast milk, urine, and sperm. Droplets or secretions from an infected host, such a fruit bat or a nonhuman monkey, can transmit the Ebola virus to other animals and humans via the zoonotonic spillover route (CDC 2014). Contrarily, human-to-human transmission happens when an infected or deceased person's blood or body fluids (including urine, perspiration, faeces, vomit, breast milk, amniotic fluid, and semen) come into contact with items including clothing, bedding, needles, and medical equipment (CDC 2014). It is also unknown whether or not the Ebola virus may spread through eating contaminated food. However, the Ebola virus can be transferred to many parts of the world through the handling and consumption of meat from wild animals that have been either hunted or are infected with the virus. It has not been shown that any other insects, including mosquitoes, can transmit the Ebola virus (CDC 2014). According to the World Health Organization (WHO), women who develop acute Ebola during pregnancy and subsequently recover may remain be infected with the virus in breastmilk or other pregnancy-related tissues and bodily fluids. Women who become infected during pregnancy put their unborn child at risk. There is no danger of transmitting Ebola to an unborn child from a survivor. Women who have contracted Ebola and are breastfeeding should be encouraged to continue their breastfeeding. In order to get started, she needs to get her breast milk tested for Ebola. The greatest risk of catching Ebola comes from intimate contacts of people with the disease, such as relatives and friends, and from healthcare workers who fail to use proper infection control procedures. Ebola can be spread through contact with infected blood or other bodily fluids (CDC 2014). Theoretically, airborne transmission between humans is possible due to the presence of Ebola virus particles in saliva, which are released into the air during coughing and sneezing (Jones and Brosseau 2015). However, observational data from previous epidemics suggests that the probability of airborne transmission is minimal. These studies often concluded

that transmission from pigs to monkeys may occur without direct contact (Vincent 2014), because pigs with EVD had considerably greater ebolavirus concentrations in their lungs than in their blood. Because of this, diseases can be transferred from one pig to another through the air or the ground when infected pigs sneeze or cough (Weingartl *et al.* 2012). The virus is more common in the blood of humans and other primates than it is in their lungs. This is thought to be the reason due to the observation of non-contact transfer from pigs to monkeys. However, no evidence of primate infection without physical touch has been detected, even in studies where infected and uninfected monkeys shared the same air.

5 Ebola Virus Genome and Structure

Together with the Marburg virus, Ebola is a member of the Filoviridae family of viruses in the Mononegavirales order (Tanmay *et al.* 2011; Feldmann, Sprecher, and Geisbert 2020). (Sanchez, Geisbert, and Feldmann 2007) found that filoviral viruses are notorious for being extremely contagious and lethal. Because there are no approved vaccines or antiviral drugs for treating EBOV or MARV, these diseases are classified as biosafety level 4 (BSL-4) pathogens. Respiratory syncytial virus (RSV), measles virus, mumps virus, and rabies virus (RABV) are all members of the order Mononegavirales (Lamb 2007). The group's non-segmented, antisense RNA genome is encapsulated within the viral nucleoprotein (NP). Genome replication is guided by a helical nucleocapsid (NC) that is assembled by the NP-RNA complex and other proteins (Feldmann, Sprecher, and Geisbert 2020; Sanchez, Geisbert, and Feldmann 2007; Lamb 2007; Ruigrok, Crépin, and Kolakofsky 2011). This property is related to the NC structure of mononucleos(MN)egas(V)ectors and the way in which their genomes are copied. Upon reaching the plasma membrane, the NC is attracted to the viral matrix protein and buds through to create an encased virion. These core features are shared by all viruses that cause mononucleosis. A single EBOV particle contains an RNA genome and seven viral proteins (called NP, VP35, VP40, GP (glycoprotein), VP30, and VP24) (L). Interaction studies have indicated that the transcriptionally and replicatively competent NC interacts with NP, VP30, VP35, and L (Leung *et al.* 2010). Additionally, NC assembly necessitates VP24, as reported by (Mateo *et al.* 2011). Virus envelope and the matrix protein VP40 interact continuously. To make the encapsulated, filamentous VLPs, mammalian cells need simply express VP40 (Timmins *et al.* 2003). Small tubular structures develop in the cytoplasm of the cell if NP is expressed in isolation (Noda *et al.* 2006). When coexpressed with VP40, these constrained structures find binding sites on VLPs. Cytoplasmic "NCs" are present in infected cells, and these can multiply by simultaneously generating NP with VP24 and VP35. When VP40 is present, these components are also incorporated into VLPs (Noda *et al.* 2006). Co-expression of NP, VP24, and VP35 is necessary for the production of an NC with a diameter similar to that of native virions, and these findings show that NP can be recruited into secreted VLPs via direct contact with VP40.

5.1 Structure

Sagar found that the typical Ebola virus measures 970 nm in length and 80 nm in width in his study (Sagar 2022). The viral envelope, matrix, and nucleocapsid are all stored within these cylinders or tubes. The shape of the virus can vary; it can be a "U," a "6" (the "shepherd's crook"), or even a circle, but more often than not it is a long, filamentous structure. Their surface lipid bilayer is studded with spike-like glycoprotein (GP) projections measuring 7–10 nm in length. Glycoproteins are proteins in which carbohydrates (glycans) have been covalently linked toward the side chains of the polypeptide. The glycoprotein GP is the only permanent resident of the Ebolavirus surface, and its primary function is to bind to and enter new host cells. The GP spikes are inserted into certain regions of the host cell membrane, which gives rise to the viral envelope (Sagar 2022).

5.2 Ebola Virus Mechanism of Action and Target Organs

EBOV enters the human body through the mucosal surfaces of the skin, skin abrasions and sores, or directly from parents (Feldmann and Geisbert 2011). The EBOV then targets numerous other organs. It has been shown that EBOV may infect nearly all human cells, with the exception of lymphocytes, by taking advantage of particular attachment mechanisms for each kind of cell. By using a variety of uptake mechanisms, such as lipid rafts, receptor-mediated endocytosis, and macropinocytosis, EBOV may be able to enter target cells (Nanbo *et al.* 2010). Recent studies have demonstrated that the class I absorption of EBOV depends on the phosphatidylinositol-3 kinase-Akt pathway and the dynamical activity of cytoskeletal proteins (Saeed *et al.* 2008). Despite having a consistent 80 nm diameter, EBOV particles can range in length from 600 to 1400 nm, with 805 nm particles having the highest infectivity (Beniac *et al.* 2012) (Siljamäki *et al.* 2013) found that the 1-integrins16 are another class of proteins involved in Filovirus entrance and are linked to the uptake of many different viruses. Interestingly, the 51-integrin has been demonstrated through in-depth investigation to regulate endosomal cathepsin, a protein required for EBOV fusion, rather than being involved in EBOV internalisation (Hunt and Lennemann 2012). Multiple mechanisms (Falasca *et al.* 2015), regulate the extensive range of pathogenetic activities that culminate in the severe clinical manifestation of Ebola. This category includes not only the virus's direct cytopathogenic effects, which kill infected cells, but also its indirect effects, which act as an amplifying mechanism and damage or impair a wide range of essential body functions, including those performed by the innate and adaptive immune systems and the endothelium. Human samples analysed after death or in infected animal models reveal that the virus is able to productively infect monocytes/macrophages, DCs, fibroblasts, hepatocytes, adrenal cells, and epithelial cells. The earliest replication sites for EBOV infection have been shown to be DC and monocytes/macrophages (Geisbert, Young, *et al.* 2003). The ability of these cells to travel from the spleen and lymph nodes to other tissues is critical in the transmission of the virus (Geisbert, Hensley, *et al.* 2003). Multiple immunological mechanisms, regulated by both the innate and adaptive immune responses, are linked to EBOV infection. Downregulation of type I interferon (IFN) responses, disruption of cytokine and chemokine networks, and impairment of DC and NK cell function are all components of innate immune dysregulation. Similarly to the humoral and cell-mediated immune systems, the adaptive immune system is also influenced by dysregulation.

5.3 Diagnosis

Clinical differentiation of EVD from other infectious diseases like malaria, typhoid fever, and meningitis has been shown to be difficult (WHO 2021; CDC 2022). There is a lot of overlap between the symptoms of pregnancy and those of the Ebola virus. Because of the risks to the developing baby, pregnant women should be checked as soon as possible if Ebola is suspected. Ebola virus infection can be diagnosed using a battery of tests, including electron microscopy, antigen-capture detection tests, serum neutralisation tests, reverse transcriptase polymerase chain reaction (RT-PCR) assays, antibody-capture enzyme-linked immunosorbent assays (ELISAs), and virus isolation from cell culture (WHO 2021; CDC 2022). Consider the technology needs, the incidence and prevalence of diseases, and the social and medical ramifications of test results when making a diagnostic test selection. Independent, in-depth examinations of diagnostic methods are highly recommended (WHO 2021).

5.4 Types of EBOV Vaccines

In this piece, we'll be looking at the Ebola vaccinations that have been authorised as well as those that are still in the works. By 2022, there will be no vaccines against any ebola virus except for the Zaire type. In the United States, the Food and Drug Administration (FDA) has only approved the

rVSV-ZEBOV vaccine as of the end of 2019 (McKee 2019). A compassionate use approach was widely used during the Ebola epidemic in the Kivu region (Beth 2019). Research by Fausther-Bovendo et al. (Mulangu and Sullivan 2012) found that potential immunisations for preventing deadly infections in nonhuman primates showed promise in the early 21st century. (mostly macaques). The human parainfluenza virus 3 (HPIV-3), vaccinia virus (VSV), and adenovirus are all examples of vectors used in vaccines. Therefore, in conventional vaccine efficacy trials, it is unethical to reintroduce the virus to humans after vaccination. As a result, the Food and Drug Administration implemented the so-called "animal efficacy rule" to control how effectively pharmaceuticals perform in animals. An approved vaccination must demonstrate both safety and the ability to stimulate an effective immune response in people before it can be distributed commercially under this rule (measured by the presence of antibodies in their blood). Vaccines are tested in human clinical trials by being given to healthy volunteers who will then be studied for their immune responses, side effects, and best dose regimen (Pavot 2016).

5.5 Treatments

The World Health Organization (WHO) claims that providing a patient with supportive care, such as symptom alleviation and the delivery of oral or intravenous fluids, increases the patient's chance of survival (WHO 2021). Diagnosis and treatment decisions are made based on the results of this analysis. During the 2018-2020 Ebola outbreak in the Democratic Republic of the Congo, the first multi-drug randomised control trial was carried out within an ethical framework designed with the help of subject-matter experts and the DRC. Assuring the efficacy and safety of the medications used to treat Ebola patients prompted this action. In late 2020, the FDA approved the use of two monoclonal antibodies, Inmazeb and Ebanga, to treat Zaire ebolavirus (Ebolavirus) infections in both adults and children (WHO 2021; CDC 2022).

5.6 Prevention

Case management, surveillance, contact tracing, a solid laboratory service, proper burial practises, and social mobilisation are just a few of the many tools at your disposal for controlling an outbreak. The community's input is crucial for managing an outbreak (WHO 2021). Knowing the symptoms of Ebola and how to prevent them can help reduce the spread of the disease among humans (such immunisation). Keep your distance from potentially infectious bodily fluids such as vomit, blood, urine, faeces, saliva, perspiration, amniotic fluid, sperm, and vaginal secretions of people who have the disease. If a man has recovered from EVD but the virus is still present in his sperm, it should not be usedStay away from anything a sick person may have handled, and wash your hands frequently (such as clothes, bedding, needles, and medical equipment). If you need to make funeral or burial arrangements, you should stay away from the body of a person with EVD or who is suspected of having EVD. Don't touch your face or eyes, and stay away from bush meat, which can be anything from a bat to an antelope in the jungle to a monkey or chimpanzee (CDC 2022).

6 Conclusion

The people must be educated on how to identify Ebola symptoms and preventive measures must be disseminated via all available media as the war against EBOV heats up. In the event that the disease does return to the country, medical personnel and isolation wards must be vigilant.

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