GSC Biological and Pharmaceutical Sciences, 2019, 09(02), 050–056

Available online at GSC Online Press Directory

GSC Biological and Pharmaceutical Sciences

e-ISSN: 2581-3250, CODEN (USA): GBPSC2

Journal homepage: https://www.gsconlinepress.com/journals/gscbps

(REVIEW ARTICLE)

The Ebola virus saga in Nigeria; the view point of a microbiologist

Adogo, Lillian Yami [1,*], Chuku Aleruchi [2] and Ajide Bukola [1]

[1] *Department of Biological Sciences, Faculty of Science and Technology, Bingham University, Karu, Nasarawa State, Nigeria.*
[2] *Department of Microbiology, Faculty of Science, Federal University, Lafia, Nasarawa State, Nigeria.*

Publication history: Received on 29 September 2019; revised on 28 October 2019; accepted on 01 November 2019

Article DOI: https://doi.org/10.30574/gscbps.2019.9.2.0188

Abstract

The largest Ebola Virus Disease outbreak in history exploded across West Africa. The World Health Organization reported a total of 21,296 Ebola virus disease (EVD) cases, including 13,427 laboratory confirmed EVD cases reported from the three most affected countries Guinea, Liberia, and Sierra Leone in 2014. Nigeria's first case of EVD was officially announced in July, 2014. In an effort to tackle the Ebola outbreak in Nigeria, the Federal Government, drawing on the experience of the Emergency Operation Centre's work with polio, declared Ebola a public health emergency and mobilized human, financial and material resources to contain the epidemic. Nigeria was officially declared Ebola free on 20th October 2014. However, the current Ebola outbreak in the Democratic Republic of Congo (DRC) has spread internationally from the DRC into neighbouring Uganda and it ranks as the second deadliest outbreak in history. This ongoing epidemic hereby calls for intensified disease monitoring at the Nigerian border posts, health centers and communities, and a prompt review of preparedness activities in the country to prevent another outbreak.

Keywords: Ebola virus disease; Haemorrhagic fever; Transmission; Nigeria

1. Introduction

Ebola virus disease (EVD) is one of the emerging viral diseases listed in the World Health Organization's International Health Regulation [1]. It is an epidemic and pandemic prone disease [2]. The virus often consumes the population. Ebola virus causes severe disease in humans and in non- human primates in the form of viral hemorrhagic fever. This viral hemorrhagic fever is one of the most virulent viral diseases known to humankind [3]. Close contact with blood, secretions, organs or other bodily fluids of infected animals allows the introduction of EVD into the human population. After an incubation period of about a week, victims rapidly develop high fever, diarrhoea, vomiting, respiratory disorders and haemorrhage. Death ensues within a few days [4].

Treatment of EVD can be considered in the context of treatment and prophylaxis windows of opportunity. In the absence of pre exposure prophylaxis through use of nonpharmacologic means (e.g., barrier precautions) or vaccines, the availability of antiviral agents would offer opportunities for post exposure prophylaxis as well as post exposure treatment to reduce disease severity, virus transmission and duration of clinical manifestations.

Despite the low incidence of infection, the lethality of Ebola virus makes it a severe biological threat [5]. In the past, outbreaks of EVD were mainly restricted to Africa [6]. The 2014–2015 Ebola outbreaks was the largest in history, as the outbreak went beyond the traditional East African countries and spread to West African countries of Guinea, Liberia, Sierra Leone and Nigeria. It was also reported in European countries of Spain, England, Italy and the United States of

* Corresponding author
E-mail address: adogolillian@gmail.com

America [7].The Ebola epidemic in West Africa destroyed lives with a total number of 28,603 cases and 11,325 deaths reported at the end of February 2016 [8].

On 1st August 2018, the 2018–2019 Kivu Ebola outbreak began. This outbreak started just days after the end of the outbreak in Équateur province. The World Health Organization confirmed that four cases had tested positive for Ebola virus disease in the eastern region of Kivu in the Democratic Republic of the Congo [9]. From August 2018 to 11th June 2019, a total of 2,084 EVD cases, including 1,990 confirmed and 94 probable cases were reported in the Democratic Republic of the Congo [10].

As of 27 August 2019, a total of 2,997 EVD cases were reported, as well as 2,892 confirmed and 105 probable cases, of which 1,998 cases died. Of the total confirmed and probable cases, 58% were females and 28% were children aged less than 18 years. To date, 156 health workers have been infected.

The outbreak became the biggest in the DRC's history [11], and has become the second largest outbreak in recorded history after the unprecedented 2014-2016 West Africa epidemic, which affected 28,000 people. It's also the first known Ebola outbreak to happen in an active war zone. In June 2019, the Ugandan Ministry of Health confirmed a case of Ebola Virus Disease in Kasese district, Uganda and two deaths has so far been reported [12].

Although Nigeria was officially declared Ebola free on 20th October 2014, the transmission of the virus in the African region is of growing concern hence, this review focuses on the misconception and the view point of the microbiologist of Ebola Virus Disease in Nigeria, how Nigeria contained the disease and highlights the preventive measures to curtail another outbreak.

2. Ebola virus saga in Nigeria

According to World Health Organization, the Ebola virus disease came into Lagos Nigeria on the 20th of July, 2014 through an infected Liberian diplomat, Patrick Sawyer. Patrick Sawyer who was the first index case of an acutely ill traveller had travelled from Liberia via Accra, Ghana, to Lomé, Togo and arrived at the Lagos International Airport on the 20th of July, 2014 [13, 14]. Patrick Sawyer was on his way to Calabar, Cross River State, for a conference of the Economic Community of West African States (ECOWAS). In the departure hall of the Liberian International Airport, Patrick Sawyer was visibly ill, lying on the floor of the departure lounge while awaiting the flight. He vomited during the flight, on arrival at the Murtala Muhammed International Airport, Lagos and again in the private car that drove him to a private hospital [15].The Liberian was a 40 year old Diplomat of the Economic Community of West African States (ECOWAS), his status allowed air travel protocols to be broken and was taken and directly attended to in a private clinic in Obalende, Lagos [16].

He infected two ECOWAS associates and nine of the medical staff nursing him became infected, of whom four died later which led to a cascade of secondary transmission. One of the ECOWAS associates died in Lagos on 12th August 2014, while the other travelled to Port Harcourt for medical attention. Four persons were reported to have contacted EVD in Port Harcourt including the doctor that attended to the ECOWAS associate, his wife, sister and an elderly woman. The Port Harcourt doctor and the elderly woman later died, while the others recovered and survived the infection. On the other hand, one of the nurses that contacted EVD in the hospital that attended to the index case in Lagos travelled to Enugu and caused 25 persons to be placed on surveillance at Enugu. None of them developed EVD and good enough, the nurse also recovered [13].

The outbreak was curtailed in Nigeria by the initial action of the Medical Consultant (Dr. Stella Adadevoh) that attended to the index case at the private hospital where he was hospitalized. He was initially treated for malaria and typhoid fever until he started vomiting accompanied with diarrhea after which microscopic haematuria was observed. The culmination of the clinical presentations and his epidemiological link to Liberia raised the suspicion for haemorrhagic fever. She suspected EVD when the patient did not respond to these earlier treatments prescribed and went on to further put herself in arms way by refusing the patient self-discharge and pressures to discharge. His specimens were subjected to viral investigations. Both blood and urine samples obtained from the patient tested positive for the Ebola Zaire MGB Virus, therefore, EVD was confirmed in Nigeria [17].

Summarily, 894 contacts were identified and followed up by the response team with a case fatality rate of 40%. Twenty cases of EVD was recorded with eight deaths, which included medical professionals whose heroics will never be forgotten by the country [17, 18].

On 20th of October 2014, WHO officially certified Nigeria free from Ebola virus. Thankfully about nine people who were infected survived from the disease however; they had to deal with the stigma associated with their recovery. In November 2015, the only female doctor to survive Nigeria's Ebola outbreak, Dr Ada Igonoh gave birth to a healthy baby girl in the United States of America (USA). Her baby was certified Ebola-free upon delivery [15].

3. Myths and misconceptions of Ebola virus disease

Four major misconceptions of EVD during the 2015 outbreak include perceptions that EVD was transmitted by supernatural spirits, air or mosquitoes and could be prevented by drinking salty water; bathing in salty water or rain water. It was also believed that traditional healers could treat EVD successfully [19]. However this misconception was debunked from clinical facts made available by medical microbiologists.

4. The microbiologist view of Ebola virus

4.1. Classification

Ebola virus is a non-segmented negative sense single stranded RNA virus classified as belonging to the genus Ebola virus in the family *Filoviridae* (order *Mononegavirales*).

Ebola virus has five distinct species which include Bundibugyo, Côte d'Ivoire, Reston, Sudan and Zaïre. Bundibugyo, Sudan and Zaïre species have been associated with large outbreaks of Ebola hemorrhagic fever (EHF) in Africa causing death in 25-90% of all clinically ill cases [20].

4.2. Mode of transmission

In Africa, infection has been documented through the handling of infected chimpanzees, gorillas, fruit bats, monkeys, forest antelopes and porcupines found ill or dead or in the rainforest. For a long time, rodents and bats have been regarded as potential reservoir species. This was proven by experimental studies in African plants and animals that confirmed the transmission of productive infection of African fruit and insectivorous bats with ZEBOV [20, 21]. The assessment for potential vectors, especially among arthropods has always been negative, including bedbugs (*Cimex hemipterus*) confined in the beds of infected persons [22, 23].

In a community, Ebola spreads 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. Direct contact with the body of the deceased person during burial ceremonies can also play a role in the transmission of the disease. Men who have recovered from the disease can still transmit the virus through their semen for up to seven weeks after recovery from illness [24]. Comprehensive knowledge on the methods of transmission and prevention are critical to preventing EVD and this include avoiding physical contacts with Ebola cases whether alive or dead, avoiding handling blood or body fluids of a person sick from Ebola and washing hands with soap and water or chlorinated water or alcohol based hand sanitizers. Ebola is not an airborne disease [18].

4.3. Pathogenesis

At the entry site into the body, EBOV has the capacity to infect macrophages and other cells of the phagocytic system. Macrophages *in vitro* are highly susceptible to infection and produce a large number of viral particles, and hence serve as a vehicle to deliver the virus to a variety of organ systems such as liver, endothelium, spleen, lymph nodes, kidney, adrenal gland and pancreas [25].

4.4. Clinical manifestations

The incubation period of Ebola virus disease is 2–21 days with a mean incubation period of 4–10 days [21]. As a result of widespread dissemination of EBOV, a wide number of organs and tissues are directly infected with EBOV. As a result, patients with EVD may show a broad range of clinical signs and symptoms. Clinically, EVD manifestations begin with high fever, headache, malaise, fatigue, nausea, vomiting, diarrhoea, hypotension, and bleeding [18, 26]. Many patients develop hemorrhagic manifestations from which the term "hemorrhagic fever" was derived.

4.5. Diagnosis

Laboratory diagnosis can only be performed in a specialized laboratory. In patients, the diagnosis is carried out by the detection of viral antigens through ELISA, identification of nucleic acid by PCR, specific antibody titer, or virus isolation.

4.6. Treatment

There is currently no approved Ebola virus-specific therapy for EVD. Treatment is primarily supportive in nature and includes minimizing invasive procedures, balancing fluids and electrolytes to counter dehydration, administration of anticoagulants early in infection to prevent or control disseminated intravascular coagulation, administration of procoagulants late in infection to control haemorrhage, maintaining oxygen levels, pain management and administration of antibiotics or antimycotics to treat secondary infections [25].

Since the discovery of Ebola virus in 1976, researchers have attempted to develop effective vaccines. Currently, vaccine development is ongoing and the potential vaccine rVSV-ZEBOV is in trial phases [26, 27].

5. The containment of Ebola in Nigeria

Following the first notification of Ebola Virus Disease (EVD) in Guinea, on 24th March 2014, the Nigerian Federal Ministry of Health, through the National Centre for Disease Control and Prevention (NCDC), took necessary steps to prevent the spread into Nigeria by putting in place the necessary machinery to contain the disease.

The following actions were taken:

i. Training of Health care personnel on EVD surveillance and medical procedures were carried out on a zonal basis across the country.
ii. Port health officers and disease surveillance units across the country were placed on red alert.
iii. A detailed action plan produced jointly with multi-sectoral collaborators was developed,
iv. Public awareness measures were carried out including the airing of jingles in English and three (3) Nigerian languages, distributions of posters and fliers, and engagement in media talk programmes on electronic media outlets on the subject.
v. All fifty-nine (59) Federal tertiary hospitals were alerted and directed to prepare isolation wards in case of an outbreak in Nigeria.
vi. Strengthening of the existing NCDC reference Virology Laboratories at Asokoro, Abuja, UCH Ibadan, LUTH, Lagos and Institute of Lassa Fever, Specialist Hospital, Irrua, and Central Public Health Laboratory, Lagos
vii. Strengthening of emergency operational centres at Asokoro, Abuja and Lagos commenced.
viii. National pandemic preparedness and response, and National contingency plans were activated and used, under which Nigeria had command structure.
ix. Presidential waiver was granted to the Federal ministry of health to recruit relevant health personnel to cover the human resource gap in public health, especially in Port Health Services, and NCDC .
x. Preparation of an intervention work plan with detailed budget was prepared [15].

5.1. Specific Ebola containment interventions by the Nigerian government and its partners include

5.1.1. Rapid action on the part of federal and state governments

Following the confirmation of the index case, rapid action was taken by both the Federal and Lagos State Governments. The President immediately declared the event a public health emergency and mobilized human, financial and material resources to contain the outbreak. The declaration of Ebola as a health emergency, gave health agencies and personnel legal powers to track calls and trace movement, in addition to tracing persons who needed to be placed under quarantine having made primary and secondary contacts with Ebola patients. The government's response plan, included identifying and monitoring 74 close contacts of the first infected patient, prompt testing of all suspected cases, stepping-up surveillance activities at the country's many entry points, and instituting nationwide awareness campaigns. A nurse who fled to Enugu State was traced and brought to Lagos State under the emergency powers, thereby curtailing the spread of Ebola to other parts of the country.

5.1.2. Establishment of a centralized Ebola emergency operational centre

An Emergency Operational Centre (EOC) was established and coordinated by the Federal ministry of health and Lagos state ministry of health on the 20th of July 2014 as an operational organ of the Nigeria Centre for Disease Control (NCDC) and proved an essential resource. The EOC also had a first class virology laboratory affiliated to the Lagos University Teaching Hospital that assisted it to turn around testing and diagnoses within 24 hours. The EOC participated in joint

strategizing, agreed on a unified plan and implemented a unified containment strategy plan in a way that accentuated efficiency, personal integrity and accountability using a war-room approach.

5.2. Other specific Ebola containment interventions by the Nigerian government and its partners include

i. Establishment of an Ebola treatment and research group with a mandate to carry out an extensive research into the Ebola virus.
ii. Establishment of six testing centers nationwide with plans to expand this further.
iii. Training of Nigerian health workers in Ebola containment related courses and high vigilance by health care providers.
iv. Increased vigilance of aviation workers and temperature checks.
v. Increasing laboratory capacity and requisitioning of drugs and other consumables.
vi. Ensuring adequate provision of protective equipment and resources to field personnel.
vii. Providing support for isolated patients or suspected cases.
viii. Delaying the reopening of schools, subject to the status of the Ebola epidemic.
ix. Banning transportation of corpses – both international and interstate.
x. Promoting an anti-stigmatization campaign to protect Ebola-free victims.
xi. Private sector players like the Dangote Foundation contributed a $1 million Foundation towards its operational costs emergency operation centre in Lagos.
xii. The Federal Government approved a grant of N200 million to each State, totaling N1.9 billion, in order to combat the Ebola virus disease. The prompt release of funds were earmarked for creating additional isolation centers, case management, contact 44 tracing, deployment of additional personnel, screening at borders and procurement of required items and facilities.
xiii. Public awareness through social media, SMS platforms and radio also played a key role in the sensitization of the public. The messages were aimed at:
    a) Raising the awareness of both risk factors and the protective measures that individuals should take to effectively reduce transmissions.
    b) The risk of wildlife to human transmission from contact with infected fruit bats or monkeys/apes and the consumption of their raw meat should be reduced.
    c) The risk of human to human transmission from direct or close contact with people with Ebola symptoms, particularly with their bodily fluids should be minimized.
    d) The importance of good hygiene and maintaining a clean environment.

6. Nigeria's preparedness for another Ebola virus outbreak

The Nigeria Centre for Disease Control is monitoring the Ebola Virus Disease outbreak in the Democratic Republic of Congo and recent cases in Uganda. Following the recent confirmation of EVD in Kasese District of Uganda, the Nigerian Ebola Preparedness team, coordinated by the NCDC, has conducted a preliminary risk assessment.

The NCDC has assured Nigerians that chances of the Ebola Virus being imported from Uganda or Democratic Republic of Congo are low as there are no direct routes from those countries to Nigeria. Based on available data, the overall risk of the importation of EVD to Nigeria is low and this data is also in line with the World health Organization's risk assessment for Nigeria. NCDC, in a press statement said this conclusion was reached following a preliminary risk assessment conducted by the agency on the overall risk of the importation of the disease into the country [28]. The disease control agency noted that it has put in place several measures to ensure adequate preparedness and these include;

a. Tightened security to properly ensure security at the airports.
b. The National Emergency Operations Centre (EOC), situated at the Incident Coordination Centre (ICC) in NCDC Abuja, is functional and currently in alert mode for EVD.
c. The teams of National first responders are always on standby and ready for deployment within 24 hours when the need arises. Public Health EOCs (PHEOCs) in States where major points of entry are located (Lagos, Kano, Abuja and Port Harcourt) are also on standby.

d. Improved point of entry screenings in major airports; the port health services unit of the Federal ministry of health is on alert and has heightened screening measures at entry points at the Nigerian ports [29].

In addition to the above, designated treatment centers and isolation facilities have been identified. Nigeria currently has in-country capacity for the diagnosis of EVD within NCDC's national reference laboratories. The risk communications technical working group has developed an all infectious diseases risk communication plan, and coordinates with a network of media houses and health educators in all States for prompt information dissemination. There are currently ongoing Infection Prevention Control (IPC) programs nationwide, including the development of new guidelines, as well as training packages for health care workers to mitigate transmission [30].

7. Conclusion

Ebola virus disease still remains one of the world's most deadly and uncommon diseases yet to have any dependable cure. Financial support for development for specific therapy and vaccine development should also be pursued rigorously. The achievements of the outbreak, such as improved port health services, public health activities in Nigeria, hand washing practices and appropriate burial practices should be strengthened and institutionalized. The ongoing outbreak of EVD in Congo has led to a record number of cases and deaths. This calls for prompt surveillance in Nigeria and other African countries. Control of this current EVD outbreak and future epidemics is likely to require a multifactorial strategy that includes high-quality disease surveillance, rapid diagnosis, and access to safe and effective therapies. The federal government of Nigeria must improve on all preventive measures to prevent another outbreak as the economic cost of prevention is lower than the economic cost of treatment.

Compliance with ethical standards

Acknowledgments

The authors would like to thank all staff members in the department for their contributions during the review.

Disclosure of conflict of interest

All authors declare that there is no competing interest.

References

[1] WHO. (2005).International Public Health Threats in the 21st Century. International Health Regulations Areas of work for implementation.

[2] Feldmann H. (2014). Ebola; A Growing Threat? N. Engl. J. Med, 371, 1375–1378.

[3] World Health Organization. (2012). Ebola Hemorrhagic Fever. Epidemic and Pandemic Alert and Response.

[4] World Health Organization. (2017). Ebola virus disease update, West Africa – update 28 August 2014: Epidemic & Pandemic Alert and Response (EPR) – Outbreak News.

[5] Borio L, Inglesby T, Peters CJ and Schmaljohn, AL. (2002). Hemorrhagic fever viruses as biological weapons: medical and public health management. Journal of the American Medical Association, 287, 2391-2405.

[6] Centers for Disease Control and Prevention. (2002). Special Pathogens Branch CDC 2002."Known Cases and Outbreaks of Ebola Hemorrhagic Fever".

[7] McElroy AK, Erickson BR, Flietstra TD and Rollin PE. (2014). Ebola hemorrhagic fever: novel biomarker correlates of clinical outcome. J Infect Dis, 210 (4), 558-566.

[8] World Health Organization Ebola Virus Disease. (2017).Democratic Republic of the Congo. External Situation Report 23.Health Emergency Information and Risk Assessment. 1-6.

[9] World Health Organization. (2018). Cluster of presumptive Ebola cases in North Kivu in the Democratic Republic of the Congo".

[10] World Health Organization. (2019). Ebola virus disease – Democratic Republic of the Congo. Disease outbreak news: Update.

[11] World Health Organization. (2019). Ebola virus disease –Republic of Uganda. Disease outbreak news: Update.

[12] Shuaib F, Gunnala R, Musa EO and Mahoney FJ. (2014). Ebola virus disease outbreak – Nigeria, July-September 2014. MMWR Morb Mortal Weekly Rep, 63, 867-72.

[13] Althaus CL, Low N, Musa EO and Shuaib F. (2015). Ebola virus disease outbreak in Nigeria: Transmission dynamics and rapid control. Peer J Pre Prints, 3, e569v3.

[14] Bureau of Public Service Reforms. (2015). How Nigeria Contained Ebola: Lessons For Institutional Reform 2015. Bureau of Public Service Reforms, Abuja, Nigeria.

[15] Oleribe OO, Crossey MM and Taylor-Robinson SD. (2015). Nigerian response to the 2014 Ebola viral disease outbreak: Lessons and cautions. Pan Afr Med J, 22 Suppl 1, 13.

[16] Centers for Disease Control and Prevention. (2014).Treatment of Ebola Hemorrhagic Fever.

[17] Baize S, Pannetier D and Oestereich L. (2014). Emergence of Zaire Ebola virus disease in Guinea. N Engl J Med, 371, 1418–25.

[18] Shittu RO, Sanni MA, Odeigah LO and Akanbi AA. (2015). Awareness Knowledge and Misconceptions about Ebola Virus Disease (EVD) in a Family Practice Setting in Nigeria. West Africa J, 7, 010-014.

[19] Feldmann H and Geisbert T. (2011). Ebola haemorrhagic fever. Lancet, 377 (9768), 849-862.

[20] Stein RA. (2015).What is Ebola? Int J ClinPract, 69 (1), 49-58.

[21] Olson SH, Reed P, Cameron KN and Ssebide BJ. (2012).Dead or alive: animal sampling during Ebola hemorrhagic fever outbreaks in humans. Emerg Health Threats J, 10.3402/ehtj.v5i0.9134.

[22] Chippaux JP. (2014). Outbreaks of Ebola virus disease in Africa: the beginnings of a tragic saga. J Venom Anim Toxins Incl Trop Dis, (20), 44.

[23] World Health Organization. (2014). Ebola virus disease update, West Africa – update 28 August 2014, Epidemic & Pandemic Alert and Response (EPR) Outbreak News.

[24] Ansari AA. (2014). Clinical features and pathobiology of Ebola virus infection. J Autoimmun, 55. 1-9.

[25] World Health Organization. (2019). Ebola virus disease. Key Facts. (www.who.int) Assessed on 19th June 2019.

[26] Jean-Philippe C. (2014). Outbreaks of Ebola virus disease in Africa: the beginnings of a tragic saga. Journal of Venomous Animals and Toxins including Tropical Diseases, 20, 44.

[27] Huttner A, Dayer JA and Yerly S. (2015). The effect of dose on the safety and immunogenicity of the VSV Ebola candidate vaccine: a randomized double-blind, placebo-controlled phase 1/2 trial. Lancet Infect Dis, 15, 1156–1166.

[28] Henao-Restrepo AM, Camacho A and Longini IM. (2016). Efficacy and effectiveness of an rVSV-vectored vaccine in preventing Ebola virus disease expressing Ebola virus surface glycoprotein: final results from the Guinea ring vaccination, open-label, cluster-randomized trial. Lancet, 389, 05-518.

[29] www.premiumtimesng.com/health/health-news/335412-nigeria-not-at-risk-of-ebola-outbreak-ncdc.html [Accessed June19, 2019].

[30] www.saharareporters.com/2019/06/17/possibility-outbreak-ebola-nigeria-very-low-says-nigeria-centre-disease-control [Accessed June19, 2019].

[31] www.reliefweb.int/report/nigeria/evd-ncdc-conducts-risk-assessment-amidst-ongoing-outbreak-drc-and Uganda [Accessed June19, 2019].

How to cite this article

Adogo, LY, Chuku A and Ajide B. (2019). The Ebola virus saga in Nigeria; the view point of a microbiologist. GSC Biological and Pharmaceutical Sciences, 9(2), 50-56.