



## How the Spread of Ebola Virus was Curtailed in Nigeria

Elijah I. Ohimain<sup>1,2,3\*</sup>

<sup>1</sup>Department of Biological Sciences, Medical and Public Health Microbiology Research Unit, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria.

<sup>2</sup>Department of Biological Sciences, Bioenergy and Environmental Biotechnology Research Unit, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria.

<sup>3</sup>Department of Biological Sciences, Microbial Ecology Laboratory, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria.

### Author's contribution

*This study was carried out by the author EIO alone.*

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Case Study

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### ABSTRACT

Ebola virus, the causative agent of Ebola virus disease (EVD) formerly called Ebola hemorrhagic fever (EHF) is one of the most dangerous microorganisms in the world. The virus ravaged West Africa countries particularly, Guinea, Sierra Leone and Liberia infecting over 22,000 people, of which nearly 50% resulted in fatalities. When the disease finally reached Lagos on 20 July 2014, it brought fear and panic because of the large population of Lagos and the chaotic socio-economic situation coupled with dysfunctional health that was even on strike at the time of the outbreak. Also, there was no approved therapeutics and preventive vaccine. It was therefore feared that the disease has finally got out of control owing to the large population of Nigeria and the high frequency of international travel. Against all expectations, Nigeria reacted swiftly by tracing all contacts of the index case, isolated and quarantined infected patients, practiced barrier nursing and supportive care for infected persons. Nigeria was declared Ebola virus free on 20 October 2014, but not before the virus had infected 20 persons, of which 8 succumbed, giving a case fatality rate of 40%, which

\*Corresponding author: E-mail: [eohimain@yahoo.com](mailto:eohimain@yahoo.com);

is a significant improvement over the 90% fatality rate of Zaire Ebola virus, the causative agent of the 2014 EVD outbreak. In all, there was only 1 index case, 13 persons were primary contacts, 3 secondary and 3 tertiary contacts of the index case.

*Keywords: Contact tracing; hemorrhagic fever; nosocomial infection; viral infection.*

## 1. INTRODUCTION

News pertaining to Ebola virus disease (EVD) dominated the media in 2014. The current outbreak of Ebola virus in West Africa was reported to have been first detected in a 2 year old baby in Guinea in December 2013 [1]. It appears the disease spread from there unnoticed until 22 – 23 March 2014 when the outbreak was officially reported in Guinea, 31 March 2014 in Liberia and 26 May in Sierra Leone. Nigeria became the fourth country that Ebola virus spread to, when a Liberian-American diplomat imported the virus to Nigeria on 20 July 2014. On 8 August 2014, the World Health Organization (WHO) declared the epidemic to be a public health emergency of international concern [2]. Thereafter, Ebola spread to other parts of the world including Senegal, Mali, USA and Spain. As of 22 October 2014, over 10,000 people have contracted EVD with about 50% dead [3]. As of 28 December 2014, EVD cases were 20,206 out of which 7,906 died [4]. Though, the rate of infection declined slightly in January 2015, but by 31 January 2015, over 22,000 EVD cases have been reported worldwide.

Ebola virus was first discovered in 1976 with 2 simultaneous outbreaks in Nzara in South Sudan and Yambuku in Democratic Republic of Congo (DRC) formally called Zaire. Since then, over 20 outbreaks of EVD has been reported mostly in East and Central Africa [5] particularly DRC, Cote d'Ivoire, Gabon, Sudan, Uganda. Ebola virus is a negatively stranded RNA virus which belongs to the Filoviridae family (Filovirus) comprising of 5 species including Zaire Ebola virus (ZEBOV), Sudan Ebola virus (SUDV), Bundibugyo Ebola virus (BDBV), Reston Ebola virus (RESTV), and Tai forest Ebola virus (TAFV) formerly called Cote d'Ivoire Ebola virus (CIEBOV). Of these, only SUDV and ZEBOV have been associated with large EVD outbreaks in Africa [1,6]. The 2014 EVD outbreak is caused by Zaire Ebola Virus [7,8]. Ebola virus causes EVD formerly called Ebola hemorrhagic fever among humans and non-human primates such as Monkeys, Gorillas and Chimpanzee [9]. Ebola virus is regarded as one of the most dangerous organisms in the World. It was classified as a risk

group 4 pathogens [9,10], which is higher than HIV [11]. The United States Center for Disease Control and Prevention (CDC) classified Ebola virus as a category A agent, which is a bioterrorism threat [10,12].

EVD is very dangerous virus and has been reported to cause 50 – 100% fatality [1,5,13]. Ebola virus has been reported to infect almost every organ in the body. The infection generally involves necrosis of the liver, kidney, spleen, lymph nodes, testes and ovaries [5]. Ebola virus infections often result in internal and external bleeding and multiple organ failures. Because of the mode of spread of Ebola virus, the short incubation period, the high mortality rates and the fact that there are no approved/licensed drugs and preventive vaccines, EVD is considered as a threat to humanity [14,15].

With a population of about 170 million people, Nigeria is the most populous country in Africa. The country also has the largest economy in Africa. Multinational investments particularly in the telecommunication, pharmaceutical and oil and gas sectors dominate the economy of Nigeria. In this era of globalization, among African countries, Nigerians are about the most populous people in Diaspora. The country's economy is mostly dependent on oil and gas. But the country performs below average in some social infrastructures and services particularly good quality water, hospitals, roads, electricity. Hence, when Ebola virus was imported into the country from Liberia on 20 July 2014, there were speculations that Ebola virus has finally got out of control, hence WHO on 8 August 2014 declared EVD to be an epidemic of public health importance. From the index case, Ebola spread into 2 major Nigerian cities (Lagos and Port Harcourt). The country promptly responded, which stopped the spread of Ebola within 3 months. And by 20 October 2014, the WHO declared Nigeria Ebola-free after 42 days i.e. twice the incubation period (21 days) of Ebola virus, without any new infections. Hence, the aim of this paper is to present the incidence of Ebola virus in Nigeria and the response that stopped the spread of Ebola virus in the country, thus averting a national and global disaster.

Information presented will also be useful to other African countries in their response to the ravaging EVD. The methodology used in this paper is based on in-depth analyses of secondary data obtained from various sources such as Journals, Newspapers, internet and Mass Media. In addition, some healthcare workers (HCW) who took part in the Ebola virus response in Nigeria were interviewed.

## 2. EBOLA VIRUS DISEASE OUTBREAK IN NIGERIA

Ebola virus was imported into Nigeria on 20 July 2014, when a 40 years old Liberian-American *Economic Community Of West African States* (ECOWAS) diplomat flew from Monrovia to Lagos via Togo. The diplomat was sick on arrival and was attended to in a private clinic in Obalende, Lagos. The diplomat (index case) claimed to have been sick of malaria; hence the medical staff that attended to him did not wear any special personal protective equipment (PPE). But when the diplomat began exhibiting EVD symptoms, samples were sent to the lab, which were positive for EVD (24 July 2014). The index case died of EVD on 25 July 2014 after infecting other people that triggered the spread of Ebola virus in Nigeria.

Fig. 1 presents the chronology of Ebola virus infection and three-generational spread in Nigeria. Among the people that got infected were 2 ECOWAS associates of the index case and health workers at the hospital that attended to the index case. Of the 2 ECOWAS associates of the index case that became infected with EVD, one of them an ECOWAS protocol officer, age 36 died in Lagos on 12 August 2014 of EVD, while the other travelled to Port Harcourt (a distance of about 435 km from Lagos) for medical attention, which led to the spread of Ebola virus to Nigeria's largest oil city. About 4 persons contacted EVD in Port Harcourt including the doctor that attended to the diplomat, his wife and sister and an elderly woman. The Port Harcourt doctor and the elderly woman later died of EVD, while the others recovered. One of the nurses that contacted EVD in the hospital that attended to the index case in Lagos, travelled to Enugu, which raised fears of possible spread of the virus to the coal city. The nurse later recovered and 25 persons were placed on surveillance at Enugu, none developed EVD. In all, including the index case, 20 persons were infected with EVD, while 12 recovered, 8 died, giving a case fatality rate of 40%, which is an improvement over the 90%

fatality rate of the Zaire Ebola virus, the causative agent of the 2014 EVD outbreak in West Africa. Of the 20 cases reported in Nigeria, 8 were health care workers. Though, other authors reported different figures of HCW infected by the virus. Fasina et al. [16] reported that of the 20 cases reported in Nigeria, 11 were health care workers, 9 of whom acquired the virus directly from the index case (primary cases). UNICEF [17] reported EVD statistics as of 21 September 2014; being 19 confirmed cases, 7 death, 12 recovered, 11 cases were healthcare workers of which 5 died. As of 3 September 2014, 3500 people have been infected with Ebola virus in West Africa among which 200 persons were healthcare workers. Among the 19 persons that became infected with Ebola virus in Nigeria, 13 persons contacted the disease primarily from the index case, 3 persons secondarily and another 3 tertiary. Shuaib et al. [18] reported three generation of EVD spread in Nigeria. Of 20 including the index case, total of 8 cases died - 6 of them were associated with health care service. Of 6 primary cases that died, 5 were associated with the health care service: doctors (2), nurses (2) and health care worker (1). Similarly of 3 secondary cases, one case that died was a doctor. However of 3 tertiary cases, one case that died was not associated with health care but was an elderly woman. According to Fasina et al. [17], the index case generated 12 secondary cases in the first generation of the disease, 5 secondarily cases in the second generation of the disease and 2 secondary cases in the third generation. According to Shuaib et al. [18], the three generation of spread of EVD in Nigeria can be traced to the index case through contact networks.

### Ebola case #

1. Index case, a Liberian-American ECOWAS diplomat, brought Ebola virus to Nigeria via air travel, male, 40 years old, died 25/7/2014.
2. Nurse, female, travelled to Enugu by road, recovered.
3. ECOWAS diplomat, male, associate of index case, travelled to Port-Harcourt by air, recovered.
4. ECOWAS protocol officer, male, associate of index case, 36 years old, died 12/8/2014.
5. Female nurse, died 2/8/2014.
6. Patient that contracted the disease nosocomically, recovered.

7. Patient that contracted the disease nosocomically, recovered.
8. Patient that contracted the disease nosocomically, recovered.
9. Patient that contracted the disease nosocomically, recovered.
10. Female nurse, 25 years old, died 15/8/2014.
11. Health care worker that contracted the disease, recovered.
12. Female doctor that attended to the index case, died 19/08/2014.
13. Health care worker that contracted the disease, recovered.
14. Health care worker at the hospital where index case was treated, died 13/9/2014.
15. Port-Harcourt male doctor that treated case #3, died 22/8/2014.
16. Spouse to case #10 male recovered.
17. Sibling of case #12, recovered.
18. Elderly woman, died 31/8/2014, contracted EVD from #15
19. Spouse of case #15, Female medical doctor, not nosocomially transmitted, recovered.
20. Sister of case #15, recovered.

### 3. NIGERIA'S RESPONSE TO EVD

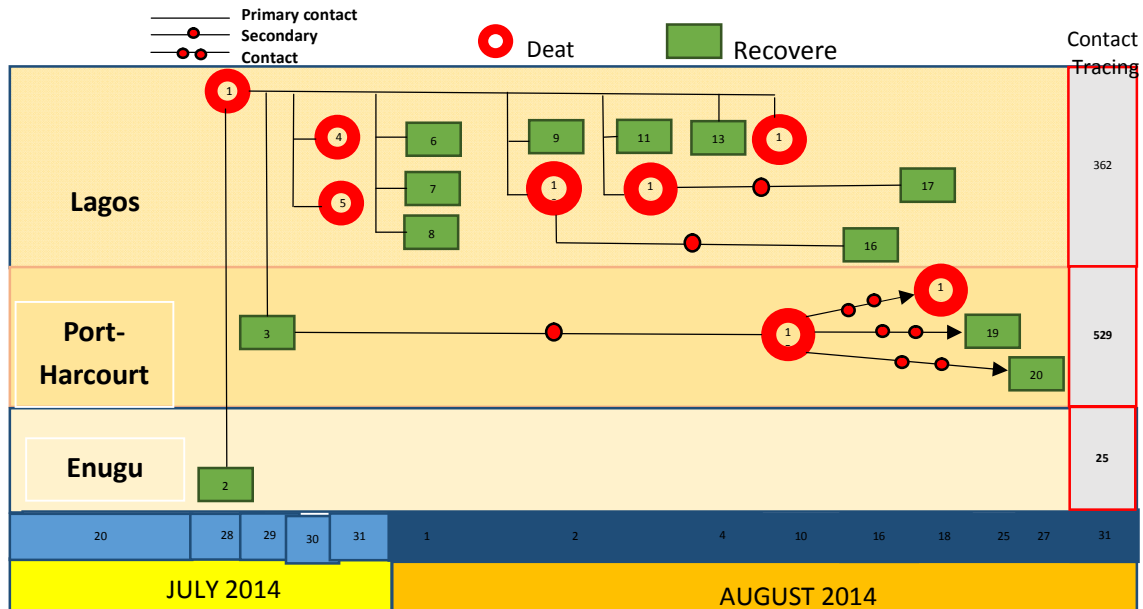
Despite the devastating effects of EVD in neighboring West African countries particularly Guinea, Liberia and Sierra Leone, Nigeria was not prepared. So when the index case brought EVD into Nigeria, the country was surprised. But Nigeria subsequently acted swiftly and appropriately to curtail the spread of the virus. This subsection of the paper presented some of Nigeria's responses that halted the spread of Ebola virus in the country.

On 23 July 2014, the Federal Government of Nigeria (FGN) through the Ministry of Health, Lagos state Government and International partners established a National Ebola Emergency Operations Centre (NEEOC), along with the Nigeria Centre for Disease Control (NCDC) coordinated response to EVD in Nigeria. It is important to note that for response against the threat of EVD, Nigeria recruited the team of NCDC that had previously responded against polio in 2012 and lead poisoning in 2010. Details of the robust organizational structure of the Ebola response Centre can be found in Shuaib et al. [18]. The Centre had 6 main units (epidemiology/ surveillance, case management/ infections control, social mobilization, lab services, point of entry and management/coordination) with

several subunits. State Ebola Emergency Operations Centers (SEEOC) were also established in Lagos and Rivers states [17]. Many international organizations supported Nigeria in response to EVD threat including World Health Organization (WHO), United Nation Children Fund (UNICEF), US Centre for Disease Control and Prevention (CDC), and Medicins Sans Frontiers/Doctor without Borders (MSF), SOS international.

As soon as the Ebola disease outbreak was announced in Nigeria, the country began contact tracing (to stop the chain of transmission) of all the people that had contact with the index case. As of 24 September 2014, a total of 814 contacts in 26,000 households, 18,500 face to face visits in 3 states (Lagos, Rivers and Enugu) have been monitored resulting in 20 confirmed EVD cases and 8 fatalities [18]. The government also made use of the services of the State Security Service (SSS) for contact tracing. According to Fasina et al. [16], a total of 898 contacts were linked to the index case including 351 primary and secondary contacts and 547 tertiary and higher order contacts. House to House and person to person visits were made. For low density areas, the contact team covered a radius of 2 km from an Ebola contact, 1 km in medium density areas and 500 m in high density areas. While all the contacts were tracked in Lagos, about 99.8% were tracked in Port Harcourt [13, 19]. Suspected cases were reclassified as confirmed case if the reverse transcriptase-polymerase chain reaction (RT-PCR) detect Ebola virus in a blood specimen [18]. For PCR negative suspected cases, testing for anti-Ebola virus immunoglobulin G was also carried out using ELISA test kits[11]. Psychosocial supports were provided to patients, family of patients, contact persons and community members affected by EVD. To prevent the spread of EVD and stigmatization of contacts, household interpersonal communication was used and over 280,000 people were visited in 28,699 households [17]. Positive EVD patients were isolated/quarantined and given intensive care, which involved the use of intravenous and/or oral rehydration therapy (ORT) and treatment of opportunistic infections, maintaining adequate oxygen level and blood pressure.

Currently, there are no approved vaccines or drugs for the treatment of Ebola virus infections. Notwithstanding, some vaccines and drug for EVD are under development and some have entered clinical trials. During Ebola virus



**Fig. 1. Chronology and spread of ebola virus infection in Nigeria (x axis not drawn to scale)**

outbreak in Nigeria, the country attempted using nanosilver for treatment, but was discouraged by USA, despite the proven antiviral properties of nanosilver [20,21]. In 2009, US Department of Defense funded research indicated that 10 ppm nanosilver is effective against Ebola virus [22]. But there are indications that some nanosilver especially the chemically synthesized ones can be toxic to humans [23], hence the Nigerian National Health Research Ethics Committee (NNHREC) did not approve the use of nanosilver, but on 9 August 2014, permitted the use of experimented drugs on humanitarian grounds. Nigeria subsequently requested for ZMapp, which US never supplied until the virus was controlled in Nigeria. In the absence of foreign drugs, the use of locally available antimicrobials of plant origin especially bitter kola (*Garcinia kola*), which have antiviral properties [24] was considered, but was not used for EVD in Nigeria, perhaps because its effectiveness specifically against EVD have not been demonstrated. Hence, it will be unwise trying it out in the midst of an emergency. Nigeria also requested for the use of TKM-Ebola from Japan [25]. Again, it was not available for use in the country before EVD was eventually curtailed. TKM-Ebola has strong antiviral activity against influenza virus and has entered Phase 3 clinical trial for influenza virus and has commenced phase 1 trial for Ebola virus. During the outbreak, there were rumors of using table salt (NaCl) as

protection against EVD. At least about 2 people died of excess salt consumption in Jos in an attempt to acquire protection against EVD.

Nigeria therefore relied on using known best practices for EVD management including screening, hand washing, the use appropriate PPE, barrier nursing, training and information. The movement of dead bodies across states without approval or medical certificate was banned, while the country increase her healthcare infrastructure for Ebola virus disease detection and management. Burial of dead EVD patients was carried out under strict WHO guidelines of cremation or deep burial in leak proof body bags.

Non-contact infrared thermometers were used to monitor the temperature of passengers' at all Nigerian airports and all land and sea borders. Contacts are classified as suspect case if their temperature is  $>37.5^{\circ}\text{C}$  auxiliary or  $38^{\circ}\text{C}$  core [18]. There is a problem using temperature to detect EVD because other hemorrhagic fevers (yellow fever, Lassa and dengue), malaria, typhoid fever, and other types of fevers also result in elevated temperatures. Besides, asymptomatic Ebola carrier could beat the temperature screening.

Hand washing, good hygiene and sanitation were actively promoted. But these also faced with

challenges. For instance, Lagos and Port Harcourt despite being coastal with abundant fresh water and brackish water resources, access to water and sanitation is poor. Many public buildings especially government institutions including schools and even hospitals lack water. Open defecation is still practiced in Nigeria due to lack of toilet facilities. It has been estimated that over 20 million people in Africa lack access to water and sanitation. Only 58% of Nigerians have access to water, while 32% had access to sanitation [26].

Many types of ethanol based sanitizers of doubtful quality emerged, which is unlikely to be effective against Ebola virus. The sanitizers recommended for Ebola virus prevention should be anhydrous and contain at least 30% ethanol. Sodium hypochlorite was used in Nigeria to prevent Ebola virus spread. Again, the concentration and purity of sodium hypochlorite used is uncertain. During the EVD outbreak, many broad spectrum disinfectants were freely used, which could affect non-target organisms in the ecosystem.

Healthcare facilities were improved especially laboratory facilities for the diagnosis of EVD in-country. Newly installed facilities for diagnosis of EVD include NCDC laboratory at Asokoro Abuja; NCDC laboratory at Lagos University Teaching Hospital (LUTH), NCDL Laboratory at University College Hospital (UCH) Ibadan; Irrua specialist Teaching Hospital, Edo state; and virology laboratory of Redeemers University, Ogun state. Installation of virology laboratory is also being considered for the University of Ilorin, Kwara state. Plans are ongoing to install additional equipment that will permit the diagnosis of EVD at the NCDC laboratories in Amino Kano University Teaching Hospital, Kano and University of Port Harcourt. The Federal Ministry of Health also plans to install mobile laboratories at Abakiliki, Port Harcourt, Jos, Bauchi and Sokoto [25]. Also EVD isolation and treatment Centre were established in many states, some of the notable ones are;

- **Lagos:** Infectious Disease Hospital (also known as Mainland Hospital), Yaba, has a 40-bed isolation facility for Ebola cases
- **Delta State:** Seven hospitals have been identified to be isolation centres for Ebola cases, including Warri Central Hospitals, Ughelli Central Hospital, Sapele Central Hospital, Agbor Central Hospital, Oleh Central Hospital, Eku Baptist Government

Hospital and Delta State University Teaching Hospital Oghara.

- **Niger State:** A quarantine centre is being established in Minna. "Containment Centres" will be established in the three Senatorial Districts.
- **Rivers State:** An isolation unit has been established at Oduoha, Emohua. The centre currently has 26 beds "with plans for possible expansion.

Source: SOS International [27]

The government embarked on massive training, sensitization and enlightenment campaigns. Healthcare workers, Nigerian immigration, service personnel and school teachers were enlightened and trained. Over 150 contact tracers, vehicles, telephones and mobile data platforms were mobilized [18]. Dixon [19] reported that at least 51,000 Nigerians received government text messages. Ubochi [13] reported that about 1800 persons were trained to trace and monitor those at risk as well as decontaminate infected places and care for the sick. The author also reported that over 600 Nigerians doctors, nurses, laboratory scientist, epidemiologists and other categories of experts have indicated interest to join the international team to combat Ebola virus in other West African countries. The government set up a toll-free hotline (0800EBOLAHELP) and a website ([www.ebolaalert.org](http://www.ebolaalert.org)). In preparedness for the opening of primary and secondary schools in 22 September 2014, UNICEF trained over 5000 school teachers in Port Harcourt on general hygiene practices, sanitation and the use of non-contact thermometers [17]. Posters, leaflets, booklets, flyers and advertisement in print and broadcast media and social media were used.

One of the major success factors in the fight against Ebola virus in Nigeria is funding. The Nigerian Government initially released ₦1.96 billion (\$1 = ₦160) to contain the virus and released additional ₦200 million to each of the states where the disease spread to. Some Nigerian organization such as Aliko Dangote Foundation donated \$900,000 while Tony Elumelu Foundation donated \$300,000. The US and some other countries donated infra-red thermometers (Dixon, 2014). Other organization, that donated money to eradicate EVD in West Africa include African Development Bank (ADB), World Bank, EU etc. Facebook CEO donated \$25 million, while China donated \$ 38.2 million. ADB donated \$210 million (Punch Newspaper

28/8/2014) while Gates foundation donated \$50 million (Guardian Newspaper12/9/2014) to fight EVD in Africa. Nigerians did not appear to have benefitted from these funds, as the disease was already under control as at the time the funds were released.

Several authors have reported that luck played a role in the successful curtailment of EVD in Nigeria [13,19]. Nigeria, being a multi-religious country [28], it was therefore considered as divine [29]. Evidence suggest that the index case was exposed to Ebola virus and have developed EVD symptoms before leaving Liberia [16,18,30]. Despite advice against travel, perhaps because of diplomatic passage or impunity he was allowed to come to Nigeria. He came into Nigeria from Liberia with a stop in Ghana and Togo and changed flight before arriving Lagos on 20 July 2014. Report also show that the index case was visibly ill and vomited during the flight, thus exposing the 42 persons that were on board the flight or 72 persons on the aircraft, at the airport and the hospital where he was treated [31].

Another element of luck was that the index case came into Nigeria through aircraft where it became possible to trace all the contacts. If the index case had come through the porous Nigerian borders and got ill in one of the numerous border villages, the scenario would have been different. The disease would have spread uncontrollably before it could have been detected. Also, as at the time EVD was imported into Nigeria, the Nigerian Medical Association (NMA) was on strike, hence the usually crowded public hospitals were not operational. Though, diplomats do not commonly patronize public hospitals in Nigeria. But if the index case was not a diplomat and was admitted into a Nigerian public hospital, it would have been a disaster. Also, diplomats are traditionally not restricted by the laws of the land. It was considered a feat when the index case was prevented from discharging himself despite the pressures from the Liberian Embassy in Nigeria. If the index case has been released into Lagos, the largest mega city in Africa of over 21 million persons, it would have been a disaster. Lagos is industrialized, crowded with chaotic traffic situations, which could increase contacts that could enhance the spread of the disease. Ubochi [13] reported that the index case was prevented from discharging himself.

There were 2 major flights that led to the spread of Ebola virus in Nigeria; the index case that flew

from Monrovia via Accra and Lome to Lagos and an associate of the index case (another ECOWAS Official) who flew to Port Harcourt from Lagos, bringing the virus to Port Harcourt. This diplomat was treated in an hotel not hospital or isolation centre without the use of Ebola virus response PPE. Again, by luck none of the hotel staff nor their guest was infected with Ebola virus. The Port Harcourt doctor attended to other patients during the period and also took part in other social activities. In all, only 3 persons contacted EVD from him, but only one died. Also, one of the infected nurses that treated the index case travelled by road to Enugu, South East Nigeria, a distance of about 500 km from Lagos. In all these cases, none of the passengers developed EVD including those that attended to the index case in the flight and clean up his vomits perhaps without appropriate PPE. Ademuwagun [32] reported several advantages that worked in favor of Nigeria in the battle against Ebola virus, which could be summarized as border advantage (Nigeria did not share border with any of the 3 major Ebola virus hit countries), city advantage, financial advantage, circumstantial advantage and chronological advantage (Nigeria learnt from the other 3 West African countries that were taken by complete surprise).

Before EVD was finally controlled in Nigeria, it caused several impacts. First the disease brought fear and panic into the country. Twenty persons became infected, while 12 recovered, 8 died. The fear of Ebola virus affected the educational sector next after the medical sector. Academic calendar was disrupted. Primary and secondary schools could not resume in August 2014 after the long (summer) holidays. The schools finally resumed on 22 September 2014 and 6 October 2014 after facilities to counter Ebola has been installed and some teachers trained on EVD response. Foreign students from Ebola infected West African countries attending tertiary institutions in Nigeria were initially prevented from resuming. They later resumed after proper screening.

There were also fears concerning the large bat population (reservoir of Ebola virus) in Nigeria particularly at the Obafemi Awolowo University Campus and Aso Rock Vila (Presidential Villa). The fear of EVD also restricted public functions including religious worship, traditional festivals and other social gathering such as parties, ceremonies and burials. The usual Nigerian courtesy of hand shaking was minimized.

Rumors fill the air waves many of non-medical ways of protection against EVD. Nigerians travelling abroad were stigmatized.

Responses to EVD are quite expensive. PPE alone cost about \$75 a piece. Nigeria spent about ₦193.78 million monthly for the purchase of PPE alone (Vanguard 4 September, 2014). Huge amount of Money was also spent in training, sensitization, and campaigns and for the procurement of drugs, installation of water systems, laboratory facilities and maintenance of Ebola Centres. Money was also spent for contact tracing and for the payment of allowances and insurance for the Ebola virus response team.

Beyond all these, the economic effects of EVD in West Africa are quite high [33]. It affected travel commerce [34,35], but the effects on Nigerian economy was adjudged low [36]. Punch Newspaper (28 August 2014) reported that EVD threatens 30 million "bush meat" consumers in Africa. This appears to be a blessing in disguise, because it helps to conserve wildlife. It has been previously reported that the "bush meat" enterprise is a threat to natural resources and the environment in Nigeria [37]. Other positive impacts of EVD on Nigeria is improvement in sanitation, water and healthcare facilities particularly the installation of virology and infectious disease laboratories. Finally, Nigeria staffs that have been trained in EVD response has now joined other international team to finally stamp out EVD from West Africa hopefully before the end of 2015.

#### 4. CONCLUSION

Nigeria is the most populous country in Africa with a population of nearly 170 million persons and Lagos is one of the largest mega cities in the world with a population of over 21 million. Lagos is crowded with chaotic traffic situation and weak healthcare infrastructure. Since March 2014, Ebola virus had ravaged 3 West African nations; Guinea, Sierra Leone and Liberia. EVD was imported into Nigeria on 20 of July 2014. The arrival of the disease into Nigeria brought fear and panic not only in Nigeria but in other parts of the world. Because of the high frequency of travels abroad from Nigeria, it was feared that the disease could spread globally uncontrollably. But against all expectations, Nigeria responded swiftly by tracing all contacts of the index case, isolated and quarantine infected patients, practice barrier nursing and supportive care for infected persons. Nigeria was declared Ebola

virus free in October 2014 before this time the virus had infected 20 persons, of which 8 succumbed, giving a case fatality rate of 40%, which is an improvement over the 90% fatality rate of Zaire Ebola virus, the causative agent of the disease. There was only 1 index case, 13 persons were primary contacts, 3 secondary and 3 tertiary contacts of the index case, among which 8 were healthcare workers. Of 20 including the index case, total of 8 cases died - 6 of them were associated with health care service. Of 6 primary cases that died, 5 were associated with the health care service: doctors (2), nurses (2) and health care worker (1). Similarly of 3 secondary cases, one case that died was a doctor. However of 3 tertiary cases, one case that died was not associated with health care but was an elderly woman. Nigeria still face the dangers of re-infection because of some of her citizens that have now joined other multinational experts in the fight of Ebola virus in Guinea, Sierra Leone and Liberia. Until Ebola virus is completely stamped out of West Africa the risk of spreading into Nigeria and elsewhere remains a possibility.

#### CONSENT

Not applicable because no specific patient's information was presented in the manuscript.

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#### COMPETING INTERESTS

Author has declared that no competing interests exist.



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