

Review Article

Emergence and Re-emergence of 2014 Ebola outbreak in Sub- Sahara Africa: 'Challenges and lessons learned' from Nigerian epidemic outbreak

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Abstract: The 2014 Ebola outbreak in West Africa was a huge and horrifying public health and socio-economic challenges that prompted the World Health Organisation to declare it as a severe public health emergency that requires urgent and collaborative attention to handle. It was assumed and seen as a global health risk given the rapid and modern transportation system that makes the entire world a global village. The infection seems to set in after an incubation period of about 14 days. However, a flue like a syndrome can develop to full blown hemorrhagic fever, given rise to multi-targeted organ and cell failure that will promote death in the end respectively. The control of Ebola in the affected zone in Africa is probably suffering a setback due to lack of vaccine and non-virus-specific treatment options. Also, non-sustainable and inadequate health facilities, lack of personal hygiene, poor sanitation strategy, misconception and cultural practice are some of the factors that have promoted the outbreak in the communities. Early detection of ribonucleic acid (RNA) in body fluids with ELISA and the use of PCR would help for prompt diagnosis and identification. There is no specific treatment lay down procedure, but treatment could entail massive and aggressive supportive care intervention strategy, early diagnosis and rehydration. Besides, prompt contact tracing, spontaneous surveillance approach, quarantine and efficient well-detailed isolation strategy that is timely remains critical for efficient control of the scourge (Ebola). The need to continue to educate the general masses on the epidemiology, control and preventive measures of the virus will naturally help to reduce the spread in our communities. Thus, Nigeria was able to contain the outbreak due to the mass mobilisation of her citizens through radio, television jingle, social media and well-coordinated approach. This was backed up by the prompt financial commitment of the government of President Good luck Ebele Jonathan that showed strong and massive political will to tackle and kick out the scourge in our vicinity (Nigeria).

Keywords: Haemorrhagic fever, Ebola, Public health, Sub-Sahara Africa, Outbreak, Nigeria outbreak

Introduction

Studies revealed that there have been several Ebola transmission outbreaks in the past [1, 2, 3] hence over 20 cases of Ebola epidemic outbreak has been documented since the 1970s [4, 5]. However, the August 2014 outbreak was very huge, devastating, and widespread thus attracted the concern of international communities' attention [6, 7] as a global health risk that must be tackled effectively. These subsequently led to the identification of this viral particle as a viral zoonosis Ebola (EBOV) which was also initially known as Zaire Ebola virus (ZEBV) [8, 9, 10, 11]. The negative enveloped single-stranded RNA virus, a member of the family Filoviridae is the most offensive and virulent species of the five family members [12] namely Tai Forest (TAFV), Bundibugyo (BDBV), Reston (RESV) subtype and Sudan (SUDV) types [13, 14]. The

application of molecular diagnostic approach revealed from the sequencing of the data that the 2014 epidemic in West Africa was linked to the infection due to ZEBV strain as the causative viral agent that was completely different from the strains already identified during the previous and early outbreaks studies [15, 16]

Increasingly, against the above background, Ebola haemorrhagic fever (EHF) is a human disease caused by Ebola virus [17]. Its symptoms typically manifest within two days to three weeks and characterized by nausea, vomiting, diarrhoea and decreased liver and kidney functioning [18]. The current Ebola outbreak in West Africa has been declared by the World Health Organization as the deadliest international health emergency worldwide [19]. In addition to the massive loss of human lives due

to the disease outbreak, a significant economic loss has been accrued by families, individuals and governments of the countries involved [20]. Despite the presence of the disease in 1976 when the first outbreak was noted in Central Africa, the WHO has described the recent outbreak as very strange and uncommon [21].

The largest and first regional EVD outbreak in Africa unfolded in 2013 with its first notable case identified in Southern Guinea [22]. Although, this outbreak was not recognised until March 2014, it has facilitated the spread to other neighbouring countries such as Sierra Leone, Liberia, and Nigeria [23]. On August 8, 2014, EVD was declared by the World Health Organization as a Public Health Emergency worldwide [24]. To adequately contain EVD, a package of interventions such as case management, contact tracing, surveillance, social mobilization as well as communication is highly essential [25]. Other key aspects of the interventions that can lead to successful control of EVD are appropriate coordination and communication across the intervention strategy, as well as early detection and quick response [26].

The WHO [27] has recently described EVD as a lethal virus and also referred to it as Marburg Virus Disease (MVD) which has usually become a global public health issue requiring emergency response since the discovery. [28; 29].

The Guinea Ministry of Health on March 21, 2014, reported an outbreak of an illness with symptoms such as fever, vomiting, severe diarrhoea, and a huge case fatality rate of 59% among forty-nine people [30]. A laboratory investigation was conducted on the specimen of some people in Institute Pasteur in Lyon, France and 15 out of 20 people were positive for Ebola virus [31]. The outbreak became the largest ever by June 2014 with the total reported confirmed, probable and suspected cases of 528 with a total of 337 death cases reported in three countries [32].

The WHO's report shows that health workers are one the most hugely affected group of persons. A review of recorded cases of EVD for 44 years since 1967-2011 shows that out of 2, 870 cases noted about 270 (9%) were health workers [33]. Filoviridae virus has been implicated in the growing category that gives rise to EVD [34]. The five different strands that have been identified as the cause of the recent outbreak are Reston, Bundibugyo, Zaire, Marburg and Sudan [35]. The estimated case fatality was between 25%-90% and has escalated through human-human transmission [36]. Interestingly, the origin of filovirus family is not from person-person infection, and the WHO stated that the natural habitat of filovirus is pteropodidae that is the family of fruit bats whose origin is Africa [37, 38]. Increasingly, there is so much information on the spread

of Ebola and its management, however given the critical and pathological nature of the virus, there is an urgent need for continued spread of health education on control strategy that could help further in strengthening the prevention and management of the future outbreak. Thus, this article would attempt to share Nigeria experience in handling the outbreak of the scourge as the only African country that was declared EVD free by WHO. Furthermore, it is also very pertinent to state very clearly that the present review on the Ebola outbreak in Sub-Sahara Africa was limited to 2014 outbreak to February 2015 only as the primary focus of the study. Thus underpinning the lessons learned from Nigeria episode and the intervention strategy deployed to curtail the spread also remains critical hallmark of information to share among stakeholders and health professionals. In most cases, Ebola virus would be referred to EVD in the body of work of this essay for clarity purposes.

Characteristics of Ebola Virus Disease

The characteristics of EVD includes sudden onset of fever and malaise, with a headache, vomiting, diarrhoea, myalgia. In addition, 30%-50% of Ebola patients manifests with haemorrhagic fever [39d]. Following a complicated case of EVD is multiple organ dysfunctions such as kidney failure, hepatic damage, renal failure, failure of the central nervous system and death [40]. The route of transmission is initially from contact with an infected wild animal and then person to person via contact with infected person's body fluid such as urine, sweat, and blood [41]. The virus has between 2-21 days as the incubation period [42, 43; 44a]. Its diagnosis can be made by detecting in the blood of suspected person the presence of the virus RNA [45]. However, there is no known cure for EVD at the moment as the present treatment is purely supportive by giving the volume of electrolytes with intravenous and oral nutrition [46; 47]. Other essential aspects of care for EVD patients are the management of associated infections such as malaria and typhoid [48].

Epidemiology

Studies uncovered that the initial case of filovirus haemorrhagic fever was first documented in the late 1960s in nonhuman primates that were moved to Germany for the overall goal of vaccine production [49, 50] to save a life. It was also reported that even workers who came in contact with the nonhuman primate who were working in the vaccine production establishment also came down with the infection [51]. The Ebola virus was named after Ebola River, which is a tributary of the Congo River in 1976; it was reported that these was the first point where the modern history of Ebola infection case was identified and documented respectively [52].

The World Health Organization's report as at 27th February 2015 shows a clinically compatible Ebola virus disease cases (CCC) of 23, 729, and this include 9,604 death cases associated with the EVD in West Africa [53]. However, the WHO speculates that the number of death cases and the true impact of EVD outbreak are underrepresented. Minor cases of EVD has been reported in the UK, US, Mali, Nigeria, Senegal, and Spain while significant cases have been reported in Liberia, Guinea, and Sierra Leone [54]. Moreover, a total of 23, 694 CCC has been reported by the WHO [55] as at 22 February 2015 for Guinea, Sierra Leone and Liberia (See Table 1). The recent report given by

the WHO on the major parameters (new cases, EVD deaths, and unsafe burials) indicates that there is an improvement in the management of EVD. In the first two weeks of February 2015 the WHO [56] reported a decrease in a number of new cases that was a total of 99 cases. This implies that significant and sustained efforts have to be employed to reduce the incidence of EVD in West Africa. While the number of reported new cases are highest in Sierra Leone (63, 63%), that of Guinea (new cases; 35%) remains an issue due to the inconsistency in reported incidence [57].

Table1: WHO report on confirmed cases of Ebola infection and death in West African Countries

Country	Case definition	Cumulative cases	Confirmed cases in past 1 month	Cumulative deaths	Case fatality rate (hospitalized patients)	Health care workers cases of deaths
Guinea	Confirmed	2,762	152	1,704	^	^
	Probable	387	*	387	^	^
	Suspected	6	*	^	^	^
	All	3,155	152	2,091	66%¹	170 (89)
Liberia	Confirmed	3,153	10	^	^	^
	Probable	1,888	*	^	^	^
	Suspected	4,197	*	^	^	^
	All	9,238	10	4,037	54%	372 (180)
Sierra Leone	Confirmed	8,289	235	3,095	^	^
	Probable	287	*	208	^	^
	Suspected	2,725	*	158	^	^
	All	11,301	235	3,461	64%	295 (221)
Total		23, 694	397	9, 589	Average 61%	837 (490)

Data from WHO, 2015

Guinea

A total of 3, 155 CCC was reported in Guinea as at 22 February 2015 with an additional 2, 091 death cases [58]. The report shows a decrease in the number of new cases between the first (52) and second (35) week of February 2015. Although, this indicates an improvement in the epidemiology of EVD for Guinea, there have been inconsistencies in the case number within the country. Six territories reported that confirmed cases were recorded in a week before the first week of February 2015 with the majority of cases (33) coming from the western part of the country. A high transmission rate was recorded for Forecariah a town near the Sierra Leone border with added confirmed new cases of 16. In Conakry and Coyah, there has been active transmission in the neighbouring territories with new confirmed cases of 6 and 8 correspondingly in the second week of February 2015. However, there have been no new confirmed cases in some other territories not mentioned since February 2015 [59].

Liberia

In Liberia, a total of 9, 238 newly confirmed cases and 4, 037 deaths were recorded as at February 22, 2015 [60]. With only one confirmed new case in the first three weeks of February 2015, there is an indication that the National incidence level is on the decrease. In Margibi, it was only one new case report since the second week of January 2015. However, there was a multiple media report of disease resurgence with a confirmed single new case in Margibi County. Although, there is an indication that the incidence of EVD in Liberia is on the decrease at the moment, the porous nature of the country's border depicts exposure to the risk of further outbreaks until West Africa becomes free of EVD [61].

Sierra Leone

According to the World Health Organization [62] the highest rate of new cases of EVD has been reported in Sierra Leone. A total of 11, 301 CCC with death cases of 3, 461 have been reported in Sierra Leone as at February 22, 2015. However, making a comparison between the second weeks of February, which recorded 63 confirmed new cases and the first

week that recorded 96 confirmed new cases, there is an indication depicting a decrease in the number of new cases in Sierra Leone [63]. Moreover, since January 2015 Sierra Leone has experienced a relative stability of 60-100 new cases per week, although with a report of a countrywide spread of EVD [64]. Eight out of fourteen districts within the country now recorded confirmed new cases in February 2015 [65]. There have been persistent new cases within various districts of the country

Pathogenesis and Viral Transmission

The incubation period of Ebola virus varies from time to time depending on the type of exposure that was involved. It ranges between six days for percutaneous and ten days for contact exposure [66, 67]. WHO Ebola response teams study group documented that the mean incubation time lag was 11.4 day, these do not vary by country to country, hence sequel to viral transmission, the signs and symptom often manifest in eight to ten days approximately (2-21 days) [68]. The dendritic cells and macrophages are the first line of body defensive mechanisms that are being attacked following the penetration of Ebola virus into the body system. The rapid proliferation of the virus within the cells is being observed, releasing several new copies into the extracellular fluid [69, 70]. The increase of the viral load in the body is being promoted by the widespread of the viral particle into the regional lymph node and vascular tissues [71]. Following these actions subsequently, a systemic inflammatory body response is initiated which triggers the release of chemokine and cytokine release from the infected microphages and other incidental vital cells [72]. The attack on the macrophages by the virus also promotes the coagulation defects attributable from the synthesis of the cell surface tissue factor from the viral infected cells and macrophages.

On transmission, fruit bats are incriminated to be the primary reservoir host of filovirus and have confounding attributable evidence to viral transmission to both man and nonhuman primates [73]. Evidence-based report from Centre for Disease Control (CDC) reveals that the mode of transmission of Ebola virus includes coming into contact with contaminated objects like needles and playing with infected animals, their body fluids such as blood or eating uncooked bush meat. Also coming in contact with a person who is infected, even as the body fluids are also a risk factor that could promote the rapid spread of the virus in a particular environment [74].

Laboratory Diagnosis of Ebola Virus

The diagnosis of Ebola Virus involves physical, clinical examination diagnosis and laboratory assay for the confirmation of the pathogen in a clinical sample. Quick physical and clinical diagnosis could be

made on a patient who is presenting some haematological symptom outcome such as the bleeding from the nose, gum, reproductive orifice and venepuncture bleeding sites. However, the haematological parameters of infected subjects are seen to be in disorder. Hence, the presentation of elevated transaminase, prothrombin, thromboplastin and proteinuria are always in disarray in critical conditions [75]. Nonetheless, confirmation of the viral antigens or RNA could be assayed in body fluids such as in blood, CSF and other body fluids. The assay of this viral particle could be achieved in a specialised laboratory that will obviously be a great challenge for the developing countries with limited resources allocated to the health sector. The detection of the RNA sequence could be obtained by reverse-transcription polymerase chain (RT-PCR) reaction or viral antigen by an enzyme-linked immunosorbent assay (ELISA) which could reveal the present of the antigen between three – ten days interval of the onset of the symptoms [76]. However, pretty very soon, it is believed that there would be an emergence of different kind of rapid diagnostic methods in the market that would help for efficient and prompt detection of the viral antigens in a sample. Furthermore, continuous training and re-training of laboratory personnel's at all-time remains critical as these will ultimately enhance their skills and also increase the accuracy, specificity and reliability of the results produced, especially in the epidemic-prone regions. However, providing adequate quality control strategy of the kits and storing them in the safe and optimal ambient temperature would be helpful in reducing the incidence of false positive or negative results in our communities.

Surveillance

The importance of prompt surveillance as a reliable tool in public health in the prevention of the spread of infections cannot be over emphasized. Thus, active surveillance approach that entails systemic collection of data, analysis, interpretation and prompt dissemination of such information to health officials that is in charge of prevention of infection spread will be helpful [77]. In the case of Ebola, health officials should monitor, collect data on vital sign and clinical symptoms that will lead to early control of the outbreak [78]. This is important in the case of high density populated cities which may likely increase human to human contact as a risk factor for Ebola outbreak [79]. However, funds should be provided for interdisciplinary surveillance responses that will promote the detection of early warning capabilities [80]. Also, the use of quarantine and isolation mechanism approach has been helpful in keeping close surveillance of an environment to reduce epidemic spread [81].

Isolation and quarantine

This is another important mechanism or strategy in public health and social medicine that is geared towards prevention and control of the spontaneous spread of infectious diseases such as Ebola and SARS outbreak. The ultimate goal is to reduce the spread of the epidemic through the reduction of human exposure and contact with the infected objects. The word isolation in the epidemiological strategy of infectious disease control entails the restriction of an infected person especially at the time and up peak of their communicability. While quarantine by definition covers a disease prevention procedure in which a supposedly healthy individual that are apparently exposed to any communicable infection undergoes a period of close observation, the overall aim is to prevent the disease from spreading during the incubation period [82; 83] and protect the public health from being compromised. Increasingly, the use of quarantine is becoming more controversial and has been seen as unfair and unjust measures that tend to be hinged on the freedom of movement of the person concerned. Thus, there is a clash and conflict of interest between protection of public health and personal liberty which is an integral part of human right (freedom). The use of isolation and quarantine strategy is mostly used in seaport of some countries far back as a means of controlling the spread of an infectious epidemic [84].

Countries with initial case (s)

Nigeria, Mali, Senegal, Spain, UK, and the United States have experienced initial reported case or cases of Ebola virus. In Nigeria, there were 20 cases with 8 deaths while there was one case of one death in Senegal [85]. However, with no further cases of Ebola virus in both Nigeria and Senegal, the World Health Organization had declared them free of Ebola virus on 17th and 19th October 2014 respectively [86]. The first case of EVD was reported in Mali on 23 October 2014 which later died on 24th October the same year [87]. On the 19th of October, a single case that was identified in Spain tested negative on the investigation and a second negative case was equally reported on 21st October the same year. However, since then Spain has been declared free of Ebola virus.

Ebola cases outside of Africa

Ebola cases have been reported in about six countries outside of Africa since December 2013. Ebola cases have been reported in the UK, US, Spain, etc. [88]. On December 29, 2014, a confirmed case of EVD was reported by the Scottish government [89]. This was an imported case of a health worker who returned from Sierra Leone. The patient was consequently transferred to London from Glasgow and following the investigation she tested negative to EVD on 23 January 2015 and was discharged from hospital on the 24th of January 2015 [90]. Following the completion of 21-day

follow-up by all contacts under investigation in the UK and with no new confirmed cases. UK was declared Ebola free on March 6, 2015 [91]. However, the risk of Ebola outbreak is currently considered to be low. It is expected that the risk of transmission within the UK remains low due to the various mechanisms of its prevention and control mechanism already put in place to contain any unprecedented outbreak.

Control and management of the current spread

Efforts in various forms have been put towards the control and prevention of EVD both in West African and other countries affected by its spread. The Ministries of Health of Liberia, Nigeria, Sierra Leone, and Guinea, with assistance from the World Health Organization, United Nations, including Centre for Disease Control sent their teams and representatives to the various countries affected by Ebola spread to offer treatment to patients and interrupt the transmission of Ebola virus. In March 2014 teams from the CDC travelled to some African countries to assist their respective Health Ministries in the control and prevention of EVD as part of their Global Outbreak Alert and Response Network [92]. These Agencies have tackled the EVD through the generation of case reports, conducting interviews with patients and their families, coordinating contact tracing and data collection as well as data centralization [93].

The various cases experienced are categorized into one of the following categories of case definitions; suspected, probable or confirmed cases [94]. These are translated as alive or dead person or animal with fever and three major symptoms as suspected case, persons that meet the suspected case definition and are closely linked to a confirmed or probable case as probable and suspected cases that have been confirmed through laboratory investigation [95]. In order to achieve a success in the campaign to prevent the spread of EVD, the communities and country leaders were equally involved to enable them mobilize their subjects, which also reduce fear among community members. The cooperation of various leaders also allows health workers to be able to care for the affected persons in the designated treatment centres and to conduct thorough contact tracing of subjects suspected to be infected [96]. The World Health Organization in June 2014 requested for extra support from CDC and other partners through their Global Outbreak Alert and Response Network [97]. This made it necessary for the WHO to deploy additional staff members to the affected countries to help in the coordination efforts targeted at prevention and control of EVD transmission. Extra support and assistance were equally sought from neighbouring nations, as well as high-level regional and international coordination to increase response efforts to end the outbreak and transmission process.

In the United States, outbreak of the virus in July 2014 aggravated emergency response and preparedness to breach its transmission by the Department of Health and Mental Hygiene (DOHMH). The DOHMH in partnership with local hospitals, clinicians, NGOs and other groups established a surveillance and management system around Ebola transmission [98]. Efforts of DOHMH was geared towards contact tracing for suspected cases, rapid response to patients in hospitals, implementation of infection control techniques, and emergency transportation of confirmed cases to designated hospitals and centres. Following the CDC alert about Ebola, enhanced planning started in the US.

Regarding the safe and dignified burial of persons dying of Ebola, special task forces have established in various countries of active transmission [99]. These are made up of trained members specifically on the safe handling of dead bodies in the communities/countries. The Ebola Communication Network was launched on October 8, 2014. This is agency constituted by the joint efforts of the United States CDC, UNICEF, USAID, and IFRC, WHO to enable the countries to implement the current health communication programmes [100].

Discussion and lessons learned from Nigerian Epidemic outbreak

Given the report above, the author wishes to assert that EVD has got some public health implication that requires more aggressive effort for its management. From the report, there is an indication that while the outbreak has been contained in some countries of the World, it has not been adequately managed in some other countries such as Liberia, Sierra Leone and Guinea. The report has shown a progressive movement of the disease regarding its spread. The available report shows that the presence of EVD in some countries of the World is an indication that more outbreak is expected in any part of the World, and this implies that more negative effect on the economy is anticipated as well [101].

The WHO [102] defined social determinant as the condition in which people are born, live, the kind of environment they grow up and work. In the case of EVD, significant numbers of health workers were infected of which some had died [103]. This implies that there is a direct association between one's chance of contracting EVD and the type of work they do. Health workers such as Bio-scientist, doctors and nurses among others constitute the most vulnerable group of individuals that are likely to be infected [104]. Also, the spread of EVD can be influenced by the living condition of the people. Considering the clustered settlement patterns and poor living conditions of some African countries [105], with the onward spread of

EVD one can deduce that there is a close relationship between EVD and peoples' living condition [106]. Cultural practices and traditional beliefs are other significant determinants that influence the spread of EVD [107; 108]. The author believed that the way burial ceremonies are being performed in some parts of Africa demands that corpses are touched and even bathed which can lead to further spread of other public health diseases. The current outbreak of EVD has resulted in unemployment, lack of food, and deaths that are some key determinants of health [109].

Furthermore, using Nigeria as a context and as the only country in West Africa that has been able to contain EVD outbreak, available literature has shown the key strategies that were employed in the fight against EVD. The Nigerian government adopted social mobilization approach involving the collaboration with communities and engaging them within a model called an Emergency Operation Centre (EOC) [110]. Through community engagement, Nigeria was able to achieve proper contact tracing, case management, and safe burial and social mobilization [111]. The first case of Ebola in Nigeria was encountered through the arrival of Patrick Sawyer on 24th July 2014 [112]. An acutely ill traveller Patrick Sawyer arrived in Lagos from Liberia and was confirmed on admission into a private hospital in Lagos and later died on 25th July 2014 [113]. With this as the index case, over 72 persons were suspected to have been exposed both at the airport and at the hospital. Noticing this, the Nigerian government through the Federal Ministry of Health and with guidance from the Nigerian Centre for Disease Control (NCDC) immediately declared an Ebola emergency [114] (FMOHN). A highly significant initial step taken was the vigilance of the Nigeria aviation health authority that identified this index case. This was immediately followed by the approval of fund amounting to 11.5 million US dollars as a special intervention fund to prevent the further spread of Ebola within the country [115]. The Government of Lagos State, Nigeria in support of this plan approved an additional 1.2 million US dollars for this emergency operation. The various state governments in close collaboration with the NCDC, WHO, UNICEF, USCDC and Medicines Sans Frontiers established Emergency Operation Centres in Lagos and Rivers State respectively [116]. These groups worked with the airport authority to trace and track down all suspected cases [117]. Airports and flights, as well as other suspected places were decontaminated. Screening centres were established at various entry and exit points. Manifests and phone records were used by health care workers to track down over 800 persons who were suspected to have come in contact with infected individuals [118]. Isolated persons were monitored for 21 days and those who were confirmed free were discharged [119].

In support of these initiatives, other various state governments established an emergency responses and coordination in readiness for the potential outbreak [120]. Additional efforts in combating the outbreak include placing embargo on transportation of corpses within and outside the country, the establishment of Ebola Treatment and Research Group [121]. Training and retraining of health care workers on the use of PPE, and closure of schools was also very helpful [122]. The involvement of the private sector and spirited individuals in the health education awareness campaign and screening/scanning of the temperature of every customer that enters into their business premises was very helpful. Even as banks, public eatery places and supermarkets in Nigeria were involved in scanning the temperature of their customer before they were allowed in after due consent was obtained. Those that had a temperature more than the normal temperature of 37°C were booked and subsequently referred to Ebola operation centre for further detailed diagnosis and investigation. The cooperation of all and sundry were commendable, infect it should be mentioned at this junction that the verse majority of Nigerian population that had access to mobile cell phone was a huge boost that promoted effective and prompt dissemination of information. Even the use of social media was helpful in promoting health education of the epidemiology and preventive approach towards reducing the outbreak through contact.

The increasing burden of Ebola infection has continued to escalate in West Africa, it is probably believed that some of the preventable factors that has encouraged the sporadic spread of the virus includes poor water for drinking and domestic use, poor waste management strategy [123], underdeveloped health care facility and poor management and leadership encapsulated by corruption, visible degree of international complacency [124]. The movement of people from rural to urban areas, cultural belief, poverty [125]. Weakness and lack of responsibility from the local, regional and global health intervention agencies [126, 127,128] were some of the factors that have promoted the outbreak in the Sub-Sahara Africa which is now becoming a global health threat. The shorted of medical personal in West African region has continued to worsen the burden[129], for instance, it was reported that before the outbreak only a 100 qualified medical doctors were attending to 4.3 million vulnerable subjects in Liberia[130]. Suffice to state very clearly with empirical evidence that huge number of health workers were seriously infected while trying to save life of those who were infected. Hence over 100 health care workers were reported dead as at late August 2014 while trying to save life. What a tragedy as this scenario has continued to critically worsened the health situation in the affected areas [131,132]. Furthermore, other

factors were that the global response to the current trend in the affected West African region was not prompt and unplanned. Also, poor financial commitment and very weak implementation policy that lack sense of focus from the beginning were also some of the visible factors that tend to encourage the widespread of Ebola virus outbreak in Sub-Sahara Africa. Though Nigeria was able to contain the initial outbreak through prompt and well-organised community mobilisation strategy backed up with health education awareness campaign that engaged all and sundry. it is believed that Nigerian approach should be adopted and replicated in some other African countries where Ebola outbreak has remains a great health challenge though there may be slight variation due to cultural and financial disposition of countries involved.

Conclusion and Smart Recommendations

The investigation reveals major facts about the current Ebola outbreak in the world particularly in Africa. However, from the information reported above, other countries outside Guinea, Liberia, and Sierra Leone can be said to have effectively contained the spread of Ebola virus. Moreover, with Nigeria, UK, US, Spain, and Mali already declared Ebola-free by the World Health Organization, one can say that a huge success has been achieved in the fight against Ebola spread around the world [133]. Nonetheless, available information shows that there are significant cases of Ebola in Guinea, Liberia, and Sierra Leone, which has been attributed to several factors such as porous borders, lack or poor health infrastructures as well as mistrust and resistance by countries or communities [135]. A continuous and close monitoring of Ebola epidemic is therefore recommended to guide control interventions in the affected countries and regions. Furthermore, sustained and renewal of measures and countermeasures aimed at tackling the outbreak should be consolidated by health organisations, NGOs, governments as well as international health agencies. Besides, as long as EVD is still in existence in some countries of the world, the world is still at risk of another round of experiencing EVD circulation around its borders. Other countries of world must continue with sustained surveillance at entry points such as airports, seaports, and on land. Treatment of active cases within the designated health facilities must be sustained. Health facilities must be properly equipped with personal protective equipment and individuals working in those areas should adequately protect themselves to avoid further spread. Nigeria was able to contain the outbreak due to purposeful and coordinated well-focused approach that was well sustained by strong political will and commitment by the federal government of Nigeria.

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