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Ebola haemorrhagic fever in africa: a necessary highlight

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ABSTRACT

The purpose of this commentary is to re-evaluate the historic and scientific facts on Ebola haemorrhagic fever and the role of the international community, especially Economic Community of West African States (ECOWAS) in stemming the tide. It rehashes the argument on causes and prevention and draws attention of readers to emphasize the need for establishment of airport, sea port and border health posts with well drilled and efficient health professionals to be able to test, detect and quarantine persons with Ebola and treat them to prevent the spread of the disease from infected persons to primary or first contacts and secondary contacts. Significantly, countries in the West African sub-region are alarmed by the potential spread of the disease to countries that have hitherto been free of the disease. The potential global threat of the disease has been analysed and measures to be taken by countries within the West-African sub-region have been emphasized. This notwithstanding, does the declaration of countries as Ebola-free suggest the last of it.

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1. INTRODUCTION

Ebola Haemorrhagic Fever (EHF), commonly known as Ebola Virus Disease (EVD) is known to be one of the numerous Viral Haemorrhagic Fevers (VHF). It is a severe, often fatal disease in humans and nonhumans such as monkeys, gorillas, and chimpanzees. Ebola Virus Disease (EVD) has been proven to be caused by the infection of a virus in the family of *Filoviridae* and genus of *Ebolavirus*. It has been noted that when an infection occurs, symptoms mostly begin shortly [1] (Centres for Disease Control and Infection, accessed; March 2015). The first *Ebola virus* species was discovered in 1976 in what is now the Democratic Republic of Congo near the Ebola River. Since then, outbreaks have appeared sporadically [1].

There are five identified subspecies of *Ebolavirus*. Four of the five have caused diseases in humans: Ebola virus (*Zaire ebolavirus*); Sudan virus (*Sudan ebolavirus*); Taï Forest virus (*Taï Forest ebolavirus*, formerly *Côte d'Ivoire ebolavirus*); and Bundibugyo virus (*Bundibugyo ebolavirus*). The fifth, Reston virus (*Reston ebolavirus*), has caused disease in nonhuman primates, but not in humans. The natural reservoir hosts of Ebola viruses remain unknown. However, on the basis of available evidence and the nature of similar viruses, researchers believe that the virus is zoonotic (animal-borne) with bats being the most likely reservoir. Four of the five subtypes occur in animal hosts native to Africa. It has been scientifically postulated that a host of similar species are associated with Reston virus, which was isolated from infected cynomolgous monkeys imported to the United States and Italy from the Philippines. Several workers in the Philippines and in the US holding facility outbreaks became infected with the virus, but did not become ill [1].

EVD is a severe, often-fatal disease caused by infection with a species of Ebola virus. Although the disease is rare, it can spread from person to person, especially among health care staff and other people who have close contact with an infected person as expressly seen in the 2014 outbreak in Guinea, Sierra Leone,

Liberia and Nigeria. Ebola is spread through direct contact with blood or body fluids (such as saliva or urine) of an infected person or animal or through contact with objects that have been contaminated with the blood or other body fluids of an infected person. The likelihood of contracting Ebola is extremely low unless a person has direct contact with the body fluids of a person or animal that is infected and showing symptoms. Close contact is defined as having cared for or lived with a person with the disease or having a high likelihood of direct contact with blood or body fluids of an Ebola patient. Close contact does not include walking by a person or briefly sitting across a room from a person. The scientific argument is that fever in a person who has travelled to or lived in an area where Ebola is present is likely to be caused by a more common infectious disease, but the person would need to be evaluated by a health care provider to be sure whether it is Ebola or other common fever. Again, the scientific evidence points to an incubation period, from exposure to when signs or symptoms appear. This ranges from two (2) to twenty-one (21) days. Early symptoms include sudden fever, severe headaches, and muscle aches. Around the fifth day, a skin rash can occur. Nausea, vomiting, chest or abdominal pain, and diarrhoea may follow. Symptoms can become increasingly severe and may include difficulty in breathing or swallowing, bleeding inside and outside the body, and multi-organ failure. It is essential to point out that the dangers associated with the diseases calls for a continuous education of citizens of satets in Africa and West-Africa in particular. The need for the behaviorial sciences to highlight the research in the field would have the tendency or the proclivity to accentuate the gains made thus far. A continuos inquiry toward this end can therefore not be gainsaid.

Significantly, the 2014 EVD scourge in countries like Guinea, Liberia, Sierra Leone and Nigeria necessitated medical interventions, scientific research in the area of drugs and testing among others. Also of primary importance is the scare it sent to Africa and the global village which further necessitated institutional actions from independent groups and supra regional political organizations like ECOWAS. It shall remain expedient to continue the commentary and the discourse; perhaps, we might see the last of it. By highlighting key knowledge of filoviral HF, this paper will help medical workers plan basic clinical studies in future outbreaks, devise efficient record-keeping mechanisms, and prepare their findings for publication. In addition to providing a concise summary of information useful to clinicians and researchers, this perspective piece can also serve as a guide to the filovirus clinical literature, which varies greatly in the quantity and quality of data in the various case reports and descriptions of outbreaks. It also has the tendency to encourage positive public action toward the prevention and mitigation of the spread of the disease in the foreseeable future.

However, of seminal importance to this discourse are the efforts of the WHO, ECOWAS and other external orginations as well as the efforts of the respective governments and local authorities. The narrative has been that which emphasizes public health and or post-colonial public health strategies to deal with the burgeoning questions of public health that dovetails into present efforts to deal with the Ebola question. Whereas the post-colonial public health literature aims at discarding the efforts of institutions of formal colonizers, there is still the need to re-evaluate the collective efforts of these institutions in line with the efforts of WHO, ECOWAS, laboritarians, medical doctors and general staff in hospitals of affected countries, local authorities as well as the governments of the countries which were affected by the Ebola outbreak within the period under review.

2. RESEARCH METHOD

This paper is based on secondary data. Research findings and publications of scientists in the field of medicine, especially those whose research have focused on Ebola since the first outbreak of the disease in 1976, responses of ECOWAS and lessons going forward. In this article, I highlight key information found in more than forty journal articles, two books published after the 1967 outbreak of Marburg HF in Germany and Yugoslavia; and the 1976 epidemics of Ebola HF in Zaire and Sudan. I also consider published compendium of the filovirus literature: Martini G. A., 1971; 1978; Kuhn J. H., 2008, among others. I focus on the objective physical features of the disease caused by Marburg virus and by species of Ebola virus. It does not discuss Ebola Reston virus, which is not known to have caused disease in humans. It is argued that at the time of the research it had not seen much report and did not describe the phenomenon of “asymptomatic” infection in close contacts of Ebola HF patients [2]. Reports from some agencies that played a role in fighting, informing and educating Africans and the world at large have been studied. Information gleaned from these sources have been pieced together to form a systematic narrative on the disease. This commentary has been grouped into themes. They include the incubation period and physical examination, laboratory tests, typical case, disease update in 2014, guidelines, some efforts by international organizations including ECOWAS and conclusion.

3. RESULTS AND ANALYSIS

3.1. The science of ebola: incubation period and physical examination

The most reliable information on the incubation period of Ebola has been obtained from situations in which a single well-defined event, such as a laboratory accident, contact with an infected animal, or exposure in a hospital, has occurred. This notwithstanding, the 2014 outbreak in countries like Guinea, Liberia, Sierra Leone and Nigeria which recorded great number of mortality has given the world scientists and laboratarians ample specimen. [3-4] The incubation period after a needle stick injury with Ebola Sudan virus was six days and it was seven days for a similar exposure to Ebola Zaire virus. Again, Formenty P. et al stressed that an ethologist who performed a necropsy on a dead chimpanzee in Côte D'Ivoire became ill eight days later. Also, two tourists who were exposed to bats while visiting the same cave in Uganda developed Marburg HF; one ten days and the other thirteen days later [5].

During the first Marburg outbreak, incubation periods for infections resulting from well-defined exposures ranged from five to nine days, while outbreaks of Ebola Zaire HF have varied from 3 to 12 days [6]. Generally, these reports showed a trend of 3 to 13 days for the incubation period. All available reports agreed that Marburg and Ebola HF patients become ill abruptly with a variety of nonspecific signs and symptoms, including fever, chills, fatigue, headache, myalgia, nausea, vomiting, and diarrhoea. As a result of the earlier nonspecific nature of these findings, physicians in sub–Saharan Africa generally assumed that a febrile patient sufferred from malaria, typhoid fever, or other illness common to the region. Filoviral HF is usually not suspected until a rash or haemorrhage is noted or person-to-person transmission, especially among doctors and nurses, has occurred. Research findings from different scientists suggest that elevated body temperature is a characteristic feature of filoviral HF [3-5, 7-13].

Also, the scientists and the laboratarians postulate that temperatures of 39°C to 40°C early in the course of the disease are mostly observed. The progression of fever over time has been displayed graphically in several articles [4, 6-8, 10, 14-16]. Wide swings in body temperature during the course of illness, which drops to below normal, have been described [3, 7, 9, 16]. Despite the utility of the blood pressure as a basic measure of cardiovascular status, the literature posit that actual values are mentioned in only a handful of reports, typically when a patient is first examined and the hemodynamic parameters are normal [4, 8-9, 12]. It is also reported that fatally infected patients are known to proceed through hypotension and shock to death, but blood pressure data during the course of illness have rarely been reported [4, 12-13, 17-19]. It is further reported that it is only in the case of a nurse in South Africa who became fatally infected with Ebola Zaire virus during patient care had data obtained through Swann-Ganz catheterization reported [19]. However, the published findings covered only day 18 of illness (which was five days before death) when the pulmonary artery occlusion pressure was 22 mm Hg and the left ventricular stroke work index and systemic vascular resistance were low.

Although it has been argued that heart rates have rarely been included in case reports, some authors have noted that a pulse–temperature dissociation (relative bradycardia) is a common finding early in the course of filoviral HF [3-4, 6, 8, 12, 14, 17, 20]. The literature posits that as the illness progresses, patients may become tachycardic, with rates as high as 120–140 beats/min, especially late in the course of the disease. Regarding the first Marburg outbreak, Martini commented that tachycardia corresponding to the height of temperature was only found in fatal cases [6]. Different authors have also argued that, the respiratory rate is the vital sign least frequently documented in clinical reports [4, 8-9, 18]. As reported, in two cases, patients had rates of 24 and 20 breaths/min, respectively, on days 4 and 5 of illness [8-9]. The two cases were febrile, and the first had an elevated pulse of 100 beats/min. Another individual whose condition was described as "extremely grave" on day 13 of illness had respiratory rates of 32–36/min when supine and 40/min when standing, with a pulse of 108 beats/min and blood pressure 90/60mmHg [8]. Accounts of the 1995 Ebola Zaire outbreak noted that tachypnea was present in 31 of 84 non-survivors, but none was found in the 19 survivors [13, 18].

Several descriptions of Marburg or Ebola HF note the development of rashes early in the course of illness. In a number of outbreak reports, a rash was seen in 25%–52% of individuals [3-10, 12-14, 16-24]. It is frequently described as being non-pruritic, erythematous, and maculopapular, sometimes beginning focally, and then become diffused, generalized, and confluent. Others have described it as morbilliform– measles-like [14, 22] or scarletinoid [7]. The rash may be difficult to discern in dark-skinned individuals. The most reliable diagnostic sign was a characteristic rash. It began between the fifth and seventh day at the buttocks, trunk, and outside of both upper arms as a distinctly marked, pin-sized red papula around the hair roots. This stage lasted up to 24 hours and developed into a macular, papular, sharply delineated lesion which later coalesced into a more diffused rash [6].

As reported by the literature, patients with filoviral HF often develop multiple foci of mucosal hemorrhage, most evident in the conjunctiva, together with easy bruising and persistent bleeding from injection or venepuncture sites. However, haemorrhage is not seen in all patients, and massive bleeding is

usually observed only in fatal cases when it is typically localized to the gastrointestinal tract. Other abnormalities on physical examination of patients with filoviral HF that have been mentioned frequently in case descriptions or outbreak reports include pharyngeal erythema with a complaint of sore throat, enlarged lymph nodes, tender hepatomegaly with the edge of the liver below the ribcage, abdominal pain and tenderness to palpation [6-9, 13, 18-20, 22, 25-27].

3.2. Ascertaining

The literature posits that haemoglobin and haematocrit indices are rarely mentioned and have been recorded over the course of illness for only two patients. In the first case, no haemorrhage was described, and only a minor, transient decrease in haemoglobin and haematocrit was seen [16]. The other patient bled from injection sites, developed a haemorrhagic rash, and had a progressive decline in haemoglobin [16]. The literature argues among others that patients with filoviral HF typically are leukopenia at the time of clinical presentation, with an abnormally low number of lymphocytes and an increased percentage of granulocytes [6, 9, 16, 19]. As the disease progresses, the total leukocyte count rises above normal, with an increase in immature granulocytes and the appearance of numerous atypical lymphocytes. In fatal cases, leukocytosis persists through to death. Also, thrombocytopenia is a constant feature of filoviral HF; it is present either at the time of clinical presentation or develops early in the course of illness In severely ill patients, the platelet count continues to decline, and in fatal cases it remains low until death [6, 9, 16, 19, 27].

Again, elevated serum levels of alanine and aspartate aminotransferase (ALT, AST) are a common feature of Marburg and Ebola HF [4, 6-10, 14, 16, 19, 21]. However, peak serum concentrations of these enzymes are usually much lower than those seen in infections by viruses such as hepatitis A or B or yellow fever. In all but one report, the AST is higher than the ALT [8]. The serum alkaline phosphatase level, when reported, has been either normal or elevated, while the lactate dehydrogenase and gamma-glutamyltransferase concentrations were elevated in the few instances when they were measured [4, 6, 16, 19, 21]. The serum total bilirubin level was mentioned in only four reports in which it was either normal or elevated [6, 9, 16, 28]. As noted above, jaundice is not a common feature of filoviral HF. Also, a study of 123 patients in the 2000 outbreak of Ebola Sudan HF in Uganda found that, mean AST values over the course of illness were significantly higher in fatal cases than in survivors. It is also revealed that the mean AST concentration was 7–12 times higher than the ALT in fatal cases and 2–4 times higher in nonfatal cases [4, 6, 9, 16, 19, 21].

An earlier study has shown that serum electrolyte and glucose measurements have rarely been reported. In the 1967 Marburg HF outbreak, hypokalemia was seen in 50% of patients, typically coinciding with vomiting and diarrhoea [6]. Patients in the 2000 Ebola Sudan HF outbreak showed a decline in glucose levels on days 3 to 5 of illness that persisted beyond day 8. No difference was noted between fatal and nonfatal cases [28]. In contrast, a decrease in the serum calcium level to less than 6 mg/dL was associated with fatal illness. Again, renal function is generally normal at the time of presentation or in the early phase of illness, but by the end of the first week, patients may show a progressive decline in urine output and a rise in Blood Urea Nitrogen (BUN and creatinine) [4, 8, 16-19, 21, 28]. Two papers describe oliguria that did not improve despite the administration of intravenous fluids [12, 3]. Renal failure is more common in fatal cases. Hematuria and proteinuria have also been noted. In two cases in which patients were tested frequently for proteinuria, its presence appeared to correspond with fever [3, 7]. The need for renal dialysis is mentioned in two reports [19, 21].

In addition, concerning pancreatic enzymes, a handful of articles mention pancreatitis without specifying its time course; when serum amylase concentrations are stated, they range from normal to elevated [4, 9, 16-17, 28]. Lipase levels have not been reported. Other related issues include coagulation parameters, terminal course, and duration of illness in fatal cases, convalescence, viremia and anti-body response. Several reports have described prolongation of the prothrombin time (PT), partial thromboplastin time (PTT), or bleeding time and other coagulation defects [6, 16, 19]. Patients with filoviral HF frequently meet the criteria for disseminated intravascular coagulation (DIC). In the 2000 outbreak of Ebola Sudan HF in Uganda, patients had elevated plasma levels of D-dimers, with markedly higher levels in fatal cases [28]. Reports generally state that patients dying of filoviral HF progress from prostration and obtundation to severe hypotension and shock, ending in coma [6-7, 18,22]. As noted above, few data have been published on the pulse, blood pressure, respiratory rate, and other physiological parameters during the final phase of illness. In 25 well-documented fatal cases of Marburg and Ebola HF, the majority of deaths occurred during the second week of illness, with a median survival of 9 days from onset of illness to death [4-7, 9, 12, 14, 19-20, 26, 29].

The only patient who died after day 16 suffered a terminal intracerebral haemorrhage while being treated in an intensive care unit [19]. The observation that persons who live through the second week of illness are likely to recover is consistent with a report from the 1995 Ebola Zaire HF outbreak that showed

that patients who were still alive on day 14 had more than 75% chance of survival [30]. From onset of illness to death in 25 well-documented fatal cases of Marburg and Ebola HF, the median survival is 9 days [4-7, 9, 12, 14, 19-20, 26, 29].

All descriptions of survivors of filoviral HF agree that recovery is prolonged, lasting weeks to months. Sequela of the acute illness include asthenia, weight loss, headache, dysesthesias, migratory arthralgias, sloughing of skin, loss of scalp hair, and persistent anaemia [3, 7-8, 10, 16, 18, 21, 26, 31]. In a number of instances, acute orchitis or uveitis might have developed weeks after the resolution of acute illness, and virus was detected in samples of semen or aqueous humour [3, 6, 9, 31]. During the 1967 Marburg HF outbreak, a convalescent male patient transmitted the virus to his wife, apparently through sexual intercourse [6]. Pathologic changes in fatal cases of filoviral HF are known from a few autopsies performed during the 1967 Marburg HF outbreak and in single cases and epidemics in Africa. In both Marburg and Ebola HF, the principal gross abnormality is the presence of multiple foci of haemorrhage. The most characteristic histopathologic finding is extensive hepatocellular necrosis, with eosinophilic inclusion bodies corresponding to aggregates of nucleocapsids seen by electron microscopy. The spleen and lymph nodes show a marked decrease in lymphocytes, variously described as follicular "necrosis" or "atrophy", leaving residual cellular debris. Evidence of acute tubular necrosis, consistent with hypovolemic shock, is seen in the kidneys. Other organs show scattered foci of necrosis, edema, and other nonspecific changes [22, 32-35]. As argued elsewhere, because the clinical and laboratory features of filoviral HF are nonspecific, confirmation of the diagnosis requires detection of virus in a blood sample or the demonstration of a virus-specific antibody response.

There is no evidence that persons infected with Ebola or Marburg virus are viremic during the incubation period. However, virus could be detected in blood samples on the onset of day of illness [36]. Serum levels of viral genomes, as detected by reverse transcription–polymerase chain reaction (RT-PCR), and of viral antigen, as detected by enzyme-linked immuno-sorbent assay (ELISA), increase during the first week of illness, and in fatal cases remain elevated until death [3-4, 31, 37-40]. Studies conducted during outbreaks in Gabon and Uganda found that titers of circulating viral genomes were significantly higher in fatalities than in nonfatal cases [36, 38-40]. In patients who survive infection, viremia usually becomes undetectable by the end of the second week of illness [31, 36-39]. However, infectious virus may persist in certain anatomic sites, such as the testes or the anterior chamber of the eye (see above). Also because immunofluorescence assays have a high positive background rate, the detection of antifilovirus antibodies has been based on ELISA since the 1995 Kikwit outbreak [36, 41]. Experiences during several large epidemics have shown that most fatally infected patients fail to develop an antibody response. The detection of virus-specific immunoglobin M (IgM) or G (IgG) in a serum specimen is therefore a favourable prognostic sign [31, 38]. When an IgM response occurs, it is generally detectable during the first week of illness, and peaks during the second week [36, 42]). Virus-specific IgG appears soon after the IgM. Limited reports indicate that IgG can be detected by ELISA in disease survivors for as long as 11 years [43-44].

3.3. Description of a typical case

In general, articles published before the mid-1980s provide more detailed clinical information on patients with Marburg and Ebola HF than papers which have appeared since that time. The best sources of data on the clinical and laboratory features of filoviral HF are the numerous publications describing the 1967 Marburg HF outbreaks in Germany and Yugoslavia and reports of individual cases of Marburg and Ebola Zaire virus infection treated in hospitals in Kenya and South Africa. Another case is the Ebola Côte d'Ivoire virus infection treated in Switzerland, and three accidental laboratory infections [3-4, 6-8, 10, 16-17, 19, 21, 25]. Considerable amounts of patient data were also obtained during the 2000 outbreak of Ebola Sudan HF in Uganda [28, 36, 40]. In contrast, most reports of epidemics in central Africa have provided either general descriptions of patients, summaries of signs and symptoms, or no clinical information at all. During the review of the literature, it was recorded that symptoms, such as fever, rash and thrombocytopenia, showed repeatedly in descriptions of patients with filoviral HF; these seem to have therefore been accepted as standard features of illness. In contrast, some other physical or laboratory findings were described in only one or few reports, and they could be considered to require further study or research. Although health workers responding to African epidemics have certainly monitored the pulse rate, blood pressure, and other physiological parameters of their patients, those data have unfortunately not been vigorously compiled and published [20].

Review of the published literature has shown that, although a number of features of filoviral HF are well defined, many aspects remain poorly characterized or incompletely documented. From the point of view of modern critical care medicine, the most significant gap in knowledge is the almost complete absence of the types of data that physicians have come to rely on in managing severely ill patients. These include basic parameters of cardiovascular function such as pulse, blood pressure, and urine output, and markers of

physiologic status such as the serum electrolytes, glucose, lactate, and PH. Impediments to collecting these data during past outbreaks have included their frequently remote location and limited resources and the traditional focus on outbreak control rather than patient care [11]. The hazard, real or perceived, of accidental exposure to the virus has also been a concern. In recent years, however, improved understanding of the specific modes of virus transmission and the standardization of personal protective equipment has lessened the risk to healthcare workers [11].

Also, simpler and less invasive measures have been proposed; they include the regular recording of pulse, blood pressure, fluid intake, and urine output, together with careful record keeping. It is envisaged that this would go a long way toward improving the understanding of experts towards the clinical course of filoviral HF [20]. Again, continuous laboratory studies have been found to be another useful approach to understand the pathophysiology of filoviral HF, especially in nonhuman primates, which appear to closely replicate the fatal disease seen in humans [20, 45]. As described in another article, implanted telemetry devices have been used to monitor body temperature, pulse, systolic and diastolic blood pressure, and other parameters in macaques infected with Ebola Zaire virus [20].

3.4. Disease updates on the 2014 Ebola outbreak

New cases and deaths attributable to Ebola Virus Disease (EVD) continued to be reported by the Ministries of Health in Guinea, Liberia, Nigeria, and Sierra Leone. Between 2nd and 4th August 2014, 108 new cases (laboratory-confirmed, probable, and suspect cases) of EVD and 45 deaths were reported from the four countries as follows: Guinea, 10 new cases and 5 deaths; Liberia, 48 new cases and 27 deaths; Nigeria, 5 new cases and 0 deaths; and Sierra Leone, 45 new cases and 13 deaths [46].

By 4th August 2014, the cumulative number of cases attributed to EVD in the four countries stood at 1,711, including 932 deaths. The distribution and classification of the cases as shown in Table 1 were as follows: Guinea, 495 cases (351 confirmed, 133 probable, and 11 suspected), including 363 deaths; Liberia, 516 cases (143 confirmed, 252 probable, and 121 suspected), including 282 deaths; Nigeria, 9 cases (0 confirmed, 2 probable, and 7 suspected), including one death; and Sierra Leone, 691 cases (576 confirmed, 49 probable, and 66 suspected), including 286 deaths [46].

Table 1. Confirmed, probable, and suspected cases and deaths from Ebola Virus Disease (EVD) in Guinea, Liberia, Nigeria, and Sierra Leone, as of 4 August 2014

	New	Confirmed	Probable	Suspect	Total (by Country)
Guinea					
Cases	10	351	133	11	495
Deaths	5	228	133	2	363
Liberia					
Cases	48	143	252	121	516
Deaths	27	128	110	44	282
Nigeria					
Cases	5	0	2	7	9
Deaths	0	0	1	0	1
Sierra Leone					
Cases	45	576	49	66	691
Deaths	13	247	34	5	286
Totals					
Cases	108	1070	436	205	1711
Deaths	45	603	278	51	932

New cases were reported between 2nd and 4th August 2014. The total number of cases was subject to change due to ongoing reclassification, retrospective investigation, and availability of laboratory results. Data reported in the Disease Outbreak News are based on official information reported by Ministries of Health [46].

3.4.1. Brussels/Geneva, 22nd March 2014

An outbreak of EVD in southern Guinea prompted the international medical organization, Médecins Sans Frontières (MSF), to launch an emergency response. Twenty-four MSF doctors, nurses, logisticians and hygiene and sanitation experts were deployed, while additional staff strengthened the team in the days which ensued. MSF set up an isolation unit for suspected cases in Guéckédou, in collaboration with the Ministry of Health, and did same in the town of Macenta, also in the Nzérékoré region in the south of the country. Dr Esther Sterk, the MSF tropical medicine advisor is reported to have said that “Isolation units are essential to prevent the spread of the disease, which is highly contagious”. Specialized staff provided care to patients

showing signs of infection. With the help of the local community, MSF's emergency team also focused on actively searching for people who might have been infected through contact with already identified EVD patients [46].

Within the period, MSF also sent some 33 tons of supplies to Guinea on two chartered airplanes departing from Belgium and France, which contained medicines, medical equipment and the supplies necessary for isolating patients, putting sanitation measures in place and protecting its teams. Within the earlier periods of their stay, 49 suspected cases were registered by the Ministry of Health in Guinea. Six cases were confirmed and 29 people have died**.** Essentially, the attestation of the impact of Ebola on these communities cannot be overemphasized. Also, it emphasizes the importance of these organizations that have persistently and continuously made significant interventions in the area of health and related social challenges affecting countries [46].

3.5. Analyses on reports on 2014 outbreak

The Guinean Ministry of Health, the Ministry of Health and Sanitation in Sierra Leone, the Ministry of Health and Social Welfare of Liberia, and the Nigeria Ministry of Health have been working with national and international partners to investigate and respond to the outbreak of the disease in 2014. The outbreak update since 2014 has been very alarming. It further suggests that the West-African region mostly affected were unable to easily stem the tide of the disease which has the potential to cause a world health menace.

Tropical and non-tropical epidemics have crossed the boundaries of sovereign nations. Bacteria, fungus or viral diseases with their human or animal host (in cases where it is zoonotic) has proven that when responsible and responsive actions are not taken by African governments in partnership with global organizations like the World Health Organization, the continent could live under a strange disease terror harsher than any insurgent group. Disease mutation could be harsher than the mutation of a nascent armed human guerrilla group in a particular political setting in a sovereign country. The records as of August 8, 2014 showed a certain level of gloom.

The World Health Organization, in partnership with the Ministries of Health in Guinea, Sierra Leone, Liberia, and Nigeria announced a cumulative total of 1779 suspected and confirmed cases of EVD and 961 deaths, as of August 6, 2014. Of the 1779 clinical cases, 1134 cases were laboratory-confirmed for Ebola virus infection. In Guinea, 495 cases, including 367 fatal cases and 355 laboratory confirmations were reported by the Ministry of Health of Guinea and WHO as of August 6, 2014. Active surveillance continued in Conakry, Guéckédou, Pita, Siguiri, Kourourssa, Macenta, and Nzerekore Districts. In Sierra Leone, WHO and the Ministry of Health and Sanitation reported a cumulative total of 717 suspected and confirmed cases of EVD as of August 6, 2014. Out of this number, 631 cases were laboratory-confirmed and 298 were fatal. All districts reported clinical EVD patients. Reports, investigations, and testing of suspect cases continued across the country [46].

By August 6, 2014, the Ministry of Health and Social Welfare of Liberia and WHO reported 554 clinical cases of EVD, including 148 laboratory confirmations and 294 fatal cases. Suspect and confirmed cases were reported in 9 of 13 counties. Laboratory testing was conducted in Monrovia. In Nigeria, WHO and the Nigerian Ministry of Health reported 13 suspect cases, including two fatal cases, as of August 6, 2014. The Centre for Disease Control and Prevention (CDC) was in regular communication with the Ministries of Health (MOH), WHO, MSF, and other partners regarding the outbreak. CDC had personnel in all four countries assisting the respective MOHs and the WHO-led international response to the Ebola outbreak. It seems to me, however that the debate concerning the lack of prompt response by the local people and international response seems to sometimes overshadow the discourse on the efforts as well as the gallantry displayed by the indigenous physicians who were on the frontline and died through their efforts to save their countrymen. It is quite clear from what saturates the reports on the efforts of respective institutions that there was some degree of coordination and support from within and without to deal with the scourge of the diseases in the end. What remains at this critical juncture is the question of the recurrence of the diseases whose experts are likely to remain in Europe and elsewhere in the Americas [46].

3.6. Guidelines for flights

3.6.1. Interim guidance about evd for airline crews, cleaning personnel, and cargo personnel

The prevention of EVD includes measures to avoid contact with blood and body fluids of infected individuals and with objects contaminated with these fluids (e.g., syringes) and stopping ill travelers from boarding aircrafs. People who have been exposed to Ebola virus disease should not travel on mercial airplanes until there is a period of monitoring for symptoms of illness lasting 21 days after exposure. Sick travelers should delay travel until cleared to travel by a doctor or public health authority [47].

3.6.2. Management of Ill people on aircraft if ebola virus is suspected

The following precautions have been prescribed if an ill-traveler (passenger or crew) has symptoms consistent with Ebola and was recently in a country with Ebola: keep the sick person separated from others as much as possible, provide the sick person with a surgical mask (if the sick person can tolerate wearing one) to reduce the number of droplets expelled into the air by talking, sneezing, or coughing, give tissues to a sick person who cannot tolerate a mask and provide a plastic bag for disposing of used tissues as well as the wearing of impermeable disposable gloves for direct contact with blood or other body fluids [47].

3.6.3. Universal precaution kits

Airplanes travelling to countries affected with Ebola have been encouraged to carry Universal Precaution Kits (UPK), as recommended by the International Civil Aviation Organization (ICAO), for managing ill on-board passengers [47].

3.6.4. Reporting Ill travellers

With the United States, the captain of an aircraft is required by law to report to the Centres for Disease Control and Prevention (CDC) before arrival any deaths on-boards or ill travellers who meet specified criteria. This is consistent with mandatory reporting requirements of ICAO (ICAO document 4444 of the Chicago Convention; Chapter 8, Annex 9). CDC staff can be consulted to assist in evaluating an ill traveller, provide recommendations, and answer questions about reporting requirements. However, reporting to CDC does not replace usual company procedures for in-flight medical consultation or obtaining medical assistance. CDC routinely conducts contact investigations to alert other passengers and crew of their exposure to ill travellers with certain diseases who were possibly contagious on their flight [47].

3.6.5. What to do if you think you have been exposed

Any airline crew, cleaning or a cargo personnel who thinks he could be exposed to Ebola either through travel, assisting an ill traveller, handling a contaminated object, or cleaning a contaminated aircraft should take the following precautions: Notify your employer immediately, monitor your health for 21 days. Watch for fever (temperature of 101.5°F/38.6°C or higher), severe headaches, muscle aches, diarrhoea, vomiting, rash, and other symptoms consistent with Ebola [47].

3.6.6. When to see a health care provider

When sudden fever, chills, muscle aches, severe diarrhea, vomiting, rash, or other symptoms consistent with Ebola is detected, you should seek immediate medical attention. Before visiting a health care provider, alert the clinic or emergency room in advance about your possible exposure to Ebola virus so that arrangements can be made to prevent spreading it to others. When traveling to a health care provider, limit contact with other people. Do not embark on any travel for any purpose travelling the see the doctor. If you are located abroad, contact your employer for help with locating a health care provider. Resident embassies or consulates in the country where you are located can also provide names and addresses of local physicians [47].

3.6.7. Guidance for airline cleaning personnel

Treat any body fluid as though it is infectious. Blood or body fluids on interior surfaces can spread Ebola if they get into your eyes, nose, or mouth. Therefore, hand hygiene is the most important infection control measure. Wear disposable impermeable gloves when cleaning visibly contaminated surfaces. For any ill traveller on board an aircraft, even if Ebola is not considered, the airline's ground and cleaning crews have been encouraged to be notified so that preparations could be made to clean the aircraft after passengers have disembarked. When cleaning an aircraft that has carried a purported Ebola patient, personnel have been advised to follow the following precautions: They are encouraged to wear impermeable disposable gloves while cleaning the passenger cabin and lavatories, wipe down lavatory surfaces and frequently touched surfaces in the passenger cabin, such as armrests, seat backs, tray tables, light and air controls, and adjacent walls and windows with an Environmental Protection Agency (EPA) registered cleaner/disinfectant that has been tested and approved for use by the airplane manufacturers, special cleaning of upholstery, carpets, or storage compartments is not indicated unless they are obviously soiled with blood or body fluids and special vacuuming equipment or procedures are not necessary. The others include: not using compressed air, which might spread infectious material through the air, if a seat cover or carpet is obviously soiled with blood or body fluids, it should be removed and discarded by the methods used for biohazardous material, throw used gloves away according to the company's recommended infection control precautions when cleaning is done or if they become soiled or damaged during cleaning and finally among other things; clean hands with soap

and water (or waterless alcohol-based hand sanitizer when soap is not available) immediately after gloves are removed [47].

3.6.8. Guidance for air cargo personnel

Packages should not pose a risk. Ebola virus is spread through direct contact with blood or body fluids (such as urine or saliva) from an infected person. Packages visibly soiled with blood or body fluids should not be handled. Cargo handlers have been encouraged to wash their hands often to prevent other infectious diseases [47].

4. SOME EFFORTS by INTERNATIONAL ORGANIZATIONS INCLUDING ECOWAS thus FAR

In countries like Sierra Leone, and Liberia, several global efforts were made by world bodies like the World Health Organization (WHO) and other Non-Governmental Organizations and groups to stem the tide of the disease. The WHO report in 2015 estimated that ten thousand (10,000) people were killed by the disease in West Africa [48]. A mission briefing with representatives from Member States was held on 5th August 2014, at the World Health Organization (WHO). Information about the nature of EVD was highlighted. This was followed by outlining the essential components for control, including the need for national leadership, improved care and case management, identifying transmission chains and stopping disease spread, and preventing further outbreaks. Among the critical issues are cross-border infections and travellers; partners reaching the limits of their capacity and ability to respond rapidly, safely, and effectively, and concerns about the socio-economic impact of continued transmission [46].

The Director-General of WHO also shared information from her meetings in Guinea with Member States of the Mano River Union–Côte d'Ivoire, Guinea, Liberia, and Sierra Leone. She noted that the response in West Africa would focus on three areas; that is treatment of Guéckédou, Kenema, and Foya as a unified sector, which included public health measures meant to reduce movement in and out of the area as well as the intensification of current measures in Guinea, Liberia, Nigeria, and Sierra Leone [46]. Taking steps to reduce international spread to other countries in Africa and outside of the African Region, the Sub-Regional Ebola Operations Coordination Centre (SEOCC) in Conakry reported on 5th August that the following actions were to be taken in the four affected countries: In Guinea, new foci emerged and case management facilities were needed. Exit screening was tested in Conakry, in partnership with the US CDC. In Liberia, security issues continued to be of concern. Notwithstanding the commitment of the government, community resistance remained high. Also, in Nigeria, the government focused on following up the contacts from the index case. Clinical support was urgently needed and a treatment centre was set up for managing cases of EVD. Again, in Sierra Leone, efforts were made to map where treatment centres were most needed and setting them up. A similar exercise was also underway for laboratories [46].

The SEOCC also assisted countries with these and many other response measures. Within the plans of WHO was the convening of an emergency committee of international experts to review the outbreak and advise the Director-General on whether the EVD outbreak constituted a Public Health Emergency of International Concern (PHEIC) [46]. This was to be done in accordance with the International Health Regulations. Experts were to receive an epidemiological briefing and determine whether the criteria for a PHEIC have been met which had the propensity to necessitate the briefing of the Director-General on temporary recommendations [46]. To emphasize, as stated elsewhere in this study, though there were some indigenous efforts which would be emphasized in the next section, the debate is that; though Africa hosts the disease, experts of EVD might remain elsewhere in Europe or the Americas. Ebola experts are likely to be located outside Africa and Africans would become increasingly dependent on foreign expertise. The WHO, United Nations, Medicines Sans Frontieres, Samaritans Purse, International Medical Purse, Canadian Red Cross, Partners in Health and USAID recruited a relevant number of staff but did not pay attention to the possibility of future dependence on equitable economic and geographic representation [48]. The territory affected by Ebola just to emphasize, have also persistently suffered from recurrent cholera, measles, meningitis and lassa fever which continuously undermined the weak health systems of these countries [48].

Again, in Sierra Leone, the National Ebola Response Centre (NERC) was funded by the UK's Department of International Development (DFID) with an additional support from the US based Centres for Disease Control and Prevention (CDC) and the United Nations Missions for Ebola Emergency Response (UNMEER). Though the persistent fall-back on old colonial powers and their agencies or institutions have been critiqued by some scholars, it seems to me that the people of Sierra Leone and other affected countries during the Ebola crisis in 2014-2015 respectively had no better financial and human capital options than the international assistance including additional human and financial resources among other things that came through the afore stated organizations [49]. However, Sisay has argued that, the importance of local

ownership and decentralizing decision-making was very crucial in dealing with the Ebola question. Notwithstanding, the financial and human resources provided by these international organizations and respective agencies from foreign countries, the impact on the citizenry and the affected population in particular was strong in instances when they were deployed in partnership with local agencies and communities [50].

The existing literature posit that in Sierra Leone for instance, there was the need for the Ministry of Health, and the Sierra Leones's National Ebola Response Centre (NERC) to play an important role in countering the outbreak of Ebola that afflicted Liberia, Guinea and Sierra leone within 2014 and 2015 respectively [51]. Again, it is important to emphasize that the efforts of the Sierra Leonean president, Ernest Bai Koroma and OB Sisay, Director of the Situation Room of NERC cannot be gainsaid. These initial efforts by NERC systematically put in place strategies and structures to support those who were making efforts to reduce the spate of infection and stop the outbreak. This notwithstanding, the literature highlights the ineptitudeness of the Ministry of Health and Sanitation in Sierra Leone. It is argued among other things that the inability of the Ministry to deliver led to the sack of the minister of Health and Sanitation in August 2014 [50].

In Liberia, the government reactivated a pre-existing Task Force within the Ministry of Health and Social Welfare in late March 2014, when the first diagnoses of Ebola were made. President Johnson Sirleaf declared a State of Emergency on 6th August and on 10th August appointed the Assistant Minister of Health and Social Welfare, Tolbert Nyenswah, as Head of the Incident Management System. The Liberian authorities invited international experts to work directly within their government structures, and received advice and support from international organizations like the WHO among others. Local and religious leaders in parts of Liberia decided to "self-quarantine", an initiative that was reported as more effective than district or individual level quarantine [51].

Significantly, there were several summits that were held by ECOWAS and more so, there were several decisions that were implemented by ECOWAS using its agency WAHO. For example, the 6th November 2014 ECOWAS Heads of State and Government Summit discussed the status of Ebola epidemic and made some recommendations to member states. Also, WAHO sent circulars to all health ministers within ECOWAS indicating the immediate measures to be taken to prevent and contain the epidemic [51]. This among other things included plans which focused mainly on health interventions: An agreement between WAHO,WHO, and AFDB signed on 19th May 2014 approved a sum of $3,091,136 to provide urgent assistance for the fight against Ebola in Guinea and neighboring countries like Cote Divoire, Gambia, Guinea Bissau, Liberia, Mali, Senegal and Sierra Leone. The 45th Summit of ECOWAS Heads of States and Government on 10th and 11th July 2014 saw Nigeria and Cote DÍvoire giving $3.5 million and $1 million respectively to support the fight against Ebola [51].

To emphasize, the Accra Response Strategy agreed upon by health ministers from eleven West-African countries on July 2014 and the "Ebola Response Roadmap" published by the WHO on 28th August, 2014 were very useful. The Accra Response Strategy was based the following strategic actions: Immedicate outbreak response interventions, enhanced coordination and collaboration as well as the scale-up of human and financial resource mobilization. Also, the WHO roadmap emphasized the use of complementary and controversial approaches to be used in areas with severe transmission to reduce the pressure on the population due to the outbreak with specific targets and timelines. These would form the bases for UN STEPP strategy which was launched on 16th September 2014 which aimed among other things to stop the outbreak, treat the infected, ensure essential services, preserve stability and prevent outbreaks in countries that were unaffected. These in essence provided an enduring, broad and flexible framework for operations [52].

5. CONCLUSION

The outbreaks in the respective countries in 2014-2015 saw several responses. These included national technical working groups, pillars or clusters which were established to deal with key components of the response. These covered issues which were identified as national priorities, which included case management, safe and dignified burials as well as surveillance and laboratory operations. Significantly, over time, they were adapted to the lines of action for the response, with additional emphasis on infection prevention and control, and on research and development. Countries developed additional structures to adapt to the national context as you will find in Sierra Leone and Liberia within the period under review. Key contributions were led by the countries, most especially by their community organizations. The leadership of the national governments of the affected countries, their preparedness and mostly their openness to embrace different sources of international support cannot be gainsaid. Though an anathema to expected homegrown strategies as discussed in different but broader discourses on Africa's development

concerning her relationship with Europe with its surrogate institutions; discussions like this ought to give praise to which praise is due. In the broader scheme of things, the efforts of International Non-Governmental Organizations (NGOs) cannot be precluded on the basis of Africa's intellectual and national jingoists.

The above notwithstanding, as elucidated elsewhere in this current contribution, the Ebola response workforce within the period under review were largely national personnel which included volunteers through the national Red Cross Societies and faith groups among others. The challenge however, is the re-emergence of the disease. A one time antidote to reduce the degree of epidemicity and pandemicityshould suffice. It seems however, that, a declaration of a region free from the Ebola disease does not suggest the finality of the matter.

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