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THE SPREAD OF THE EBOLA VIRUS DISEASE AND ITS IMPLICATIONS IN THE WEST AFRICAN SUB-REGION

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ABSTRACT: On August 8, 2014, the United Nations World Health Organization declared the current Ebola outbreak in West Africa an international public health emergency. The high level of poverty in the West African sub-region and the dearth of medical personnel couple with the inadequate medical equipment poses a serious challenge to the prevention, treatment and eradication of the virus. In curbing the spread, there have been calls for collective support for containment of the disease in the affected countries. The paper examined the spread of the Ebola Virus Disease and its implication in the West Africa sub-region. The correlation analysis revealed a strong positive association between the reported cases of new infections and fatalities suggesting that as the number of new infections increases so is the strong likelihood of the number of fatalities increasing. The Kruskal Wallist Test revealed a statistically significant difference in the reported cases of infections and fatalities across the months. The paper finds that the spread of the virus has effects on health, productivity of workers, social life, migration, and national economy. Efforts towards prevention have been acknowledged at the international, regional, and national level. The study, however, cannot be empirically generalized in the analytical term. There is the need for further study to know the remote cause of the virus, how it is transmitted, the impact on affected persons and the treatment in a holistic perspective. The paper recommends:strong political will, quick intervention and efficient case management; improvement in the medical infrastructure base; and widespread education.

KEYWORDS: Ebola Virus, Health, Response, West Africa, World Health Organization

1 INTRODUCTION

Ebola Virus Disease (EVD), formally known as Ebola hemorrhagic fever or Zaire Ebola is a critical illness that habitually leads to death. Its mortality rate is up to 90% and affects human beings as well as animals [1]. The first Ebola virus outbreak occurred in Zaire, now the Democratic republic of Congo in 1976. Subsequent outbreaks have been experienced in Uganda, Gabon, Cote d'Ivoire, and Sudan. There is no cure for the virus which has brought great concern to the people of West Africa and the international community. In mid-December, 2013, an outbreak occurred in Guinea but was officially communicated to the World Health Organization in March 2014 [2]. Thereafter, the virus has spread to Liberia, Sierra Leone and Nigeria.

On August 8, 2014, the United Nations World Health Organization (WHO) declared the current Ebola outbreak in West Africa an international public health emergency. According to Dr. Chan, it is the "largest, most severe, most complex in the nearly four-decade history of this disease" [3]. In March 23, 2014, the EVD resurfaced in West Africa, where out of the first 49 cases of infection reported, 29 persons were recorded dead. Thereafter, the WHO has reported about 2,615 cases and 1,427 deaths as at August 20, 2014. The Centre for Disease Control has reported about 1,528 cases and 844 deaths which have all been confirmed in the laboratory.

The high level of poverty in the West African sub-region and the dearth of medical personnel couple with the inadequate medical equipment have posed a serious challenge to the prevention, treatment and the eradication of the virus. For instance, the family of the late Dr. Ameyo Adadevoh who contracted the virus from the Liberian-American, Patrick Sawyer berated the Nigerian government for not doing enough to provide substantial treatment for her. In another development, the Head of Medecins Sans Frontieres Elwa Hospital in Liberia, Joanne Lu asserts that lack of leadership and emergency management skills are hindering the effort to curtail the spread of the deadly virus. According to her, "we are missing everything right now; we are missing a strong leadership centrally, with core nation capacity and disease emergency management skills. It's not happening" [4]. The spread of EVD continues to ravage the West African sub-region despite efforts made by governments, stakeholders, non-governmental organizations and the international community to curb the spread of the disease, Dr. Chan posits that "our collective health security depends on support for containment in support in these countries" [3].

This paper examines the spread of the Ebola disease and its implication in the West Africa sub-region. It specifically focuses on the spread of the EVD taking into account analysis of reported cases of infection and fatalities, its implications and efforts towards prevention. It concludes with recommendations towards curbing the spread of the disease.

2 SPREAD OF EVD IN THE WEST AFRICAN SUB-REGION

Guinea was the first country that the EVD broke out in December 2013 but not until March 2014 that the WHO alerted the world on the outbreak. Indication emerged from medical experts that the first person to contract the virus in 2013 and that led to the subsequent outbreak in 2014 was a two-year old boy from Guinea who later died in December 2013. Before his death, he had passed the virus to some members of his family who also transmitted the virus to other people in a village [5], [6]. The proximity of Sierra Leone and Liberia to Guinea increased the chances of these two countries being affected with the Ebola Virus. The disease eventually surfaced in the Lofa and Nimba counties of Liberia in March, 2014 [7]. Thereafter, it spread to other parts of the country [8].

In the case of Sierra Leone, the first clinical samples from suspected cases proved negative for the deadly virus. But afterward, cases of EVD were reported in the Kilahun District close to the Guinea border [9]. The outbreak of the EVD spread to other regions in Sierra Leone including the capital Freetown. Unlike the cases of Liberia and Sierra Leone that are neighbours to Guinea which made the easy transfer of EVD to these countries. The case of Nigeria was different. Patrick Sawyer, who contracted the disease during her sister's burial who had died from the virus, travelled to Nigeria en-route to the United States of America. The hospital where Sawyer was first admitted in Lagos transmitted the disease to some of the medical officers in the hospital.

2.1 ANALYSIS OF REPORTED CASES

This section of the paper presents an analysis of the reported cases of EVD in West Africa. Statistical tables and graph were used in presenting the findings. Data (as per occurrence in the month) was extracted from the Time Magazine based on the WHO figures as at 19th August, 2014. The analysis focused on establishing a relationship with the number of newly reported cases of infection and fatalities.

As shown in Table 1, the distribution showed an increasing growth in both newly reported cases of infection and fatalities aside the month of May. This was confirmed in the correlation analysis which revealed a strong positive significant association between newly reported cases of infections and fatalities (r=.893, p-value=.000, N=49). This suggests that as the reported cases of new infections increases, so is the likelihood of the reported cases of fatalities increasing. The variable, month, was controlled for in order to find out whether it influences the relationship between the cases of infections and fatalities. The result did not differ much from the previous finding (r=.826, p-value=.000, N=49) as shown in Appendix A. Thus, irrespective of the month under consideration, there exists a positive likelihood of experiencing both newly reported cases of infection and fatalities.

Table 1: Distribution of newly reported cases of infection and fatalities

Month	Number of new infections	Number of new fatalities
March	116	74
April	132	74
May	120	66
June	231	148
July	724	367
August	917	500

Source: *Extracted from the Time Magazine Map based on World Health Organization (2014)*

As shown in Figure 1, the distribution of the newly reported cases of infections and fatalities is not uniform. From mid-May, the distribution gets more erratic and intense. Although, Figure 1 does not highlight country-specific cases of infections and fatalities, the WHO, as of August 20, 2014, published the following confirmed or suspected cases of Ebola: Guinea (607 cases, 406 deaths); Liberia (1082 cases, 624 deaths); Nigeria (16 cases, 5 deaths); and Sierra Leone (910 cases, 392 deaths) resulting in 2,615 cases and 1,427 deaths.

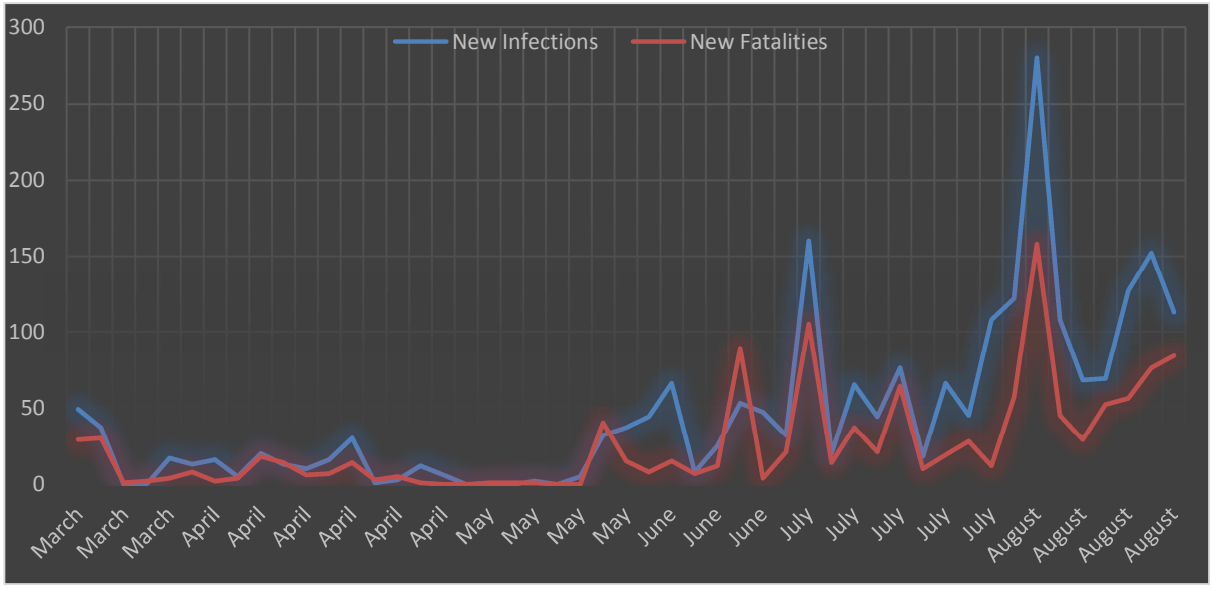

Fig. 1: Graph showing newly reported cases of infections and fatalities across the months.

Source: Extracted from the Time Magazine based on the World Health Organization (2014).

Between March and April, there was a positive change in the number of newly reported cases (13.79%); however, this reduced by 22.88 percentage points in May. With the number of newly reported cases of fatalities, the period between March and April recorded no change. The number of fatalities fell by 10.81 percentage points in May. Beyond this month, there was a huge increase by 101.59 percentage points and 135.05 percentage points in June for both the number of newly reported cases of infections and fatalities respectively. Similarly, the month of June and July recorded the highest percentage change of 213.14 percent and 147.97 percent and fell later in August by 186.76 percentage points and 111.73 percentage points for both the number of newly reported cases of infections and fatalities respectively. The general trend can be described as a rise and fall of the number of infections and fatalities.

The non-parametric test of K-independent samples was used and results are shown in Appendix A. The choice for this test was based on the skewed distribution of both the reported cases of new infections (skewness=2.2) and new fatalities (skweness=2.1) suggesting the presence of outliers. Similarly, the Tests of Normality were significant (p-value=.00) for both cases at the five percent alpha level suggesting violation of the assumption of normality. The K-independent samples test was used to explore whether the newly reported cases of infections and fatalities differ across the months. The data analysis from

March to August revealed that the median case of newly reported cases of infections and fatalities was 30 and 14 respectively.

The Kruskal Wallist Test showed a statistically significant difference in the newly reported cases of infections [χ^2(5, n = 49) = 31.013, p = .000.] and fatalities [χ^2(5, n = 49) = 26.036, p = .000.] across the different months (March, *n* = 6: April, *n* = 11: May, *n* = 9: June, *n* = 6: July, *n* = 10: August, *n* = 7). With respect to newly reported infections, the median scores declined from March (*Md* = 15) through April (*Md* = 12) to May (*Md* = 2). It subsequently rose through June (*Md* = 39.5), July (*Md* = 65.5, and August (*Md* = 113). Similarly, the median scores for the newly reported cases of fatalities declined from March (*Md* = 6) through April (*Md* = 5) to May (*Md* = 1) and subsequently rose through June (*Md* = 13), July (*Md* = 24, and August (*Md* = 56). The preliminary findings suggest that the spread of the virus is on the ascendency after the month of May, hence the need for critical action.

Further analysis was undertaken using the Mann-Whitney U Test to explore which of the months were statistically significantly different from the other in terms of the newly reported cases of fatalities and infections. To control for Type I errors, a Bonferroni adjustment to the alpha values was applied (alpha value divided by the number of categories in the categorical value; 0.05/6=0.008) to compare each month with the other. The results showed that statistically significant differences were recorded in the newly reported cases of fatalities between March and August (p = .005), April and July (p = .001), April and August (p = .000), May and July (p = .004), and May and August (p = .001). Similarly, the results showed statistically significant differences in the newly reported cases of infection between March and August (p = .003), April and July (p = .001), April and August (p = .000), May and July (p = .004), May and August (p = .000), and June and August (p = .003). Inferring from this preliminary finding, it is instructive to probe the issues surrounding the rise and fall of recorded cases of infections and fatalities.

3 EFFECTS AND IMPLICATIONS OF EVD

The outbreak of the EVD has affected the way of life especially for the people of the West African sub-region. Its effects have been felt in the areas of health, social life, and migration. Consequently, these effects have implications for the national economy. Any action or inaction taken in mitigating the spread of the EVD will simply have implication in people's way of life.

3.1 HEALTH

The health effects of Ebola Virus Disease are disastrous and when it attacks its victim it causes a severe damage to the skin. People get contact with the virus through close contact with blood, secretions, organs or bodily fluids of infected animals. Once this happens, the infection can be transmitted from person to person. "Patients initially present with fever, headache, joint/muscle and abdominal pain accompanied by diarrhoea and vomiting" [10]. "In its early stages, EVD is easily confused with other tropical fever, such as malaria or dengue, until the appearance of the hemorrhagic terminal phase, presenting with the characteristic internal and sub-cutaneous bleeding, vomiting of blood and reddening of the eyes. If sufficient blood is lost, this leads to renal failure, breathing difficulties, low body temperature, shock and death" [10]. In a report by the AFP, 32 nurses between May 24 and August 14 have died from the Ebola virus while performing their duties.

People living in Ebola-prone areas risk experiencing psychological problems which can affect their health. The outbreak of the disease comes along with its attendant fear and panic, anxiety, and stress. According to Sue Towey (a mental health practitioner), living under constant fear weakens the immune system and can cause cardiovascular damage, gastrointestinal problems such as ulcers and irritable bowel syndrome, and decreased fertility [11].

The health of health workers is also at risk. The density of physicians (total number per 1000 population) in these affected countries is woefully inadequate: Guinea (0.100); Liberia (0.014); and Sierra Leone (0.022) [12]. Hence, there is a greater burden on health workers, in terms of working hours and number of patients, to go an extra mile in providing quality service for patients including Ebola-infected patients which require extreme caution. In Sierra Leone, the country's chief medical officer admits the difficulties that health workers were facing in fighting the epidemic and suggests that "we still have to break the chain of transmission to separate the infected from the uninfected", however, "there is a rejection among people of the existence of Ebola and hostility towards health workers" [13].

3.2 PRODUCTIVITY OF WORKERS

The productivity of workers is also affected. As of August 25, more than 250 health care workers have developed the disease in Guinea, Liberia, Nigeria, and Sierra Leone, and more than 120 have died [14]. The demise of these health workers in these affected countries means a deprivation of not only experienced and dedicated medical care but also inspiring

national heroes. Consequently, any ordinary worker who falls ill and visits the clinic or hospital may not receive adequate care and treatment from health workers and may have to spend some amount of his/her productive hours at the health center. Such a situation denies workers of the opportunity of using their working hours for productive use.

3.3 SOCIAL LIFE

Another knock-on effect of the EVD is on social life. As reported by the Daily Nation in an interview with a Kenyan who returned from Monrovia, "there are no handshakes or hugs. Life has changed a lot. People are uncertain because they know there is an epidemic that has neither a cure nor a vaccine" [15]. In Liberia, the president has restricted the movement of people living in the densely populated West Point slum area. In addition, the president has ordered cinemas, theatres, night clubs, muster points shut in order to curtail the spread of the virus. In Nigeria, the Federal government and the Lagos government met with some leading pastors with large congregations to take precautionary measure to hinder the spread of the virus in the church. In Ghana, a few numbers of churches have asked their members not to hug and handshake each other [16]. Hand sanitizers have been provided by these churches for members to use. Religious and cultural practices that require either a handshake, hug or kiss remain challenged by the outbreak of Ebola disease. In a situation where one unconsciously stretches the arm for a handshake or a hug, that gesture may be frowned upon leading to embarrassment. The normal way of greeting is never the same again.

3.4 MIGRATION

The migration of people has also been restrained. A number of countries have banned flights coming from these infected countries. In particular, Nigeria and Ivory Coast have restricted flights from Ebola-infected countries emphasizing fears of the virus in West Africa. Zambia has also banned all citizens of Guinea, Sierra Leone, Liberia, and Nigeria from entering the country [17]. Furthermore, Kenya has banned flights from Sierra Leone and Liberia as a precautionary measure in preventing the disease from entering its territory. Ghana is also considering banning flights from Ebola affected countries once the spread becomes threatening in West Africa [18]. This situation has resulted in screening of all passengers leaving international airports, seaports, and major ground crossings as directed by the UN health agency. The challenge is that if immigrant workers are not provided with the proper protective clothing and equipment, they stand the risk of getting infected with the virus and when infected with the virus, they become agents of transmission. The outbreak has also affected hosting of international conferences. In the case of Ghana, the government per the ECOWAS meeting has cancelled all international conferences between August and November as part of an attempt to prevent the spread of the disease.

3.5 NATIONAL ECONOMY

The effects of the EVD on health, productivity, social life, and migration have serious implications for the national economy. There is the risk of having a direct financial drain on government budgets via increased health expenditures. Liberia has spent $12 million (nine million euros) in tackling the Ebola outbreak between April and June and may have to spend more. Moody's rating agency has warned of a severe economic toll on the economies of these affected countries as a consequence of mitigating the spread of the virus.

Given the low ratio of physicians per 1000 population in these affected countries, there is pressure on the governments to deploy more health workers. In such a situation, workers need to be properly motivated by the provision of better working conditions which includes, but not limited to, provision of proper protective gears and equipment, pay which commensurate with the service being delivered, insurance cover, and availability of high quality care should an health worker get infected with the virus. The government of affected countries will also have to provide rapid testing equipment, mobile laboratories, and clinics. There is also the urgency for the governments to communicate effectively with international partners about the Ebola outbreak and how it is affecting communities in order to receive the required aid in mitigating its spread.

At the micro level, individual to corporate kind of business is affected as flights have been restricted to the Ebola-hit countries. Consequently, this has a negative effect on the businesses leading to a fall in revenue. The airline industry has been affected by the outbreak of the disease. According to OGA, an airline data provider, 216 flights of the 590 monthly flights that were supposed to fly to Guinea, Liberia, and Sierra Leone have been cancelled [19]. Some of the airlines that have banned flights to the virus hit countries include Arik Air, British Airways and the Korea Air. The economic implication of the cancellation of flights by these airlines is that their revenue for the year will shrink.

4 EFFORTS TOWARDS PREVENTION

This section of the paper looks at the efforts towards prevention. This is discussed in view of responses at the international, regional, and national level.

4.1 INTERNATIONAL RESPONSE

A number of efforts have been made toward the prevention of the EVD. International support as well as national and local support has been crucial in mitigating the spread of the disease. At the international level, the UN has made "a clear call for international solidarity" to boost the capacity of countries currently affected. It has also been recommended that "there should be no international travel of Ebola contacts or cases, unless the travel is part of an appropriate medical situation" and specific ways are outlined to minimize the risk of international spread of the EVD as well as giving advice to currently unaffected countries and those bordering the affected states [3].

Again, the WHO on August 11, 2014 convened a panel of medical ethicists, scientific experts, and lay people from affected countries to deliberate on the ethical implications of the potential use of unregistered interventions. Per the consensus reached, ethical justification was given for the provision of unproven interventions as a potential treatment or prevention though their efficacy and adverse effects are unknown. Nonetheless, ethical criteria including transparency about all aspects of care, informed consent, freedom of choice, confidentiality, respect for the person, preservation of dignity and involvement of the community have been issued to guide the provision of such interventions. Further, the WHO has launched a $100 million EVD Outbreak Response Plan in West Africa [3].

The international community has contributed and pledged a substantial amount of fund to bring the spread of the virus under control. For instance, the European Union, China, United States, Japan and the United Kingdom have donated large sums of money to curtail the spread of the virus. Countries that have pledged funds and vaccines to prevent the spread of the virus includes Australia, Japan and Canada.

Despite these efforts aimed at curbing the spread of the disease, the international response has been criticised. In a report by the Guardian, de la Vigne, the operations director of Doctors Without Borders, have indicated that "Globally, the response of the international community is almost zero" adding that "Leaders in the West are talking about their own safety and doing things like closing airlines—and not helping anyone else." However, the international governmental response has, to a large extent, focused on containing the virus in West Africa.

4.2 REGIONAL RESPONSE

The Africa Union has urged its members to recruit more health care workers. The ECOWAS Commission has also directed that "all meetings and missions be suspended unless absolutely essential and well-guided, a three (3) month moratorium be placed on all international conferences and international gatherings which have the potential of spreading the Ebola Virus" [20]. There has also been regional support from the south. In a report by the AFP, South Africa has extended a helping hand to Sierra Leone by sending a mobile laboratory to be installed in the capital city to ensure quick access to analysis of blood samples.

4.3 NATIONAL RESPONSE

At the national level, governments and local associations are making commitments in curbing the spread of the disease. For instance, in Guinea, Medicines San Frontieres (MSF) is running centers for the treatment of EVD. According to Reference [20], the ministry and MSF are collaborating in the transfer of Ebola victims by ambulance for treatment in Conakry. In Liberia, the response of the government is encouraging despite some hiccups in the prevention, treatment and precautionary measures taken by the government. The Liberian Ministry of Health began to implement the tactical plan in accordance with the Accra meeting that was held on 23 July, 2014 to enhance the country's response to the EVD outbreak [1]. Furthermore, Ellen Johnson Sirleaf, the Liberian President, has ordered the shut down of nightclubs, Cinema houses and other gathering points in order to halt the spread of the virus. However, the spread of the virus is likely to increase because of the Ebola clinic that was attacked and ransacked by an angry mob in the West Point region who were concerned that the clinic was located in their region [22].

The case of Nigeria in respect to the fatality being caused by the EVD is smaller when compared to other infected countries. Despite this, the Nigerian government is not leaving any stone unturned since the introduction of the virus to Nigeria by the Liberian Patrick Sawyer. All those who came in contact with Sawyer were put under surveillance. The Nigerian

Federal Government and the Lagos state government are working jointly in the control, prevention and the treatment of EVD patients. The government has approved a whopping sum of N1.9 billion as an intervention fund to restrict the spread of the virus. The measures taken by the Sierra Leone government include the introduction of the reactivation of its "Active Surveillance Protocol" [23]. The declaration of a state of emergency and the deployment of troops to quarantine the epicenters of the virus [24]. In addition, the government passed a law that will see anybody hiding Ebola victims with a two-year jail term.

In Ghana, the government has allocated GH¢6 million ($1,612,903.23) and announced plans to procure protective gears for frontline workers in health, immigration and other agencies who are most likely to encounter a possible victim. Also, the Pharmaceutical Society of Ghana has put up an initiative dubbed PREVENT (Patients' Research Empowerment Vigilance and Education through new Technologies) which seeks to prevent the entry of fake and counterfeit medicines via the country's supply chain.

5 CONCLUSION AND RECOMMENDATIONS

This study evaluates the spread of Ebola virus disease in the West African sub-region vis a vis its implications in the affected countries. It finds that the spread of the EVD has effects on health, productivity of workers, social life, migration, and national economy. Also, efforts towards prevention have been acknowledged at the international, regional, and national level. The study, however, cannot be empirically generalized in the analytical term. There is the need for further study to know the remote cause of the virus, how it is transmitted, the impact on affected persons and the treatment in a holistic perspective. The following recommendations are made to mitigate the spread of the virus.

In order to win this war on Ebola, there are a number of issues that needs to be addressed. First, in the words of Brice de la Vigne, "The solution is not that complicated but we need to have a political will to do so. Time is running out. But you need very senior people with high profiles, the kind of people who can coordinate a response to a million people affected by an earthquake." Great and influential leaders have to make a personal commitment to champion the cause of mitigating the spread of EVD. For instance, the UN Secretary General and other philanthropists such as Bill and Melinda Gates and some most powerful people in Africa such as, AlikoDangote (President, Dangote Group), Christo Wiese (Chairman, Shoprite), and Kofi Annan (immediate past UN Secretary-General) can help demonstrate the political will to win the war on Ebola.

Secondly, quick intervention and efficient case management as well as psychosocial support are crucial. Also, as has been suggested by a number of concerned persons, there is the urgent need to deploy more health workers to work in the treatment centers in the affected areas. These workers should educate people about protection measures and provide medical and emergency relief by tracing people who may be infected with the virus. This sacrifice requires that health workers be provided with proper protective gears and equipment, a remuneration that will be commensurate with health workers' heroic work as well as a comprehensive medical insurance cover that ensures immediate delivery of quality healthcare service to health workers who get infected with the disease in their line of duty.

Another issue of concern is that the level of investment towards building medical infrastructure in these Ebola-hit countries is lacking. Hence, the local government has to focus on providing funds in developing its medical infrastructure base. Also, access to the necessary supplies of medical drugs, provision of additional mobile laboratories, clinics, and rapid testing equipment are crucial. Local government should also liaise with international partners to receive support in terms of training of its health workers, provision of medical equipment, and communicating effectively about the outbreak of the EVD to its communities.

Again, managing the Ebola panic which Dr. Joanne Liu notes as "emergency within an emergency" has to be addressed properly. According to Liu, the threat has caused deaths due to malaria and other diseases with similar symptoms since hospitals may not treat such patients for fear that they may be carriers of the Ebola virus. An unfortunate case is that of the 24-year-old American, Nathaniel Dennis, who died of an unrelated illness because the hospital in Liberia refused to treat him because the hospital attributed the illness to the Ebola virus [25]. Early detection, investigation, reporting, active surveillance and diagnostic capacity should be a matter of concern. The need for widespread education on the risk factors for transmission, signs and symptoms, method of control and prevention of the disease is relevant to forestall such future occurrence. The washing of hands should be encouraged.

Finally, even though the WHO admits that the current statistics regarding the Ebola outbreak is "vastly underestimated", timely release of data on the number of patients who are receiving treatment, and experiencing partial or full recovery is relevant for statistical analysis. It will be of great importance if data could be obtained with respect to countries on the number of reported cases of infection and fatalities. This will inform policy makers about appropriate measures. Nonetheless,

as the correlation analysis revealed a strong positive relationship between the number of newly reported cases of infection and death, the sooner we take a decisive political action, the better the chances of saving a dignified human life.

REFERENCES

[1] WHO (2014). Ebola Virus Disease, West Africa (Update of 26 May, 2014). *Ebola virus disease, West Africa* (Update of 26 May 2014). http://www.afro.who.int/en/clusters-a-programmes/dpc/epidemic-a-pandemic-alert-and-response/outbreak-news/4143-ebola-virus-disease-west-africa-26-may-2014.html

[2] Roy-Macaulay, C. (2014, July 31). Ebola crisis triggers health emergency. *Drug Discovery & Development.* Retrieved from http://www.dddmag.com/news/2014/07/ebola-crisis-triggers-health-emergency on 3rd August 2014.

[3] UN News Centre (2014). *UN declares Ebola outbreak global 'international public health emergency'.* Retrieved from http://www.un.org/apps/news/story.asp?NewsID=48440#.U_dQIPl_vAE on 22nd August, 2014.

[4] News Agency of Nigeria (2014, August 23). Bad leadership hampers Ebola Fight in West Africa. *News Agency of Nigeria*. Retrieved from http://www.punchng.com/news/bad-leadership-cripples-ebola-fight-in-west-africa-msf/ on 23rd August, 2014.

[5] Grady, D. & Fink, S. (2014, August 9). "Tracing Ebola's Breakout to an African 2-Year-Old". *The New York Times*. ISSN 0362-4331. Retrieved from http://www.nytimes.com/2014/08/10/world/africa/tracing-ebolas-breakout-to-an-african-2-year-old.html?_r=0

[6] Baize, S., Pannetier, D., Oestereich, L., & Rieger, T. (2014). "Emergence of Zaire Ebola Virus Disease in Guinea — Preliminary Report". *New England Journal of Medicine*. doi:10.1056/NEJMoa1404505

[7] Liberian Obsever (2014). *Two of Five Tested Positive for Ebola in Liberia*. Retrieved from http://www.liberianobserver.com/security-health/2-5-test-positive-ebola-liberia

[8] Ministry of Health and Social Welfare (2014). *Ebola Virus Disease Epidemic in Liberia: Situation Report.* Retrieved from http://www.mohsw.gov.lr/documents/13aprilEbola%20Virus%20Disease%20Epidemic%20in%20Liberia.%20Sitrep%20No.11(1).pdf

[9] WHO (2014). "Ebola virus disease, West Africa – update 22 August 2014". *Epidemic & Pandemic Alert and Response (EPR) - Outbreak News* (WHO). Retrieved 23 August 2014. "2014 Ebola Outbreak in West Africa". Centers for Disease Control and Prevention.

[10] Paessler, S. & Walker, D. H. (2013). Pathogenesis of the viral hemorrhagic fevers. 313 *Annual review of pathology 8*, 411-440.

[11] University of Minnesota (2014). *Taking charge of your health and wellbeing.* Retrieved from http://www.takingcharge.csh.umn.edu/enhance-your-wellbeing/security/facing-fear/impact-fear on 19th August, 2014.

[12] WHO (2014). *Ebola virus disease, West Africa* (Situation as of 16 April 2014). Retrieved from http://www.afro.who.int/en/clusters-a-programmes/dpc/epidemic-a-pandemic-alert-and-response/outbreak-news/4100-ebola-virus-disease-west-africa-16-april-2014.html

[13] AFP report (2014). W. Africa struggles to deal with Ebola outbreak. *New Vision*. Retrieved from http://www.newvision.co.ug/mobile/Detail.aspx?NewsID=658747&CatID=2 on 22nd August, 2014.

[14] WHO (2014). *Health workforce.* Retrieved from http://gamapserver.who.int/gho/interactive_charts/health_workforce/PhysiciansDensity_Total/atlas.html on 22nd August, 2014.

[15] Mutambo, A. (2014, August 20). No hugs, greetings in Ebola hit West Africa countries. *Daily Nation*. Retrieved from http://mobile.nation.co.ke/news/No-hugs-greetings-Ebola-/-/1950946/2425880/-/format/xhtml/-/4cerbbz/-/index.html on 22nd August, 2014.

[16] Ansah-Addo, H. (2014, August 12). Churches ban handshakes over Ebola Panic. *Daily Guide*. Retrieved from http://www.dailyguideghana.com/churches-ban-handshakes-over-ebola-panic/ on 14th August, 2014.

[17] Hinshaw, D. & McGroarty (2014, August 13). Ebola virus: Nigeria and Ivory Coast restricts flights from countries hit outbreak. *The Wall Street Journal*. Retrieved from http://online.wsj.com/articles/nigeria-ivory-coast-restrict-flights-from-countries-hit-by-ebola-virus-1407767218

[18] StarrFMonline (2014, August 19). Ghana to ban flights from 'Ebola countries'. *StarrFMonline* Retrieved from http://www.starrfmonline.com/1.1813676 on 22nd August, 2014.

[19] Aworinde, T. (2014). *Ebola: Sri Lanka turns back Nigerian travelers*. Retrieved from http://www.punchng.com/news/ebola-sri-lanka-turns-back-nigerian-travellers/

[20] Mordy, J. T. (2014). *Ebola response: Government bans international conferences in Ghana for three months.* JoyOnline. Published 14th August, 2014. Last accessed at http://www.myjoyonline.com/news/2014/August-14th/ebola-response-govt-bans-international-conferences-in-ghana-for-three-months.php on 22nd August, 2014.

[21] Medicines San Frontieres (2014). *Response to West African Ebola Epidemic Remains Dangerously Inadequate*. Retrieved from http://reliefweb.int/report/guinea/response-west-africa-ebola-epidemic-remains-dangerously-inadequate

[27] WHO (2014). Ebola Virus Disease, West Africa (Update of 26 May, 2014). *Ebola virus disease, West Africa* (Update of 26 May 2014). http://www.afro.who.int/en/clusters-a-programmes/dpc/epidemic-a-pandemic-alert-and-response/outbreak-news/4143-ebola-virus-disease-west-africa-26-may-2014.html

[22] Paye-Layieh, J. (2014). *Ebola Fears Heightened in Liberia as Clinic Looted*. Retrieved from http://www.usatoday.com/story/news/world/2014/08/17/west-africa-liberia-ebola/14195347/

[23] Charm, K. (2014). *Sierra Leone Restricts Movement Across Borders Over Ebola Fears*. Retrieved from http://www.africareview.com/News/Sierra-Leone-restricts-movement-across-borders-over-Ebola-fears/-/979180/2265738/-/yo7wu0/-/index.html

[24] Fofana, U. & Kpodo, K. (2014). *Sierra Leone Declares State of Emergency Over Ebola.* http://in.reuters.com/article/2014/07/31/health-ebola-leone-idINKBN0G00PM20140731

[25] Martel, F (2014, August 22). Doctors without borders senior official: International response to Ebola 'almost zero'. *Breitbart*. Retrieved from http://www.breitbart.com/Big-Peace/2014/08/22/Doctors-Without-Borders-Senior-Official-International-Response-to-Ebola-Has-Been-Almost-Zero on 22nd August, 2014.

[26] Gatherer, D. (2014). The 2014 Ebola virus disease outbreak in West Africa. JGV Papers in Press. Published May 2, 2014 as doi: 10.1099/vir.0.067199-0. Division of Biomedical & Life Sciences, Faculty of Health & Medicine, Lancaster University, Lancaster LA1 4YQ, UK.

[27] Johnson, D. (2014, August 8). Watch how Ebola has spread across West Africa. *Time Magazine.* Retrieved from http://time.com/3089810/ebola-map/ on August 19, 2014.

APPENDIX A

Correlations

Correlations

		Number of new infections	Number of new fatalities
Number of new infections	Pearson Correlation	1	.893**
	Sig. (2-tailed)		.000
	N	49	49
Number of new fatalities	Pearson Correlation	.893**	1
	Sig. (2-tailed)	.000	
	N	49	49

**. Correlation is significant at the 0.01 level (2-tailed).

Partial Corr

Correlations

Control Variables			Number of new infections	Number of new fatalities
Month	Number of new infections	Correlation	1.000	.826
		Significance (2-tailed)	.	.000
		df	0	46
	Number of new fatalities	Correlation	.826	1.000
		Significance (2-tailed)	.000	.
		df	46	0

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Number of new infections	.200	49	.000	.776	49	.000
Number of new fatalities	.223	49	.000	.747	49	.000

a. Lilliefors Significance Correction

Statistics

		Number of new infections	Number of new fatalities
N	Valid	49	49
	Missing	0	0
Mean		45.7143	25.0816
Median		30.0000	14.0000
Mode		.00	1.00
Skewness		2.157	2.120
Std. Error of Skewness		.340	.340

NPar Tests
Kruskal-Wallis Test

Ranks

	Month	N	Mean Rank
Number of new infections	March	6	17.67
	April	11	15.32
	May	9	13.11
	June	6	28.17
	July	10	35.60
	August	7	43.93
	Total	49	
Number of new fatalities	March	6	20.75
	April	11	16.32
	May	9	12.94
	June	6	27.33
	July	10	34.20
	August	7	42.64
	Total	49	

Test Statistics[a,b]

	Number of new infections	Number of new fatalities
Chi-Square	31.013	26.036
df	5	5
Asymp. Sig.	.000	.000

a. Kruskal Wallis Test

b. Grouping Variable: Month

Mann-Whitney Test

Ranks

	Month	N	Mean Rank	Sum of Ranks
Number of new fatalities	March	6	3.75	22.50
	August	7	9.79	68.50
	Total	13		
Number of new infections	March	6	3.50	21.00
	August	7	10.00	70.00
	Total	13		

Test Statistics[b]

	Number of new fatalities	Number of new infections
Mann-Whitney U	1.500	.000
Wilcoxon W	22.500	21.000
Z	-2.790	-3.004
Asymp. Sig. (2-tailed)	.005	.003
Exact Sig. [2*(1-tailed Sig.)]	.002[a]	.001[a]

a. Not corrected for ties.

b. Grouping Variable: Month

Ranks

	Month	N	Mean Rank	Sum of Ranks
Number of new fatalities	April	11	6.00	66.00
	August	7	15.00	105.00
	Total	18		
Number of new infections	April	11	6.00	66.00
	August	7	15.00	105.00
	Total	18		

Test Statistics[b]

	Number of new fatalities	Number of new infections
Mann-Whitney U	.000	.000
Wilcoxon W	66.000	66.000
Z	-3.489	-3.489
Asymp. Sig. (2-tailed)	.000	.000
Exact Sig. [2*(1-tailed Sig.)]	.000[a]	.000[a]

a. Not corrected for ties.

b. Grouping Variable: Month

Ranks

	Month	N	Mean Rank	Sum of Ranks
Number of new fatalities	May	9	5.11	46.00
	August	7	12.86	90.00
	Total	16		
Number of new infections	May	9	5.00	45.00
	August	7	13.00	91.00
	Total	16		

Test Statistics[b]

	Number of new fatalities	Number of new infections
Mann-Whitney U	1.000	.000
Wilcoxon W	46.000	45.000
Z	-3.248	-3.359
Asymp. Sig. (2-tailed)	.001	.001
Exact Sig. [2*(1-tailed Sig.)]	.000[a]	.000[a]

a. Not corrected for ties.

b. Grouping Variable: Month

Ranks

	Month	N	Mean Rank	Sum of Ranks
Number of new fatalities	June	6	4.50	27.00
	August	7	9.14	64.00
	Total	13		
Number of new infections	June	6	3.50	21.00
	August	7	10.00	70.00
	Total	13		

Test Statistics[b]

	Number of new fatalities	Number of new infections
Mann-Whitney U	6.000	.000
Wilcoxon W	27.000	21.000
Z	-2.143	-3.000
Asymp. Sig. (2-tailed)	.032	.003
Exact Sig. [2*(1-tailed Sig.)]	.035[a]	.001[a]

a. Not corrected for ties.

b. Grouping Variable: Month

Ranks

	Month	N	Mean Rank	Sum of Ranks
Number of new fatalities	May	9	6.11	55.00
	July	10	13.50	135.00
	Total	19		
Number of new infections	May	9	5.72	51.50
	July	10	13.85	138.50
	Total	19		

Test Statistics[b]

	Number of new fatalities	Number of new infections
Mann-Whitney U	10.000	6.500
Wilcoxon W	55.000	51.500
Z	-2.868	-3.159
Asymp. Sig. (2-tailed)	.004	.002
Exact Sig. [2*(1-tailed Sig.)]	.003[a]	.001[a]

a. Not corrected for ties.

b. Grouping Variable: Month

Ranks

	Month	N	Mean Rank	Sum of Ranks
Number of new fatalities	April	11	6.73	74.00
	July	10	15.70	157.00
	Total	21		
Number of new infections	April	11	6.32	69.50
	July	10	16.15	161.50
	Total	21		

Test Statistics[b]

	Number of new fatalities	Number of new infections
Mann-Whitney U	8.000	3.500
Wilcoxon W	74.000	69.500
Z	-3.314	-3.629
Asymp. Sig. (2-tailed)	.001	.000
Exact Sig. [2*(1-tailed Sig.)]	.000[a]	.000[a]

a. Not corrected for ties.

b. Grouping Variable: Month