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## Ebola Epidemic

The largest epidemic of Ebola virus disease (EVD) was experienced between December 2013 and April 2016 where it recorded more than 28,000 cases with more than 11,000 deaths in Guinea, Sierra Leone, and Liberia. Studying this epidemic in the West African countries has led to an understanding of the disease and the generation of insights into its control. However, despite knowing the geographic distribution of this epidemic, the transmission or diffusion methods from animals and survivors over a wide area of West Africa is still unpredictable. Until this is established, any future outbreaks will have to be addressed the way this other outbreaks have been controlled. This includes, extensive surveillance, detection, contact tracing, isolation of the patients, proper and supportive clinical care, extensive efforts aimed at preventing and controlling the infection, safe burial and community involvement. Empirical studies that were conducted during the outbreaks have revealed that such epidemics can be prevented with a rapid response that will interrupt the transmission rate, but the big question is how health personnel and services are prepared for future outbreaks.

### **History and Geographic Distribution**

There have been 23 Ebola outbreaks in West Africa since the 1970s. The 2013-2016 epidemic was the largest one to have been recorded in history where it is reported that the first human case involved a 2-year-old boy from Meliandou village in Gueckedou which is a forested area in southeastern Guinea (World Health Organization). An investigation carried on the death

of the boy revealed that he fell sick on 26 December 2013 and died two days later. The cause of the infection is believed to be *Zaire ebolavirus species* whose origin is still unknown, but scientists have said that it is likely to originate from an animal, possibly a bat.

Despite the first infection being from an animal, subsequent cases were as a result of human-to-human transmission. In all the outbreaks, the main transmission mode was direct personal contact with the blood or any body fluid from an infected person. By early March 2014, the infection had spread into neighboring regions of Gueckedou (Kissidougou and Macenta) and by 10<sup>th</sup> March 2014, cases of the infections were reported in the capital city of Guinea-Conakry. There occurred massive transmission rates in Guinea between 10<sup>th</sup> March and April that resulted in more than 150 new cases and due to lack of interventions, the infection became more entrenched in Guinea. This allowed to spread farther and faster within the country and beyond its boundaries to other countries. Towards the end of March, the infection was reported in the counties of Lofa and Margibi in Liberia and Kailahun district in eastern Sierra Leone in May 2014.

Although the first infection originated in Guinea, rapid infections occurred in Sierra Leone and Liberia followed by Nzerekore in Guinea. Despite having a large number of people crossing the western border between Guinea and Sierra Leone, incidences of Ebola infections were synchronized within Guinean prefectures but this was not done in the adjacent district of Kambia in Sierra Leone. This led to the transmission of the infection across national borders. A phylogenetic analysis that was done on this epidemic provided valuable insights into the origins of this virus and how the impact of migration by infected individuals. Genomic analysis on this epidemic has demonstrated that it arose after a single introduction from an animal reservoir. In addition, this analysis also revealed how infected people moved fast over long distances

## Spread of the Epidemic

The rate at which the epidemic spread from one region to another varied among the three countries as well as the consequences were also different. The first epicenter to have been hit by this infection was Conakry, but the incidences remained relatively low throughout the period of the epidemic. The detection of the epidemic in Monrovia, Liberia was later, after Conakry but three weeks after it was reported in the north central region of Liberia. Of the three epicenters, Freetown recorded the highest incidences of Ebola infections (both cases and per capita), but increases in case incidences in Western Sierra Leone was reported in full 12 weeks. The infection rate and impact in both countries has never been predicted so far.

The first attacks of the infections from Guinea to other countries as well as its spread to the epicenters indicated the epidemics growth periods in both countries. The periods were characterized by “prolonged, exponential increases in the numbers of cases and the numbers of infected districts”. The size of the epidemic was measured through the duration of the exponential growth and not the weekly growth of case incidences in both countries. Sierra Leone recorded the slowest geographic spread rate where the period lasted for 22 weeks with case incidences doubling after every five weeks. Liberia reported the fastest geographic spread rate where it lasted for 15 weeks with case incidences doubling in two and half weeks. Despite the origin being from Guinea, it recorded the shortest and fastest growth that lasted for nine weeks with case incidences doubling in every 2 weeks.

If the growth period could have continued in this rate in both countries, by 2<sup>nd</sup> November case incidences could have gone beyond 20,000, and if the growth rate could have continued into 2015, then more cases could have been reported. The number of case incidences peaked at 950 cases during the last week of September 2014. Guinea recorded a total number of 3358

confirmed cases, Liberia 3163 confirmed cases and Sierra Leone 8706 cases. Number of cases per 100,000 per capita were 32, 87, and 137 respectively (Cori et al.). This demonstrates that Sierra Leone suffered most based on the number of cases and in per capita cases. Although there were uncertainties in reporting accuracies, differences in epidemic magnitude as well as its effect among the countries were witnessed.

The rapid spread of Ebola does not only present a characteristic of number of cases but also that of geographic dispersal. An example is the outbreak in Aberdeen in the period of January and February 2015 where Ebola cases were confirmed in 24 people with the infection having originated from a single source. Later the infections developed into a disease during the incubation period. Aberdeen was quarantined and the second generation of the epidemic was expected to occur in this area but it happened in Bombali district which is 200 km away. This happened after an infected man fled the area to see an herbal healer but died and was given a secret and unsafe burial in Rosanda village. Throughout the epidemic it was unpredictable where new cases were to be found. During this epidemic in equatorial Africa, different generations of cases were witnessed in both large and small scales. The intervention efforts that were aimed at interrupting the spread of the epidemic proved to be ineffective to break the transmission cycle in both countries.

### **Transmission Factors**

The reasons why the epidemic spread so fast cannot be attributed to the failure to contain the virus early since the reasons for this are complex. The first place where the first case was confirmed, Gueckedou, is a remote area in equatorial Africa and is almost inaccessible. In this area, healthcare services are severely limited, those who are sick are cared for differently from those in the Western countries. Patients are nursed at their homes by family members, when the

situation gets worse, they seek for further care from traditional healers and private and unofficial healthcare providers. The improved health care units are only equipped for the treatment of malaria, pregnancy and uncomplicated conditions. Although the patients may seek health services from hospitals, most of the settings lack basic equipment like soap and gloves. Moreover, the number of trained healthcare professionals in these regions is low. In addition, there is a shame similar to that which was witnessed in the early years of HIV associated with Ebola. The epidemic began in a region that has little trust in the government. Since its first outbreak, its acceptance is increasing as well though in the first people never believed that it existed and there were various conspiracy theories that surrounded it. The media spread such theories that it was a method of population control.

This fallacy of population control infested fear among people and the mistrust in the government hindered communication about this threat. This led families to be reluctant in handing over their loved ones for treatment by people who had the right protection equipment such as masks and suits. This was contributed with the fear that they might never see their family members again. These factors combined together led to the faster spread of the epidemic within the community and led to a delayed response from within the country and internationally. Keeping the patients at home to die and unsafe and incorrect burial practices such as touching the body by the mourners facilitated the spread of the virus further (Liu et al). During the early outbreaks of the epidemic, families buried their loved ones due to lack of funds to conduct a safe burial.

Provided that most of these factors exist in Ugandan and Democratic Republic of Congo settings which had reported outbreaks, an outbreak in miles away from where it had previously occurred also contributed to the spread of the virus. Lassa Fever which is endemic led to false

alarm amongst healthcare professionals in regard to the transmissibility that is associated with the epidemic. Moreover, wearing protective equipment in humid settings has its own challenges. Also, safe disposition of waste in these settings has its own challenges as well. There happen to be a general a slow international response during the early days of the outbreak when the traditional control strategies seemed to work was not forthcoming. WHO was also slow in deploying experts with necessary skills and equipment because it did not take the outbreak seriously from the beginning. Those who were involved in the control of the infection followed approaches that were used in smaller outbreaks and health care settings took long to adapt new strategies. Moreover, most organizations were unwilling to deploy their clinical staff to help the situation and most NGOs withdrew their staff from the affected countries. This fear from organizations lead to delayed response giving the disease enough time to develop and spread faster. Most of the Western countries were not affected but they did nothing, this demonstrates that the world just watched as the epidemic spread.

### **What can be done if it occurs now?**

Ebola is transmitted through human-to-human transmission via having a direct contact with body fluids of someone who has been infected. It has been proved that the chances of transmission increases in the advanced stage of the virus when the symptoms such as bleeding, vomiting and high viral load occurs. Controlling the disease should be aimed at interrupting the transmission rate through appropriate interventions such as identifying and testing suspected cases, isolating and tracing the contacts. These interventions did not prove to be effective during the early stages of the outbreak because there was late case identification when maximum exposure to the disease had occurred, testing the cases was done in several days, health settings did not have the capacity of handling such cases, and tracing of the contacts was not organized.

Equatorial Africa required a multifaceted international response, an integration of different agencies and bringing all the affected nations together to address this issue. The increase in the number of case incidences made it difficult to achieve a coordinated response. Each new case increased the health care professionals' workload. This epidemic thought the international and other organizations a lesson, currently we are witnessing doubled efforts towards disease spread control. International and regional organizations have developed a coordinated response, there is massive deployment of human and financial resources in daily basis. Governments have also joined these organizations by taking up the challenge. Governments are deploying their armed forces who have meaningful intervention strategies to provide effective infrastructure and support. There is massive construction of treatment centers with the necessary equipment and health professionals with the required technical support.

### **The Future**

Although Ebola was controlled in the equatorial Africa, it is important to consider how it affected the health infrastructure in these countries. Like other humanitarian disasters, the epidemic affected other programmes of communicable and non-communicable disease control. Since it was first discovered, there is a wide acceptance that Ebola is a potential threat to global health, it goes beyond the affected regions. With the current surge in movement of people from one region to another, the threat is expected to increase. The Freetown case proves this since a person who fled from the quarantined area led to an outbreak in a neighboring region. Since the previous outbreak was controlled, the current priority should be on how to contain and prevent future outbreaks. The previous outbreaks may have been controlled, but the question is, are we ready for the next one if at all it comes?

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