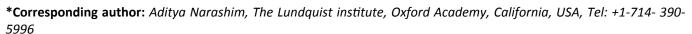## International Archives of
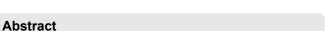# Public Health and Community Medicine

REVIEW ARTICLE

Social and Economic Factors Behind Ebola in Sierra Leonne

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Abstract

Backgrounds: The Ebola Hemorrhagic Fever, caused by the Ebola virus, is a rare but severe disease and claims a fatality rate of 50%. Although its origins date back to the 1970s, the epidemic in 2014-2016 marked its most prominent appearance. Amongst the Central- and West-African regions which showed a spike in cases during this epidemic period, the infections in Sierra Leone stood to be the most severe in the region, totaling about 14,000 cases in the country alone. Fruit bats are seen as the likely method of transmission of the Ebola virus. The first case in Sierra Leone was reported to be of an asymptomatic guest to the index case household and was confirmed in May 2014. However, the initial zoonotic transmission cannot account for the magnitude of cases seen during this epidemic.

Methods: This report aims to elucidate in depth how the virus spread so rapidly. Through studying a population-level biological event, many socioeconomic aspects of the population turn out to be the major contributors in compounding cases. This paper analyzes these socioeconomic aspects in depth through the use of numerous reports and sources to determine their effect.

Conclusions: It can easily be seen how many socioeconomic factors present during the epidemic aided in the vast caseload. Economic factors such as poverty, extremely poor socio-economic status, high governing instability, and illiteracy contributed widely to the spread of Ebola. Along with poverty and illiteracy came many confounding social factors such as resistance to modern medical practices, unsafe burials, and high mobility of populations during the epidemic also played important contributing roles. Having poor transport and healthcare infrastructures only added to the already present strain on the nation. However, organizations such as the United Nations Mission for Ebola Emergency Response (UNMEER) and WHO tackled the epidemic albeit with great difficulties. Together using advanced public health education, these organizations have since achieved a zero-case load since 2016—the end of the epidemic.

Introduction

The Ebola Virus Disease (EVD) or the Ebola Hemorrhagic Fever (EHF) is a highly fatal disease caused by infection of the Ebola family of viruses (EBV). An EBV infection most commonly affects humans and non-human primates such as Chimpanzees, Gorillas, and monkeys. The EBV family consists of six strains namely- Ebola virus (species *Zaire ebolavirus*), Sudan virus (species *Sudan ebolavirus*), Taï Forest virus (species *Taï Forest ebolavirus*, formerly *Côte d'Ivoire ebolavirus*), Bundibugyo virus (species *Bundibugyo ebolavirus*), Reston virus (species *Reston ebolavirus*), and the Bombali virus (species *Bombali ebolavirus)*. Out of these, the first four (*Zaire, Sudan, Taï*, and *Bundibugyo*) viruses lead to disease progression in humans. While the *Reston* virus infects only non-human primates and pigs, the *Bombali* virus infects bats with no known infections in humans. EVD becomes observable anytime from six days to twenty-one days after exposure to the virus. The most common Ebola virus symptoms are fever, headache, sore throat, and muscle pain. Untreated, symptoms progress to diarrhea, vomiting, and decreased liver, and kidney functioning. In its gruesome climax Ebola causes internal bleeding (most often in the liver, brain, or kidneys) and in rare cases external bleeding (the virus has been shown to reduce platelet count which inhibits clotting mechanisms). The shock from extreme fluid loss is seen as the cause of death due to this disease, which has a high fatality rate of an average of 50% [1,2].

The disease gets its name from the Ebola River in the Democratic Republic of Congo (DRC), where the first outbreak was recognized in 1976 (parts of this outbreak also took place in Sudan, but they were significantly smaller). The initial transmission was zoonotic- humans

coming into contact with animals such as bats, rats, and other bush animals; the virus then propagated from human to human through contact with bodily fluids. Rightly claimed as the "disease of social intimacy", EVD is spread mainly through acts of social interaction, such as between caregivers who look after the infected at home, health care professionals tasked with treating the infected, or community workers who undertake burials of the dead. A widespread belief (which was also a factor that allowed uncontrolled propagation of the virus in early epidemics)- that it is air borne- was quickly proven to be false. The virus multiplies and remains in the sweat, urine, blood, and other bodily fluids of infected individuals. Physical contact transmits viral cells to the recipient's skin, which can then enter the bloodstream through any cuts, abrasions, and mucus surfaces it may come into contact with, thus completing the cycle of transmission [1-3].

While parts of Central and East Africa had seen EBV outbreaks in the 1970s, West Africa had not been a site of an Ebola outbreak before the epidemic of 2014-2016. Fruit bats, considered a delicacy in many West African regions, are natural carriers of this virus: contact with them is thought to have caused the spill-over to humans. However, the initial zoonotic transmission cannot account for the magnitude of cases seen during the 2014-2016 Ebola epidemic. Sierra Leone, a coastal nation lining the west region of the African continent, shares borders in the southeast with Liberia and northeast with Guinea. With a population of around ~8 million people, it is mainly a unitary presidential republic. From post-independence, Sierra Leone saw an increase in civil unrest, upheavals, and various humanitarian and socio-economic crises. This has left the economy, health care and literacy levels in the country decimated. Sierra Leone saw the highest EBV infection numbers among the other two west African countries affected by the 2014-2016 Ebola outbreak (Guinea, and Liberia). Sierra Leone's weak health care systems, poverty, and governing systems in addition to its strongly held traditional beliefs are believed to have compounded the rise in the spread of Ebola vastly.

The Viral Trail

Although the exact origin of the virus remains unknown, the first identified outbreak of Ebola can be traced to 1976. The infections were at that point simultaneously detected in Zaire (Democratic Republic of Congo) and South Sudan [4]. Estimated cases of this initial outbreak range in the 600s, claiming a high fatality rate of nearly 70%. Since this initial outbreak, there have been around 25 outbreaks detected, with most of the cases in West African countries. Fewer cases were detected after the 1976 initial outbreak until 1994, after which the frequency of outbreaks increased drastically. Major outbreaks have been located around Central and West Africa, while contained or single cases have also

been reported around the world in countries such as the United States, and the United Kingdom [4-6].

The 2014-2016 epidemic stemmed from Meliandou- a village in the Guéckédou Prefecture, Guinea, as a result of zoonotic transmission from the contact of an eighteen-month-old child with a group of bats in December 2013. After a chain of human-to-human transmissions which remained undetected for several months, the virus resurfaced in March 2014 after several complaints of cases with severe diarrhea, fever, and vomiting with a high mortality rate. The WHO upon investigation confirmed an Ebola outbreak in West Africa. The first case in Sierra Leone, a rare asymptomatic occurrence, was confirmed in May 2014. After the initial introduction in Sierra Leone, the virus grew rapidly, peeking from September 2014-January 2015. After around 2 years of strife, in March 2016, the WHO declared Sierra Leone to be Ebola free. Since the end of the epidemic, no cases of Ebola have been reported in Sierra Leone. The toll of the virus has, however, been deeply indented on the nation [7-10].

Factors Involved in the Viral Spread

The West African Ebola infection has been unanimously termed the most devastating Ebola epidemic seen across the globe. Sierra Leone recorded the highest number of infections during the epidemic and suffered the most among the three west-African countries during the 2014-2016 epidemic. While the initial zoonotic transmission of the Ebola virus explains the initial few cases, biology alone cannot account for the massive influx of cases seen during the epidemic. Many other social, behavioral, and economic factors also contributed to the compounding of the infection count, and stand to explain how the outbreaks morphed into an epidemic [11].

Economic Factors

Poverty

According to the World Bank, ***poverty*** can be explained as a state of pronounced depreciation in the well-being of an individual, a state where the individual cannot buy the basic goods and necessities for survival. In a population of closer to 8 million people, 53% of Sierra Leone's residents live below the poverty line. The GDP. based on PPP, in 2014 for Sierra Leone was among the lowest in the world at around 12.6 billion USD [12]. Per capita, the GDP of Sierra Leone was equally as low (1.32 $ per day) in 2014 [13].

The Oxford Poverty and Human Development Initiative and the United Nations Development Program (UNDP) released a survey comparing the Multidimensional Poverty Index of 80 countries. The results of the analysis showed that 74% of people in Sierra Leone were multi-dimensionally poor- a state of deprivation in three broad sectors: health, education,

and standard living (considered apart from the basic income level) [14]. A study conducted by Fallah, et al. in 2014, also discusses poverty as a driver for Ebola infections in West Africa. The study uses data from Montserrado County to determine Socioeconomic Status-stratified temporal trends and drivers of Ebola transmission. They found that infections spread 3.5 times faster among poor people who were mostly located in regions with high population density. This study starkly highlights how while the people play an important role, drivers such as poverty, population density, and lack of healthcare facilities are the main causes of the spread [15].

Socio-economic status (SES): Social standing of the subject (individual, community, or a country)- is a combined measure of different sectors of daily existence, such as education, income, and health, in addition to other factors such as culture, societal, and geographical factors. Many studies have established SES factors as important determiners of health and have strongly indicated populations with higher SES experience better life expectancies, health, and also improved chances of recovery from illness. Determinants of the SES can be divided into five main groups: Health and health care, social and community context, neighborhood and built environment, education, and economic stability. Sierra Leone ranks 180 out of the 187 countries on the Human Development Index- a measure of average achievement in key dimensions of human development. This rating has even reduced to the 182nd position in 2020. Showing the extreme nature of the SES problem in Sierra Leone [3,16].

Economic and governmental instability

The economy of Sierra Leone has been a consistently weak one. The index of economic freedom (which describes an economically free state as one where the individuals are free to work, produce, consume, and invest freely as they please), placed Sierra Leone at 50.5 (out of 100 during the 2014 Ebola epidemic. The judiciary effectiveness was not quantifiable, and the overall financial freedom remained at only 20.0 points, highlighting the major ***economic and governmental instability***. Today the country holds an index score of only 51.7, a sign of persisting economic and governmental instability [17]. Before the Ebola epidemic, decades of civil unrest and war consistently kept the revenue at low levels. Poverty rates remained as high as 60%, such trends were also visible in illiteracy and unemployment rates. The government was politically hybrid- with multiple points of political power, such as militant armies, alliances of elites in urban areas, and secret societies in rural areas. With such a diverse political configuration, the loyalties of the inhabitants remained very divided, with groups of people being more trusting toward non-official governmental bodies, such as the LDF or other militant groups. Subsequently, causing

heaves of destruction and unrest in the nation Judiciary, financial, and state institutions too have largely remained in conflicted states and under the control of the elites, thus resulting in financial and other government resources being unavailable to the public. The economy has been suffering through low job creation festered by corruption. Such periods of absence of government heads or action drove a massive shift of people to informal agriculture, mining, and travel to the remote forest areas in search of food such as bushmeat [18]. So much so that, one of the safety measures against Ebola spread was to educate communities against handling or hunting bushmeat.

During the epidemic in Sierra Leone, the head of the African Socialist party Chernoh Alpha Bah, blocked a shipment containing more than $140,000 of medical equipment, reasoning that the ruling party refused to pay the shipment fees. The shipment lay on the docks for over two months, during which many of the healthcare workers were left without proper PPE (e.x. gloves, masks, hazmat suits, etc.) while caring for infected individuals. The shipment contained over 100 cases of PPE equipment which is essential to prevent the spread to the healthcare workers as well as cross-contamination between patients and their relatives. Many other shipments and aid parcels were blocked for political gains throughout the epidemic period [19]. The continued existence of a corrupt, inactive, and unstable state from its inception and through the epidemic period, resulted in a huge mistrust in the government bodies and thus, drove the public to prominently ignore any initial Ebola warnings or information tried to be disseminated by them, allowing the infection numbers to rise unhindered.

Government inaction

Oversight by different government bodies also played a role in the epidemic's massive reach. The WHO declared Ebola an epidemic in March 2014. Many government bodies acted only when the death toll reached about 4000. The initial neglect was the delayed response by the local government of Guinea in alerting neighboring countries or even making an effort to curb the spread, allowing the transmission into Sierra Leone and Liberia. The countries lived in denial and remained porous across borders till September- when cases were already prevalent. When the WHO declared the epidemic an international public health concern, the governmental bodies from the west scrambled to aid in curbing the virus. The UK and USA scurried to pledge millions of dollars and ensured troops were being sent to aid in the flattening of the curve- just in time as the frightening statistic of "5 infections every hour" in Sierra Leone was stated by a WHO authority in a conference held to end Ebola in Sierra Leone [20].

A 2014 article explains that the WHO accepts that it

mishandled the early stages of the Ebola outbreak in a draft internal document obtained by an associated press. Stages that have now clearly proven to be quite crucial to saving lives and money, went unrecognized. The early warning signs should have been seen and governments should have acted differently considering the extremely porous borders of the three countries and the failing health systems in place. The article reports how an interplay of politics prevailed over action. The Médecins Sans Frontieres (MSF) or Doctors Without Borders, who had promptly begun to take action immediately after the epidemic declaration, had warned the regional WHO director Dr. Louis Sambo about how this spread was different from any other infections seen before.

The MSF was quick to notice the trail of the virus and how the geographical area is a triangular confluence of three of the poorest countries. All warning signs were met with inaction and apathy from the government bodies and the African WHO director, indicating the ineffectiveness of governmental systems. The general director of WHO was finally notified only in June, but by then the roots of Ebola had grown quite deep in the three countries [21]. In support of this, and exactly a year after the epidemic, the MSF pointed out huge voids which were present during the epidemic. The inability of WHO to act in time stretched the MSF beyond capacity for training the healthcare providers at a time when they should have been in action. The MSF also pointed out how the lack of political will to learn from other previous global emergencies led to catastrophic numbers during the Ebola epidemic [22,23].

Social Factors

Population density

Adding on to the failing and meager health care systems in Sierra Leone, the *population density* also played a central role in the large case numbers observed during the 2014 Ebola epidemic. World bank data reports the population density of Sierra Leone to be as high as 97 people per square kilometer in 2014 during the epidemic. The density has increased over time and currently stands at 110 people per sq. km; the new density marked a 178% increase in population density since the end of the civil war. Urbanization in Sierra Leone also increased by about 130% [24]. Numerous studies establish a positive correlation between population density and the spread of infectious diseases [25]. While modeling data indicate that population density may not be directly correlated to the increase in infections, overcrowding which often leads to a decrease in sanitation, intense competition for resources, and increased human-human contact due to lack of space, all derivatives of increased population density, cause an infection to spread especially in the case of a virus that moves as quickly as Ebola [26]. The phenomenons mentioned in the previous sentence apply to Freetown, Sierra Leone which currently houses about 74 informal settlements with very poor planning. The significance of overpopulation in disease spread is exemplified in a study by Barosso, et.al. 2014, which indicated that an increase in the road density by even 0.01 (values vary between 0 to 1) implicated an increase in Ebola cases by about 3% in the given area [27].

High mobility

Porous borders and high population mobility are other features observed in the West African countries that contributed to the expansive spread of Ebola. Due to weak and under-established borders, rural populations often move free in the West African outskirts.

According to the WHO, mobility across borders in the three countries most heavily affected by the epidemic is shown to have been seven times higher than anywhere else in the world. Poverty and the need for a steady salaried income forced people to travel across geographical regions in search of necessities. It is also a common practice to bury the dead near their ancestors, causing people to travel to tribal or familial lands in the outskirts of the countries, usually, these areas are unbordered and free to access-a factor which compounded cases until the people were educated on safe burial methods [28]. Contact tracing becomes immensely difficult in such situations, as people often traveled across borders and could have made many unaddressed contacts.

Improving situations on one side of the border caused people from other sides to flock, seeking free beds. Thus, expanding the number of patients and straining the records and resources of health care centers [29]. People in these regions do not see borders as physical barriers. A study by Dudas, et al. commented on how the highly porous borders between Guinea, Sierra Leone, and Liberia may have allowed for an unimpeded spread of Ebola during the epidemic [30]. Even mobility within Sierra Leone contributed to an increase in cases. An article in the Wall Street Journal describes grave situations where ambulances had to travel around carrying Ebola-positive people- often for hours together in search of beds, in the heat, and on unpaved roads, which meant a lot of movement, and hence contact between the infected and ambulance workers [31]. Mobility and the porous nature of borders permitted mass interactions and thus blurred many contacts and interactions. At a time when there should have been absolute contact isolation, mobility increased the contagion spread at an exponential rate.

Unsafe burials

Unsafe burials were among the foremost factors in the spread of Ebola, forcing the government to place a ban on the traditional way of burying the dead. The burial of the traditional healer in Kailahun illustrates this spread. The burial is linked to around 365 deaths and positive cases [32]. Burials in most of West Africa

including Sierra Leone remain highly traditional, deep-rooted traditions make burials a sacred practice in many tribal communities. These traditions are inter-woven by marriages and dowries, all of which have survived through decades of civil war and unrest. Burials in these regions involve a lot of touching of the corpse by washing the dead with bare hands, caressing/spending time with them, and dressing them. In certain parts, even drinking the washed waters is considered holy to transfer powers from one person to another.

Open marriages are another prominent practice in Sierra Leone. These poly monogamous relationships were most prevalent in rural areas. Marriages and the traditional burials together played a huge part in the spread of Ebola. But still, these practices were defended vehemently by the communities, with disregard for all safety guidelines issued by WHO.

Tribal marriages in Sierra Leone posed as factors that aided in the viral spread, especially in rural areas. Marriages in many regions of the country are done with the man from one community and the wife from either neighboring or far-off communities/chiefdoms, which means traveling long distances, inherently passing viruses from one community to another. The marriage involves a promise of gifts in form of labor/land access/other tilling rights from the man's side. Upon the death of the wife, the man has to travel to the wife's ancestral home-with the wife's dead body to complete any "outstanding gifts", so that the marriage can be considered complete and the woman can be buried in dignity, failing which, the body has to be carried back by the husband in a hammock-like structure to his community. For the wife, upon her husband's death, the wife has to be applied with mud mixed with waters obtained from the washing of her husband's dead body. All these procedures included much movement and all death rituals involved a plethora of physical contact with the corpse; due to Ebola's viral nature, this created a near-perfect breeding ground for the virus.

Ebola causes hemorrhagic fevers resulting in death, and the dead bodies can harbor live viruses for days together-far beyond the scope of time that traditional burial takes to complete, reigniting a whole new chain of infections. Due to these deadly conditions, official bans were declared on traditional burials in December 2014, and it was stipulated that the dead should be buried after spraying with disinfectants followed by bagging. This was met with huge resistance by tribal communities, with many people retrieving buried corpses secretly during the nights to secretly carry out tribal burials or even carrying out the traditional burials openly if/when the official burial team did not arrive. Up to 80% of the deaths in Sierra Leone are linked to individuals following unsafe burials, showing how this social factor was a primary contributor to the prevalence of Ebola [11,24,33].

Conclusions

Political leader George Bernard Shaw once said, "Progress without change is impossible"; Sierra Leone's citizens began to grasp the necessity for change. They saw their loved ones dying, and saw other families suffering. Soon the government too realized the time for action. Many measures put into place finally began to take effect. The Ebola recovery strategy saw governments across sectors reviewing their portfolios to identify changes yielding positive outcomes to improve public health. A direct effect of this was sanitation and education being significantly improved. The involvement of traditional healers proved to be the single most efficient step to get engaging with the communities. As they went about educating their village communities, Ebola measures were more welcomed and practiced. Educating and re-educating communities about Ebola resulted in a huge improvement in health literacy. Many villages began to seek vaccination against Ebola voluntarily, showing an increased understanding of the virus [68].

However, the conditions regarding poverty, SES, migration, and health care systems remain dire. Plans are put into place for improving these aspects, but much is still to be done. The outbreak also brought to attention the necessity to further develop health infrastructure in numerous countries. Open communication, involving local communities, improving health literacy, and open dialogue between government authorities were the most important actions taken to curb the viral spread.

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