Meeting the Challenge of Ebola Virus Disease in a Holistic Manner by Taking into Account Socioeconomic and Cultural Factors: The Experience of West Africa

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ABSTRACT: Even if an effective vaccine against Ebola virus disease (EVD) becomes available, the challenges posed by this disease are complex. Certain socioeconomic and cultural factors have been linked to recent outbreaks of EVD in West Africa. The outbreaks revealed widespread ignorance by laypersons of EVD etiology, mode of transmission, and personal protective measures that can be taken. Lack of trust in the authorities, virus infection during the preparation of “bushmeat” for human consumption, traditional funerary practices, and relatively free flow of goods and people between regions and across international borders may have facilitated the spread of EVD and hindered outbreak control efforts. Inadequacy in health systems of the most seriously affected countries, such as Guinea, Sierra Leone, and Liberia, is also an important factor. The objectives of this article are to argue that EVD should be evaluated in a systematic and holistic manner and that this can be done through the use of the modified Haddon Matrix.

KEYWORDS: Ebola virus disease, socioeconomic factors, cultural factors, modified Haddon Matrix

Introduction

Ebola virus disease (EVD) has generated much attention probably because of its dramatic effects on the bodies of victims such as bleeding from orifices and its high case fatality rate. The case fatality rate can range from 25% to as high as 90%, with an average rate of 50%.1

The availability of an effective vaccine against EVD appears to be on the horizon.2 However, even if a vaccine emerges, it is advisable to meet the challenges posed by this disease in a holistic manner. This is because socioeconomic and cultural factors have been identified as being deeply enmeshed with the outbreaks of EVD in various regions of Africa. The latest outbreaks in Africa reveal that there continues to be widespread ignorance of its etiology (infection by one of the strains of the Ebola virus), mode of transmission (direct contact with animal or human blood or body fluids containing the virus), and personal protective measures that can be taken on the part of laypeople.

Lack of trust in the authorities in countries such as Sierra Leone due to corruption,3 preparation of “bushmeat” (the flesh of wild animals such as bats and nonhuman primates such as apes and monkeys) for human consumption in parts of Africa,4 and the ritual washing and shrouding of dead bodies prior to burial practiced by some communities5 may have facilitated, to varying degrees, the spread of the disease and hindered outbreak control efforts. Funding problems resulting in weak and inadequate healthcare systems are also a factor.

The modified Haddon Matrix can be used to approach EVD in a systematic and holistic manner, including consideration of socioeconomic and cultural factors.

Socioeconomic and Cultural Factors Linked to EVD and their Identification and Analysis Using the Modified Haddon Matrix

Modified Haddon Matrix. The Haddon Matrix was originally derived to reduce morbidity and mortality from injuries (especially motor vehicle injuries).6,7 It took into account the agent–host–environment epidemiological triad, for example, the vehicle, the driver, and the physical environment, and also incorporated a time dimension. The time dimension was divided into three intervals, that is, pre-event, event, and postevent. This gave rise to a 3 × 3 table, with time on the left side of the table and the agent–host–environment triad across the top of the table.

The “environment” part of the Haddon Matrix was subsequently expanded into two (ie, physical environment and social environment) and is illustrated in Figure 1.
Modifications of the Haddox Matrix have been introduced and used in the analysis of other health challenges such as natural disasters and infectious disease outbreaks. In a similar vein, a modification of the Haddon Matrix presented later. It incorporates an analysis of socioeconomic and cultural factors linked to EVD outbreaks in Africa, that is, the columns “Health Policy and Funding Environment” and “Social and Cultural Environment” have been added. Table 1 helps us to think about the challenges associated with EVD in a more holistic manner. This will allow the identification of a wider range of possible intervention strategies in the battle against EVD.

**Bushmeat preparation and consumption.** Some of the social and cultural factors that are linked to outbreaks of EVD are listed in Table 1 under the column “Social and Cultural Environment”. One of these is the practice of preparing and consuming bushmeat such as bats and nonhuman primates (monkeys and apes), which have been identified as animal reservoirs of various zoonotic viruses, including the Ebola virus. It has been pointed out that even during the height of the recent EVD outbreaks in countries such as Liberia, Sierra Leone, and Guinea, the preparation and consumption of bushmeat continued among populations at risk. This is because bushmeat has traditionally served as a source of protein for these populations.

Although the risk of Ebola virus transmission via consumption of bushmeat is minimal (since thorough cooking can destroy the virus), this is not the case during the initial stages of hunting, processing, and preparation of bushmeat as the persons involved in these stages could have come into contact with fluids such as blood.

The challenge here is to persuade people, in the short run, to stop processing and eating bushmeat during EVD outbreaks. In the long run, other sources of protein need to be made available and affordable for them.

**Lack of trust.** Corruption is a significant challenge in the governance of some of the sub-Saharan African countries. Another challenge is the uneven recovery of nations such as Sierra Leone and Liberia from the devastating civil war. This has resulted in widespread lack of trust in and misunderstanding or fear of certain actions of the authorities (including health authorities) among some segments of the population. This, together with the relatively low level of literacy among the rural or urban slum populations, would present stronger challenges in the effort to quickly bring any outbreak of EVD under control. Hence, the most recent outbreaks in West Africa were accompanied by statements such as the following from the President of Liberia Ellen Johnson Sirleaf in August 2014:

> We have been unable to control the spread due to continued denials, cultural varying practices, disregard for the advice of health workers and disrespect for the warnings by the government.

It was also reported that some people even dismissed the outbreak as a hoax, while others believed that the disease is due to witchcraft. All these views have no scientific basis.

In Guinea, public health teams were even attacked as they attempted to carry out their duties in the rural areas. Thus, eight staffers from a public health team were attacked and killed as they tried to raise awareness about the danger of EVD in the southeastern region of the country.

Unless basic literacy levels rise and “health literacy” also improves, health education programs will continue to face problems with negative attitudes from the people such as fear, suspicion, disbelief and even hostility, and a corresponding lack of significant behavioral change on their part. People would also continue to move in and out of affected areas during EVD and other similar outbreaks as many of them do not understand the importance of public health measures relating to isolation and quarantine of cases and suspected cases. The porous international borders between nations such as Guinea and Sierra Leone, which allow relatively free flow of people and goods, unfortunately, can also facilitate the spread of EVD.

**Ritual washing, shrouding of the dead, and other funeral practices.** Partly because of the influence of religion in countries such as Guinea, close relatives are expected to carry out preburial ritual washing and shrouding of the dead bodies. Burial rituals and other traditional funeral practices have been linked to the transmission of Ebola virus.

For example, in the earlier 2000–2001 outbreak in Uganda in East Africa (425 cases and 224 deaths for a case fatality rate of 53%), the risk of transmission of Ebola virus was increased by traditional funeral practices such as ritual washing of hands in a common bowl by family members of the deceased and by the “love touch,” that is, the giving of a final touch on the face or the body of the deceased person during open casket viewing. A recent United Nations report also noted that long distance transfer of corpses—to enable the newly dead to be buried close to the graves of ancestors—can also increase the chances of transmission of Ebola virus.

During the outbreak in Guinea in late December 2014 and early January 2015, 85 EVD cases were also linked to the traditional funeral ceremony. It was argued by the authors of the report that if rural communities can be persuaded to adopt safe burial methods, this would lower the risk of transmission of Ebola virus. However, an analysis of the experience of

| Agent | Host | Physical Environment | Social Environment |
|-------|------|----------------------|-------------------|
| Preevent | | | |
| Event | | | |
| Postevent | | | |

*Figure 1. The original Haddox Matrix was modified as shown here, expanding the original Environment component into Physical Environment and Social Environment.*
Table 1. Thinking about Ebola virus disease in a holistic manner (using a modified Haddon Matrix).

|                | AGENT                                                                 | HOST                                                                 | PHYSICAL ENVIRONMENT       | HEALTH POLICY AND FUNDING ENVIRONMENT | SOCIAL AND CULTURAL ENVIRONMENT |
|----------------|-----------------------------------------------------------------------|----------------------------------------------------------------------|-----------------------------|---------------------------------------|----------------------------------|
| Before the outbreak occurs | Ebola virus is present in animal reservoirs (bats and primates) | Level of “health literacy” of local people—including knowledge of EVD, its signs and symptoms and how to respond appropriately | Human settlements near forested regions | Adequacy of human resources and facilities (e.g. diagnostic labs, isolation facilities, ambulances)—have these been affected by spending cuts? Proper training of health personnel System to monitor occurrence of viral disease outbreaks exists | Customary to prepare and eat animals that can host the Ebola virus e.g. “bush meat” such as monkeys and apes Literacy level of local people Trust of people in the authorities (including public health authorities) i.e. low trust means little attention paid to anti-EVD public health messages |
| During the outbreak | Virulence of specific Ebola strain responsible for the outbreak | Behaviour of people infected with Ebola virus (e.g. do they continue to engage in social interaction or travel to other areas?) | Adequate road and communication systems exist Easy for outside experts, helpers and aid to get to the infected area by road or by air | Quick identification and strict isolation of people harboring Ebola virus, and quarantine of contacts. Adequate exit screening of people from affected areas. Implementation of cross-border contact tracing measures Adequacy of infection control procedures and equipment in health care facilities e.g. gloves, masks, disinfecting liquids Safe disposal of clothing and bedding from Ebola patients Adequacy of supply of rehydration fluids (oral and intravenous) Serum therapy using convalescent plasma from survivors Arrangements for help from other countries when outbreaks occur Implementation of public awareness campaign | Cultural practices that can facilitate the spread of Ebola e.g. religious requirement to wash and shroud the body before burial Survivors (who are immune) help with burial work, contact tracing and community education |
| After the outbreak is brought under control or ends | Mutation of Ebola virus to less virulent strain? Elimination of animal reservoir? | Recovered patients successfully re-integrated into their communities | Deforestation and destruction of habitat of bats and primates continues? | Adequate number of mental health workers (including non-physician ones) to help recovered Ebola patients and families of deceased patients Funds from external donors are actually used to help recovered patients, their families and affected communities (rather than diverted through corruption) | Prejudice and discrimination against recovered Ebola patients and even against their family members Avoidance of “bush meat”?


health authorities in Sierra Leone indicated that attempts to change customary burial practices through health education could prove to be a challenge.\textsuperscript{16}

**Use of survivors.** Survivors of EVD appear to acquire immunity against it (or at least, the strain of Ebola that they survived). Thus, besides the use of donated convalescent plasma from EVD survivors for “serum therapy,” it has been suggested that EVD survivors could even be mobilized to help control outbreaks. One reason is because they can operate with less sophisticated personal protective equipment (PPE)\textsuperscript{17}

… recovered responders could operate with much less onerous PPE than current health-care workers. They would require only the training and protective equipment (medical gloves, face shield and goggles) used to minimize the transmission of more familiar blood-borne pathogens such as HIV. This would allow them to have much more extensive contact with patients than Ebola PPE normally affords. Generally, providers in full Ebola PPE work only two-hour shifts to avoid overheating.

Survivors could also be used to assist with burial work; contact tracing; isolation, quarantine, or transport of suspected cases; and community education. Other possibilities include the recruitment and training of survivors for carrying out infection control work and decontamination exercises such as spraying disinfecting liquids in houses where people have died, disposal of the clothing and bedding from Ebola patients, and perhaps even assisting with nursing work such as the administration of food and rehydration fluids to the sick. The latter would enable the limited numbers of skilled health personnel to have more time for the performance of more complicated tasks.\textsuperscript{17}

However, the use of survivors is only possible if prejudice and discrimination against survivors from the rest of the community is not a problem. Otherwise, community members would avoid the recruited survivors and render the latter ineffective as members of public health intervention teams doing contact tracing or community education work.

There is also the possibility of “post-Ebola syndrome” hampering their participation in postepidemic community education work, that is, longer term negative effects on the health of those who survived EVD. These include visual problems; hearing loss; joint, muscle, and chest pain; headaches; and extreme fatigue.\textsuperscript{18,19} There is uncertainty about whether these health problems experienced by survivors are caused by the disease, the treatments they underwent, or by the heavy disinfection procedures carried out during outbreaks.\textsuperscript{18}

**Prejudice and discrimination.** In addition to long-term effects on health, survivors can also continue to suffer in many other ways.\textsuperscript{20} These include prejudice and discrimination from the rest of the community. Family members who did not fall sick with EVD may even be subjected to the same phenomena. Such experiences are likely to have negative effects on their social and mental well-being. The longer term mental health of survivors and their family members should also be taken into account in the battle against EVD.

In a study of 60 Uganda survivors of EVD (22 men and 38 women), in response to questions on stigmatization, the survivors mentioned that they were stigmatized in the following ways\textsuperscript{14}:

Feared by others when they returned to the community.

Experiencing rejection at the market or store.

Experiencing rejection at the village well or borehole.

Experiencing rejection when walking through the neighborhood.

Prejudice and discrimination can perhaps only be reduced through culturally sensitive community education efforts. The nongovernmental organization Medecins Sans Frontieres actually awards Ebola survivors in Sierra Leone a “certificate of discharge” to prove that they have recovered from the disease and to help reduce stigmatization of survivors.\textsuperscript{21}

**Inadequacies in the healthcare system.** Possible shortcomings in the healthcare system itself are listed in Table 1 under the column “Health Policy and Funding Environment”. These include government funding problems and their effects such as inadequacy with respect to numbers and quality of healthcare human resources and facilities, for example, shortage of health personnel (including public health personnel), lack of diagnostic laboratories, limited number of treatment centers and hospital beds for isolation and care of patients with EVD, and shortage of PPE.

It has been argued that economic “structural adjustment programs” carried out by the governments of nations such as those of Guinea, Sierra Leone, and Liberia in return for assistance from international organizations such as the International Monetary Fund (IMF) have had detrimental effects on their respective health systems. These effects include low pay for public sector health personnel and reductions in the number of community health workers. Robinson and Pfeiffer claimed that\textsuperscript{22}

When countries sacrifice budget allocations to meet macroeconomic policy prescriptions, as per the IMF’s decree, it is at the expense of social spending. Without money to fund basic infrastructure, health facilities are left crumbling, sometimes without access to water or electricity, and completely unprepared for complex emergencies. Few health workers are trained in infectious disease control, and those that have received training lack protective equipment and materials due to non-functioning supply systems.

Inadequate funding also means that dedicated health personnel are unnecessarily exposed to increased risk when carrying out their tasks. This is especially so if the PPE needed for
handling EVD patients or carrying out public health activities such as decontamination are in short supply, low quality, or even makeshift in nature.

Discussion and Conclusion
This article argues that it is advisable to meet the challenges posed by EVD in a holistic manner because socioeconomic and cultural factors are deeply enmeshed with outbreaks of EVD in various regions of Africa. Low levels of literacy among rural people as well as urban slum dwellers are further compounded by lack of trust in the authorities because of widespread corruption in the civil service and other manifestations of poor governance. Health education programs carried out under emergency conditions are further weakened if their target populations simply do not believe what they are told with respect to steps they can take to avoid being infected with Ebola virus.

Deeply ingrained cultural practices such as the preparation and consumption of bushmeat and the ritual washing and shrouding of dead bodies prior to burial are probably impossible to stop. Nevertheless, during outbreaks of EVD, attempts to persuade people to temporarily stop preparing and consuming bushmeat will still need to be carried out. This will also necessitate the provision of other forms of protein to populations at risk.

The assistance of anthropologists and locals will be needed along with modified funeral rites that not only respect tradition but also reduce the risk of transmission of Ebola virus. Simply ignoring local customs and having public health teams seize corpses of Ebola victims for safe burial are not advisable and have resulted in cases of violent responses from uncomprehending and upset relatives and villagers. It has also been reported that some people hid sick relatives and then secretly buried their corpses at night to prevent public health teams from taking away the dead bodies for safe burial.23

Poor countries that are also afflicted by corruption in governance and civil service operations will be faced with the challenge of poor transportation networks and highly inadequate healthcare systems. There will be challenges such as shortages of personnel, facilities, as well as equipment and supplies. Therefore, these countries will require extensive help from other countries and from international health organizations when outbreaks occur. If critics such as Robinson and Pfeiffer are correct, other international organizations such as the IMF should revise their policies and avoid imposing “conditionalities” that have a negative impact on public health infrastructure.22,24

Furthermore, it is not enough just to control and stop EVD outbreaks. The longer term economic and social needs of survivors and their family members also need to be taken into consideration.25 It should be noted that EVD can result in the phenomenon of orphaned children in affected communities. The orphaned children may even be survivors themselves. Steps need to be taken to protect survivors and their family members from further suffering arising from prejudice and discrimination and even exploitation.26 Longer term effects on their physical health (post-Ebola syndrome) and mental health will also need to be managed.

Reconstruction aid provided by outsiders will need to be carefully monitored by donors and international organizations such that the aid actually reaches survivors, their families, and affected communities rather than get diverted or wasted because of corruption.

International cooperation between governments and health ministries in West Africa also needs to be enhanced. This includes steps to facilitate cross-border contact tracing during infectious disease outbreaks.12

The modified Haddon Matrix is a useful tool for the analysis of challenges associated with EVD outbreaks, because it is a holistic approach and there is a time dimension built into it. It can be used to design public health, health policy, and sociocultural intervention programs in a more comprehensive and thorough manner.8

There is reason to be optimistic. Besides the possibility of appearance of effective vaccines against EVD, and of highly sensitive and rapid diagnostic methods to detect the presence of Ebola virus,26 the experience of Uganda indicates that quick containment of EVD outbreaks is possible. However, this necessitates strong political support, effective coordination throughout the public health system, and community mobilization through the formation of village health teams.27

As of October 2015, WHO data reveal that Guinea has had 3,800 cases with 2,534 deaths; Sierra Leone has had 13,957 cases with 3,955 deaths; and Liberia has had 10,666 cases with 4,806 deaths.28

Author Contributions
Conceived the concepts: KLP. Wrote the first draft of the manuscript: KLP. Developed the structure and arguments for the paper: KLP. Made critical revisions: KLP. The author reviewed and approved of the final manuscript.

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