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# Relationship Between Cultural and Religious Practices and Ebola Virus in Freetown, Sierra Leone

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# Walden University

College of Health Professions

This is to certify that the doctoral dissertation by

Richmond Samuel Kpange

has been found to be complete and satisfactory in all respects,
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Walden University
2021

Abstract

Relationship Between Cultural and Religious Practices and Ebola Virus in Freetown, Sierra Leone

by

Richmond Samuel Kpange

MBA, Strayer University, 2015

BS, University of Sierra Leone, 1993

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Health

Walden University

November 2021

## Abstract

The 2014 Ebola virus epidemic in the West Coast of Africa was a historically unprecedented epidemic with a sustained spread in multiple West African nations, including Sierra Leone. The World Health Organization (WHO) classified Sierra Leone as a high Ebola-affected country as it reported the highest number of deaths (14,124) during the last Ebola outbreak compared to other Ebola-affected countries. Public health experts have given little attention to the impact of sociocultural factors on infectious diseases, especially Ebola. The purpose of this study was to ascertain whether there is a relationship between the spread of EVD and a patient's gender, age, washing of the corpse, the role of housewife, contact with a living sick person, and funeral attendance. The theoretical framework for this investigation was the social-ecological model, which supported research involving physical, behavioral, and social determinants associated with information on the Ebola virus. This quantitative cross-sectional study from the Sierra Leone Ebola Data, a sample size of 81,923 collated by the Sierra Leone Ministry of Health and Sanitation, used a binary logistic regression and chi-square test analysis to investigate the research questions. Results showed that age, gender, funeral attendance, and contact with a living sick person were significant predictors of the spread of the Ebola virus while washing a corpse and fulfilling the traditional role of a housewife were not essential indicators for the spread of the virus. This study contributes to social change by helping health experts to implement strategies to contain and treat the disease. Healthcare experts must consider the success of interventions and social and behavioral factors while considering issues that may inhibit combating the spread of the virus.

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# Dedication

This dissertation is dedicated to the memory of my loving wife, Jebbeh Juliet Kpange, and children; Ruth Boi Kpange and Richmond Fejaweh Kpange, Jr. Second, I would like to dedicate this dissertation to the memory of my loving parents, Richard Max Kpange and Marie Kumba Harding. Third, I would also like to dedicate this work to my loving sisters, Rosaline Tutu Kpange and Grace B. Mansaray, my family in Sierra Leone who believed in me and who had so much passion for education and encouraged me to attain my maximum potential. I would also like to dedicate this dissertation to people who were affected by Ebola virus disease, both survivors and deceased in Ebola-affected countries and the entire world.

## Acknowledgments

I want to express my sincere thanks and appreciation to the almighty Jehovah for granting me the strength to accomplish my dream. I want to acknowledge my committee chair, Dr. German Gonzalez (Dr. G), my committee member, Dr. Heidi Sato, and my URR, Dr. Scott McDaniel for providing their invaluable support during the entire capstone process. Without their constant scrutiny and guidance, this work would have seemed impossible. To them, I owe a lot of thanks and appreciation. I sincerely acknowledge the many communities and professional colleagues such as Dr. Yera Keita and Mr. Alex Tucker, who provided critical insights and insider knowledge about the Ebola outbreak, as well as the complexities and importance of more effectively engaging communities in prevention and containment efforts. Thanks to the Walden Library and Writing Center personnel for their helpful information, networks, and perspectives. I also profoundly acknowledge with thanks the tireless support and editing provided by Tracy Hiatt Grice. This article is dedicated to those who have lost their lives in the Ebola outbreak, and particularly to those health care workers, family, and community members whose commitment to assisting and caring for those affected exacted the ultimate price. Finally, I acknowledge and sincerely thank those Ebola survivors who have returned to continue their efforts to prevent and contain this deeply feared disease, and those who are working to support and engage communities in this process.

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# Chapter 1: Introduction to the Study

The Ebola virus has devastated many regions around the world, especially towns, villages, and cities in African countries. This lethal virus made its first appearance in 1976 in the Democratic Republic of the Congo (Breman et al., 2016). The Ebola virus is highly infectious and contagious with an incubation period of fewer than 21 days (Rajak et al., 2015) and case fatality rate (CFR) of about 90% (Gire, 2014). The virus causes Ebola hemorrhagic fever (EHF), an infectious disease that can be transmitted from animals such as bush pigs, rodents, porcupines, and forest-dwelling antelope to both human and nonhuman primates, including monkeys, chimpanzees, gorillas, and baboons (Matua et al., 2015).

In 2014, Sierra Leone (and its neighboring countries Guinea and Liberia) was the site of the largest known outbreak since the discovery of the disease in 1976. Fang et al. (2016) said the Ebola virus disease (EVD) epidemic affected 114 of 150 chiefdoms in Sierra Leone and demonstrated spatial heterogeneity in terms of cumulative incidence data across the nation. In addition, the invasion of EVD into chiefdoms was significantly associated with intersections of primary and secondary roads, which are vital connections between rural towns and densely populated cities like Freetown. This may be because convenient access to streets facilitated the transportation of EVD patients or dead bodies and therefore contributed to the rapid and extensive spread of the disease in Sierra Leone (Fang et al., 2016).

By contrast, the simultaneous EVD outbreak in the Democratic Republic of Congo of Equatorial Africa was much smaller because it occurred in remote forested

areas, where human contacts were limited due to small populations and infrequent connections due to poor communication and transportation (Fang et al., 2016). According to the World Health Organization (WHO, 2014), cultural and religious practices such as burial ceremonies, housewife occupation, washing of corpses, and congregational prayers in impacted communities to a large extent facilitated the rapid spread of the Ebola virus. Also, the emergence of the Ebola virus in a densely populated urban environment with insufficient healthcare facilities, combined with a general misunderstanding of the virus among affected communities and even among public health professionals exacerbated the spread of the Ebola virus. The WHO (2014) said 60% of all Ebola cases in Sierra Leone were caused by cultural and religious practices.

Healthcare providers in Sierra Leone were unsuccessful in terms of their efforts to manage the 2014 Ebola outbreak in Sierra Leone. During this serious 2014 Ebola virus outbreak of the, the only preventive measures in widespread use were avoidance of feces, direct skin contact, bodily fluid, and contaminated utensils and cutleries (WHO, 2014). People who contracted the virus faced complications such as segregation (biosocial stigma), distrust of health systems, social stigmatization, and inability to obtain medical attention (Manguvo & Mafuvadze, 2015). The purpose of this research project is to investigate the relationship between religious and cultural practices in terms of the spread of the Ebola virus in Freetown, Sierra Leone. The objectives of this study are to analyze preventive measures and examine burial ceremonies and other religious practices that enhanced the spread of Ebola with the goal of containing the rapid spread of the deadly virus during future outbreaks.

## Background of the Study

In the Democratic Republic of Congo, the EVD, named after the Ebola River, is known to be a highly contagious disease with a high rate of mortality (Dietz et al., 2015). Since 1975, the EVD has created a severe universal health threat to many African countries. Over 20 additional outbreaks of the virus have occurred in the western and central regions of Africa, resulting in more than 28,000 cases of EVD (Dietz et al., 2015).

Viruses in the family Filoviridae and genus Ebolavirus cause EVD (Dietz et al., 2015). EVD in humans often causes severe infection and begins with symptoms such as high fever, diarrhea, hemorrhage, sepsis, organ failure, vomiting, muscular pain, and abdominal pain (Furuse et al., 2017). Human-to-human contraction of the disease often occurs through close contact with bodily fluids, watery stools of a symptomatic person infected with the virus, or skin of EVD patients who have died of the illness (Centers for Disease Control and Prevention [CDC], 2017a). The outbreak of EVD in 2014 in West Africa was the largest in history with a sustained transmission in several West African countries, including Liberia, Guinea, and Sierra Leone (Khan et al., 2015). The 2014 EVD outbreak has been one of the most challenging global health emergencies in recent years, resulting in more than 19,000 confirmed and probable cases primarily in Liberia, Guinea, and Sierra Leone (Agua-Agum et al., 2016). The 2014epidemic of the Ebola virus in Sierra Leone has been deemed the deadliest outbreak in living memory (Squire et al., 2017).

Sierra Leone remains the epicenter of the pandemic. The reemergence of cases in Freetown portends that Sierra Leoneans are not complying with their Ebola virus

regulation efforts. Traditional funeral ceremonies and burial rites exacerbate the spread of the disease, thus impeding containment of the virus. Conventional funeral practices, direct contact with infected Ebola persons, and caring for infected Ebola patients could be high-risk transmission methods for the EVD (Cenciarelli et al., 2015; Tiffany et al., 2017). Behaviors regarding killing and consuming infected animals also have an increased risk of infection (Cenciarelli et al., 2015; Tiffany et al., 2017). Hazardous cultural approaches to burial have persisted because adherents perceive them to be imperative despite environmental and communal disparities across Sierra Leone (Manguvo & Mafuvadze, 2015). The Ebola virus is transmitted from person to person through direct and unprotected contact with infected bodily fluids such as blood from living or dead bodies and contaminated materials or objects through phlegm, mucosal surfaces, breaks, and abrasions in the skin (Adongo et al, 2016; Deen et al., 2017; Tiffany et al, 2017; WHO, 2014; WHO, 2019).

Knowledge is scarce about this deadly contagious disease that claims approximately seven out of 10 infected people (Manguvo & Mafuvadze, 2015). Investigators have made efforts to formulate a description of specific features of the disease to accompany knowledge of the epidemiological and biological characteristics of the virus and infections. Comprehensive knowledge of factors that contribute to the sudden spread of the disease may be employed to curtail the death rate and rapid spread of the virus. This investigation involves ascertaining the relationship between cultural and religious behavior as well as environmental and social factors are related to the rapid spread of the disease since the Ebola virus is highly contagious by direct contact.

The aim of this study was to investigate how the relationship between religious and cultural practices differed according to age group, housewife occupation, washing of corpse, gender, contact with the living sick, and funeral attendance, which were critical factors in the spread of EVD, in the hope of curtailing the disease. The findings of this study will contribute to positive social change by educating the people of Sierra Leone and other developing nations regarding how to identify risk factors for EVD, thus preventing and controlling its spread. This study will also contribute to positive social change by informing future efforts to improve EVD outbreak reviews at the individual and community level of the social Ecological Model and implement health programs that may reduce the rate of EVD contraction, transmission, and deaths in Sierra Leone. The 2018 outbreak of the disease in the Democratic Republic of Congo reinforces the urgency to mount sustained efforts to continue to address the spread of EVD.

I address the knowledge gap that exists regarding the relationship between demographic, sociocultural, and behavioral factors and Ebola disease status among women and men of reproductive age (15-49 years) during the 2014 outbreak in Sierra Leone. Alexander et al. (2015) completed a comprehensive assessment of Ebola and increased understanding of cultural and traditional risk factors within Sierra Leone is warranted to prepare for future EVD outbreaks. Sharareh et al. (2016) said future considerations of behavioral factors are needed for an effective response to outbreaks of deadly diseases such as the EVD in Sierra Leone. Effective prevention and management strategies of Ebola depend on better knowledge of sociocultural and behavioral factors that influence Ebola (Nielsen et al., 2015; WHO, 2015).

## Problem Statement

The Democratic Republic of Congo experienced an active Ebola outbreak in 2018; however, the 2014 eruption of the Ebola virus in the west coast of Africa was a historically unprecedented epidemic with a sustained spread in multiple West African nations, including Sierra Leone (Dietz et al., 2015). The WHO (2014) classified Sierra Leone as a high Ebola-affected country as it reported the highest number of deaths (14,124) during the last Ebola outbreak compared to other Ebola-affected countries. According to the WHO (2014), the number of deaths that occurred in other countries were 2,536 in Guinea, 10,675 in Liberia, eight in Nigeria, and one in Mali.

Apart from the public health hazards of the outbreak, the Ebola epidemic caused distinct social and financial consequences in Sierra Leone. There was tremendous fear by public health experts in Sierra Leone that the Ebola crisis could undermine the small improvements the country had achieved as a result of new investments in the country (Heymann et al., 2015). Sierra Leone's GDP in 2015 dropped from 11.3% to 8% as a result of the Ebola outbreak in 2014 (Elmahdawy et al., 2017). Furthermore, the Ebola outbreak overwhelmed the Sierra Leonean public health system. The aim of this quantitative study is to investigate how the relationship between religious and cultural practices differed according to age, gender, funeral attendance, and other variables. Public health experts have given little attention to the impact of sociocultural factors on infectious diseases, especially Ebola.

Previous researchers identified the poverty-related, economic, and social-cultural factors that influence the spread of EVD. However, no existing literature emerged to

address coping strategies to eliminate the threat of EVD, including social stigma, community reactions, and the effect of governmental laws and policies during EVD outbreaks. Gaps in knowledge exist regarding this disease in Sierra Leone that need immediate attention. The virus is a regional problem in the west coast of Africa, where outbreaks persist and recur (Kratz et al., 2015). Mitigation strategies require urgent attention because of the rapid transmission of the virus among humans. There are no approved drugs for treatment, despite indications that vaccines are necessary for human safety (Kratz et al., 2015).

The purpose of this study is to investigate how the relationship between religious and cultural practices differed according to age group, housewife occupation, washing of corpse, gender, sick contact, and funeral attendance. Fully understanding the biology of the disease may help curb some of its risk factors. Public health professionals have overlooked risk factors such as age, gender, funeral attendance, and contact with body fluids in research studies as possible causes of the spread of the virus in Sierra Leone. I address the knowledge gap that exists involving Ebola disease status among women and men of reproductive age (15-49 years) during the 2014 Sierra Leone outbreak and demographic, religious, sociocultural, and behavioral factors. According to Alexander et al. (2015), a comprehensive assessment of Ebola and increased understanding of cultural and traditional risk factors within Sierra Leone is warranted to prepare for future EVD outbreaks. This may help ensure that hazardous factors are appropriately understood, and public concerns will not escalate unnecessarily.

## Purpose of the Study

This quantitative study is an investigation of the relationship between religious and cultural practices and the spread of the Ebola virus in Freetown, Sierra Leone. I investigated how the relationship between religious and cultural practices differed according to age group, role of housewife, washing of corpse, gender, sick contact, and funeral attendance. Data for this study derive from archival records generated by the Sierra Leone Ministry of Health and Sanitation (MoHS) during the 2014 outbreak.

The spread of EVD is the dependent or outcome variable, and values for this variable are measured by testing the number of patients who either tested or confirmed positive for EVD by reverse transcriptase-polymerase chain reaction (RT-PCR). Secondary data from the MoHS database also establish independent variables for this study: age of the patients, gender of the patients, contact with a suspected case or ill person, funeral attendance, contact with body fluids, and country of residence. No researchers have investigated how EVD can be transmitted, although several researchers in Liberia, Guinea, and Sierra Leone studied the transmission of EVD.

Among 8,448 children under 20 in Guinea with a suspected or probable case of EVD, 695 were highly susceptible to death (Chérif et al., 2017). Children younger than 5 years of age had the highest case fatality rate (82.9%) with characteristic clinical features of high fever, fatigue, weakness, and diarrhea (Chérif et al., 2017). The outbreak of EVD started in December 2013 in Guinea, where the first case of the disease was reported in a 2-year-old child who died (Chérif et al., 2017). Preventing the exposure of children in EVD-affected homes may be difficult because children need to be fed, held, played with,

and cared for (Bower et al., 2016). During the outbreak of EVD in Guinea, Chérif et al. (2017) suggested that young children were vulnerable and highly susceptible to contracting EVD. I noticed a difference in age groups and gender during the 2014 outbreak in West Africa.

Secondary data from the MoHS revealed differences in behaviors among age and gender groups during the 2014 outbreak in West Africa. Therefore, in this study, gender is one of the possible factors associated with the outbreak of EVD in Sierra Leone. The differences in gender (male and female) described how men and women could influence the pattern of exposure to EVD. Bower et al. (2016) said exposure patterns were most likely to differ by gender (female and male). Bower et al. (2016) said women might be more susceptible to the disease because they cared for people who were ill compared to men, whose exposure occurs mainly when they transport sick people to healthcare facilities.

Furthermore, I used secondary data from the MoHS to examine the association between other epidemiological risk factors such as attending funerals, administering funeral rites, coming into contact with body fluids, and having contact with a suspected infected person, as well as contraction of EVD. Funerals are important occasions in West African cultures, and people value attendance and travel long distances to attend (Nielsen et al., 2015); however, attending funerals is a risk factor associated with the transmission of EVD (Agua-Agum et al., 2016). Safe funeral practices can influence or contribute to containment of outbreaks of EVD (Agua-Agum et al., 2016).

One of the essential funeral rituals common among the people of Sierra Leone is washing of dead bodies with bare hands and spending time with corpses before burial (Coltart et al., 2017). In Sierra Leone, funeral rituals or practices vary within Christians and Muslim traditions. Muslims wash the corpse and bury it the same day, whereas Christians wait for up to several weeks to make funeral arrangements for their loved ones to be buried (Nielsen et al., 2015).

Funeral attendance and practices pose a substantial risk for the transmission of EVD, which may increase with viral load– that is the highest in nonsurvivors during the late stages of the progression of the disease and at death (Curran et al., 2014; Lever & Whitty, 2016). The traditional practices of washing, preparing, and touching dead bodies including direct and prolonged contact, pose significant risks for EVD contraction and transmission (Curran et al., 2014). EVD infection involving funeral rites and traditional preparation of dead bodies were critical for the spread and contraction of the disease (Lever & Whitty, 2016). Persons or patients who died of EVD are possible key sources of EVD infection, and 33.33% of outbreaks of EVD have involved funeral rites and rituals and traditional preparation of dead bodies that involve close contact.

## Research Questions/Hypotheses

*RQ1:* Is there a relationship between washing of corpse, role of housewife, funeral attendance, contact with the living sick person, and spread of EVD in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak?

*$H_0$1:* There is no relationship between washing of corpse, role of housewife, funeral attendance, contact with the living sick person, and spread of EVD in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak.

*$H_A$1:* There is a relationship between washing of corpse, role of housewife, funeral attendance, contact with the living sick person, and spread of EVD in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak.

*RQ2:* Is there a relationship between the spread of EVD and individuals' age group and gender in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak?

*$H_0$2a:* There is no relationship between individuals' age group and the spread of EVD in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak.

*$H_A$2a:* There is a relationship between individuals' age group and the spread of EVD in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak.

*$H_0$2b:* There is no relationship between individuals' gender and the spread of EVD in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak.

*$H_A$2b:* There is a relationship between individuals' gender and the spread of EVD in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak.

## Theoretical Framework

The theoretical framework for this investigation was the social ecological model, which supported this research involving physical, behavioral, and social determinants associated with the transmission of the Ebola virus. The model incorporates psychological, relational, managerial, societal, and governmental effects (Sallis & Owen, 2015). Individual layers in the model explain the basis for comprehending and comparing

determinants of the disease. The internal or personal level is religious and cultural factors that lead to the possibility of one becoming a potential victim of the deadly virus. The relational level is social and cultural features of individuals. The community level includes organizations within the environment such as workplaces, neighborhoods, and schools. At the community level, the occurrence of social interactions is imminent, and the model supports identification of features of these settings that determine which individuals become victims or commit brutality (Sallis & Owen, 2015).

The fourth level (societal) is general societal elements that help create an atmosphere in which the threat of the virus is eliminated. Societies are normally highly responsive to dangerous avoidance and communication strategies to eliminate the threats of viruses. Opportunities for gathering information regarding plausible strategies appear at this stage. During this phase, therapeutic communication with shareholders informing them about control of the threat and acknowledging attempts to overcome it becomes pertinent. Determining what responses worked, including resources that should have been in place to speed up responses can help responders clarify their approaches and advocate for such resources. During this phase, the opportunity also arises to recognize, locate, and reinforce initiatives, community leadership, and actions which will encourage future attempts (Sallis & Owen, 2015).

The model assisted in addressing research questions. According to Glanz et al. (2008), the model also emphasizes population, unlike other theories that emphasize the individual. Knowing how factors influence the Ebola risk of women and men between the ages of 15 and 49 may help in terms of reduction of these risks. For this study, the model

was used to provide a comprehensive framework to address demographic, sociocultural, and behavioral factors that may be associated with Ebola infection in the study population in Sierra Leone.

## Nature of the Study

This study involves a quantitative approach consistent with examining and understanding associations between independent and dependent variables. The purpose of this quantitative cross-sectional study is to evaluate secondary data collected during the 2014 to 2015 outbreak of EVD regarding patients admitted to various Ebola treatment units in Sierra Leone. This design was suitable for this study as it allows the researcher to investigate an association at a single point in time and measure contact or exposure prevalence regarding the prevalence of the disease). Smith et al. (2009) said the use of a retrospective cross-sectional study is cheap and less time-consuming than other approaches.

Secondary data collected by public health and health care professionals during and after the outbreak of EVD in Sierra Leone in 2014 informed this investigation of factors associated with contraction of EVD during the outbreak among patients who were examined at various Ebola treatment centers in Sierra Leone. In partnership with the MoHS, health experts collected data in all Freetown communities. Health professionals from the MoHS work with other international organizations including the Centers for Disease Control (CDC), National Institutes of Health (NIH), and WHO to strengthen existing infection prevention and control efforts, surveillance laboratories, infectious disease control, public health capacity, and monitoring and rapid response to outbreaks of

infectious diseases. This collaboration and expertise indicated that records from MoHS would provide high quality data for analysis in this study. Common themes contributing to the potential spread of the Ebola virus among Sierra Leoneans are discussed in detail. Also, I explored how observed phenomena contribute to achieving needed changes in behavior regarding burial practices and EVD risks.

This quantitative cross-sectional study involved using logistic regression to ascertain whether a statistically meaningful relationship exists between religious and cultural practices and spread of Ebola. Logistic regression analysis determined whether a statistical relationship exists between the demographic independent variables and transmission of Ebola virus. Similarly, logistic regression analysis was conducted to ascertain whether there was a statistical relationship between cultural/religious variables and the spread of Ebola virus. Based on secondary data obtained for this study, the number of people who contracted the disease or tested positive for EVD was the outcome variable. The outcome variable was dichotomized into positive (coded as 1) for contracting the virus and negative (coded as 0) for not contracting the virus. Secondary data collected by the MoHS facilitated quantitative analysis using Statistical Package for the Social Sciences (SPSS) software. I used this tool to collate and complete frequency distribution tables and statistical charts and graphs and validate interactions between independent variables.

## Definitions

*Burial practices:* A belief system in the afterlife is a common concept among many Sierra Leoneans (Manguvo & Mafuvadze, 2015). Methods of washing the dead and

preparing the corpse for burial vary by tribe and religion, but these rituals express community members' love and respect for the deceased (Manguvo & Mafuvadze, 2015). Burial practices may also vary based on the individual's position or status in the society or community (Manguvo & Mafuvadze, 2015). Traditional beliefs and practices also influence how and when West African communities perform burials (Nielsen et al., 2015). Cremation is rare among the Sierra Leoneans, although the WHO recommends cremation during EVD outbreaks (Nielsen et al., 2015).

*Contact with the sick:* When a person comes in close contact with a suspected or confirmed EVD patient (Vetter et al., 2016). For purposes of this study, *contact with an infected person* is a variable meaning a person who took unprotected care of a patient with EVD or participated in washing the linen, bathing, or sleeping in the same room as a case-patient (Vetter et al., 2016).

*Disease outbreak*: A disease outbreak is the occurrence of cases of a disease in excess of what would normally be expected in a defined community, geographical area, or season. An outbreak may occur in a restricted geographical area or extend over several countries. It may last for a few days or weeks or several years (WHO, 2014).

*Ebola virus disease (EVD):* EVD is a rare and deadly disease most commonly affecting people and nonhuman primates (monkeys, gorillas, and chimpanzees). It is a fatal hemorrhagic infection that has sporadically infected humans since it was first identified in 1976 (Coltart et al., 2017). EVD is mainly transmitted through person-to-person contact with infected persons and bodily fluids (Coltart et al., 2017).

*Epidemic*: An outbreak of disease that spreads quickly and affects many individuals at the same time. Epidemic is a term that is often universally used to describe any problem that has grown out of control (WHO, 2014).

*Hemorrhagic fever:* Increased permeability of the blood vessels resulting in bleeding into the skin, internal bleeding, or bleeding from the mouth or other orifices. The bleeding is usually not life-threatening. Signs and symptoms of viral hemorrhagic fever (VHF) include high fever, weakness, dizziness, and myalgia. In severe cases, shock, coma, delirium, seizures, and death may result (WHO, 2014).

*Incubation period:* The time from the moment of exposure to an infectious agent to when signs and symptoms of the disease appear. The incubation period for Ebola is from two to 21 days. People are not contagious until they develop symptoms. EVD infections can be confirmed only through laboratory testing (WHO, 2014).

*Self-efficacy:* The ability of an individual to make positive decisions and act to implement those decisions (Meehan, 2016).

SEM: Social Ecological Model

*Zmapp:* An experimental biopharmaceutical drug comprising three chimeric monoclonal antibodies under development as a treatment for EVD (Coltart et al., 2017).

## Assumptions

Assumptions for this study derived from cultural beliefs and behavioral practices. The primary premise of this research was that sociocultural factors had an effect on the speed and magnitude at which the epidemic spread across Sierra Leone communities. As such, because adherence to ancestral funeral and burial rites fueled massive explosions of

new cases (WHO, 2015), I assumed that high-risk behaviors of Sierra Leoneans were almost identical to those of victims of previous Ebola epidemics in equatorial Africa. High-risk behaviors of Sierra Leoneans are significant as they might have contributed to the unprecedented expanse, duration, and size of the EVD outbreak in Sierra Leone**.** However, therapeutic anthropologists have noted that burial and funeral practices in Sierra Leone and other West African countries are abnormally precarious. According to Lee et al. (2016), Guinea's Department of Health reported that three out of five cases of Ebola infection in that country during the last epidemic were related to funeral and conventional burial practices. The WHO (2014) in Sierra Leone estimated that eight out of 10 cases of Ebola in that country resulted from the same traditional burial customs. Some mourners bathe in or bless others with rinse water from the washing of corpses in Guinea. In both Sierra Leone and Liberia, several secret societies reinforce burial observances (WHO, 2015).

In this study, I assume that the virus spread via networks that bring societies together in a culture that emphasizes compassionate and ceremonial care for the ill. Lastly, I assume that some doctors became infected when they rushed, unprotected, to offer aid. Control efforts must work within cultural conventions and not against them.

## Scope and Delimitations

In this quantitative cross-sectional study, I used logistic regression to analyze archival data. In the absence of an opportunity to collect primary data, results were based on secondary data consisting of intake forms recorded during the EVD crisis for all patients admitted to treatment centers in Sierra Leone. Therefore, only variables present

in these data were analyzed. In this study, I included data only regarding EVD outbreaks among a cross section of patients who were enrolled and admitted to Ebola treatment units between 2014 and 2015.

Although data includes other variables in the dataset, I did not analyze or use variables that are not included in my research questions and hypotheses testing. The study was delimited to neighborhoods most affected by the Ebola virus in the western urban and rural districts of Freetown. The study sample was representative of all Ebola patients admitted at various treatment locations in 2014. Delimiting the study to only neighborhoods most affected by the Ebola virus in these areas of Freetown would introduce selection bias. These two districts are representative of the country's demographics. The choice of Freetown as the study area was essential because it is the administrative, commercial, and political capital of the country, and a substantial percentage of the population resides there.

Also, this city was the area hardest hit by the EVD due to its dense population concentration. Freetown is densely populated because people who migrated from provincial districts to Freetown to seek refuge during the last civil war in the country reluctantly refused to return. The city was selected because a preliminary review of available data from Sierra Leone's MoHS indicated high incidences of the disease in these communities. I focused on the EVD rather than other infectious diseases because it was the most recent outbreak, and to date, little knowledge exists and limited research has been conducted regarding factors that impact the spread of the disease.

In generalizing findings of this study, I considered the unique nature of the outbreak in Sierra Leone regarding safe funeral practices, behavior changes, and community mobilization among other variables. The generalizability of this research is limited to Sierra Leone. My analysis will provide a quantitative basis for hazardous factors regarding the spread of EVD in this country.

## Limitations

Several significant limitations impacted this study. Wide confidence intervals may be due to low power and should thus be interpreted with caution. All information for all patients was captured under extreme conditions in an emergency setting and was retrospectively obtained from secondary data collected by Sierra Leone's MoHS in 2014; therefore, data quality may be an issue. According to Timothy et al. (2019), because of the time that has elapsed since the outbreak, recall bias is likely. I partially offset this limitation by using group interviews and key informants. Serology was restricted to adults (aged ≥ 18 years), so children with mild or no symptoms might have been overlooked, resulting in underestimated disease states (Timothy et al., 2019).

Research was conducted in a high-risk environment with a mandatory no-touch policy and apparent restrictions. Biomedical information on risk might hold limited relevance to people when trying to care for sick loved ones or attend to the dead. Time and resource availability was a significant factor in terms of limiting the study to the western area of Freetown, Sierra Leone instead of the entire country. While it was not feasible to conduct individual interviews in communities, the use of personal structured interviews for public servants and NGO workers was practical because of the small

sample size. The large sample size totaling 100 people could only allow for group interviews in 10 selected communities within Freetown as the process was too cumbersome for research of this nature.

It is practical to use the group interview approach to collect community data on issues. Another major limitation was the timing of data collection. Since Sierra Leone has not been declared EVD free at the time of this investigation, careful monitoring of the disease trend in the study area was employed to determine the safest time to collect data. Data collection was restricted to a safe period when EVD incidents were low to ensure safety for myself and respondents. Interviewing officials from five NGOs with different administrative procedures and scheduled programs meant interviews were fixed at times that were convenient for each participant.

## Significance of the Study

The principal objective of this study was to determine the biological, behavioral, environmental, religious, and social determinants that led to the transmission of the Ebola virus. A considerable body of literature indicated factors that impacted the rapid spread of EVD. Study regarding the extent of the impact of cultural and religious behaviors on the Ebola outbreak in Sierra Leone has been limited. This quantitative study represents a thorough investigation of how physical, behavioral, and societal factors through social and religious conduct affected the spread of Ebola. During the 2014 outbreak, North America was affected by people who had contracted the disease and entered the country or transferred to the United States to receive advanced healing treatment (WHO, 2014).

Understanding the elements responsible for the development, pathogenesis, and biology of the Ebola virus is one of the most challenging systematic problems facing scientists today. Gaps in knowledge regarding this disease in Sierra Leone need immediate attention. The virus is a regional problem in the west coast of Africa, where it causes considerable outbreaks in Guinea, Liberia, and Sierra Leone (Omoleke et al., 2016). Mitigation strategies have been difficult in terms of identifying rapid communication of the disease among humans (Omoleke et al., 2016). No medications have been certified for treatment while using immunization strategies for safety reasons. Investigating the virus has been a problematic concept as its virulent form renders approaching victims challenging in many developing and developed countries. The aim of this in-depth investigation of the Ebola outbreak in Sierra Leone in 2013/2014 is to bridge the gap in the literature. Health experts may be able to apply findings regarding spread of the virus during the 2014 epidemic to determine how to prevent and manage future outbreaks.

**Significance to the Theory**

The SEM theoretical framework was employed in this study. Data on EVD data included individual, family, and community history of contact with suspected case EVD persons, laboratory findings, and self-reported information for patients admitted to Ebola treatment facilities in Sierra Leone. Therefore, application of the SEM theoretical framework was appropriate for this study.

## Significance to Practice

The identification of EVD during early stages is paramount in order to prevent the spread of an outbreak (CDC, 2014). Findings from this study may be useful to Sierra Leoneans, the WHO, and CDC by strengthening public health efforts to prevent Ebola transmission. Results may provide emic perspectives regarding how to develop culturally sensitive health promotion policies for EVD-related and other infectious disease outcomes. Findings may add to growing literature regarding hazardous factors involved with EVD outbreaks and transmission. By planning and completing culturally sensitive surveillance programs to prevent future EVD, epidemic conclusions could be useful.

## Significance to Positive Social Change

This quantitative cross-sectional study may lead to positive social change. Positive social change is attainable through community education in schools. Public health professionals in Sierra Leone will inform Sierra Leoneans in the event of any reoccurrence of the Ebola virus in a timely fashion. Additional implications for positive social change include strengthening community awareness, health education and literacy efforts, policy implementation, individual and group decision-making processes, public health needs, and quality of life of community members. Health organizations around the world and the government of Sierra Leone are working to implement policies involving disease prevention, identification, and surveillance response systems for future outbreaks of infectious diseases. This study's findings could contribute significant elements and knowledge required for these policies.

## Summary and Transition

Chapter 1 included information about the Ebola virus and how it was transmitted and spread during past outbreaks, including the 2014 outbreak throughout certain countries in the West African region and beyond. A comprehensive background of the virus based on literature was included, along with explanations of gaps within Ebola virus research. I also addressed the purpose of the study, research questions, and hypotheses. The chapter concluded with a discussion of delimitations and limitations of the study.

# Chapter 2: Literature Review

## Introduction

The primary aim of this quantitative cross-sectional study is to determine community, environmental, and behavioral factors associated with transmission through direct contact of EVD during an outbreak. Researchers have made constant efforts to understand specific features of the disease. Previous literature includes analysis relating to the hygiene and ecology of the Ebola virus; however, knowledge is lacking within the medical community and general public regarding cultural and religious factors that impact transmission of roughly 70% of infected cases. Comprehensive information about determinants that impact the asymmetric dissemination of the virus via contact can be used to reduce the mortality rate and diligent procreation of the virus.

Disease outbreaks have both social and biological implications. Many researchers have evaluated the effect of social determinants of disease transmission and outcomes on Ebola disease outbreaks, but literature lacked focus regarding cultural complexities which influence social health determinants in communities affected by the EVD around the world. Performance of funeral rites including internment and burial practices accelerated the spread of the virus, thus impeding efforts of NGOs, the WHO, and the Sierra Leonean government to contain the virus.

## Literature Search Strategy

To initiate this literature review, I systematically reviewed accessible data about scientific effects of Ebola outbreaks. The literature reviewed in this study involved EVD transmission and burial practices as practiced in Sierra Leone and other related places.

The literature search included studies that applied the SEM and promoted positive social change and healthy behaviors. Some literature addressed the lived experiences of Sierra Leoneans regarding burying practices.

I completed searches for valuable information regarding Ebola using databases in the Walden University Library, including CINAHL, ProQuest, Medline Plus, PubMed, and Google Scholar. The search included peer-reviewed articles published between 2014 and 2019. The following search terms were used: *infectious diseases*, *burial practices*, *funeral practices among Sierra Leoneans*, *handwashing*, *traditional funerals*, *origin of Ebola*, *etiology of Ebola*, and *modes of spread of the virus*. These phrases were used in all databases to identify literature reviewed in this study. Information presented in these articles could be useful in terms of answering research questions.

I obtained and thoroughly reviewed data, sorted them by critical terms, and stored information on flash drives and hard drives. Extracted data included type, origins of authors, financial distribution, and impact factors of related publications. I identified and examined research methodologies, including theoretical frameworks employed in each article.

## Theoretical Foundation

The theoretical foundation supported this study was the SEM. The SEM was first employed by Bronfenbrenner and later modified by Baral et al and the CDC for cancer screening initiatives and assessment of HIV risk factors. Bronfenbrenner formulated a theoretical structure for understanding versatile and mutual consequences of personal and environmental determinants. The SEM was appropriate for this study of environmental,

observable, and communal determinants that influence the transmission of the Ebola virus.

The model involves cognitive, relational, administrative, societal, and governmental effects. Although the SEM framework has been applied to cancer screening, influenza vaccine uptake, and HIV screening, the model can also be used for other infectious diseases. The SEM was the theoretical framework for this multilevel cross-sectional study that involved secondary data regarding EVD from the MoHs in Sierra Leone.

McLeroy et al. (1988) said individual behavior is shaped by individual, interpersonal, community, organizational, and environmental or policy levels. The SEM can be adapted to contextualize or understand the risk of EVD contraction among people who are vulnerable to the disease. The SEM framework may help researchers determine how to focus intervention strategies to prevent the transmission and contraction of infections. It is paramount to implement intervention programs and policies that can minimize risk factors associated with EVD (CDC, 2015).

A variety of biological factors may increase a person's vulnerability in terms of becoming infected with the virus (Baral et al., 2013). Prevention strategies at the individual level are frequently designed to promote behaviors and beliefs that prevent the contraction of the disease. Also, the SEM provides a foundation for looking into influences of social elements and defining the need for public health and healthcare professionals to maximize the combined effect of initiatives for the most significant impact.

## Literature Review Related to Key Variables and/or Concepts

In this section, I present a review of literature relating to critical variables in this study. Key findings include the geographical location and population of Sierra Leone, epidemiology of Ebola, and risk factors associated with the contraction of EVD, including age, gender, religious and community rituals, funeral attendance, exposure to bodily fluids, and close contact with living sick persons. Finally, I identify gaps in literature related to hazardous factors that cause the spread of EVD.

### Population and Geographical Location of Sierra Leone

This quantitative cross-sectional study was focused on Sierra Leone, where an outbreak of EVD occurred between 2014 and 2015 (see Figure 1). Sierra Leone is a densely population nation located on the west coast of Africa, bordered by Guinea and Liberia along the Atlantic Ocean. Sierra Leone lies between the latitude of 12.2 degrees west and longitude 8.5 degrees north (Omondi, 2017). Sierra Leone is one of the smallest and lowest-income nations in Africa, with a population of at least 7.557 million people (WHO, 2017).

The birth rate of Sierra Leone is 37.4 births per 1,000 inhabitants, whereas the death rate of Sierra Leone is 11.03 deaths per 1,000 inhabitants (WHO, 2016). The population of the inhabitants in the capital city of Freetown is nearly one million people, according to a census carried out in 2015. Sierra Leone's dominant cultural, educational, economic, political, and financial institutions are in Freetown. Sierra Leone covers a total area of about 71,740 square kilometers. A large portion of it is land, while water covers an area of 120 square kilometers (Omondi, 2017). Sierra Leone has four geographical

regions, including the Coastal Guinean Mangroves, Eastern Mountains, an Upland Plateau, and the Wooded Hill Country (Omondi, 2017).

**Figure 1**

*Map of Sierra Leone Showing Districts and Study Area of Freetown*


## Epidemiology of EVD in Sierra Leone

The recent Ebola virus (species *Zaire ebolavirus*) outbreak in West Africa is the most massive and unprecedented outbreak in history, and the transmission of the disease

affected multiple countries, including Guinea, Sierra Leone, and Liberia. Guinea reported the initial casualties in December 2013, and the first appearance in Sierra Leone occurred in May 2014 (Dietz et al., 2015). In Kailahun and Kenema districts, Sierra Leone experienced an initial concentration of transmissions. Dietz et al. (2015) posited that the instances then became worse in the Western regions, including the capital city, Freetown with an estimated population of 1,304,507 (Dietz et al., 2015).

Another species of Ebola virus called the genus *Ebolavirus* (family Filoviridae*)* also emerged. The prototype virus of the genus was initially recognized in the Democratic Republic of the Congo in 1976. The genus *Ebolavirus* is the virus responsible for the recent outbreak in West Africa (Loignon et al., 2017). The symptoms of EVD include the sudden attack of fever and discomfort, which is frequently followed by diarrhea, headache, abdominal pain, and vomiting. Fewer patients manifested hemorrhagic signs at the time of presentation in the last outbreak. In severe cases, shock develops, leading to failure of most organs and death, with an overall case fatality rate of 50% to 90% (Loignon et al., 2017).

Presently, no cure for EVD exists. Nevertheless, supportive care is important as part of efforts to prevent or treat the symptoms of a disease as early as possible. In the same vein, supportive care can also ease side effects caused by treatment of a disease and the psychological, social, and spiritual problems related to an illness or its treatment (Lamunu et al., 2018). Successfully controlling an outbreak of Ebola virus requires multiple critical interventions.

Such interventions may include but are not limited to immediate seclusion, safe burials, early detection of cases, and accessible and timely laboratory testing (Dietz et al., 2015). Training medical personnel and community members to recognize instances of EVD and strictly follow infection control practices are viable options. In addition to reporting doubtful cases in a timely fashion and minimizing the risks of transmission, Sierra Leoneans need to follow safety infection control protocols (Lamunu et al., 2018).

In Sierra Leone, the MoHS, WHO, and CDC implemented a surveillance structure to monitor the last epidemic (Dietz et al., 2015). The name of the surveillance structure is viral hemorrhagic fever (VHF). A group of illnesses that are caused by several distinct families of viruses is referred to as VHF (CDC, 2016). The selected public health experts from the MoHS, WHO, and CDC who implemented the surveillance structure (VHF) got data from the doubtful cases of patients and designated EVD laboratories (CDC, 2016). Dietz et al. (2015) stated that the evaluation of the epidemiologic data was completed in Sierra Leone from May 23, 2014, to January 31, 2015, using the daily reports from the MoHS and VHF databases. The VHF data include sociodemographic characteristics as well as reports of potential exposures to infection (CDC, 2016).

**Factors That May Affect Spread of Disease**

A wide variety of influences contribute to the spread of infectious diseases such as EVD. This section mainly focuses on describing studies related to the constructs of sociocultural, religious, traditional and spiritual healing, and funeral and burial practices; demographic considerations such as the gender and age of EVD patients, and physical events such as exposure to bodily fluids and other contact with the living sick.

### *Role of Housewife and Ebola*

The caretaking of corpses by women in Sierra Leone is a traditional cultural practice. Stehling-Ariza et al. (2016) conducted an Ebola risk factor study in 2014–2015 addressing the impact of active surveillance and health education on an Ebola virus disease cluster in the Kono District, Sierra Leone. Stehling-Ariza et al. (2016) found that of 50 laboratory-confirmed Ebola cases, 19 (38.0%) included health care provided to confirmed cases either in their homes, such as with family or neighbors, or in a health care facility. In examining the individual level determinant, Stehling-Ariza et al. (2016) revealed that housewife/caretaker behavior using chi-square test show that there was a statistically significant association between housewives and Ebola virus status: chi square (1, $N$ = 34,715) = 20.086, $p$ = .001. The caretaker norms for women in Sierra Leone may be attributed to the contraction of the virus, and this raises the question that caretaker activity social norms for housewives may be underlying factors that drive the adoption of risk behavior and can be regarded as a critical determinant of vulnerability to Ebola virus infection in Sierra Leone, thus must be targeted for prevention intervention in this at risk population in Sierra Leone. Brainard et al. (2016) said caring for a case in the 6 community was strongly associated with contracting Ebola disease, likely due to a high degree of direct physical contact with the case.

Additionally, a recent systematic review and meta-analysis, conducted by Brainard et al. (2016) to assess risk factors for transmission of Ebola virus disease found that, among household contacts who reported directly touching a sick person, the attack rate was 32% [95% CI (26, 38)]. However, risk of disease transmission between

household members without direct contact was low at 1% [95% CI (0, 5)]. Researchers concluded that taking care of an Ebola patient in the community, especially until death, was strongly associated with acquiring the disease. The participation of women in the risky behavior of the burial ritual of Ebola-infected corpse, caring for Ebola-infected patients are factor in 2013 to 2016 and previous Ebola epidemic in Africa, particularly in Sierra Leone that recurred multiple times in the literature (Adongo et al., 2016; Brainard et al., 2016; Nkangu et al., 2017; Phua, 2015; Sharareh et al., 2016; WHO, 2017). The results of this review suggested that women engage in culturally specific risk behaviors more than men in the local community, and therefore, women are at a higher risk of contracting the Ebola disease. Also, a recent systematic review and meta-analysis of 31 reports conducted by Brainard et al. (2016), evaluated risk factors for transmission of Ebola or Marburg virus disease. The review showed a high risk of Ebola virus transmission for those caring for the sick at home [unadjusted PPR = 13.33, 95% CI (3.2, 55.6)].

Adongo et al. (2016) conducted a descriptive qualitative study in five regions in Ghana. They used 25 focus group discussions (5 in each area) with community members (4 in each part) and nurses (1 in each region). Also, Adongo et al. (2016) conducted 40 comprehensive interviews with various stakeholders and opinion leaders having eight in each area. All conversations were recorded using a digital voice recorder and transcribed. With the aid of Nvivo 10 for Windows, Adongo et al. (2016) analyzed the data using framework analysis. Results indicated that about 80% of Ghanaians engaged in socio-cultural practices, such as preparing the body of dead and burial practices, widowhood

rites, and anointing children with water used to rinse the dead (Asampong, et al., 2016). These practices required individuals to come into direct contact with the deceased or items used to take care of the dead. Social norms also require frequent handshakes in all social gatherings such as funeral and religious congregations. Asampong et al. (2016) also found that self-medication (using herbs and orthodox medications) was a common practice. People use both biomedical and unconventional health outlets either simultaneously or in sequence in times of ill-health. The researchers concluded that high-risk socio-cultural practices were standard among Ghanaians, who generally perceived them to be indispensable. These high-risk practices may hinder containment efforts in the event of an outbreak. Community leaders should be engaged in any social mobilization to modify these practices as part of preparation efforts (Asampong, et al., 2016).

### *Washing of Corpses and EVD in Sierra Leone*

Caleo et al. (2018) conducted a cross-sectional study to analyze and examine factors affecting the dynamics of EVD transmission and contraction and community compliance with EVD control measures over a period. Duncombe et al. (2018) conducted a mixed-methods study to examine factors associated with the contraction and transmission of EVD in a remote district in West Africa (Kailahun District). The study population consisted of 240 households (1,161 individuals). Caleo et al. (2018) noted that household size ranged from 1 to 17 people with a median household size of 5. Caleo et al. (2018) found that 48% of household cases of EVD had a history of contact with symptomatic patients and a funeral exposure with dead bodies, especially by Muslims. Duncombe et al. (2018) further noted that EVD was associated with older age and

household size in unadjusted analysis; these associations became more energetic after adjustment for both variables and gender. The rate of EVD was similar by gender [Adjusted Hazard Ratio (aHR) = 1·03, 95% CI (0.49, 2.17)] for females versus males. However, the rate of EVD was more significant among those aged 15–54 years [aHR = 23·04, 95% CI (3.06, 173.12)] and ≥ 55 years [aHR = 57·28, 95% CI (7.03, 466.33)] compared with those aged 5–14 years, and among those living in households with more than 5 members [aHR = 56.53, 95% CI (9.64, 162.73)] compared with smaller households (Duncombe et al., 2018).

Olu et al. (2016) further opined that people who had multiple contacts with dead bodies, washing of corpses, and funeral attendance accounted for 80% of EVD cases and were below 35 years of age. Most of the contacts at funerals and washing of corpse were linkable to the confirmed cases of EVD (Olu et al., 2016). During the early-stage outbreak of EVD in the Democratic Republic of the Congo, when Ebola was first discovered to be known as a fatal and deadly infectious disease to a human. Dowell et al. (1999) conducted a cross-sectional study to investigate the risk factors among family members in the Democratic Republic of the Congo. Dowell et al. (1999) indicated in their research that, of the 173 households contact of first cases of EVD, 16% developed EVD among those with direct contact and exposed to body fluids presented a risk of EVD contraction and transmission [RR = 3.6, 95% CI (1.9, 6.8)].

The outbreak of EVD in Uganda was a massive outbreak, with 425 cases and 224 deaths (Francesconi et al., 2003). Francesconi et al. (2003) said contact with body fluids via washing of corpse showed a strong correlation with a crude and adjusted prevalence

proportion ratios (PPR) of 5.30 [95% CI (2.14, 13.14)]. Also, the authors mentioned that direct physical contact with a sick person was linked to the spread of the disease [PPR = 3.53, 95% CI (0.52, 24.11)]. Human-to-human spread of the disease occurs through contact with body fluids of the asymptomatic infected individual while providing care in health care centers, at home, and during traditional burial rituals (Lindblade et al., 2015).

### *Traditional and Spiritual Healing Practices*

Most societies in West Africa traditionally depended on herbal remedies to cure illnesses. In Sierra Leone, however, contemporary health care and Western medicine are now considered the norm. According to the WHO (2017), nearly 75% of the inhabitants in most states along the west coast of Africa rely on conventional drugs for treatment. Practitioners of Western medicine are usually more respected than other healers who promote peculiar forms of health care (WHO, 2014). Still, some traditional healing methods persist and may have a significant adverse effect on health outcomes. For instance, ethnomedical beliefs and practices can affect pathogen transmission pathways and spread the disease.

Recent investigations regarding the last Ebola epidemic in West Africa indicated that some classical and divine faith therapists deceitfully alleged to have the competence to treat Ebola (Manguvo & Mafuvadze, 2015). For example, faith healers falsely claimed they could prevent the transmission of Ebola by bathing victims with warm salt (Manguvo & Mafuvadze, 2015). Similarly, traditional doctors in Uganda made incisions into the bodies of patients and topically applied herbal medications on the pretext of curing Ebola (WHO, 2014). These cultural practices caused many people, including a

traditional therapist, to become infected. Person-to-person transmission of the virus may also result from touching body fluids of the infected (Manguvo & Mafuvadze, 2015). Traditional therapists who misleadingly profess they can restore health to patients with Ebola may end up being infected in the absence of proper preventive resources (Alexandra et al., 2015).

Because they laid hands on the body of a sick person while praying, some of the trusted religious therapists who visited Ebola sufferers caught the disease and transferred the infection to others (Manguvo & Mafuvadze, 2015). Several places of worship for Christians have made efforts to eradicate the practice of placing hands on the sick as a measure to inhibit the transmission of the virus. Thus, religious heads play a significant role in enlightening their followers regarding the relevance of stringent devotion to the safety net for fighting the escalation of the infection (Manguvo & Mafuvadze, 2015). In general, efforts to treat Ebola using traditional and divine techniques necessitate higher mutual efforts among classic therapists, religious doctors, and health professionals. WHO (2017) suggested that sensitivity drives may reach traditional and spiritual doctors in affected neighborhoods. During these contacts, public health experts can identify susceptible hazardous environments where the virus is present, as religious and traditional doctors may find it difficult to differentiate between Ebola clients and patients with other conditions (Alexandra et al., 2015).

Traditional and religious healers sometimes represent sources of false information because of a deficit of knowledge about the disease. This problem derived from citizens' restricted access to information from electronic and print media, particularly in remote

rural areas. WHO (2014) recommended that classical and spiritual therapists can form regional and national societies by participating in collaborative workshops to increase their knowledge of the disease. Such workshops offer healers the potential to help reduce the transmission of Ebola and combat additional health issues. Manguvo and Mafuvadze (2015) posited that most religious specialists in Sierra Leone acknowledge their inexperience with the Ebola virus and desire adequate training. Appropriately traditional healers may become health instructors or personnel to educate other traditional and spiritual healers. In passing on their knowledge, trained traditional leaders may be able to dispel myths about the root causes, pathogenesis, transmission, and the prevention of EVD (Manguvo & Mafuvadze, 2015), thus limited the spread of disease.

***Funeral and Burial Practices***

. One of the challenges included identifying a method that would be acceptable culturally for Muslims, Christians, and traditional leaders (Coltart et al., 2017). The difficulty arose because each of these religious groups has individual practices or rites executed at burial ceremonies. The WHO (2017) instituted new policies to incorporate the input of families and community leaders in conducting safe and honorable burials to celebrate and respect each of the religious groups.

Coltart et al. (2017) said avoiding ceremonies that involve touching or washing the corpse of EVD patients are essential strategies for preventing the spread of the virus during an outbreak. During the EVD outbreaks in Liberia, most tribal ceremony rituals were closely held in secret (WHO, 2017). One of the critical funeral ceremonies common to all conventional groups in Sierra Leone was washing the dead body with bare hands

and spending time with the dead. Washing the corpses of Ebola patients was a serious cause of contagion during the epidemic (WHO, 2017). The populations that were affected by the outbreaks of EVD consisted primarily of Muslims and Christians. To prepare dead bodies for funerals, Christians close the deceased's eyes and wash and dress their dead, while Muslims wash the dead and wrap them in a white cloth (Coltart et al., 2017).

Also, Caleo et al. (2018) conducted a mixed-methods study to examine factors associated with the transfer of EVD in a remote district of Kailahun, in eastern Sierra Leone. The study population consisted of 240 households (1,161 individuals). Researchers noted that household size ranged from one to 17 people with a median household size of five. Findings indicated that 48% of household cases of EVD had a history of contact with symptomatic patients and exposure to corpses at funerals. Caleo et al. (2018) confirmed that his study was significant as out of the 31 cases (index case plus 30 secondary cases), 29 died [CFR = 93.5%, 95% CI (78.6, 99.2)]. Thirteen of 15 were confirmed cases, and all 16 probable cases died. About half (55.2%) of EVD deaths were among females; three were pregnant and miscarried at home. Olu et al. (2016) further reported that people who had multiple contacts with dead bodies and attended funerals accounted for 80% of EVD cases, and these people were below 35 years of age. Most of the exposures at funerals and contact with dead bodies were related to the confirmed cases of EVD (Olu et al., 2016).

Previous findings indicated funeral attendance and cultural practices for preparing the dead represented a substantial risk for the transmission of EVD and may have increased the viral load, which was the highest among nonsurvivors during the late stages

of the progression of the disease and at death (Lever & Whitty, 2016). Curran et al. (2014) confirmed that EVD is transmitted from person-to-person via direct contact with blood, body fluids, or contaminated clothing and other personal items of symptomatic or deceased patients. Traditional funeral practices, including washing and touching the corpse, posed a substantial risk for Ebola transmission. For example, a single, traditional funeral of a prominent pharmacist was associated with a sharp increase in the number of reported Ebola cases in a previously low-incidence district of Sierra Leone. Twenty-eight laboratory-confirmed cases occurred in persons who reported attending the pharmacist's funeral. Sixteen (57%) patients had direct contact days or weeks before the funeral, 21 (75%) had touched the corpse, and eight (29%) died. Rapid and effective outbreak control limited the second and third generations to four cases each, including one death.

Due to the potential for high levels of transmission from a single patient or event, vigilant Ebola surveillance and rapid response are essential, and immediate, safe, dignified burials by trained teams are critical to interrupting transmission and controlling the spread of Ebola. Enhanced community-based surveillance strategies, such as a community event-based surveillance system, are essential to identify high-risk events and prevent ongoing transmission quickly. The traditional practices of washing, preparing, and touching dead bodies, including direct and prolonged contact with a dead body, also pose a significant risk for EVD contraction and transmission (Curran et al., 2014). EVD infections resulting from funeral rites and traditional preparation of dead bodies compounded the spread and contraction of the disease (Lever & Whitty, 2016). Lever and Whitty (2016) agreed with Curran et al. (2014) that individuals who died of EVD are a

paramount source of EVD infection. Also, more than one out of three of the Ebola epidemics have reported the spread and contraction of the virus pertain to funeral rites and traditional ceremonies in commemoration of the dead (Curran et al., 2014).

### *Gender and EVD*

Nkangu et al. (2017) described how gender roles determined the patterns of exposure to infectious diseases for men and women. Furuse et al. (2017) conducted a retrospective research study to analyze patient data from 10 laboratories operated by national and international agencies in Liberia during the EVD epidemic in West Africa. The researchers acknowledged a considerable disparity between unfavorable suspected cases for the ribonucleic acid (RNA) of EVD. According to Nkangu et al. (2017), despite the differences among the 20,035 cases of EVD reported in Liberia, Guinea, and Sierra Leone during the 2014 EVD outbreak, men and women had a similar average rate of contracting EVD with the frequency of exposure higher among women.

The incidence rate (IR) of EVD among women was 34.3% [95% CI (0.27, 0.42), $p < 0.001$], whereas men's IR was 30.7% [95% CI (0.24, 0.38), $p < 0.001$]. From 1976 to 2012, over 1,530 people died in EVD outbreaks in Africa, and more than 11,300 deaths occurred during the 2014 eruption. Women were affected the most because they spent time at home caring for the sick. During the EVD outbreaks, women were on the frontline as caregivers in homes and communities, and some were health-care workers (Fawole et al., 2016).

The progression of the disease differed according to gender as well. The average interval from onset of symptoms to hospitalization was about 12 hours shorter for female

than male patients. Agua-Agum (2016) explored the presence of gender-specific differences in effect size estimates at 142 established loci for seven difference traits at $p < 0.05$ (with odds ratio > 1 and $r^2 > 0.80$). Female patients were less likely to die from EVD than male patients with a case fatality rate of 63.0% for females and 67.1% for males [odds ratio = 0.83, 95% CI (0.77, 0.91)].

Agua-Agum et al. (2016) documented significant differences in survival rates among female patients and male patients at the various Ebola treatment units across the country. Male patients spent more time (12.5% longer) than female patients. In other words, male patients spent about 12 hours on average in their respective communities while exhibiting signs and symptoms of EVD than female patients (Agua-Agum et al., 2016). Also, 51.7% of the people who contracted or confirmed positive for EVD were female (Dietz et al., 2015). Gender or sex-specific differences can play a significant role in creating public health measures to reduce the community-based spread of EVD (Agua-Agum et al., 2016). In contrast, Li et al. (2015) found no significant difference between men and women ($p = 0.119$, ns) as the *p*-value was more than 0.05 conventional threshold. Correspondingly the effect size was not strong.

***Age or Age Groups and EVD***

The Ebola virus has the potential to infect anyone, regardless of age and gender. Glynn (2015) noted that during previous Ebola epidemics, children were very susceptible to the disease. Using histories of household members of Ebola virus disease (EVD) survivors in Sierra Leone, Glynn (2015) calculated risk of EVD by age and exposure level, adjusting for confounding and clustering, and estimated relative risks. Of 937

household members in 94 households, 448 (48%) had had EVD. Glynn (2015) reported a significant relationship between age and EVD exposure. The EVD risk ranged from 83% for touching a corpse to 8% for minimal contact and varied by age group: 43% for children less than 2 years of age; 30% for those 5 to 14 years of age; and more than 60% for adults more than 30 years of age. Compared with risk for persons 20 to 29 years of age, exposure-adjusted relative risks were lower for those aged 5 to 9 years (RR = 0.70), 10 to 14 years (RR = 0.64), and 15 to 19 years (RR = 0.71) years but not for children less than 2 years old (RR = 0.92) or 2 to 4 (RR = 0.97) years of age. Lower risk for 5 to 19-year-olds, after adjustment for exposure, suggested decreased susceptibility in this group.

The low rates of infection among children may be attributable to their lower exposure compared with adults as parents keep their children away from the sick. Also, children may be less involved in funerals and funeral preparations (Furuse et al., 2017). In determining the effect of planning public health response and interventions, understanding and identifying age groups of people who were infected and died from EVD is critical. Evaluations of data from the 2014 to 2016 EVD outbreak revealed differences in age between EVD cases and non-EVD suspected cases (Furuse et al., 2017). Young children, the elderly, and patients inhabiting the remote areas of Sierra Leone were more likely to get the Ebola infection than people who live in the urban area and die as a result of poor hygienic surroundings.

Oshitani et al. (2017) analyzed laboratory data from various EVD laboratories in Sierra Leone that contained information on multiple samples that were tested for EVD between 2005 and 2014. An in-depth reassessment of the laboratory data identified a total

of 10,536 patients, 3,897 of whom were EVD positive, and 6,639 tested negatives for EVD. Among the patients diagnosed with EVD, numbers increased among children aged less than six years and among people aged 21-30, 31-40, 41-50, and >60 years (Furuse et al., 2017). The decrease in CFR was statistically significant [63%, 95% CI (49-78), $p <$ .001].

Data may have been incomplete because Furuse et al. (2017) did not include households in which individuals with EVD died. Another limitation of this study was that the researchers deleted over 601 cases from the analysis due to missing information about the patients' gender and age. Johnson et al. (2016) maintained that the high rate of EVD transmission was noted in children less than five years old. Johnson et al. (2016) suggested that young children are more susceptible to be infected with EVD than the elderly and noted that the risk for the spread of EVD was increased for children less than two years of age. For example, in their findings, Johnson et al. (2016) revealed that children less than 5 years of age had a fatality of 79.6% ($n$ = 13), compared with 37.5% for children 6 to 15 years of age ($n$ = 16), and 41.6% for adolescents 16 to 21 years of age ($n$ = 26), whereas the adult case fatality was 56%. The highest risk for exposure to EVD among adults up to 35 years of age and older adults 50 years and up was in contact with body fluids and contact with dead bodies.

Bower et al. (2016) observed that a nine-year-old child who gained readmission because of virus infection (meningoencephalitis) tested positive for EVD after a polymerase chain reaction (PCR) test. After a postmortem PCR analysis, the authors noted that a six-year-old child who died of severe productive cough and fluctuating

pyrexia tested borderline positive for EVD. Among patients with EVD, the authors found a high case fatality rate in the younger and older age groups. Bower et al. (2016) suggested that the differences in susceptibility of age pattern are critical in determining the outcome of EVD. The strength of the study by Bower et al. (2016) was inherent in the method used to follow-up participants for six to 13 months after discharge from the Ebola treatment unit. The lengthy follow-up time ensured researchers did not fail to account for slow deaths.

In a similar inquiry, Fitzgerald et al. (2016) undertook a retrospective cohort study to examine and explain factors that contributed to the ends of children admitted to 11 Ebola facilities during the 2014-2015 EVD epidemics. Fitzgerald et al. (2016) analyzed data stored in the Western Area Emergency Response Command Center (WAERC) database using 309 patients. Data described children ranging from two days to 12 years old who tested positive for Ebola virus. Fitzgerald et al. (2016) explained that case-fatality was 57% (95% CI: 51%– 63%) and 55% (95% CI: 23%–83%) of the deaths from EVD took place in Ebola treatment facilities. Most deaths from EVD occurred three days after admission to Ebola treatment centers and were associated with younger age groups and diarrheal disease. The retrospective study by Fitzgerald et al. (2016) was prone to bias because a large proportion or percentage of the data was excluded due to incomplete information. Furthermore, the authors provided no further details regarding other variables in their study. The study by Fitzgerald et al. (2016) did not include a sample size, and the authors presented only a summary statistical analysis indicating the proportion of children affected by the disease.

Bah et al. (2015) carried out a retrospective observational study examining the clinical presentation of out-patients with EVD in Conakry. The researchers applied Student's t test, Fisher's exact test, and the Wilcoxon rank-sum test to determine the association between EVD contraction and mortality and the clinical variables of age, occupation, gender, and more. The median age of the confirmed cases of EVD was 38 years. Bah et al. (2015) found that the mean age of non-survivors of EVD was low, and the association between older age and a worse outcome among the patients with EVD could often be attributed to other co-existing conditions, including infectious and chronic diseases. Y.-J. Ji et al. (2016) continued the discussion regarding the clinical features and outcomes of patients with EVD admitted to the Holding and Treatment Center of Jui Hospital from October 2014 to March 2015.

Y.-J. Ji et al. (2016) conducted a retrospective observational study on a total of 773 patients with suspected cases of EVD; the sample contained 285 confirmed cases of EVD. The average and median age of the EVD patients was 29 ± 16 years and 28 years, respectively. The youngest patient was one month old, and the oldest was 80 years of age. Y.-J. Ji et al. discussed that 62 of 773 suspected case-patients were under the age of 16; 144 patients were between 16 and 35 years; 60 patients were between the age of 36 to 60 years; and 19 patients were above the age of 60 years.

Researchers conducted statistical analyses utilizing SPSS Software to analyze the overall survival rate. Y.-J. Ji et al. (2016) further performed multivariate analyses via the logistic regression model and using the chi-square test to investigate the inter-group studies. The authors investigated the survival rate of EVD patients based on different age

groups. Y.-J. Ji et al. (2016) found that the survival rate of EVD patients' age group 0 to 6 years indicated a statistically significant difference compared to the patients' age group of 7 to 59 years. Y.-J. Ji et al. (2016) suggested that the survival rates for patients' age groups 7 to 59 and 60+ years did not show any statistically significant differences for patients confirmed with EVD, the survival rate (51.23 %; $p = 0.6621$). The survival rate is not significant as its $p$ value is above the conventional threshold of 0.05. The study by Y.-J. Ji et al. (2016) was limited in the sense that the researchers did not describe how they selected the sample. Sample size calculations are relevant in replicating the study for validity purposes.

Similarly, Qin et al. (2015) conducted a retrospective observational study on 83 Ebola patients who were hospitalized for clinical care at the Freetown China Friendship Hospital from October to November 2014. The study included clinical features of patients with confirmed cases of EVD including age, gender, date of onset, medical history, and more. Qin et al. (2015) revealed that six of the nine patients aged less than10 years died from an infection of the disease. Three of the seven patients aged 10 to 20 years recovered from the illness, while four of the patients died; 12 of the 22 patients aged 21 to 30 years died from the disease. Among the 18 patients who were 31 to 40 years old, 16 of them died, and only two survived from the infection of the virus (Qin et al., 2015). The results showed that age and duration from the symptom onset were closely associated with the mortality of EVD (Qin et al., 2015).

Additionally, Ji et al. (2016) investigated the survival rate of EVD among patients in different age groups, specifically 285 patients diagnosed with EVD in the three age

categories of 0 to 6 years, 7 to 59 years, and 60 years and older. The survival rate for children aged 0 to 6 years was statistically significantly different from age groups 7 to 59 years with $p = 0.00424$, risk of non-survivors = 48.77% and 60 years and older with $p = 0.00447$ (Ji et al., 2016). The results indicated no statistically significant difference in the survival rates between age groups 7-59 years and 60 years and older with $p = 0.6621$(Kaplan–Meier Estimate).

According to a research study conducted in Kerry Town, Sierra Leone, young children experienced increased case fatality rate during the EVD outbreak in Sierra Leone. EVD is a significant risk to the lives and well-being of young children, whose overall case fatality rate may be as high as 63% (Chérif et al., 2017). Young patients exhibit a significantly high rate of confirmed EVD cases and mortality with the adjusted OR (odds ratio) = 0.995 [95% CI (0.7, 1.5), $p < 0.05$]. No researchers in Sierra Leone have explored the relationship between EVD and young age groups in Sierra Leone.

***Exposure to Body Fluids and EVD***

Previous research indicated that EVD can be transmitted or spread through human-to-human through direct contact with body fluids such as blood, secretions, breast milk, saliva, and stool of a person who is sick with the disease (Rewar & Mirdha, 2015). The incubation period after human-to-human contact with body fluids from infected patients is one to 21 days, and patients are not considered contagious or infectious until they develop the symptoms of EVD (Beeching et al., 2014). Human-to-human infection transmits a high case fatality rate depending on the quality of supportive care and the

species of EVD, and most cases of EVD result from directly touching the body fluids (Beeching et al., 2014).

Bausch et al. (2007) tested clinical specimens from confirmed laboratory cases of EVD collected from Ebola isolation units. The study was conducted in an isolation unit at a local, regional hospital during the outbreak of EVD in 2000, in Uganda. The Ebola isolation unit was divided into patients with suspected and probable cases of EVD (Bausch et al., 2007). The collection of samples of stool, urine, blood, vomit, and saliva took place at the patients' bedsides. Dowell (2007) used the reverse transcription-polymerase chain reaction (RT-PCR) to evaluate the virus using the virus culture technique. In all, researchers examined 16 to 54 clinical specimens from bodily fluids, including semen, breast milk, blood, saliva, stool, and skin swab (Dowell et al., 2007).

Bausch et al. (2007) found that 16 clinical specimens from 26 patients were positive by RT-PCR, including eight of 16 saliva samples, one of 11 skin swab, two of four stool samples, one of two semen, two of two breast milk, and one of one nasal blood sample. The authors also found that urine, sputum, vomit, and sweat tested negative by RT-PCR for EVD (Dowell et al., 2007). The authors elucidated that the presence of EVD in human breast milk raised the potential for mother-to-child transmission of the disease. Dowell et al. (2007) indicated that mothers whose breast milk samples were tested in this study died of laboratory confirmed EVD during the early stages of the outbreak in Uganda. Glynn et al. (2017) explained that the highest level of EVD transmission was from direct contact with body fluids. However, among those who touched the corpses of

people who died of EVD, no association was evident between the case fatality of EVD and the extent of bodily fluids exposure.

Vetter et al. (2016) carried out a study to understand the critical factors of EVD transmission necessary to control the spread of the disease, implement control measures to protect healthcare workers, and eradicate the spread of the disease in communities. Vetter et al. (2016) noted that EVD RNA takes at least 18 days in bodily fluids for the disease to be transmitted. For example, EVD RNA lasts 22 days in saliva, 29 days in stool days after onset, 33 days in virginal fluid, 44 days in sweat, 38 days in amniotic fluid, nine months in cerebrospinal fluid, 16 months in breast milk, and 18 months in semen.

During the early stages of outbreak of EVD in the Democratic Republic of the Congo, Ebola was first known to be a fatal and deadly infectious disease to humans. Of the 173 households with cases of EVD, 16% developed EVD—among those with direct contact and exposed to body fluids presented a risk of EVD contraction and transmission [Relative Risk (RR) = 3.6, 95% CI (1.9, 6.8)].

Francesconi et al. (2003) identified some of the risk factors associated with EVD transmission in Uganda from August 2000 through January 2001. The outbreak of EVD in Uganda featured 425 cases and 224 deaths (Francesconi et al., 2003). Findings indicated that the contact with body fluids showed a strong correlation with a crude and adjusted prevalence proportion ratios (PPR) of 5.30, 95% CI [2.14, 13.14]. Also, the authors mentioned that direct physical contact with a sick person was linked to the spread of the disease [PPR = 3.53, 95% CI (0.52, 24.11)].

Human-to-human spread of the disease occurs through contact with body fluids of an asymptomatic infected individual who provides care in health care centers, at home, and during traditional burial rituals (Lindblade et al., 2015). According to the CDC (2016), the Ebola virus RNA levels in body fluids, including blood, increased significantly during the acute phase of the disease. During the outbreaks in Liberia, Guinea, and Sierra Leone, significant numbers of EVD patients had severed vomiting (68%), diarrheal infection (66%), and bleeding (18%) during the late phase of the disease (CDC, 2016). Family members, healthcare workers, other caregivers, and people who handled corpses without using suitable personal protective equipment were at high risk for contracting the virus (CDC, 2016). The EVD RNA levels in the blood of patients who have died from the disease are on average 2 to 10 times higher than the RNA levels of patients who survived the virus (CDC, 2016).

Ebola is an under-studied disease, and few researchers are looking at examining whether contact with infected persons without protective gear is associated with EVD. Yet even this small number of studies show that the virus can persist in multiple different fluids after being cleared from the blood and the studies were consistent with each other. Understanding the relationship between these risk-associated factors will help decision-making process for healthcare and public health professionals and policymakers involved in the concentration of resources, program planning and implementation in areas that might have the most significant impact on EVD prevention, treatment, and control (Chughtai et al., 2016). Considering the high case-fatality rate of Ebola and the low infectious dose infection risk in convalescence should be assumed. Also, the

precautionary principle must be applied, and close contacts of convalescent Ebola patients should have clear guidance on infection control (Chughtai et al., 2016).

### *Contact with the Living Sick and EVD*

According to the WHO (2018a), EVD can be transmitted through human-to-human contact by directly touching an infected person. People and healthcare employees may become infected with the virus while providing care and treating patients with the disease (WHO, 2018a). Most of the family members and health-care employees became infected with the virus while providing care for infected patients. Furthermore, some healthcare workers contracted the virus due to lack of proper infection control protocols or underutilization of those precautions (WHO, 2018a). Dietz et al. (2015) indicated that 48% of the participants in their study reportedly touched infected patients. Of 8,311 participants in the study, 4,885 (59%) confirmed that they had to touch a suspected-case patient or a sick patient within one month of suspected EVD symptom onset. Dietz et al. (2015) indicated that out of 4,885 participants, 558 (11%) reported contact with a critically ill patient.

Olu et al. (2016) carried out a descriptive study to examine EVD contact by tracing participants' activities from June 2014 to August 2015 in Sierra Leone. The mixed-methods design included secondary data analysis, a review of reports, and key informant interviews (Olu et al., 2016). The study included 3,838 confirmed cases of EVD and 32,706 contacts with ill patients with EVD. Olu et al. (2016) explained that 852 (22%) of the confirmed cases of EVD listed as contacts at the early onset of the disease. Olu et al. (2016) explained that most of the communications with ill individuals, about

52.5%, were close neighbors of the confirmed cases of EVD, while 38% were family members.

Wolfe et al. (2017) said during an Ebola outbreak, the virus can spread quickly within healthcare settings such as clinics or hospitals. Clinicians and other healthcare personnel providing care should use dedicated, preferably disposable, medical equipment. Proper cleaning and disposal of instruments such as needles and syringes are essential. Healthcare personnel must sterilize medical equipment before using them again if they are not disposable. Ebola virus can survive on dry surfaces, like doorknobs and countertops for several hours; in body fluids like blood, the virus can survive up to several days at room temperature. Cleaning and disinfection should be performed using a hospital-grade disinfectant. Wolfe et al. (2017) discussed that 168 contacts associated with confirmed cases of EVD existed among 73 households within four districts of Montserrado County in Liberia.

Wolfe et al. (2017) found that 45% of contacts with living sick persons were males, with ages of connections ranging from 2 weeks old to 72 years with a median age of 14 years. Bah et al. (2015) carried out a retrospective observational study of patients with suspected cases of EVD who were admitted at an Ebola care center in Conakry from March to April 2014. The purpose of their investigation was to examine the clinical presentation of patients of all ages with EVD. As a result, the findings of this retrospective study indicated 37 out of 80 patients who had symptoms of suspected cases of EVD and were admitted to the Ebola treatment centers were confirmed to have EVD. Bah et al. (2015) concluded that the most common means of close contact was contact

with other patients with confirmed cases of the disease and through household clusters. According to Bah et al. (2015), contacts by way of household clusters accounted for 23 (62%) of the confirmed cases of EVD.

## Literature Review Summary

Descriptions of the variables in this study will help establish relationships between the dependent (EVD contraction) and independent variables (age, gender, funeral attendance, contact with body fluids, county and community of residence, and communication with sick persons). This literature review contained enough evidence to establish that understanding the factors that lead to the outbreak of EVD can minimize the spread of the disease (Caleo et al., 2018). Based on the review of the literature, secondary data from the MoHS, collected at various Ebola Treatment Units in Sierra Leone, supported investigation of the association between the factors that impacted the contraction and spread of EVD. The 2014 Ebola outbreak devastated Sierra Leone, and results from several studies established a high Ebola virus infection proportion among all individuals with EVD in Sierra Leone during the 2014 Ebola epidemic (Ravi & Gauldin, 2014). Understanding and addressing the various Ebola risk factors in this population could help improve healthcare delivery and research efforts around the disease in Sierra Leone.

Furthermore, treating the Ebola risk factors may help to determine gender and age-specific interventions for mitigating the spread of the disease and assist policymakers and public health decision-makers to organize the most appropriate health intervention programs to prevent or fight the spread of the disease. Most of the previous studies

produced scanty and unclear data based on the disease features in the community around the country. Almost no previous studies included individual examinations of the relationship between the status of EVD and potential cultural and religious factors among the people of Sierra Leone. To address the knowledge gap in the literature and to provide contemporary information on the problems associated with Ebola in this study population, I intend to use secondary data from the Sierra Leone Ministry of Health and Sanitation collected during an outbreak of EVD. Also, I will conduct a cross-sectional study analysis to sufficiently distinguish and assess the extent to which specific cultural and religious factors may increase or decrease the likelihood of catching the disease in this specific population. Chapter 3 includes a complete description of the methodology I used to investigate research questions.

# Chapter 3: Methodology

## Introduction

The primary purpose of this quantitative cross-sectional study was to explore the roles of religious and cultural rituals in the spread of the Ebola virus in Freetown, Sierra Leone. The focus of this investigation was to evaluate precautionary measures and examine ritual observances and procedures regarding burial and religious practices. Results may enhance knowledge of how to limit the spread of Ebola and potential preventive strategies aimed at curbing the quick spread of the virus. Many factors influence contraction and proliferation of EVD, including religious practices, cultural practices, exposure to body fluids, exposure to funeral rites, and exposure to a sick person (CDC, 2017). Identifying risk factors regarding EVD contraction could help guide public health interventions and distribution of resources during an outbreak of EVD. In this study, I conducted a quantitative cross-sectional study by analyzing secondary data collected by Sierra Leone MoHS personnel during the 2014 Ebola epidemic.

In Chapter 2, I described crucial variables in this study, including the geographical location and population of Sierra Leone, epidemiology of the outbreak of EVD in Sierra Leone, and factors associated with contraction of EVD, including age, gender, funeral attendance, exposure to body fluids, and close contact with living sick people. In this section, I discuss the research design, research questions and rationale, and dependent and independent variables. This chapter also contains descriptions of the methodology, target population, sampling procedures used to collect data,

instrumentation, threats to validity, operationalization of variables, and ethical considerations.

## Research Design and Rationale

The purpose of this quantitative cross-sectional study was to evaluate secondary data collected during the 2014 to 2015 outbreak of EVD involving patients admitted to various Ebola treatment units in Sierra Leone. The design was suitable for this study as it allowed me to investigate an association at a single point in time and measure contact or exposure prevalence regarding prevalence of the disease.

One feature of a cross-sectional study is that the researcher collects data from the entire study population at a single point in time to examine relationships between variables of interest (Dubois et al., 2019). Cross-sectional studies therefore provide information regarding frequency of a disease or other health-related characteristics in a population at a given point in time (Dubois et al., 2019). This methodology can be used to assess burdens of illness or health needs of a community, and is therefore particularly useful in informing the planning and allocation of health resources. Using this design provided the opportunity to investigate the association between hazardous factors and contraction of EVD among patients admitted at various Ebola treatment units in Sierra Leone.

## Methodology

In this section, I define and describe the target population and study area, as well as sampling procedures used to collect secondary data for this study. Discussions of

instrumentation and operationalization of variables, data analysis, threats to validity, and ethical procedures that impacted the study also appear in this section.

## Study Population

The target population in this study was specifically people in the western part of Freetown who were admitted to hospitals during the 2014 outbreak. The WHO (2019) said 14,124 individuals contracted EVD in Sierra Leone during the 2014 outbreak; this number included suspect, probable, and confirmed EVD cases. Sierra Leone is a densely populated nation located on the west coast of Africa, bordered by Guinea and Liberia. Sierra Leone lies between the latitude of 12.2 degrees west and longitude 8.5 degrees north. It is one of the geographically smallest and lowest-income nations in Africa, with a population of at least 7.557 million people (WHO, 2017). The capital city of Freetown has a population of nearly one million, according to NAME OF AUTHOR (YEAR). Sierra Leone is a low-income nation that went through 10 years of civil wars, which led to significant impacts on the healthcare and disease surveillance systems, as well as the healthcare workforce.

## Sampling and Sampling Procedures

This research involves public health data during an outbreak of EVD in Sierra Leone. Healthcare organizations collected information during the epidemic to help with supervision and public health responses to the crisis. The sampling strategy derives naturally from the research design and research methods in academic research, and researchers must consider research ethics (Mann, 2015). Stratified random sampling

ensured that a cross section of subjects in the secondary dataset of the Sierra Leone Ebola Data were used in this study.

Researchers' ability to access secondary data is contingent on the willingness of institutions to make data available (Cheng & Philips, 2014). Secondary data may be private or public information provided by collecting agencies or institutions that fund the data collection process. To help maximize data output, researchers must weigh data by assessing variables needed to answer their research questions and study hypotheses (Cheng & Philips, 2014). The MoHS of Sierra Leone provided archival data from Ebola treatment units originally collected by public health and healthcare professionals during and after the outbreak of EVD in Sierra Leone in 2014.

During the outbreak of EVD, several public health agencies, including the WHO, Sierra Leone MoHS, the CDC, and NIH collected data in communities, counties, and Ebola treatment units for purposes of surveillance and public health response. The unprecedented outbreak of Ebola claimed the lives of over 11,000 people and infected more than 28,000 people (MoHS, 2017). In collaboration with the MoHS and other international health institutions, public health experts in Sierra Leone gathered information on Ebola in all districts in Sierra Leone. The Sierra Leone MoHS worked with foreign organizations to strengthen infectious disease control and increase the nation's capacity for public health care.

### *Sampling Frame*

Using the MoHS dataset, the sample included people who had been tested and screened for virus and admitted to Ebola treatment facilities in Sierra Leone during 2014

whereas the control group, which was also obtained from MoHS will be individuals who did not receive the intervention. I excluded data before 2014 because the government of Sierra Leone had not yet declared the existence of an Ebola outbreak. I excluded all data taken after 2015 because the Sierra Leone government banned all reporting of pertinent data after WHO officially announced the deadly Ebola disease had ended in 2015. Furthermore, I excluded deaths for which no Ebola diagnosis was made; therefore, data did not include patients who died before getting to the clinic or who died of diseases other than EVD, such as malaria or HIV/AIDS.

The secondary data I obtained from the Sierra Leone MoHS included gender, ages of patients between 15 to 49 years, de-identified patients' ID numbers, all treatment units in Sierra Leone, and patients' history of contact with sick individuals, exposure to body fluids, funeral attendance, performance of burial rituals, and EVD status (laboratory findings). The data did not include details related to patients' socioeconomic status, such as income, or educational achievement. Inclusion of all eligible participants increased the methodological rigor of this study. This control group obtained from the MoHS data was also selected because literature indicates that individuals aged 15 to 49 years are at high risk of Ebola infection and participate in high risk behavioral and sociocultural behaviors (Bower et al., 2016; Dietz et al., 2015). I restricted the analysis to all suspected, probable, confirmed cases, and not a case reported for whom data were available on a set of variables relevant to this study behaviors (possible funeral attendance, funeral touch body, contact sick person, hunt touched ate primate), and demographic factors such as gender and person's age. The sample did not include any patient data from the hospitals

or clinics before 2014, when the Ebola outbreak was first reported and documented, and information before this period was not included in the database.

### *Power Analysis/Sample Size Calculation*

In this doctoral research, I used the OpenEpi version 3 created by Dean, Sullivan, and Soeto calculate the sample size of the population in this study. OpenEpi is a free, web-based, open-source, operating system-independent series of programs designed for use in public health and medicine for training or practice. The program provides several epidemiologic and statistical tools for summary data. The OpenEpi is appropriate for calculating sample sizes for cross-sectional studies, cohort, case-control, comparisons of two means, and randomized controlled trials, including power calculations for proportions such as cross-sectional studies, case-control, cohort, clinical trials, and for comparisons for two means (Sullivan et al., 2009).

To calculate the sample size for this study, I selected the cohort or cross-sectional statistical calculator and inputted several assumptions about the study to determine the sample size. The assumptions of the study were based on the odd ratio (OR) of the outcome variable with association with independent variables, with the OR of the unexposed to the exposed, and the percentage outcome in the unexposed group as well as the percentage outcome in the exposed group. The percentage outcome in the unexposed group represents the incidence rate of patients in the unexposed group, whereas the percentage outcome in the exposed group represents the incidence rate of patients in the exposed group. I selected the two-sided confidence level of 95% with the desired power of 80% to detect the group difference at the 95% confidence level. My summary of peer-

reviewed literature provided information on the contribution of the key independent variables to the odd ratio of the dependent or outcome variable. Based on the literature, the selection of the OR contributed by one of my independent variables on the dependent variable to determine the sample size for my research.

Based on the review of the literature, I selected the OR that would generate the maximum sample size for this study. The independent variables, such as age, gender, contact a living sick person, exposure to body fluids, and contact with dead bodies during funeral rites, were available useful information in determining the sample size and making use of the OR of the independent variables. Nkangu et al. (2017) mentioned that gender is a significant factor that contributed to the outbreak of EVD in Liberia, Guinea, and Sierra Leone. Their results indicated that female patients had a higher exposure rate than men, but the survival rate among female patients was higher than male patients, and the odds of death were much lower for female patients when compared to male patients after adjusting for age with the recorded OR of 0.83 at 95% CI [0.76, 0.91].

The WHO (2016) showed significant differences and higher survival rates among female patients than male patients who were hospitalized at various Ebola treatment units across the country with the OR of 0.83, 95% CI [0.77, 0.91]. Age of patients is well documented as a contributing factor for the spread of EVD during an outbreak. Chérif et al. (2017) found that patients of younger age groups in Guinea had a significant high proportion of confirmed EVD cases and mortality with an adjusted OR of 0.995 [95% CI (0.990, 1.000), $p = 0.046$]. Several researchers established a significant association between the patients' age groups and the spread and contraction of EVD (Bah et al.,

2015; Bower et al., 2016; Fitzgerald et al., 2016; D. Ji et al., 2016; Y.-J. Ji et al., 2016; Qin et al., 2015). To further investigate the characteristics of patients who were admitted at Ebola treatment units, the International Ebola Response Team et al. (2016) performed multivariate logistic regressions on the risk of being a potential source contact or potential transmitter. Results indicated that patients who were named as potential funeral contacts represented the more severely affected cases of EVD with the OR of 1.81.

As indicated in Table 1, I used the OR of 3.0 to estimate sample size to generate enough power for this research. Also, 95% CI and an 80% power were appropriate to determine the sample size, since the research hypothesis is a two-sided significance level test. Table 1 provides a summary of the results of the sample size calculation using the OpenEpi model. The required sample size of 400 is suitable for this study, as indicated by the Fleiss with continuity correction method (Gail & Haneuse, 2019).

**Table 1**

*Sample Size: X-Sectional, Cohort, & Randomized Clinical Trials*

| Set Assumptions | | | Values |
|---|---|---|---|
| Two-sided significance level (1-alpha): | | | 95 |
| Power (1-beta, % chance of detecting): | | | 80 |
| Ratio of sample size, Unexposed/Exposed: | | | 1 |
| Percent of Unexposed with Outcome: | | | 5 |
| Percent of Exposed with Outcome: | | | 14 |
| Odds Ratio: | | | 3 |
| Risk/Prevalence Ratio: | | | 2.7 |
| Risk/Prevalence difference: | | | 8.6 |
| Sample | Kelsey | Fleiss | Fleiss with CC |
| Sample Size - Exposed | 178 | 177 | 200 |
| Sample Size - Nonexposed | 178 | 177 | 200 |
| Total sample size | 356 | 354 | 400 |

*Note*. Sullivan, K. M., Dean, A., & Soe, M. M. (2009). OpenEpi: A web-based epidemiologic and statistical calculator for public health. *Public Health Reports, 124*(3), 471–474. doi:10.1177/003335490912400320

### *Data Accessibility and Permission*

Generation of this archival data occurred during the 2014-2015 EVD outbreak when trained healthcare workers, such as nurses, completed a standardized case investigation form by interviewing patients or family members. The data set for this study consisted of the Ebola admission records, which contained information such as address, age, gender, date of symptom onset, possible exposures, and symptoms. Health care professionals then entered the information from this form into the VHF surveillance system using the Epi Info Viral Hemorrhagic Fever application developed in Epi Info 7 software (CDC). Clinical outcome and laboratory test results were also entered into the patient's case record in the VHF surveillance system for eventual reporting to various organizations such as the CDC, WHO, and other surveillance groups in each health district (Cori et al., 2017; Dietz et al., 2015, Henwood et al., 2017; McNamara et al., 2016).

Representatives from the Ministry of Health Sierra Leone and the CDC compiled all the district data into one dataset, which is available at the Sierra Leone Ministry of Health and Sanitation for research purposes. To gain access to the data, I secured a data use agreement and letter of confidentially or permission to use the data. This data use agreement will be signed by the Sierra Leone Ministry of Health representative and approved by Walden University's Institutional Review Board (IRB). A copy of the data use agreement and letter of confidentially and permission to use the data will appear in the appendixes of this paper.

## Instrumentation and Operationalization of Constructs

The sources of data were individual patients' medical records and histories of their admissions to Ebola treatment facilities during the outbreaks of EVD in Sierra Leone (MoHS, 2015). Each Ebola treatment center retained and managed possession of the medical records of patients, including each patient's medical history, laboratory test results, and other relevant information.

I plan to use information about EVD cases, making use of an assimilated case investigation form and the Epi Info Viral Hemorrhagic Fever Application (MoHS, 2015). Each Ebola treatment center categorizes information on patients and sends it to the national case databases and then shares them with the Ministry of Health, CDC, WHO, NIH, and foreign organizations working in Sierra Leone (MoHS, 2015). To gain access to the data, a data use agreement and letter of confidentially or permission to use the data will be obtained and signed by the Ministry of Health coordinated by Walden's IRB (see Appendix A).

## Instrumentation

To conduct this quantitative analysis, I will make use of the secondary data gathered by public health experts during and after the 2014 outbreaks of EVD in Sierra Leone. The purpose of using secondary data is to determine the factors that fueled the explosion of EVD in Sierra Leone with the outcome of interest being patients who underwent a comprehensive examination for EVD. The design of this study necessitates the employment of secondary data collected by the Sierra Leone's MoHS. During the outbreak of EVD, several public health facilities, including the Sierra Leone MoHS,

WHO, the CDC, the NIH, and other foreign institutions collected data in communities, districts, and Ebola treatment units for purposes of surveillance and public health acknowledgment.

In seeking data, I will use the secondary data already collected by the Sierra Leone Ministry of Health and Sanitation to identify participants. The secondary data will include essential unidentifiable biographic data and social dynamics of the targeted community in the area of the management of the sick and deceased. Data may also include information on fundamental standardized healthful behavior in an individual situation in the management of the ill and treatment of corpses. The secondary data from MoHS may further provide general information on targeted environments related to daily socio-cultural activities that impacted the potential spread of contagious diseases, such as Ebola.

In this quantitative cross-sectional study, I will use binary logistic regression via SPSS to ascertain whether a statistically meaningful relationship exists between religious and cultural practices and the spread of Ebola (Warner, 2013). The binary logistic regression analysis will determine whether a statistical relationship exists between the demographic independent variables and the transmission of Ebola virus. Similarly, binary logistic regression analysis will allow me to ascertain whether a statistical relationship exists between the cultural (housewife occupation)/religious (washing of corpse) variables and the spread of Ebola virus. SPSS is a statistical software used to analyze a considerable volume of quantitative data. Another name of the software is Predictive

Analytics Software. Using this tool, I will collate and complete frequency distribution tables, construct statistical charts/graphs, and calculate the Cohen kappa coefficient.

**Operationalization of Variables**

Operationalizing a variable refers specifically to how researchers observe or measure each variable. It is crucial in this study that how the value of each variable will be collected is well defined and accurately measured or recorded. In the process of increasing the quality of the results and improving the robustness of the design of this study, operationalization requires establishing exact definitions of each variable. Table 2 depicts the variables in this study, including the variable names, variables labels, and level of measurement. The independent variables used in this study are occupation, washing of corpse, age group, gender, contact with a sick person, and funeral attendance. The outcome or dependent variable is the spread of EVD.

**Table 2**

*Independent and Dependent Variables*

| Name of Variable | Variable Label | Level of Measurement |
|---|---|---|
| Role of Housewife (cultural practice) | Question on housewife role | Nominal/dichotomous |
| Washing of corpse (Touch Body) | Islamic religious practice | Nominal |
| Age group | Age group of patients | Ordinal |
| Gender | Gender of patient | Nominal/dichotomous |
| Contact with the living sick person | Exposure to a sick person | Nominal/dichotomous |
| Funeral exposure | Funeral attendance and contact with a dead body | Nominal/dichotomous |

| | | |
|---|---|---|
| Spread of Ebola | EVD laboratory test results | Nominal/dichotomous |

*Note.* Spread of Ebola was the dependent variable.

Based on the secondary data obtained for this study, those who contracted the disease or tested positive for EVD represent the outcome variable. The outcome variable will be dichotomized into positive for contracting the virus and negative for not contracting the virus. Hence, the variable will be coded as *0* = Negative and *1* = Positive for EVD. This study included six independent variables, as follow.

***Role of Housewife***

This information derived from a question about the main occupation of the patient. Anyone who responded "housewife" or health-care professional may have provided care to a living sick EVD patient; this variable was categorized as *true* = 1 or *false* =2.

***Washing of Corpse***

Funeral practices in Freetown are varied with differences between typical Muslim and Christian practices. For the purpose of the study, washing of corpse was dichotomous (*Muslim* = 1 and *Christian* = 2).

***Age or Age Groups***

Age refers to the years of life at the time when the MoHS gathered patients' histories, carried out laboratory tests, stored results in the database for research purposes. Age is a categorical variable occurring in the following groups: 0 = *1-4 years*; 1 = *5-9 years*; 2 = *10-14 years*; 3 = *15-19 years*; 4 = *20-24 years*; 5 = *25-29 years*; 6 = *30-34*

*years*; and 7 = *35-39 years*; 8 = *40-44 years*; 9 = *45-49 years*; 10 = *50-54 years*; 11 = *55-59 years*; 12 = *60-64 years*; and *13 = 65 or more years*.

***Gender***

In this study, male and female are considered as gender. Gender differences among male and female described how the roles of gender could influence the pattern of exposure to infectious diseases. Gender is a dichotomous variable in this study indicated by 0 = *male* and 1 = *female*.

***Funeral Exposure***

Funeral exposure occurs with touching of the dead and attendance at a funeral. Funeral attendance was recorded as a dichotomous variable, where 1 = *Yes* (attended funeral) and 0 = *No* (did not attend funeral).

***Contact with a Living Sick Person***

Contact occurs when a living sick person comes in proximity with a suspected or confirmed case patient. Contact with a living sick person was recorded as a dichotomous variable, where 1 = *Yes* (contact with a living sick person) and 0 = *No* (no contact with a living sick person).

## Data Analysis Plan

Using SPSS version 25, I evaluated the data and then calculated descriptive and inferential statistics to describe the dataset and determine whether there is a relationship between the dependent variable and the independent variables. Using median and interquartile ranges will allow me to summarize the skewed quantitative variables and using frequencies and percentages will support summary of the variables. I will test for

the assumption of multicollinearity before analyzing logistic regression as the presence of multicollinearity will make it tedious to assess the relative importance of the independent variables in explaining the variation caused by the dependent variable. There is a simple way to assess multicollinearity in my regression model. The variance inflation factor (VIF) identifies correlation between independent variables and the strength of that correlation. Statistical software calculates a VIF for each independent variable.

I carried out a binary logistic regression analysis (with a level of significance of 5%) to identify predictors of EVD among residents of Freetown. Calculations using IBM-SPSS statistical software provided meaningful insights from the dataset, predicted the statistical significance of the variables, and improved the efficiency of the study. Also, using SPSS, I conducted both inferential and descriptive statistics utilizing all the statistical tests necessary to address the research questions. The descriptive statistics included frequency and percentage distributions. I cleaned the data by assigning binary values to the levels of the columns (lumping together levels that are equivalent in meaning) and changed the data types of the columns to facilitate logistic regression (Green & Salking, 2008).

## Research Questions

*RQ1:* Is there a relationship between washing of corpse, role of housewife, funeral attendance, contact with the living sick person, and spread of EVD in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak?

*$H_0$1:* There is no relationship between washing of corpse, role of housewife, funeral attendance, contact with the living sick person, and spread of EVD in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak.

*$H_A$1:* There is a relationship between washing of corpse, role of housewife, funeral attendance, contact with the living sick person, and spread of EVD in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak.

*RQ2:* Is there a relationship between the spread of EVD and individuals' age group and gender in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak?

*$H_0$2a:* There is no relationship between individuals' age group and the spread of EVD in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak.

*$H_A$2a:* There is a relationship between individuals' age group and the spread of EVD in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak.

*$H_0$2b:* There is no relationship between individuals' gender and the spread of EVD in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak.

*$H_A$2b:* There is a relationship between individuals' gender and the spread of EVD in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak.

## Statistical Tests for the Study Outcome

Logistic regression is a statistical method for analyzing a dataset in which there are one or more independent variables that determine a dichotomous outcome (Green & Salking, 2008). In logistic regression, the outcome variable signifies binary or dichotomous characteristics. My goal was to use logistic regression on a data set to determine which factors are significant in predicting a binary element. I cleaned the data

by assigning binary values to the levels of the columns (lumping together levels that are equivalent in meaning) and changing the data types of the columns to facilitate logistic regression (Green & Salking, 2008). I did explore the possibility of converting categorical data, currently stored as factors, into numeric data. Logistic regression aims at investigating the best fitting model to describe the relationship between the dichotomous feature of interest (dependent variable = response or outcome variable) and a set of independent (predictor or explanatory) variables (Green & Salking, 2008). I performed all statistical tests in this study at a 5% (0.05) significance level. Further, I conducted the tests using an estimate of effects calculated at the 95% CI and an OR and *p*-value of less than or equal to 0.05. All independent variables that show a significant contribution to the dependent or outcome variable will be modeled into logistic regressions. Identifying early predictor variables will assist public health experts to avert the spread of EVD in subsequent epidemics in Sierra Leone.

## Threats to Validity

Research is an essential part of modern reality, assisting the progress of communities, economies, and individuals. As such, it is crucial to ensure the quality of research by every criterion at all its stages. According to Creswell (2009), the most critical facet of quality is research validity or whether researchers interpret and understand the results of studies correctly. Creswell (2009) added that threats to validity are features of research designs that diminish the correct interpretation of results. In quantitative research, validity strictly encompasses measurement validity, or the degree to which an instrument or test measures what the researcher intends to measure (Creswell,

2009). In other words, the validity of a quantitative research study refers to whether researchers can draw useful and purposeful inferences from scores on instruments (Creswell, 2009).

Establishing the validity to threat in this study will help to ascertain whether the study instrument is an appropriate tool for this study. According to Creswell (2009), researchers must consider three traditional forms of validity when conducting a study: (a) predictive or concurrent validity, (b) content validity, and (c) construct validity. A researcher may encounter difficulty in demonstrating that outside forces do not influence the variable of interest or the outcome variable. Therefore, a researcher must identify threats to validity and investigate ways to diminish the effects of those risks. Accordingly, I identified two types of threats to validity in this study: (a) internal threats to validity and (b) external threats to validity. In brief, internal and external validity are concepts that reflect whether the results of a study are trustworthy and meaningful.

**External Threats to Validity**

While internal validity relates to how well a researcher conducts a study (its structure), external validity relates to how applicable the findings are to the real world. External validity refers to how well the outcome of a study can be expected to apply to other settings. In other words, this type of validity refers to how generalizable the findings are. Drawing improper or incorrect inferences from the sample data and sharing with other persons, settings, and past or future conditions may lead to threats to external validity (Creswell, 2009). Further threats to external validity may also arise when the investigators generalize beyond the groups in the study to other groups outside the study

who did not participate in the study. The timing of the survey, the uniqueness of the research setting, and the features of the participants selected for the sample may give rise to the external threats to the study (Creswell, 2009).

Selection bias is one of the most significant threats to external validity (Aschengrau & Seage, 2014). Selection bias results from measures that apply to the selection of the study subjects. Biased selection of subjects for a study yields results different from the results that would take place among all eligible participants in the study population (Aschengrau & Seage, 2014). The selection of the study population and locations can be a possible source of bias, which may potentially introduce threats to external validity. Careful avoidance of selection bias will preserve the possibility of generalizing the conclusions of this study to the general EVD population because the participants of this study are a subset of Ebola patients at the treatment facilities in Sierra Leone. The purpose of the selection of the different Ebola treatment facilities was to represent each geographical location in the study.

Threats to external validity can be any factors within the study that minimize or reduce the generalizability of the overall results of the survey (Aschengrau & Seage, 2014). The evaluation of external validity requires a review of the study design or methods and the biological makeup of the study subject or population. Selection biases, or corruption of the measures used to select the participants, are one of the most significant threats to external validity. A study's participants provide results separate from the results that would emerge from all eligible participants in the study population (Aschengrau & Seage, 2014). The location and selection of the study population can be a

potential representation of bias, which may initiate threats to external validity. The potential for generalizing conclusions of the study to the general EVD population exists because the subjects or participants of this study were chosen from Ebola treatment centers in Sierra Leone (Aschengrau & Seage, 2014).

**Internal Threats to Validity**

Internal validity is the extent to which a researcher establishes a trustworthy cause-and-effect relationship between a treatment and an outcome (Allen et al. 2011). Internal validity also allows a researcher to eliminate alternative explanations for research findings. Internal validity depends largely on the rigor with which the researcher performs the procedures of a study. In the same vein, the degree of control the researcher exerts over potential extraneous variables determines the level of internal validity (Allen et al., 2011).

Controlling for potentially confounding variables minimizes the potential for an alternative explanation for treatment effects and provides more confidence that effects occur because of the independent variable. Internal threats to validity must be established before the study results can be generalized to the populations beyond the subjects of the study (Aschengrau & Seage, 2014). Internal validity is not a simple concept because the consideration determines how confident the researcher can be in the findings of a study, based on whether they avoided traps that rendered the findings questionable. The less chance there is for *confounding* the results of a study, the higher the internal validity, and the more confident the investigator can be in the findings (Aschengrau & Seage, 2014). Confounding refers to a situation in which other factors come into play that confuse the

outcome of a study. If systematic bias, random error, and confounding are eliminated from a study, the researcher can conclude that the relationship between the variables is dependable, and the study possesses internal validity (Aschengrau & Seage, 2014).

After establishing the measure of association, the researcher must investigate whether the observed result of the study is reliable by assessing the internal validity of the results of the study (Aschengrau & Seage, 2014). In making sure that the results of this study are valid, I may reduce the likelihood of systematic bias and random error. According to Aschengrau and Seage (2014), systematic bias or error in the study design can lead to an erroneous relationship between the outcome (disease) and independent (exposure) variables. Controlling for any potential confounding variables will provide more confidence that the contraction or transmission of EVD occurred because of the influence of the independent variables (Aschengrau & Seage, 2014).

Internal threats to validity must be established before the study results can be generalized to the populations beyond the subjects of the study (Aschengrau & Seage, 2014). After the determination of the measure of association, the researcher must evaluate whether the observed result of the survey is accurate. After the evaluation of the outcome, the researcher must assess the internal validity of the results of the study (Aschengrau & Seage, 2014). To make sure that the results of my research are valid, I will minimize systematic bias and random error. According to Aschengrau and Seage (2014), systematic bias or failure in the study design can lead to an erroneous relationship between the independent (exposure) and outcome (disease) variable. Controlling for any potential confounding variables will provide more confidence that the contraction or

transmission of EVD is due to the independent variables. If I can rule out systematic bias, random error, and confounding variables, I will be able to conclude that the relationship between the variables is accurate, and the study will have internal validity (Aschengrau & Seage, 2014).

## Ethical Procedures

The ethical behavior of individual researchers is under unprecedented scrutiny. In the 21st century, any concerns regarding ethical practices may adversely influence attitudes about science. The abuses committed by several researchers, who exaggerated hazards and offered consumers deceptive solutions, received ubiquitous publicity (Rid & Emanuel, 2014). Further, specific ethical considerations apply to researcher involving who people encounter lasting disease, where no specific therapies or preventive measures exist.

For instance, clients with severe cancer who do not respond to treatments usually are invited to take part in preliminary trials. Considering several ethical issues is essential when designing or planning any type or kind of research study. The collection of data for the research study costs money and time to collect, analyze, interpret, and disseminate data and results (Aschengrau & Seage, 2014). It is essential to recognize and address ethical issues at all stages of the research studies. Ethical issues in research studies may emanate from the methods used in data collection, interviews, informed consent, questionnaires, and voluntary participation (Creswell, 2009). The analysis of secondary data will generate new hypotheses and answer paramount research questions (Tripathy,

2013). However, working with the secondary data in individual research studies will necessitate stringent ethical procedures.

The secondary data collected by the MoHS for this study will represent part of the public health responses to the 2014 outbreaks of EVD in Sierra Leone. Following the United States federal human subject's protection regulations and the CDC's guidelines for defining public health research and public health non-research, the data collected on patients are not considered to be human subjects' research (Fallah, Skrip, Gertler, Yamin, & Galvani, 2015). This research study utilizes de-identified secondary data from the 2014 EVD outbreaks in Sierra Leone. The dataset will not include the name or identity of the participants. Despite the de-identification of the dataset, the data use agreement must be adhered to by safeguarding and not disclosing or discussing any confidential information with others, including friends or family members.

During my activity utilizing this secondary data, I will have access to de-identified patients' information that is confidential and will not be disclosed or shared with others. I will uphold the highest virtue of academic integrity by respecting individual privacy at all levels of the study and acknowledge that the improper disclosure of confidential information can be detrimental to the participants. I will make sure not to allow any unauthorized transmissions, inquires, modification, or purging to the confidential information in the dataset. I agreed with MoHS that violation of the data confidentially would have legal implications (Kim, 2012).

Additionally, a letter of authorization will appear in Appendix A following approval from the IRB at Walden University (Walden IRB approval no. 09-18-20-

0613066). The IRB is responsible for making sure that all researchers act in agreement with the ethical standards of research on human subjects as well as the federal regulations (Kim, 2012). Protecting the safety of the participants in research studies is a high priority for researchers or investigators. The IRB is an independent committee formed by institutions or organizations that sponsor research studies. The IRB was able to review the research proposal for compliance with all ethical protocols relating to the study participants. The IRB granted approval to use this dataset (Kim, 2012).

## Summary

In this chapter, I discussed and provided comprehensive information regarding the research method and design. A detailed description of the study methodology included study participants, a description of the target population, and sampling procedures used to obtain data. Also, I reviewed and justified the sampling strategy used in the study**,** including inclusion and exclusion criteria. Operationalization of each variable was defined and discussed, and levels of measurement were determined. Research questions and hypotheses were restated, and statistical methods that were used to address research questions were thoroughly discussed. Statistical software used to analyze data was identified. Both external and internal threats to validity were addressed and how their effect on the outcome of the study could be alleviated or mitigated. Ethical procedures and agreements to gain access to secondary data were elucidated. All steps that are necessary to maintain patient confidentiality were explained, including permissions from the IRB that allowed me to use the secondary dataset for the 2014 outbreak of EVD in

Sierra Leone. In Chapter 4, I discuss results and findings of the study in connection with the research questions.

# Chapter 4: Results

## Introduction

The purpose of his quantitative cross-sectional study was to investigate how the relationship between religious and cultural practices differed according to age group, occupation of housewife, washing of the corpse, gender, contact with a living sick person, and funeral attendance. Data for this study were derived from archival records generated by the Sierra Leone MoHS during the 2014 outbreak. This study was an analysis of what contributes to the spread of EVD and public health interventions and resources during a future outbreak.

This study involved using a quantitative cross-sectional design and analysis of secondary data collected regarding patients admitted to Ebola treatment units in Sierra Leone to assess the associations between factors and EVD status. The SEM guided the study, and the design supported analysis of 81,923 samples. Further, a binary logistic regression analysis was conducted to predict the most prominent risk factors for the dependent variable (spread of EVD) while controlling for potential confounders and testing for effect modification of the primary exposure.

The following research questions and hypotheses were used:

*RQ1:* Is there a relationship between washing of corpse, role of housewife, funeral attendance, contact with the living sick person, and spread of EVD in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak?

*$H_0$1:* There is no relationship between washing of corpse, role of housewife, funeral attendance, contact with the living sick person, and spread of EVD in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak.

*$H_A$1:* There is a relationship between washing of corpse, role of housewife, funeral attendance, contact with the living sick person, and spread of EVD in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak.

*RQ2:* Is there a relationship between the spread of EVD and individuals' age group and gender in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak?

*$H_0$2a:* There is no relationship between individuals' age group and the spread of EVD in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak.

*$H_A$2a:* There is a relationship between individuals' age group and the spread of EVD in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak.

*$H_0$2b:* There is no relationship between individuals' gender and the spread of EVD in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak.

*$H_A$2b:* There is a relationship between individuals' gender and the spread of EVD in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak.

This chapter includes three sections. The first section details data collection procedures. The second section contains a description of the study sample's sociodemographic characteristics, including probable and confirmed Ebola disease status and descriptive statistics (frequencies and percentages for independent variables and covariates). The third section includes data analyses, including logistic regression analysis to test hypotheses for each research question. Research questions and hypotheses

derived from an extensive literature review of EVD and potential risk factors. I arranged results from statistical analysis tests in a manner consistent with research questions and predictions of the outcome of my study.

## Data Collection

For this research, use of a quantitative cross-sectional design was appropriate for analysis of secondary data involving patients admitted to various Ebola treatment facilities in Sierra Leone during the 2014 and 2015 EVD outbreak. Public health and healthcare professionals collected data during and after the outbreak. Data included individual medical records and histories of patients admitted to Ebola treatment facilities during outbreaks of EVD in Sierra Leone. Each Ebola treatment facility kept and managed medical records of patients, including medical history, triage, laboratory test results, and other relevant information. Each Ebola treatment facility collated information on patients and sent it to national case databases to which the MoHS, WHO, NIH, and CDC, working in Sierra Leone have access. A data use agreement and letter of confidentiality and permission to use the data (see Appendix A) was obtained and signed by Sierra Leone's MoHS coordinator and reviewed by the IRB during the process of obtaining access to data.

### Time Frame for Data Collection and Discrepancies of the Secondary Dataset

Data collection in Sierra Leone occurred between 2014 and 2015 during the outbreak of EVD among patients who gained admission to Ebola treatment centers. Data included deidentified patient ID numbers, Ebola treatment unit, age, gender, history of

contact with sick individuals, exposure to body fluids, funeral attendance, and burial rituals, and EVD status. The deidentified dataset contained 81,923 samples.

The dataset was analyzed using IBM SPSS version 25 to ensure quality, address discrepancies, and check for missing data. To control the missing values in the dataset, I automatically recorded the variables in SPSS and treated blank string values as missing users. Using an appropriate technique to handle cases with missing data when performing secondary analyses is crucial to reducing biases, avoiding inaccurate results, and not reaching invalid conclusions. Missing data can be defined as data that are not accounted for or stored (Kang, 2013). Missing data occurs in nearly all research studies, even well-designed studies (Kang, 2013). If the researcher does not account for missing values in the dataset, he or she may reach erroneous conclusions, leading to inaccurate findings (Kang, 2013).

A cross section of all cases of EVD were recorded and reported in the subservient dataset provided by the MoHS. Data in this study were either self-reported or reported by family members or friends or inferred by interviewers, and therefore may contain biases. For instance, some patients may have recalled their exposure to bodily fluids or funeral rituals in more detail or have different perceptions of what constituted exposure to body fluids and contact with people suspected to have EVD. The sample size was adequate and exceeded the minimum sample size determined in the power analysis, as explained in Chapter 2.

**Baseline Descriptive and Demographic Characteristics of the Sample**

A cross section of patients of all ages, both males and females, hospitalized in Ebola treatment centers during the 2014 outbreak of EVD in Sierra Leone constituted the target population. Sierra Leone is located in western Saharan Africa; it is located south and southeast of Liberia and north and northeast of Guinea. Sierra Leone also shares borders with the Atlantic Ocean to the west between 7th and 10th parallels north of the equator (WHO, 2016). Sierra Leone is one of the smallest and lowest-income nations in sub-Saharan Africa, with a population of approximately 7.65 million people (WHO, 2018a). According to the WHO (2018b), more than half of Sierra Leone people live in the urban areas, with one-third of the total population residing within 40 to 50 miles of Freetown, the capital city. People who were isolated and tested for the virus and admitted to Ebola treatment centers in Sierra Leone during 2014 represented the sample in the MoHS dataset.

In contrast, the control group, whose data was also obtained from MoHS, was individuals who did not receive the intervention. Therefore, only variables that appeared in this dataset were analyzed. I included only the EVD outbreaks among a cross-section of patients who were admitted to the Ebola treatment centers during the years of 2014 and 2015. In all, 81,923 samples ($n$ = 81,923) were analyzed in this study. Even though a colossal number of cases were recorded and reported by Ebola treatment units in Sierra Leone, the MoHS provided a random sample of 81,923 cases for this study.

To quantify the risk factors for the spread of EVD, I performed descriptive analyses of the secondary data; 81,923 samples were analyzed using laboratory findings

for patients tested for the detection of EVD RNA by RT-PCR or IgM antibodies against EVD (Coltart et al., 2017; Furuse et al., 2017). People who tested positive for the virus with RT-PCR test specific for EVD were labeled as having confirmed cases of EVD. A descriptive characteristic of the sample population included the patients' gender, age range, exposure to people sick with the virus, exposure to body fluids, attendance of funerals, and each patient's EVD status. The sample size in the analysis was adequate and exceeded the minimum sample determined in the power analysis in Section 2.

## Results

### Summary of Descriptive Statistics That Characterize the Sample

The sample consisted of 81,923 participants. Table 3 displays the percentages and frequencies of the characteristics of the patients sampled in the study. The results indicated that among the 81,923 cases, 47.5% (38,879) of the study participants were female, and 51.8% (42,403) were male. Members of the sample represented all stages of the human lifespan for the residents of Freetown; about 44% (35,855) of participants were aged 19 years or younger, 31.2% (25,553) were 20 to 49 years of age, and 23.5% (19,292) were 50 or older (Sierra Leone Ebola Data [SLED], 2014-2015). Table 3 also shows that 2.4% (1958) of the patients indicated they attended funeral arrangements, and 61.2% (50,157) did not attend funeral rites. About 58.9% (48,231) of the participants met a living sick person, and 5.5% (4,508) indicated that they were in close contact with a sick person (SLED, 2014-2015). Approximately 12.2% (9,960) indicated exposure to human bodily fluids, while 38.8% (644) did not encounter human bodily fluids exposure.

A total of 12.2% (9,960) of the patients tested positive for EVD, while 87.8% (71,963) of the patients were negative for EVD, as depicted in Table 3.

**Table 3**

*Descriptive Statistics of Patient Characteristics*

| Patient Characteristic | Frequency | % |
|---|---|---|
| Gender | | |
| Male | 42,403 | 51.8 |
| Female | 38,879 | 47.5 |
| Missing | 641 | 0.8 |
| Total | 81,923 | 100.0 |
| Age in Years | | |
| 0-4 | 25,392 | 31.0 |
| 5-9 | 4,237 | 5.2 |
| 10-14 | 2,799 | 3.4 |
| 15-19 | 3,457 | 4.2 |
| 20-24 | 4,402 | 5.4 |
| 25-29 | 5,306 | 6.5 |
| 30-34 | 4,214 | 5.1 |
| 35-39 | 4,989 | 6.1 |
| 40-44 | 3,381 | 4.1 |
| 45-49 | 3,261 | 4.0 |
| 50-54 | 2,711 | 3.3 |
| 55-59 | 2,104 | 2.6 |
| 60-64 | 2,211 | 2.7 |
| 65 and older | 12,266 | 15.0 |
| Missing | 1,193 | 1.5 |
| Total | 81,923 | 100.0 |
| Housewife | | |
| True | 3,625 | 4.4 |
| False | 78,298 | 95.6 |
| Missing | 0 | 0.0 |
| Total | 81,923 | 100.0 |
| Touch Body | | |
| Yes | 795 | 1.0 |
| No | 15 | 0.0 |
| Missing | 81,113 | 99.0 |
| Total | 81,923 | 100.0 |

| Patient Characteristic | Frequency | % |
|---|---|---|
| Funeral | | |
| Yes | 1,958 | 2.4 |
| No | 50,157 | 61.2 |

| | | |
|---|---|---|
| Missing | 29,808 | 36.4 |
| Total | 81,923 | 100.0 |
| Contact with Living Sick | | |
| Yes | 4,508 | 5.5 |
| No | 48,231 | 58.9 |
| Missing | 29,184 | 35.6 |
| Total | 81,923 | 100.0 |
| Ebola Diagnosis | | |
| Negative | 71,963 | 87.8 |
| Confirmed | 9,960 | 12.2 |
| Missing | 0 | 0.0 |
| Total | 81,923 | 100.0 |

## Assumptions of Binary Logistic Regression

### *Logistic Regression*

Logistic regression does not share many of the key assumptions of linear regression and general linear models based on ordinary least squares algorithms, particularly regarding linearity, normality, homoscedasticity, and measurement level. The following distinctions include logistic regression does not require a linear relationship between the dependent and independent variables, the error terms (residuals) do not need to be normally distributed, homoscedasticity is not required and the dependent variable in logistic regression is not measured on an interval or ratio scale.

However, some other assumptions still apply. First, binary logistic regression requires that the response or dependent variable only takes two possible outcomes. In this case, the two possible outcomes of the dependent variable (Ebola or EpiDef) are 0 (*not a case)* and 1 (*confirmed case).* Second, logistic regression requires the observations to be independent of each other. In other words, the observations should not come from repeated measurements or matched data. The easiest way to check this assumption is to

create a plot of residuals against time and observe a random pattern. If there is not a random pattern, then this assumption may be violated.

Here, the assumption was not violated because a random pattern was evident in the scatterplot in Figure 2. Third, logistic regression requires there to be little or no multicollinearity among the independent variables. This means that the independent variables should not be too highly correlated with each other such that they do not provide unique independent information in the regression model. As shown in Table 4, the respective correlations are not closely related when compared to each other. If the degree of correlation is high enough between variables, it can cause problems when fitting and interpreting the model.

**Figure 2**

*Standardized Residuals*

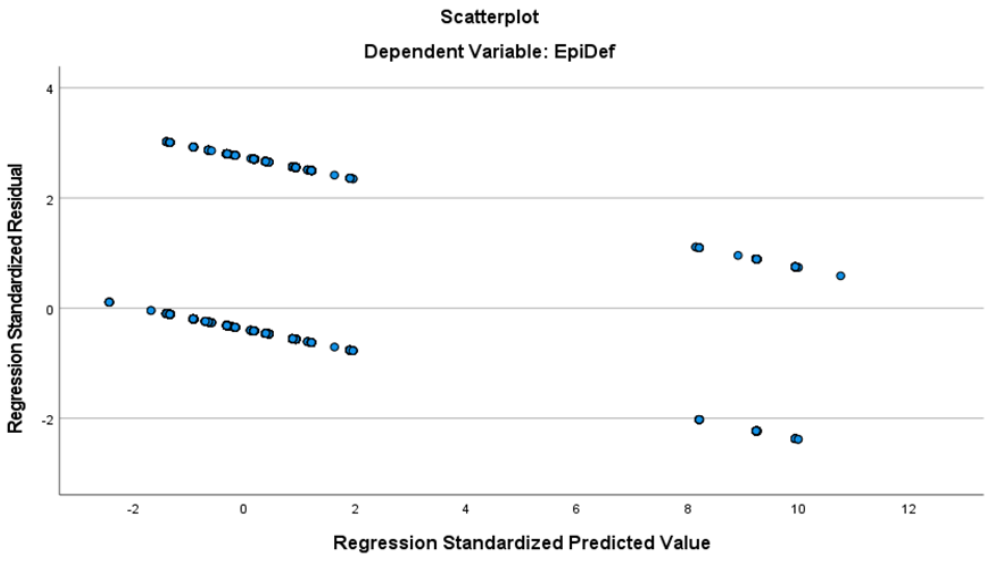

**Table 4**

*Correlations between the independent variables*

| | | Gender | Age | Housewife | Funeral | Contact with Living Sick | Touch Body |
|---|---|---|---|---|---|---|---|
| Gender | Pearson Correlation | 1 | .124** | -.011 | .034** | .036** | .006 |
| | Sig. (2-tailed) | | .000 | .002 | .000 | .000 | .080 |
| | *N* | 81,923 | 81,923 | 81,923 | 81,923 | 81,923 | 81,923 |
| Age | Pearson Correlation | .124** | 1 | -.027** | .113** | .115** | .009* |
| | Sig. (2-tailed) | .000 | | .000 | .000 | .000 | .012 |
| | *N* | 81,923 | 81,923 | 81,923 | 81,923 | 81,923 | 81,923 |
| Housewife | Pearson Correlation | -.011** | -.027** | 1 | -.061** | -.058** | -.012** |
| | Sig. (2-tailed) | .002 | .000 | | .000 | .000 | .001 |
| | *N* | 81,923 | 81,923 | 81,923 | 81,923 | 81,923 | 81,923 |
| Funeral | Pearson Correlation | .035** | .113** | -.061** | 1 | .126** | .075** |
| | Sig. (2-tailed) | .000 | .000 | .000 | | .000 | .000 |
| | *N* | 81,923 | 81,923 | 81,923 | 81,923 | 81,923 | 81,923 |
| Contact | Pearson Correlation | .036** | .115** | -.058** | .226** | 1 | 0.69 |
| | Sig. (2-tailed) | .000 | .000 | .000 | .000 | | .000 |
| | *N* | 81,923 | 81,923 | 81,923 | 81,923 | 81,923 | 81,923 |
| Touch Body | Pearson Correlation | .006 | .009* | -.012** | .075** | .069** | 1 |
| | Sig. (2-tailed) | .080 | .012 | .001 | .000 | .000 | |
| | *N* | 81,923 | 81,923 | 81,923 | 81,923 | 81,923 | 81,923 |

Other ways to measure multicollinearity include the variance inflation factor (VIF), condition index, and tolerance. VIF assesses how much the variance of an estimated regression coefficient increases if the predictors are correlated. The VIF and low tolerance are two useful statistics that are reciprocals of each other. Therefore, either a high VIF or a low tolerance is indicative of multicollinearity. As such, the values for both VIF and tolerance in Table 5 were within range. A condition index (sometimes called a condition number) shows the degree of multicollinearity in a regression design matrix. It is an alternative to other methods like variance inflation factors.

Kennedy (2003) offered the following rule of thumb for interpreting a condition index; any index greater than 30 "indicates strong collinearity." The IBM knowledge center calls values over 30 a "serious problem" and also suggests values greater than 15 may indicate that collinearity is suspected as indicated below for touch body. As shown in Table 5, the condition indices for gender, age, housewife, funeral, and contact are within specifications.

**Table 5**

*Test for Multicollinearity*

| | Sex | Age | Housewife | Funeral | Contact | Touch Body |
|---|---|---|---|---|---|---|
| VIF | 1.016 | 1.029 | 1.004 | 6.987 | 6.983 | 1.006 |
| Condition Index | 1.000 | 1.899 | 2.086 | 2.207 | 9.206 | 19.829 |
| Tolerance | 0.984 | 0.972 | 0.996 | 0.143 | 0.143 | 0.994 |

Fourth, logistic regression assumes linearity of independent variables and log odds. However, this analysis does not require the dependent and independent variables to be related linearly; instead, it requires that the independent variables be linearly related to the log odds. Finally, logistic regression typically requires a large sample size. A general guideline is that you need a minimum of 10 cases with the least frequent outcome for each independent variable in your model. For example, if a researcher has five independent variables and the expected probability of his least frequent outcome is .10, he will need a minimum sample size of 500 (10*5 / .10). As indicated in Table 5, the sample size of 81,923 was large enough to offset the large sample size requirement.

**Chi-Square Tests**

Pearson's Chi-square test assumptions are the data in the cells should be frequencies or counts of the cases rather than percentages or some change or transformation of the data (McHugh, 2013). Another Pearson's Chi-square test assumption: the categories of the variables must be mutually exclusive (McHugh, 2013). The study groups must be independent, which means that a different test must be performed if the two groups are related. For example, should the researcher's data consists of paired samples, an additional examination must be used, such as in studies in which a parent is paired with their child (McHugh, 2013). There are two variables, and both are measured as categories, usually at the nominal level. Interval or ratio data that have been transformed into ordinal categories may also be used. While Chi-square has no rule about limiting the number of cells (by limiting the number of classes for each variable), a considerable number of cells (over 20) can make it challenging to meet

assumption #6 below and interpret the meaning of the results (McHugh, 2013). The variables used in this study are categorical (nominal or ordinal level), and the value of the expected cells is five and above. The Chi-square assumptions were met since the sample size had cell count of at least 5, the study groups are independent, mutually exclusive, and categorically nominal or ordinal.

**Statistical Analysis Findings Organized by Research Questions**

Statistical analysis included Chi-square test for association and binary logistic regression for each research question presented in Chapters 1, 2, and 3 are presented in this section. Chi-square test for association represented the primary statistical test to investigate whether an association between the research variables in each of the research questions existed. Contrarily, logistic regression was used to evaluate the predictive influence of the independent variables (housewife, washing of corpse [touch body], age, gender [sex], funeral attendance, and contact with the living sick person) on the dependent variable (Spread of Ebola or Epidef). This subsection includes the statistical analysis findings organized by the research questions (RQ1 and RQ2).

**Chi-Square Test for Association**

*RQ1:* Is there a relationship between washing of corpse, role of housewife, funeral attendance, contact with the living sick person, and spread of EVD in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak?

*$H_01$:* There is no relationship between washing of corpse, role of housewife, funeral attendance, contact with the living sick person, and spread of EVD in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak.

*$H_A1$:* There is a relationship between washing of corpse, role of housewife, funeral attendance, contact with the living sick person, and spread of EVD in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak.

**Table 6**

*Chi-Square Test Results for Independent Variables and EVD*

| Independent Variables | Value | df | Asymptotic Significance (2-sided) | Exact Sig. (2-sided) | Exact Sig. (1-sided) |
|---|---|---|---|---|---|
| Role of housewife | | | | | |
| Pearson Chi-Square | 60.228[a] | 1 | .000 | | |
| Continuity Correction[b] | 59.826 | 1 | .000 | | |
| Likelihood Ratio | 55.449 | 1 | .000 | | |
| Fisher's Exact Test | | | | .000 | .000 |
| Linear-by-Linear Association | 60.228 | 1 | .000 | | |
| a. 0 cells (0.0%) have expected count less than 5. The minimum expected count was 440.72. | | | | | |
| b. Computed only for a 2x2 table. | | | | | |
| Washing of corpse | | | | | |
| Pearson Chi-Square | 2707.825[a] | 2 | .000 | | |
| Likelihood Ratio | 1564.928 | 2 | .000 | | |
| Linear-by-Linear Association | 2707.066 | 1 | .000 | | |
| a. 1 cells (16.7%) have expected count less than 5. The minimum expected count was 1.70. | | | | | |
| Contact with living sick person | | | | | |
| Pearson Chi-Square | 12502.332[a] | 2 | .000 | | |
| Likelihood Ratio | 8153.704 | 2 | .000 | | |
| Linear-by-Linear Association | 41.401 | 1 | .000 | | |
| a. 0 cells (0.0%) have expected count less than 5. The minimum expected count was 548.07. | | | | | |
| Funeral attendance | | | | | |
| Pearson Chi-Square | 6323.852[a] | 2 | .000 | | |
| Likelihood Ratio | 3941.645 | 2 | .000 | | |
| Linear-by-Linear Association | 125.996 | 1 | .000 | | |
| a. 0 cells (0.0%) have expected count less than 5. The minimum expected count was 238.05. | | | | | |
| Age group | | | | | |
| Pearson Chi-Square | 5893.714[a] | 14 | .000 | | |
| Likelihood Ratio | 6504.330 | 14 | .000 | | |
| Linear-by-Linear Association | 26.451 | 1 | .000 | | |
| a. 0 cells (0.0%) have expected count less than 5. The minimum expected count was 145.04. | | | | | |
| Sex (gender) | | | | | |

| | | | |
|---|---|---|---|
| Pearson Chi-Square | 72.153[a] | 2 | .000 |
| Likelihood Ratio | 76.292 | 2 | .000 |
| Linear-by-Linear Association | 22.692 | 1 | .000 |

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count was 77.93.

*Note*. *N* of valid cases = 81,923.

Using a sample size of $N = 81{,}923$, a chi-square test for association was conducted to assess whether washing of corpse (Touch Body), role of housewife, funeral attendance, contact with the living sick person are associated with the spread of Ebola virus disease in Freetown, Sierra Leone, during the years of 2014-2015 Ebola outbreak. As illustrated in Table 6, the *p*-values (asymptotic significance [2-sided]) for all the corresponding chi-square values were zero, less than the traditional threshold of $p < 0.05$. This result indicated that washing of corpse [$X^2$ (2) = 2707.83, $p < 0.05$], role of housewife [$X^2$ (1) = 60.23, $p < 0.05$], funeral attendance [$X^2$ (2) = 6323.85, $p < 0.05$] and contact with the living sick person [$X^2$ (2) = 12502.33, $p < 0.05$] had a statistically significant relationship with the spread of EVD. Therefore, the null hypothesis was rejected, whereas the alternative hypothesis was accepted.

*RQ2:* Is there a relationship between the spread of EVD and individuals' age group and gender in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak?

*$H_0$2a:* There is no relationship between individuals' age group and the spread of EVD in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak.

*$H_A$2a:* There is a relationship between individuals' age group and the spread of EVD in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak.

*$H_0$2b:* There is no relationship between individuals' gender and the spread of EVD in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak.

*$H_A$2b:* There is a relationship between individuals' gender and the spread of EVD in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak.

Also, using the sample size of $N$ = 81,923, a Chi-square test for association was conducted to evaluate whether the participant's age group and gender were associated the spread of EVD. The results in Table 6 indicate statistically significant relationships between age group [$X^2$ (14) = 5893.71, $p < 0.05$], gender [$X^2$ (2) = 72.15, $p < 0.05$) and the spread of EVD. Therefore, the null hypothesis can be rejected, whereas the alternative hypothesis can be accepted as the *p*-values for both the age groups and the gender were below the conventional threshold of 0.05.

**Binary Logistic Regression**

Binary logistic regression was performed to assess the impact of several factors on the likelihood that the respondents would report that they had contracted Ebola virus disease. The model contained six independent variables (housewife, washing of corpse, contact with living sick, funeral attendance, age, and sex). The full model containing all predictors was statistically significant, $X^2$ (23, $N$ = 81,923) = 12692.161, $p < 0.001$ (Table7), indicating that the model was able to distinguish between respondents who reported and did not report the contraction of Ebola virus disease. In Table 7, the model explained between 14.4% (Cox and Snell R Squared) and 27.4% (Nagelkerke R Squared) of the variance in Ebola virus status, and correctly classified 87.8% of cases.

**Table 7**

*Model Summary*

| Step | -2 Log likelihood | Cox & Snell R Square | Nagelkerke R Square |
|---|---|---|---|
| 1 | 47940.111a | .144.274 | .274 |

As shown in Table 9, only four of the independent variables made a unique statistically significant contribution to the model (age, sex, contact and funeral). In table 9, the strongest predictor of Ebola virus contraction was funeral attendance [OR = 2.293 and 95% CI (1.926, 2.731)]. This indicated that respondents who had contact with the living sick person were over two times more likely to report having Ebola virus disease than those who did not attend funeral services, controlling for all other factors in the model (Pallant, 2010). In table 10, the odds ratio of 0.148 for age was less than 1, indicating that for every additional hour of contracting the virus, the ages were 0.148 less likely to report contracting the virus, controlling for other factors in the model (Pallant, 2010). This section includes an interpretation of the findings, the limitations of the study, recommendations for future investigation, and the implications for professional practice and positive social change.

**Table 8**

*Omnibus Tests of Model Coefficients*

| | | Chi-square | *df* | Sig. |
|---|---|---|---|---|
| Step 1 | Step | 12692.161 | 23 | .000 |
| | Block | 12692.161 | 23 | .000 |
| | Model | 12692.161 | 23 | .000 |

**RQ1**

Based on the cross-section of the output of the binary logistic regression using SPSS in Table 9, there was no relationship between washing of corpse (touch body) [OR = 1.080, 95% CI (0.866, 1.346), $p = 0.494$ and the Wald chi-square = 0.468.], role of housewife [OR = 0.917, 95% CI (0.823, 1.022), $p = 0.117$ and the Wald chi-square = 2.462], and the spread of EVD in Freetown, Sierra Leone during the years of 2014-2015 Ebola outbreak. The *p*-values for both the washing of corpse and the role of housewife were above the conventional threshold of 0.05. On the other hand, there was a relationship between funeral attendance [Wald chi-square = 86.677, $p < 0.05$, OR = 2.293 and 95% CI (1.926, 2.731)], contact with the living sick person [Wald chi-square = 1026.538, $p < 0.05$, OR = 0.135 and 95% CI (6.060, 7.663)], and Ebola virus disease (Table 9). In conclusion, although no relationship existed among washing of corpse, housewife, and EVD, the overall model achieved significance.

**Table 9**

*Logistic Regression Predicting the Likelihood of the Spread of EVD (RQ1)*

| | | B | S.E | Wald | df | Sig. | Odds Ratio | 95% C.I. for EXP(B) | |
|---|---|---|---|---|---|---|---|---|---|
| Step 1 | | | | | | | | Lower | Upper |
| | Touch Body | .077 | .112 | .468 | 1 | .494 | 1.080 | .866 | 1.346 |
| | Housewife | -.087 | .055 | 2.462 | 1 | 0.117 | 0.917 | .823 | 1.022 |
| | Funeral | .830 | .890 | 86.677 | 1 | 0.000 | 2.293 | 1.926 | 2.731 |
| | Contact with Living Sick | -2.004 | .191 | 109.627 | 1 | 0.000 | .135 | 6.060 | 7.663 |

**RQ2**

*RQ2:* Is there a relationship between the spread of EVD and individuals' age group and gender in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak?

*$H_0$2a:* There is no relationship between individuals' age group and the spread of EVD in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak.

*$H_A$2a:* There is a relationship between individuals' age group and the spread of EVD in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak.

*$H_0$2b:* There is no relationship between individuals' gender and the spread of EVD in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak.

*$H_A$2b:* There is a relationship between individuals' gender and the spread of EVD in Freetown, Sierra Leone during the 2014-2015 Ebola outbreak.

The results in Table 10 show statistically significant associations between the spread of EVD and individuals' age group [Wald chi-square = 463.542, $p < 0.05$, OR = 0.148 and 95% CI (0.124, 0.176)], gender [Wald chi-square = 9.529, $p < 0.05$, OR = 1.730 and 95% CI (1.121, 2.449)]. Therefore, the null hypothesis that there is no statistically significant association between individuals' age group, gender, funeral attendance, and contact with the living sick person and the spread of EVD can be rejected. The observed difference is statistically significant, and there is evidence to reject the null hypothesis, while the alternative hypothesis can be accepted.

**Table 10**

*Logistic Regression Predicting the Likelihood of the Spread of EVD (RQ2)*

| | | B | S.E. | Wald | *df* | Sig. | Odds Ratio | 95% C.I. for EXP(B) | |
|---|---|---|---|---|---|---|---|---|---|
| Step 1 | | | | | | | | Lower | Upper |
| | Age | -1.911 | .089 | 463.542 | 1 | .000 | .148 | .124 | .176 |
| | Gender | .548 | .178 | 9.529 | 1 | .002 | 1.730 | 1.221 | 2.449 |

## Summary of the Results and Findings

The results and findings from the analysis of secondary data from the 2014 outbreak of EVD in Sierra Leone were evaluated and presented in this section. This section included the purpose of the study, the baseline representation and demographic characteristics of the sample, the results of the descriptive statistics that appropriately characterize the sample, the research questions and hypotheses testing, and the key findings. The study included examination of six categorical independent variables (age, gender, washing of corpse, funeral attendance, role of housewife, and contact with a living sick person) and one categorical dependent variable (contraction of EVD). Chi-Square tests and Binary logistic regression were the statistical tests used to analyze the variables in the study dataset. I examined two research questions and hypotheses, including statistical tests of the hypotheses that consisted of the Wald chi-square test for association, logistic regression, confidence interval, and the odds ratio for the logistic regression model.

The Chi-square results (see Table 6) indicated that all the variables were significant contributors to the spread of the EVD as the p-values for all variables were zero, which were below the traditional threshold of 0.05. On the other hand, binary regression results for RQ1 indicated no statistically significant relationship between the role of housewife, washing of a corpse, and the contraction of EVD, whereas there was a statistical relationship between funeral attendances, contact with the living sick person and the spread of Ebola virus disease. Although there was no statistically significant association between these three variables, the logistic regression model indicated a significant relationship between the predictor variables and the spread of the virus. The results for RQ2 showed a statistically significant relationship between age group, gender and the spread of EVD as the p-values for age and gender were below the conventional threshold of 0.05 (see Table 10).

Chapter 5 contains a discussion of the interpretation of results and findings from analysis in Chapter 4. Results are interpreted based on literature reviewed for this study. I also provide an analysis and explain findings in the context of the SEM framework. Finally, I discuss implications for positive social change, provide recommendations, and describe limitations that impacted this study.

# Chapter 5: Discussion, Conclusions, and Recommendations

## Introduction

The fundamental purpose of this quantitative cross-sectional study was to explore the roles of religious and cultural rituals in the spread of the Ebola virus in Freetown, Sierra Leone. Thus, the focus of this investigation was to evaluate precautionary measures and examine ritual observances and religious burial procedures. This study relied on secondary data collected from Ebola treatment facilities during the 2014 outbreak of EVD in Sierra Leone. The Sierra Leone's MoHS provided secondary data used in this study. The dataset included patients' age, gender, washing of corpse, role of housewife, funeral attendance, and contact with a living sick person, and the dependent variable was spread of EVD. Results may enhance knowledge of how to limit the spread of Ebola and suggest potential preventive strategies aimed at curbing the quick spread of the virus.

The quantitative cross-sectional design was appropriate for this study because it involves exploration of associations at a single point in time and measurement of contact or exposure related to the prevalence of the disease. I conducted this study to investigate the relationship between religious and cultural practices and Ebola in Sierra Leone.

## Summary of Key Findings

The study included examination of six categorical independent variables (age, gender, washing of corpse, funeral attendance, role of housewife, and contact with a living sick person) and one categorical dependent variable (contraction of EVD). Findings from this quantitative cross-sectional study revealed that age, gender, funeral

attendance, and contact with a living sick person were significant predictors for the spread of Ebola virus, while washing of a corpse and fulfilling the traditional role of housewife were not significant indicators. Binary logistic regression was performed to assess the impact of factors on the likelihood that respondents reported they had contracted EVD. The model was statistically significant, with $X^2$ (23, $N$ = 81,923) = 12,692.161 and $p < 0.001$ (see Table 14), indicating that I was able to distinguish between respondents who reported and those who did not report the contraction of EVD.

Pearson's chi-square test for association and binary logistic regression were statistical tests used to analyze variables in the study. I examined two research questions and sets of hypotheses, and used statistical tests that consisted of the Wald chi-square test for association, logistic regression, confidence interval, and odds ratios. Although Table 14 showed a statistically significant association for the entire model, the logistic regression model showed that washing of corpse [*OR* = 1.080, 95% CI (0.866, 1.346), $p$ = 0.494, and Wald chi-square = 0.468] and role of housewife [*OR* = 0.917, 95% CI (0.823, 1.022), $p$ = 0.117, and Wald chi-square = 2.462] were not statistically significant. Both the role of housewife and washing of corpse were not statistically significant because $p$-values were above the traditional threshold of 0.05. Pearson's chi-square values had corresponding p-values of less than the 0.05 conventional threshold, thereby indicating that all independent variables (housewife, washing of corpse, age, gender, funeral attendance and contact with the living sick person) had a statistically significant relationship with the spread of EVD.

## Interpretation of Findings

The purpose of this study was to investigate how relationships between religious and cultural practices differed according to age group, role of housewife, washing of corpse, gender, contact with a living sick person, and funeral attendance. In this quantitative cross-sectional study, two main research questions followed by hypotheses were considered. Results indicated that there was no statistically significant difference in terms of washing of corpse and role of housewife and spread of EVD after adjusting for other variables such as age, gender, funeral attendance, and exposure to sick person.

In Table 13, results indicated a statistically significant relationship between spread of EVD and individuals' age group [Wald chi-square = 463.542, $p < 0.05$, $OR$ = 0.148, and 95% CI (0.124, 0.176)], and gender [Wald chi-square = 9.529, $p < 0.05$, $OR$ = 1.730, and 95% CI (1.121, 2.449)]. As such, the null hypothesis for RQ2 was rejected, while the alternative hypothesis was accepted. Table 12 showed a statistically significant association between spread of EVD and funeral attendance [Wald chi-square = 86.677, $p < 0.05$, $OR$ = 2.293, and 95% CI (1.926, 2.731)], and contact with the living sick person [Wald chi-square = 1026.538, $p < 0.05$, $OR$ = 6.85 and 95% CI (6.060, 7.663)].

### Interpretation of Findings with Peer-Reviewed Literature

Table 6 indicated that the Wald chi-square test of association between touched body and Ebola was not statistically significant ($p = 0.494$). Bundibugyo ebolavirus was not as deadly (case-fatality rate 34%) as Ebola viruses that had caused previous outbreaks in the region. The most transmission was associated with handling dead persons without appropriate protection (adjusted $OR$ = 3.83, 95% confidence interval, 1.78–8.23).

Curran et al. (2016) said of 28 persons who attended funerals and later developed Ebola, 23 (82%) were family members, and 18 (64%) were men. Eight (29%) of these patients, all of whom were male and had touched the corpse, died. The case fatality rate among men was 44%; no deaths occurred among women ($p = 0.02$). The WHO (2016) found that 60% of infections in Guinea could be related directly to participation in traditional funeral activities involving washing and touching the dead in a high-infestation area in Guinea. Another significantly high-risk cultural and behavioral factor that contributed to the transmission of EVD in Africa were traditional burial activities and rituals (Alexander et al., 2015; Manguvo & Mafuvadze, 2015).

Results of this study revealed that the relationship between housewives and Ebola was not statistically significant ($p = .117$). This finding was consistent with outcomes by Brainard et al. (2016) in Sierra Leone; those results indicated a high risk of 156 Ebola virus transmission among those caring for the sick at home (unadjusted PPR 13.33; 95% CI: 3.2–55.6). Similarly, results from a retrospective observational study in Guinea, Liberia, and Sierra Leone in 2016 found 87% of exposures occurred between family members (WHO Ebola Response Team, 2016). In this same study, more than 90% of cases reported involved contact with bodily fluids and direct physical contact with Ebola patients, and 38% were reported as occurring in a household.

Previous research in Sierra Leone has consistently demonstrated that women's traditional role as care takers of the family places women at increased risk for Ebola infection. Fawole et al. (2016) and Ravi and Gauldin (2014) agreed that behavior and practice that may be correlated with the spread of Ebola virus disease in West Africa,

particularly, Sierra Leone, is the housewife role or caretaker of Ebola patients. Conclusions by Fawole et al. (2016) and Ravi and Gauldin (2014) also indicated that Sierra Leone's deeply rooted family social and cultural norms that women fulfill the caregiver role have been associated with behavioral changes and resulted an increased Ebola disease risk and higher exposure among women. Ebola virus is transmitted by direct contact with contaminated bodily fluids and other contaminated materials (Fawole et al., 2016).

Table 13 indicated a statistically significant relationship between the spread of EVD and individuals' age group [Wald chi-square = 463.542, $p < 0.05$, OR = 0.148 and 95% CI: 0.124, 0.176]. This result aligned with outcomes by Li et al. (2016), who found no significant difference between age groups and EVD mortality ($p = 0.06$). Li et al. used the chi-square test to determine the association between age and EVD mortality. Li et al. also indicated that older patients with high viral load of EVD and those with diarrhea symptoms have a shorter survival time than other age groups. The study was a retrospective study conducted on 288 patients with confirmed cases of EVD. However, the results of their research study must be interpreted with caution due to the relatively small sample size ($n = 288$). The sample size was significantly small to give a stronger statistical power. The study by Li et al. was only conducted on confirmed cases of EVD.

Table 12 shows statistically significant association between the spread of EVD and gender [Wald chi-square = 9.529, $p < 0.05$, OR = 1.730 and 95% CI (1.121, 2.449)]. Sana (2019) tested for the existence of the relationship between gender and the contraction of EVD. She hypothesized that there was no link between gender (male and

female) and the contraction of EVD. The result of her study showed that 47.9% of women tested positive for EVD while 44.5% of the male patients tested positive for EVD. The result of this study showed that there was no statistically significant link between male and female and the contraction of EVD ($p = 0.17$). Given that the chi-square test results were different from most research findings, a binary logistic regression was conducted to further examine the influence of gender on the contraction of EVD. The logistic regression analysis showed that the difference in gender was not associated with the contraction of EVD after adjusting for age, funeral attendance, exposure to body fluids, and contact with a living sick person ($p = 0.99$).

Table 12 show a statistically significant association between the spread of EVD and funeral attendance [Wald chi-square = 86.677, $p < 0.05$, OR = 2.293 and 95% CI (1.926, 2.731)]. Also, Sana (2019) tested the association between funeral attendance and the contraction of EVD. She hypothesized that funeral attendance was not associated with the contraction of EVD. The chi-square test for association showed a statistically significant association between patients that attended funeral rites and EVD contraction 116 ($p < 0.05$). The result logistic regression analysis showed that the OR of contracting EVD while participating in funeral rites is statistically significant after adjusting for age and gender, OR = 4.59, 95% CI [3.08, 6.83], $p < 0.05$ and the Wald = 56.19. It is evident from the result that the odds of contracting EVD is 4.59 times higher for people who participate in funeral rites. The chi-square test for association and the logistic regression model confirmed the existence of a significant association between funeral attendance and the contraction of EVD.

Table 12 indicated a statistically significant association between the spread of EVD and contact with a living sick person [Wald chi-square = 1026.538, $p < 0.05$, OR = 6.85 and 95% CI (6.060, 7.663)]. This finding was consistent with other studies of the association (Dietz et al., 2015; Dowell et al., 1999; Francesconi et al., 2003; WHO Ebola Response Team, 2016). Sana (2019) examined whether there was an association between contact with a living sick person and the contraction of EVD, speculating that there was no link. The results of the chi-square test from Sana's analysis showed a statistically significant link between contact with a living sick person and the spread of EVD ($p < 0.05$). The results from the logistic regression analysis showed that the exposure to a living sick person with EVD significantly predicted the odds of spreading EVD when adjusting for age and gender.

Furthermore, Brainard et al. (2015) assessed risk factors for transmission of EVD and found that, among household contacts who reported directly touching a case, the contraction rate was 32% [95% CI (26, 38)]. Risk of disease transmission between household members without direct contact was low [1%; 95% CI (0, 5)]. The chi-square test for association and the logistic regression model confirmed the existence of a significant association between patients' contact to a living sick person and the contraction of EVD.

**Interpretation of the Findings and the Theoretical Framework**

The theoretical base for this investigation was the social ecological model (SEM), which supported the research by pinpointing the physical, behavioral, and social determinants in association with the transmission of the Ebola virus. Sallis & Owen

(2015) posit that the theoretical model embraces several psychological, relational, managerial, societal, and governmental effects. The single strata in the framework delineate the groundwork for comparing and discerning determinants of the disease to interpret this project's results. This study conceptualized health within a socio-ecological context, emphasizing the interaction and interdependence of factors across all levels of health concern, including people's interactions with their socio-cultural and physical environments. Key premises underpinning this perspective were that health behavior both affects and is affected by multiple levels of influence and that individual behavior shapes and is shaped by reciprocal causation (USDHHS, 2005). Building on the earlier work of Bronfenbrenner (1979), results in this study serve to direct socio-ecological attention to both behavior and its individual and environmental determinants.

Bronfenbrenner (1979) divided environmental health behavior influences into five levels, including micro, meso and macro interactions. The SEM provided information at the individual, interpersonal, community, and policy levels of how and when individuals can recognize the risk factors such as contact with a living sick person, touching dead bodies at funerals, and washing dead bodies before burial associated with the contraction of EVD. The SEM can be adapted to contextualize or understand the risk of EVD contraction among people that are vulnerable to the disease (Baral et al., 2013).

The first stratum pinpoints living and personal history characteristics that will increase the plausibility of spreading the virus. Some of these factors include age, income, education, substance use, or history of abuse. EVD tends to affect all age groups and genders Agua-Agum et al., 2016; Furuse et al., 2017; Nkangu et al., 2017).

Strategies for prevention at this level encourages beliefs, acceptable attitudes, and behaviors that prevent violence. Specific approaches may include conflict resolution and life skills training, social-emotional learning, and safe dating and healthy relationship skill programs. Results of this study revealed a strong statistically significant association between age and the spread of EVD and between gender and the contraction of EVD. Understanding and identifying age groups of individuals who contracted and died from EVD is critical for determining the effect of planning public health response and interventions.

The second level was an examination of close relationships that may increase the risk of experiencing the humiliation associated with contracting the Ebola virus. An individual's closest family members, social circle acquaintance, and spouse influence their behavior and contribute to their experience. Plan of action for prevention at this level may include parenting or family-focused prevention strategies and mentoring or peer programs designed to bolster child-parent communication, enhance problem-solving skills, promote positive peer norms, and promote healthy associations. Understanding and identifying close relationships and contacts and the exposure to body fluids are vital for examining the public health initiatives at the interpersonal level of the SEM theoretical framework.

People at high risk of contracting EVD include family members, healthcare workers, and those who have close contact and relationship with infected persons or who have contact with dead bodies during funeral rites and burying rituals (Coltart et al., 2017). According to Coltart et al. (2017), the disease often arises from close human-to-

human contact at home, healthcare facilities, family members taking care of their loved ones, and more. The initial phases of the outbreak of EVD went unnoticed and led to chains of the infection among the Kissi people on the borders of Liberia, Sierra Leone, and Guinea (Coltart et al., 2017). Failure to control the transmission and contraction of EVD in the early phases of the outbreak of the disease allowed the disease to spread from rural and urban areas affecting many families, communities, and healthcare workers (Coltart et al., 2017). The findings of this study suggested that the exposure to close contact with a living sick person and exposure to body fluids was related to the contraction of EVD in Sierra Leone.

The third level deals with exploring the settings, such as schools, places of work, and neighborhoods. Social relationships occur to identify the characteristics of these settings associated with contracting EVD. Prevention strategies at this level should focus on improving the physical and social environment in these settings (e.g., by creating safe places where people live, learn, work, and play) and by addressing other conditions that give rise to violence in communities (e.g., neighborhood poverty, residential segregation, and instability, high density of alcohol outlets).

During the outbreak of EVD in Sierra Leone, many communities, towns, and cities were significantly impacted by the outbreak of the disease (Coltart et al., 2017). Many of the people who contracted the disease in Freetown transmitted the disease to their respective communities, which led to sustained widespread of the disease that was difficult to eradicate because it was hard to reach communities and remote villages (Lindblade et al., 2015). According to Fallah et al. (2015), more than 320 communities in

Sierra Leone were affected by the outbreak of EVD. Lindblade et al. found that 94% of the decrease in the spread of EVD came after the initiation of community interventions in remote rural areas of Sierra Leone during the 2014 outbreak. The United Nations Statistics Division indicated that over 68% of the urban population lives in the network of slums characterized by overcrowding, lack of basic sanitation, and high crime rates.

**Policy level.** The policy level of the social ecological model related to the variables of washing of corpses and the role of housewife in this study. However, both the washing of corpse and housewife role were not good predictors of the spread of EVD. High-risk behaviors such as traditional burial rituals and practices promote the spread of EVD (Coltart et al., 2017). According to Coltart et al., over 60% of new cases of EVD in Guinea were linked to funeral practices, and 80% of new cases of EVD were linked to traditional burials ceremonies in Sierra Leone. Safe burials were an integral aspect of responding to the outbreak of EVD in Sierra Leone (Coltart et al., 2017). Because one of the primary means of human-to-human contact and spread of EVD is through direct contact with the dead bodies, including funeral and traditional burial practices and contact with infected body fluids (Manguvo & Mafuvadze, 2015).

In Sierra Leone, one of the most common and important funeral rituals is the washing of corpses using bare hands and spending time with the corpse before burial; these responsibilities mostly fall within the role of housewife (Coltart et al., 2017). In Sierra Leone, funeral rituals or practices varied with differences between the Christians and Muslim practices. Muslims wash the corpse and bury the same day, whereas Christians wait for up to several weeks to make funeral arrangement for their loved ones

to be buried (Nielsen et al., 2015). The persistence of these traditional practices highlights the need for decision-makers to put in place policies that require safe burial practices.

Policymakers must implement policies that will regulate how funeral practices are handle during funeral arrangements for all groups, including Christians, Muslims, tribal groups, and others in Sierra Leone. The Ministry of Health and Sanitation must work relentlessly to develop policies to remedy the shortage of burial space, train communities on proper burial techniques, and provide education and training about EVD. The lack of trained burial teams, a shortage of burial space, and the lack of community engagement to facilitate safe burial technique can increase the risks associated with funeral rituals (Coltart et al., 2017).

## Limitations of the Study

Several limitations impacted this study. While data from this study provided insight into the characteristics of Ebola and its potential risk factors in this study population, there are a number of limitations to the study that need to be considered when interpreting results, and the data in this study should be interpreted with caution. First, secondary data were used, thereby limiting the analysis to the variables collected by the survey. Second, due to the cross-sectional nature of the analysis, I was not able to make inferences about causal relationships between EVD status and the factors under investigation. Moreover, the cross-sectional nature of this study made it difficult to determine the direction of relationships of the factors associated with Ebola infection, and to determine whether factors independently associated with Ebola infection were influential before versus after Ebola was acquired.

All these limitations establish the need for longitudinal studies to establish the exact causal relationships between Ebola virus infection and many of the investigated variables. The interpretation of the results, therefore, is limited to associations between variables rather than cause-and-effect relationships (Creswell, 2009; Frankfort-Nachmias & Nachmias, 2008). Third, the information collected during the survey was self-reported, and it was therefore subject to recall errors and biases, which could lead to underestimation or make generalizability of the results difficult, or limit the study's external validity (Cori et al., 2017; Creswell, 2009; Frankfort-Nachmias & Nachmias, 2008; McNamara et al., 2016).

Additionally, uncertainty characterized the data as many who died were buried immediately and no information was captured about them (McNamara et al., 2016). Most people were not RT-PCR diagnosed; some were suspected, and some were probable cases (Cori et al., 2017; McNamara et al., 2016). Furthermore, this research analysis was limited to confirmed Ebola virus disease cases; therefore, results may not be generalizable to other populations. A final limitation was that assessing the burden of Ebola such as prevalence among this group could have been useful, but I was unable to investigate or calculate Ebola prevalence rate due to the fact that the Sierra Leone Ebola Data (SLED) survey was not a national population-based Ebola prevalence survey. Therefore, conclusions based on those data cannot be used for Ebola prevalence estimates (Cori et al., 2017; Creswell, 2009; Frankfort-Nachmias & Nachmias, 2008; McNamara et al., 2016). Accordingly, this study did not collect Ebola prevalence information.

SLED collected data only for surveillance purposes, creating a gap in this study on establishment of disease prevalence burden in this population caused by potential risk factors. Incorporating Ebola surveillance into population-based surveys, such as those conducted by Demographic and Health Surveys (DHS) or antenatal health clinics, can provide useful information on disease prevalence levels and distribution to capture the full burden of Ebola in the future (Kamara, 2019). Despite these limitations, data in this study described Ebola and risk factor characteristics of an important population in Sierra Leone with many needs. Results demonstrated that the ecological model is a promising theoretical framework to guide further studies and interventions related to Ebola and risk factor characteristics in the study population (Kamara, 2019).

## Recommendations

Several recommendations for rebuilding a resilient health system post-EVD outbreak emerged from this study. These recommendations include building and maintaining infection, prevention, and control (IPC) practices to contain future epidemics through in-service training and supportive supervision. Besides, the health experts should support isolation wards with essential equipment and institutionalizing the triage system in all facilities. Healthcare professionals should also effectively incorporate most of the infrastructure created in response to Ebola into the health system and the outstanding gap areas (such as limited drug supplies). These measures align with recent reports, such as evaluating the Free Health Care Initiative and the Partners in Health experiences of responding to the outbreak and ensuring future emergency preparedness. It is also

essential to re-establish services and strong links with the community to regain their trust and involvement.

Communities should seize any opportunity to build back better health facility committees, and community health staff may work more effectively to link communities and health facilities. These approaches are indeed anticipated in the post-Ebola plans, including the Health Sector Recovery Plan 2015–2020, the review of the HRH strategic plan 2015–2020, and the newly finalized Community Health Worker policy. Expansion of health workers' existing coping strategies is needed. Health experts should explore every possibility to understand better how networks peer and information and communication technology (ICT) can support health workers. Also, the participants highlighted the government's responsibility to provide a safe health system for both patients and staff. Three hundred seven health workers were infected with Ebola in Sierra Leone, and 221 died (out of a reported 518 healthcare worker deaths in the region during this epidemic). Researchers have recognized that psychosocial support for those workers will need to be provided on a long-term basis (Raven, Wurie, & Witter, 2018).

This study documented an excruciating period and moving experiences of health workers as they continued to try to work and protect their households and communities. At the same time, the workers found considerable reserves resilience. They must strengthen these patterns of strength as the sector is rebuilt in both Sierra Leone and elsewhere. The health experts should pursue better communication technology, supportive supervision, and peer support networks, alongside a straightforward program for rebuilding trust with community structures. Health workers are at the heart of the

healthcare system, and therefore listening to their voices regarding what helps them stay and do their job during a crisis is vital for building a responsive health system. The challenge is making these coping strategies into routine procedures and forestalling shocks rather than responding late to emergencies (Raven et al., 2018).

## Implication for Social Change

EVD is an infectious disease with severe consequences for individual and population health. The last Ebola outbreak in Western Africa in 2014 was the worst in recent times as it was highly contagious. Healthcare experts implemented several strategies to contain and treat the disease; nevertheless, some were inadequate because of a lack of concentration on social and behavioral factors. Healthcare professionals must highly consider the success of tenable interventions, social and behavioral factors while considering issues that may inhibit the success of combating the spread of the virus at the individual, community, and international levels. Researchers that incorporated social and behavioral understandings into their projects can have positive and long-lasting consequences within the affected districts and institutions. As a result, healthcare professionals may have the ability to bolster health and social systems by removing the barriers of the outbreak response. Excellent outbreak response, in turn, will help to prevent EVD infection considerably.

### The Individual

Agents of socialization can promote appropriate communication for behavior change while upholding cultural competence. Influential people in a particular neighborhood who are capable of influencing community outcomes represent agents of

socialization. Socialization is a permanent process of learning the norms, beliefs, and values of an organization or a particular social group. It is the agents who contribute to providing information and teaching culture. Families, friends, community members, and religious leaders constitute agents of socialization (Zolmikov, 2018).

Behavior is essential in socialization, where agents can employ observation and imitation (Bandura, 1986). In West Africa, extended family that reserves the capacity to teach cultural norms and values regarding EVD dangerous and transmission method to younger family members represent agents of socialization. Among large family units, communication of cultural values and standards may favor safe practices and contribute to behavior change. Consequently, safe practices and evolution of behavior will potentially minimize the spread of the Ebola virus. The health experts will ultimately integrate cultural values and standards that lead to safe practices into affected communities as a long-term behavioral tool for EVD prevention.

One component of successful change is changing individual behavior. Thorough observation and modeling can lead to human behavior through which individuals may learn to cultivate positive outcomes and avoid negative ones (Gibson, 2014). People can determine suitable responses in specific settings and adjust behavior accordingly by creating the pathways of observing and modeling the effects of actions (Zolnikov, 2018). The principles of this theory raise the possibility of a positive change resulting from how the agents of socialization react to Ebola survivors.

WHO (2014) opined that people who contracted the Ebola virus suffered significantly from several psychological and social effects such as stigmatization,

depression, discrimination, and disrupted social support. Relentlessly working with agents of socialization may change individual reaction to people who contracted the virus. For example, people offer consolation and kindness to families who lose their children to death instead of casting them aside as a bad omen. Similarly, the affection people have for parents who lose their children applies to EVD situations regarding the behavior change. Behavior change in individuals may change the possible outcomes of EVD, which may decrease the spread of the virus. Good communication from the Ebola-affected individuals to other people regarding their experience with EVD will potentially reduce fear and stigma, thereby contributing to preventing future outbreaks.

**Community**

At the community level, healthcare professionals establish protective health practices. The approval of community-driven behavioral change is fundamentally contingent on identifying, diagnosing, and treating diseases to control their spread, consistent with many outbreaks (Leung et al., 2005). However, EVD outbreaks are different. Shifts in community leadership due to mortality rates, loss of trust in health services, and failure of healthcare services may lead to a cyclical pattern of fear (Van Bortel et al., 2016). This breakdown in usual care necessitates an extreme focus on the populations' psychological responses and developing culturally appropriate responses (WHO, 2012). Hughes (2015) mentioned that healthcare employees played a vital role in communication, which contributed immensely to behavior change during the 2014 Ebla outbreak in West Africa. Hughes (2015) added that the health experts focused on training

and supporting healthcare workers in which they paid closer attention to the affected individual's health and psychological needs.

**International**

At the international level, various cultural groups within a society may lead to behavior change problems. Nevertheless, the integration of the international level in combating the EVD outbreak is imminent as the spread of the virus will reach global neighborhoods due to travel. For example, the last 2014 Ebola outbreak had international psychosocial implications. Reports of prejudice, stigma, and blame aimed at neighborhoods of African descent in western countries increased due to fear of infection. As a result, the fear contributed to diminished reciprocities with countries with the ubiquitous spread of the virus, including the provision of resources such as health workers, tourism, economic investment, industry, travel, and business. Health workers returning from affected countries experienced stigmatization too (Van Bortel et al., 2016).

The consequences of the interrelation of social factors and individual thought and behavior on the outbreak of Ebola reflect similar epidemic emergencies where communities and health workers are exposed to disease and psychosocial stressors, thereby making the existing challenges worse. Therefore, health experts must react to this type of emergency by using guidelines for identifying and responding to the psychosocial effects of global health crises. Besides, the impediments and trainers for solving the psychological influences of this epidemic should be documented, with reviews of

previous responses to problems, to strengthen mechanisms for global response (Van Bortel et al., 2016).

Communities in developing countries are susceptible to outbreaks and psychosocial outcomes, amalgamate health needs due to persistent lack of investment in health systems. For example, there was a failure to respond, both by the global and local communities in the last 2014 Ebola outbreak in Sierra Leone, to identify risks of an epidemic identified by the worldwide community during previous epidemics (Van Bortel et al., 2016). The severity of this epidemic and its long-lasting consequences should bring investment in and develop health systems, including mental and physical health. It is essential that the global response to Ebola considers psychosocial needs and is committed to robust community-based initiatives that will help better prepare in the future. At the same time, there is now investment dedicated to rebuilding health systems in West Africa (Van Bortel et al., 2016).

## Conclusion

The last epidemic of Ebola in sub-Saharan Africa in 2014 revealed that evidenced-based methods of tackling the spread of communicable diseases were resisted and less effective. The inability of health experts to demonstrate scientifically proven methods of salvaging the outbreak necessitated the need to investigate and align preventive measures with cultural norms and values of affected communities. The healthcare experts must resolve the incompetencies between religions and cultural practices and prescribe scientific preventive measures. There is a need to consulting and collaborating with traditional and religious leaders to understand the contradictions.

Engaging or assigning essential roles to traditional leaders will foster the monitoring and implementing preventive measures against the transmission of the Ebola virus (Manguvo & Mafuvadze, 2015).

Lack of mutual trust and understanding between health professionals and members of the affected communities represented a major challenge of the Ebola outbreak. The mistrust became exacerbated when people carried burial ceremonies without the knowledge of the relatives. The completion of the emergent burial rites in the absence of family members culminated into a belief that medical experts were keeping the corpses for nefarious reasons. Similarly, during the outbreak of Ebola in Uganda in 2003, mistrust was imminent when rumors circulated that some Westerners were buying human body parts (Manguvo & Mafuvadze, 2015). The ultimate key to combatting the spread of the virus using evidence-based methods is by encouraging mutual trust between the community members and the healthcare officials.

In the absence of mutual trust, adherence to preventive measures is likely to be compromised. As witnessed in some communities, health officials were even attacked and obstructed from executing their duties. There is a show of probability that the inclusion of spiritual and traditional leaders and community members in leadership positions will help the ordinary community members to understand and adhere to preventive strategies. Alexander et al. (2015) opined that majority of the residents in West African neighborhoods repose high confidence in traditional leaders for advice in times of catastrophic strikes. Alexander et al. (2015) added that the community members

passionately believe that the spiritual and traditional heads can influence the practical implementation of preventive measures against the spread of Ebola.

Public healthcare personnel may launch Ebola vaccination campaigns to minimize the spread of the virus. Some communities boycotted previous polio vaccination campaigns in Nigeria amidst rumors that the vaccine contained infertility drugs, caused poliomyelitis, and spread HIV and AIDS, in addition to various religious objections (Jegede, 2007). Consequently, it is probable that the success of Ebola immunization campaigns in West Africa is contingent on the direct involvement of religious and traditional heads. These Ebola vaccination drives will have the potentials of necessitating the need for awareness campaigns thereby targeting conventional and spiritual leaders. It is hard to control the spread of Ebola effectively without the support of traditional and spiritual healers due to the religious and cultural beliefs of some people in the neighborhood.

In mobilizing communities for effective prevention of Ebola transmission, Umeora et al. (2014) stated that some conventional and spiritual leaders had demonstrated willingness to collaborate with health officials. Also, the involvement of other influential community leaders may support solutions to problems in high-risk areas to implement Ebola awareness and preventive measures effectively. In epitome. It is highly imperative for community members to collaborate with leaders of traditional and religious institutions for advice regarding Ebola prevention campaigns, especially those that are not consistent with their cultural and religious practices (Manguvo & Mafuvadze,

2015). I propose that awareness campaigns should explicitly target traditional and spiritual leaders.

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Appendix: Data Use Agreement Letter

**GOVERNMENT OF SIERRA LEONE**
**MINISTRY OF HEALTH AND SANITATION**
**Directorate of Health Security and Emergencies**

**Richmond Samuel Kpange**
**141 East Kennedy Boulevard Apt 8**
**Lakewood New Jersey**
**United States of America**

*Monday 10th August, 2020.*

Dear Richmond Kpange,

**Letter of Corporation to Conduct Research on Ebola Virus Disease in Sierra Leone**

Your request to obtain permission to conduct research on the **"Relationship between Cultural and Religious Practices and Ebola Virus in Freetown, Sierra Leone"** as described in your doctoral premise has been received and reviewed. Based on the review of doctoral premise and confidentiality agreement to protect patients' information in the secondary dataset, you are hereby granted permission to gain access and use the available anonymised data on Ebola to conduct your study. You are requested to liaise with the Ministry of Health and Sanitation research ethics committee throughout the research.

Please explore every possibility to keep all information in the dataset confidential. Do not discuss or disclose any information in the dataset with others; do not make any unauthorized transmissions, inquiries, modification or purging of confidential information.

I hope that the results and recommendation of your research will provide useful information that will enhance the implementation of positive social change in Sierra Leone in its effort to maintain zero transmission and control of Ebola virus disease in the future.

Sincerely,

**Dr. Mohamed Alex Vandi**
**Director Health Securities and Emergencies**

DIRECTOR OF HEALTH SECURITY AND EMERGENCIES
SIGN
DATE 10/08/2020

**Cc:** *The Hon. Minister of Health and Sanitation*
*The Deputy Minister of Health and Sanitation 1&2*
*The Chief Medical Officer, MoHS*
*The Permanent Secretary, MoHS*
*The Research and Publication Specialist, MoHS*

MINISTRY OF HEALTH AND SANITATION, *Emergency Operation Centre, Cockrill, Wilkinson Road Freetown.*
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