2019

Predictors and Risk Factors of Ebola Virus Disease in Sierra Leone

Kandeh Kamara
Walden University

Walden University

College of Health Sciences

This is to certify that the doctoral dissertation by

Kandeh Kamara

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

Review Committee
Dr. Srikanta Banerjee, Committee Chairperson, Public Health Faculty
Dr. Egondu Onyejekwe, Committee Member, Public Health Faculty
Dr. Gudeta Fufaa, University Reviewer, Public Health Faculty

The Office of the Provost

Walden University
2019

Abstract

Predictors and Risk Factors of Ebola Virus Disease in Sierra Leone

by

Kandeh Kamara

MPH, Indiana University School of Medicine, 2008

MS, Ball State University, 2003

BA, Indiana University Purdue University Indianapolis, 1993

BS, Indiana University Purdue University Indianapolis, 1992

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Health

Walden University

November 2019

Abstract

Sierra Leone had the highest number of cases of Ebola virus disease in history during the 2014 Ebola epidemic. The purpose of this quantitative, cross-sectional study was to examine the relationship between sociocultural and behavioral risk factors and Ebola status among women and men ages 15 to 49 years in Sierra Leone. The ecological model served as the theoretical framework. Secondary data were collected from the Sierra Leone Ebola Disease Survey. Results of chi-square tests revealed that attending a funeral (p = .001), touching a dead body at a funeral (p = .023), contact with a sick person (p = .001), touching bodily fluids (p = 0.001), gender (p = .035), traditional healer occupation (p = .001), and housewife/care taker occupation (p = .001) were significantly associated with Ebola infection status among the study population. Age, seeking traditional healer care, and preparation and consumption of primate meat were not associated with Ebola virus infection. Results of stepwise backward elimination logistic regression indicated the only significant predictor of Ebola infection was attending a funeral (adjusted R^2 = .013 or 1.3%, p = .031). Findings may be used to promote awareness of funeral-related Ebola infection risk and avoiding traditional and religious practices that elevate infection risk during burial of the dead, which may be used to reduce or prevent future Ebola outbreaks in Sierra Leone.

Predictors and Risk Factors of Ebola Virus Disease in Sierra Leone

by

Kandeh Kamara

MPH, Indiana University School of Medicine, 2008

MS, Ball State University, 2003

BA, Indiana University Purdue University Indianapolis, 1993

BS, Indiana University Purdue University Indianapolis, 1992

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Health

Walden University

November 2019

Dedication

I dedicate my dissertation first and foremost to God almighty, who gave me the opportunity to start and complete this remarkable journey. To my grandmother, Ya. Boinky Conteh, and my late grandfather, Pa. Kaprie Kamata, who raised me and put me through primary and secondary school. To my father, Mr. Frank B. Kamara, and my mother, Ms. Susan P. Turay, for all the tremendous love and support throughout my academic journey, making me realize my potential in life, and for helping me achieve my goal of writing this dissertation.

Acknowledgments

I would like to thank my chair, Dr. Srikanta Banerjee, for his tremendous mentorship, comments, suggestions, and dedicated guidance and support throughout this dissertation writing process, and my late chair, Dr. Earnest Ekong, for his relentless support and guidance. I would also like to express my profound gratitude to my committee member, Dr. Ego R. Onyejekwe, and my university research reviewer, Dr. Gudeta Fufaa, for their time, constructive feedback, and continuous encouragement during the dissertation.

I wish to acknowledge and sincerely thank my CDC/NCHS, Sierra Leone Ministry of Health and Sanitation project team members: Mr. Negasi Beyene, who supervised the data and assisted me with SPSS analysis; Mr. Brima Bangura, who prepared my data package for my research; and Dr. Yelena Gorina, for coordinating my proposal process for permission to use the SLED data set for my research. I am greatly indebted to them.

For inspiring this study, I thank my grandmother in Sierra Lone whom I interviewed during a project on infectious disease and the significance of frequent hand washing in 1990 in Sierra Leone. Finally, I am also grateful to my daughter, Kiara Kamara, for the marvelous support she gave me while I undertook this dissertation writing. The greatest honor goes to God almighty for his love and mercy to me and my family always.

Table of Contents

List of Tables....vi

Chapter 1: Introduction to the Study....1

Background....4

Gender/Age and Ebola....5

Housewife/Caretaker and Ebola....5

Traditional Funeral Activities and Ebola....6

Preparation and Consumption of Primate and Ebola....6

Other Studies of Ebola Virus Disease in Africa....7

Problem Statement....12

Purpose of the Study....15

Dependent Variable....16

Independent Variables....16

Covariate Variables....16

Research Questions and Hypotheses....17

Theoretical Framework....18

Nature of the Study....21

Definitions....22

Assumptions....24

Scope and Delimitations....25

Limitations....25

Significance....26

Summary 27
Chapter 2: Literature Review 29
Literature Search Strategy 31
Theoretical Foundation 33
Studies of the Ecological Model 35
Studies of History and Epidemiology of the Ebola Virus Disease in Africa 39
Literature Review 41
Gender and Ebola 42
Age and Ebola 45
Interpersonal-Level Determinants 52
Research Methodologies Found 63
Summary and Conclusions 66
Relevant Factors Identified in the Literature 66
Gaps in the Research 68
Chapter 3: Research Method 70
Research Design and Rationale 71
Study Variables 71
Research Design 72
Rationale for the Design 73
Time and Resource Constraints 75
Methodology 76
Target Population and Size 76

Data Collection Associated With the Secondary Data Set 77
Sample and Sampling Procedure for Current Study 78
Sample Frame: Inclusion and Exclusion Criteria 79
Sample Size Calculation and Power Analysis 80
Permission to Access Data 84
Data Management 84
Instrumentation and Operationalization of Constructs 85
Validity and Reliability of the Instruments 86
Variables and Measures 87
Rationale for Including Potential Covariates 89
Data Collection 90
Data Analysis Plan 91
Research Questions and Hypotheses 91
Statistical Analysis 92
Research Questions and Hypotheses 93
Statistical Analysis for Research Question 1 93
Statistical Analysis for Research Question 2 95
Materials 100
Threats to External and Internal Validity 101
Ethical Procedures/Considerations 102
Dissemination of Results 103
Study Limitations 104

Summary 104
Chapter 4: Results 106
Research Questions and Hypotheses 107
Data Collection 108
Results 110
Univariate Analysis (Descriptive Statistics) 110
Demographic Factors 114
Ebola Virus Status 117
Bivariate Analysis and Hypothesis Testing 118
Hypothesis 1 Results 131
Factors Predictive of Ebola Virus Disease 133
Hypothesis 2 Results 135
Summary 137
Chapter 5: Discussion, Conclusions, and Recommendations 140
Interpretation of the Findings 144
Research Question 1 145
Comparison With Previous Studies 147
Research Question 2 159
Study Findings in Context of Conceptual Model 161
Intrapersonal or Individual-Level Determinants 162
Limitations of the Study 169
Recommendations 170

Implications 173
Intrapersonal/Individual Level 174
Interpersonal Level (Family and Community Level) 176
Societal and Policy Level 181
Conclusion 185
References 190

List of Tables

Table 1. Socio Cultural and Behavioral Demographic Characteristics of Study Participants 114

Table 2. Demographic Characteristics of Study Participants 114

Table 3. Crosstabulation of Funeral Attend and Ebola Status (N=21514) 114

Table 4. Chi-Square for Funeral Attend and Ebola Infection Status 114

Table 5. Crosstabulation of Funeral Touched Body and Ebola Status (N = 1205) 114

Table 6. Chi-Square for Funeral Touch Body and Ebola Infection Status 114

Table 7. Crosstabulation of Contact With Sick Person and Ebola Status (N = 10975) ..114

Table 8. Chi Square for Contact With Sick Person and Ebola Infection Status 114

Table 9. Chi-Square for Preparation and Consumption of Primate and Ebola Infection Status 114

Table 10. Crosstabulation of Gender and Ebola Status (N = 17230) 125

Table 11. Chi Square for Gender and Ebola Infection Status 125

Table 12. Chi Square for Age and Ebola Infection Status 126

Table 13. Crosstabulation of Housewife/Caretaker and Ebola Status (N = 34715) 127

Table 14. Chi Square for Housewife/Caretaker and Ebola Infection Status 127

Table 15. Crosstabulation of Touched Bodily Fluids and Ebola Status (N = 28238) 128

Table 16. Chi Square for Touch Body Fluids and Ebola Infection Status 128

Table 17. Chi Square for Consultation With Traditional Healer and Ebola Infection Status 129

Table 18. Crosstabulation of Traditional Healer Occupation and Ebola Status (N = 17374) 130

Table 19. Chi-Square for Traditional Healer Occupation and Ebola Infection Status 131

Table 20. Backward Multiple Regression Analysis Summary Predicting Ebola Virus Infection From Predictor Variables (N=289) 131

Chapter 1: Introduction to the Study

The 2014-2016 West Africa Ebola virus epidemic began in December 2013 with the death of a 2-year-old boy after contracting Ebola virus in the village of Guéck- édou, Guinea (Alexander et al., 2015; World Health Organization [WHO], 2015). The epidemic quickly spread to the neighboring countries, Liberia and Sierra Leone, and a few other nations and became the worst and largest outbreak in history, with case fatality rates of up to 90% (Dallatomasina et al., 2015; Lokuge et al., 2016; WHO, 2015). Statistics showed that the Ebola epidemic infected 28,646 and killed 11,323 people, most of whom were in Sierra Leone, accounting for 14,122 of 28,646 (49.35%) of all Ebola cases, and killing 3,955 people in West Africa (Dietz, Jambai, Paweska, Yoti, & Ksaizek, 2015; Gamma et al., 2017; Henwood et al., 2017; WHO, 2015). Also, women accounted for 5,118 (52%) of the 9,944 confirmed cases of Ebola virus disease (EVD) in the country (Deen et al., 2017; WHO Ebola Situation Report, 2015; WHO, 2016).

According to Dallatomasina et al. (2015) and Lokuge et al. (2016), EVD is a hemorrhagic fever caused by viruses in the filovirus Filoviridae family, and is characterized by a high case fatality rate of up to 90%. Evidence suggested that the 2014-2016 Ebola epidemic in West Africa was related to the Zaire Ebola virus, one of six viruses in the genus Ebolavirus (Kouadio et al., 2015; Mulangu et al., 2016; WHO, 2019). Ebola disease in humans in Africa first emerged in 1976 in the town of Nzara in Sudan and the villages of Yambuku in the Democratic Republic of Congo, close to the Ebola River from which its name was derived (Alexander et al., 2015; Dowell et al., 1999; WHO, 2019). These outbreaks were linked to the use of contaminated needles in

hospitals, contact with infected fruit bats, primates, and bushmeat handling (Alexander et al., 2015; Dowell et al., 1999).

EVD is characterized by multiple symptoms. According to Dietz et al. (2015), Haaskjold et al. (2016), Schieffelin et al. (2014), and the WHO (2019), EVD symptoms include: high fever, headache, fatigue, muscle pain, diarrhea, stomach pain, weakness, sore throat, profuse internal and external bleeding, vomiting, rash, and failure of vital organs such as liver and kidney function. Reports from the Centers for Disease Control and Prevention (2014) and the WHO (2015) indicated that the incubation period of Ebola ranges from 2 to 21 days. Studies indicated that proper diagnosis of Ebola is achieved through blood test and swab, and performing Ebola virus-specific reverse-transcription polymerase chain reaction-based (RT-PCR) testing (CDC, 2014; Cenciarelli et al., 2015; Dietz et al., 2015; Haaskjold et al., 2016; WHO, 2015). Alexander et al. (2015) acknowledged that the main reservoir of the Ebola virus is unknown, but fruit bats of species *rousettus aegyptiacus* appear to be the primary reservoir for the Ebola virus. Studies by Lokuge et al. (2016) and Pourrut et al. (2005) showed that primates such as chimpanzees, monkeys, forest antelope, and porcupines also harbor the virus, which is then passed to humans by contact with infected living or dead animals because the virus is also believed to be a zoonosis. Like Deen et al. (2017), studies by Adongo et al. (2016), Tiffany et al. (2017), and the 2014 and 2019 WHO Ebola reports indicated that 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 mucosal surfaces, breaks, and abrasions in the skin.

Cenciarelli et al. (2015) and Tiffany et al. (2017) suggested that traditional funeral practices, caring for infected Ebola patients, and direct contact with infected Ebola persons can be high-risk transmission methods of the Ebola virus. Cenciarelli et al. and Tiffany et al. also indicate that, as a zoonosis, behaviors related to killing and consuming infected animals also have an increased risk of infection. A 2016 analysis of publications in the Web of Science by Yi, Yang, and Sheng (2016), and studies by Dietz et al. (2015), Schieffelin et al. (2014), Stehling-Ariza et al. (2016), the WHO Ebola Response Team (2014), the WHO (2015, 2019), and Bower et al. (2016) showed that because Ebola virus is transmitted through contact with contaminated body fluids of symptomatic patients and infected tissues, the disease can be controlled or prevented through strategies such as rapid contact tracing of suspected cases, isolation, safe burials, early diagnosis or detection of the disease, supportive medical care, and simple and consistently good hygiene. These researchers noted another strategy that includes community education and social mobilization to promote Ebola protective behaviors and discourage high-risk behaviors.

Although these studies have provided vital epidemiological and historical information on Ebola infection and the potential risk factors in the general population in Africa and Sierra Leone, not much is known about the relationships between the predictors, risk factors, and EVD in women and men ages 15 to 49 years in Sierra Leone. The current study addressed this relationship in this population to improve Ebola prevention efforts in the local communities in Sierra Leone (see Dietz et al., 2015). Knowledge of risk factors could guide policymakers, health professionals, and public

health decision-makers to organize the most appropriate gender- and age-specific health intervention programs to fight the issue (WHO, 2015, 2019). This information could also inform health education messages and interventions regarding Ebola high-risk behaviors in the community (Stehling-Ariza et al., 2016; WHO, 2019).

Chapter 1 includes a brief discussion of the epidemiology of Ebola and background research on EVD in Africa, particularly Sierra Leone, followed by the problem statement and the purpose of the study. Next, the theoretical foundation for this study is highlighted followed by a brief discussion of the nature of the study . Finally, the chapter includes definitions of terms used in this study, and the assumptions, scope and delimitations, limitations, and a summary.

Background

Sierra Leone, a small nation in Western Africa, has approximately 6.5 million inhabitants and is classified as an underdeveloped country (Lokuge et al., 2016; United Nations Development Group [UNDG], 2015). Sierra Leone is bounded by Guinea on the Northeast and Liberia on the Southeast. A 1991-2002 civil war ravaged the country and caused major destruction of the health care infrastructure (Chan, 2014; Lokuge et al., 2016; UNDG, 2015). The country's dilapidated situation was complicated by the Ebola disease that first emerged in Sierra Leone in May 2014 and spread to all 14 districts in the country by December 2015 (Lokuge et al., 2016; Stehling-Ariza et al., 2016). According to Lokuge et al. (2016) and Richards et al. (2015), Sierra Leone experienced the largest and worst recorded Ebola virus disease outbreak in 2014-2016, accounting for 14,122 (49.35%) of all persons infected with Ebola in West Africa and killing 3,955 people.

Many studies have been conducted to evaluate and characterize the Ebola virus disease in humans since 1976 and the 2014 Ebola epidemic. These studies are reviewed in Chapter 2.

Gender/Age and Ebola

Women and men were affected by the 2014-2016 Ebola epidemic (WHO, 2015). Women accounted for 5,118 (52%) of 9,944 of the Ebola virus infection cases reported in the country (WHO, 2015). Qin et al. (2015) found that of 61 patients were confirmed with EVD; 28 (45.9%) were male, and 33 (54.1%) were female. Similarly, Kouadio et al. (2015) found that, of 619 Ebola cases, 326 (52.7%) were female and 293 (47.3%) were male. Furthermore, according to Dietz et al. (2015), the median age in all confirmed EVD cases in Sierra Leone was 28 years, with 7.3% of those affected ages <5 years, 14.5% ages 5–14 years, and 15.3% ages ≥50 years. Most confirmed cases (62.8%) were ages 15–49 years.

Housewife/Caretaker and Ebola

In a 2014–2015 Ebola risk factor study 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. Stehling-Ariza et al. also found that 13 additional confirmed Ebola cases resulted from exposure to care for secondary cases. In a meta-analysis of 31 reports selected from 6,552 reports, Brainard, Hooper, Pond, Edmunds, and Hunter (2016) found that caring for a case in the

community was strongly associated with contracting Ebola disease, likely due to a high degree of direct physical contact with the case.

Traditional Funeral Activities and Ebola

According to Brainard et al. (2016), other possible risk factors of Ebola disease include contact with Ebola-infected dead bodies during traditional burial activities. Brainard et al. found that traditional funeral and burial practices in West Africa, particularly Sierra Leone, were high-risk factors in the Ebola outbreak. According to a WHO (2017) report, the first confirmed Ebola case in Sierra Leone was a woman who had contracted Ebola virus after participating in a traditional burial ritual of a prominent traditional healer who had also contracted Ebola after treating Ebola patients from neighboring Guinea. The report indicated that several other individuals who also participated in the traditional healer's burial ritual contracted Ebola and died. Also, a WHO (2017) report indicated that approximately 365 Ebola deaths were linked to the same traditional healer's burial activity, including 12 health care workers working at the Kenema Government Hospital where the Ebola patients were treated.

Preparation and Consumption of Primate and Ebola

Studies from recent Ebola outbreaks demonstrated that the risk of Ebola virus infection in humans may be linked to contact with meat or blood from Ebola-infected animals (WHO Ebola Response Team, 2016). According to Beeching, Fenech, and Houlihan (2014), some traditional activities related to killing, preparing, and consuming bush meat are found to have an increased risk of Ebola infection. This is particularly true for animals such as gorillas and fruit bats in the forest that have been shown to be

possible reservoirs for the Ebola virus (Beeching et al., 2014). Ebola is believed to spread by direct contact with infected bodily fluids or tissue. Hunting and preparing activities put individuals in direct contact with animals that could harbor the virus and increase its transmission from these animals to humans, especially women (Beeching et al., 2014). Women's traditional role of cooking and activities related to handling animal tissues that may be infected with the Ebola virus put them at increased risk of Ebola virus infection in communities around Africa, particularly Sierra Leone (Beeching et al., 2014).

Other Studies of Ebola Virus Disease in Africa

Senga et al. (2016) analyzed data for Ebola virus disease cases in health care workers at the Kenema Government Hospital May 2014 and January 2015 and compared them with cases of non-health-care workers in Kenema District to evaluate factors associated with Ebola virus exposure and mortality in health care workers. Senga et al. found that 18 (29%) of 62 health workers in the Ebola Treatment Unit contracted Ebola, compared with 48 (58%) of 83 who worked in another area in the hospital. Senga et al. also found that 13% of health workers with EVD reported contact with EVD patients, while 27% reported contact with other infected health workers. In another recent population study of more than 800 household members of EVD survivors, Bower et al. (2016) looked at exposure-specific and age-specific attack rates for EVD in Ebola-affected households in Sierra Leone. Bower et al. found that in 94 (48%) of 448 households had contracted EVD, and EVD risk ranged from 83% for touching a corpse to 8% for minimal contact. Bower et al. also noticed that Ebola infection varied by age group: 43% for children and 60% for adults >30 years of age. Also, exposure relative

risks were lower for people ages 5–9 (0.70), 10–14 (0.64), and 15–19 (0.71) years but not for younger children. In one broad study of multiple countries, the WHO Ebola Response Team (2016) used data from confirmed and probable EVD cases in Guinea, Liberia, and Sierra Leone to compare sex-specific epidemiologic patterns of EVD among males and females in West Africa. In this study, 48.8% of the 20,035 confirmed and probable EVD cases were male. Also, the percentage of patients with EVD who were male was 47.3% in Guinea, 50.2% in Liberia, and 48.8% in Sierra Leone. Furthermore, the WHO Ebola Response Team found that a higher percentage of female patients than male patients reported exposure to a sick person. The WHO Ebola Response Team (2014) conducted another multicountry population study to investigate the progression and outcome of EVD in confirmed and probable pediatric cases reported from Guinea, Liberia, and Sierra Leone. In this study, the average time from infection until symptom onset was shortest, on average ranging from 6.9 days in 14 children younger than 1 year of age to 9.8 days in 184 children 10 to 15 years of age, and younger children also had shorter times from symptom onset to hospitalization and from symptom onset to death.

A report from the United Nations Development Group (UNDP; 2015) indicated that during the 2014 Ebola outbreak in Sierra Leone, many women abstained from seeking services such as maternity, preventive, medical, and surgical services from health clinics and Ebola health facilities due to the lack of Ebola knowledge and fear of contracting the disease in such settings. The report also indicated that many women and individuals might have resorted to seeking care from traditional village healers and delivering at home with the help of traditional birth attendants.

Women and men of reproductive age (15 to 49 years) form an important constituency in interventions against EVD. These individuals are also identified as an interesting target group because they represent mothers, fathers, and caretakers of the elderly, and are future leaders and the economic backbone of Sierra Leone (Government of Sierra Leone, 2013). Ebola infection in women of reproductive age could generate a multiplicative effect through infection of other community members and the unborn child (Bower et al., 2016; Caluwaerts et al., 2016; Kamali et al., 2016). Furthermore, Bower et al. (2016) found that young adults >30 years of age constitute one of the groups at highest risk of Ebola infection (60%) in Sierra Leone.

The current study was conducted to build on studies that did not address age-specific and gender-specific sociocultural and behavioral factors in EVD spread in Africa (see Alexander et al., 2015; Dallatomasina et al., 2015; McDonald, 2016; Nkangu, Olatunde, & Yaya, 2017; WHO Ebola Response Team, 2014). According to a report from the WHO Ebola Response Team (2014), most published data indicated that key epidemiologic parameters from the 2013 to 2016 Ebola epidemic in West Africa have been based on patients of all ages. Furthermore, Nkangu et al. (2017) noted in a scoping review that gender is a determinant of health that has been given relatively less attention in medicine and the design of national and global health programs. Nkangu et al. also emphasized that when gender is considered, it is most often from the perspective of women rather than from men and women. Dallatomasina et al. (2015) noted that even though the WHO has analyzed the epidemiologic characteristics of the 2014 Ebola epidemic using multicountry data from West Africa, no investigation has focused on the

characteristics of EVD and risk factors in women and men ages 15 to 49 years in Sierra Leone. According to Alexander et al. (2015), a comprehensive assessment of Ebola and increased understanding of cultural and traditional risk factors within nations is warranted to prepare for future Ebola virus disease outbreaks. Also, Sharareh, Sabounchi, Sayama, and MacDonald (2016) concluded that future consideration of behavioral factors is desperately needed for an adequate and effective response to outbreaks of deadly diseases such as the Ebola virus disease in Sierra Leone. Previous studies of EVD in Africa, particularly Sierra Leone, focused on the broader attention to the disease (WHO Ebola Response Team, 2015, 2016). Few studies have focused on selected subpopulations' experiences of Ebola transmission and fewer on the Ebola disease experience in women and men ages 15 to 49 years in Sierra Leone (Senga et al., 2016; UNDG, 2015). The lack of research on sociocultural and behavior factors for women and men ages 15 to 49 years in Sierra Leone makes this group an at-risk population and stifles Ebola prevention efforts for them.

This study addressed the patterns of risk behavior that contribute to high vulnerability to Ebola virus infection for women and men ages 15 to 49 in Sierra Leone. Another objective was to identify potential sociocultural and behavioral risk factors predictive of EVD infection and diagnosis in this population. This information may help policymakers understand the effects of Ebola and use the information to make better decisions regarding policy and programs to improve the EVD prevention efforts for this population. Findings may also foster Ebola prevention interventions that could reduce the risk of transmission of Ebola virus from mother to child and contribute to the realization

of the country's goal of reducing infant mortality (Chan, 2014; Government of Sierra Leone, 2013; Lokuge et al., 2016). Valeri et al. (2016) noted that the effects of the recent Ebola epidemic in West Africa have left policymakers with concerns about how to combat the epidemic in the future. Findings may provide policymakers and other stakeholders with direction for improving EVD prevention programs in Sierra Leone and elsewhere in the world. Also, findings may also provide a better understanding of the characteristics of the transmission pattern among this population. Understanding and addressing Ebola characteristics and risk factors for women and men ages 15 to 49 years, and working side by side with this population may positively impact the disease burden in affected communities in the country (see Bower et al., 2016; Jamieson, Uyeki, Callaghan, Meaney-Delman, & Rasmussen, 2014; Richards et al., 2015). Findings may provide a quantitative basis for preventive measures against the spread of Ebola in women and men ages 15 to 49 years in Sierra Leone. Furthermore, proper knowledge of how and from whom these women and men acquire Ebola virus infection may help inform responses to future outbreak to limit the impact of an epidemic. Fully understanding the epidemiologic characteristics of the outbreak in this at-risk population is important to identify gaps in Ebola control efforts and inform an effective response agenda, thereby fostering a healthy population and an economically strong and productive workforce in the country. Data were analyzed on suspected, probable, laboratory-confirmed cases in the Sierra Leone Ebola virus disease (SLED) database, which was created to capture and analyze data from the 2014 Ebola outbreak. This cross-sectional study was guided by the ecological model (see Glanz, Rimer, & Viswanath,

2008), which posits that there are multiple levels of influence on individual health behaviors.

Problem Statement

Sierra Leone was the country most affected by the deadly and widespread 2014 EVD epidemic, accounting for 49.35% of all persons infected with Ebola in West Africa (Dietz et al., 2015; WHO, 2015). A high burden of Ebola virus infection was seen among women and men during the 2014 EVD epidemic in Sierra Leone (Ravi & Gauldin, 2014), with women accounting for 5,118 (52%) of 9,944 confirmed cases of EVD in the country (WHO, 2015). At the Kenema Government Hospital in Sierra Leone, 59 (60%) of 106 EVD cases were female, including one pregnant woman (Schieffelin et al., 2014). In a recent population study of more than 800 household members of EVD survivors in Sierra Leone, Bower et al. reported that Ebola infection varied by age group: 43% for children and 60% for adults >30 years of age, and most Ebola confirmed cases were aged 15–49 years. Furthermore, Dietz et al. (2015) found that 7.3% of those affected were <5 years old, 14.5% were 5–14 years old, 62.8% were 15–49 years old, and 15.3% were ≥50 years old. This crucial problem is often attributed to high-risk sociocultural and behavioral factors, such as funeral activities (Bower et al., 2016; Dietz et al., 2015; Nielsen et al., 2015). In Bower et al.'s study, EVD risk ranged from 83% for touching a corpse to 8% for minimal contact. This presents major concerns for health intervention and calls for a more vivid and thorough investigation. The different social and cultural roles of female and male individuals in the country, including women as caregivers for sick family

members, may increase women's vulnerability and risk to EVD (Adongo et al., 2016; Fawole, Bamiselu, Adewuyi, & Nguku, 2016; Sia et al., 2016).

In studies from Bower et al. (2016), Dietz et al. (2015), Dowell et al. (1999), Nielsen et al. (2015), Senga et al. (2016), and the WHO Ebola Response Team (2016), women and men of all ages have been lumped together, and categories have also been broad. Studies have not addressed women and men ages 15 to 49 years despite the heavy burden of Ebola among this population during the 2014-2016 Ebola epidemic in Sierra Leone (Bower et al., 2016; Dietz et al., 2015; WHO Ebola Response Team, 2015). Lumping or combining of this population with the whole population has limited the information available on the demographic, sociocultural, and behavioral factors that increase Ebola vulnerability among women and men ages 15 to 49 years and how these factors may differ from other groups. Previous study findings may also be masking patterns of risky behavior that may exist in this study group, further undermining Ebola awareness of the critical need for community-led age- and gender-specific prevention interventions to empower this at-risk group (Bower et al., 2016; Dallatomasina et al., 2015; Dietz et al., 2015; MacDonald, 2016; Nkangu et al., 2017; WHO Ebola Response Team, 2015) and possibly inhibiting health care access for this group, causing imbalanced resource allocations. For example, Dietz et al. (2015) broadly addressed the epidemiology associated with the 2014 Ebola virus epidemic in Sierra Leone, notably date of the report; date of symptom onset, and district residence. Dietz et al. also used different methodologies such as analyzing the incidence of Ebola and looking at risk ratios for all ages. Furthermore, Dietz et al.'s study and related studies lacked a clear

theoretical framework to address Ebola. Factors associated with Ebola virus infection status and the patterns of Ebola risk behavior that contribute to elevated vulnerability to Ebola virus infection among the women and men ages 15 to 49 years are unclear (Alexander et al., 2015), and previous studies did not provide evidence to identify strategies that could improve modification or avoidance of Ebola risk behaviors and future resilience to Ebola diseases. The absence of comprehensive data on this group has stifled progress in this area. According to Alexander et al. (2015), a comprehensive assessment of Ebola and increased understanding of cultural and traditional risk factors within nations is warranted to prepare for future EVD outbreaks. Also, Sharareh et al. (2016) concluded that 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).

I addressed the gap that exists regarding the relationship between demographic, sociocultural, and behavioral factors (e.g., possible funeral attendance, participation in funeral rituals, contact with Ebola patients, preparation and consumption of bushmeat, tradirional healer care, contact with infected bodily fluids, gender, age group, house wife/care taker occupation, and traditional healer occupation) and Ebola disease status among women and men of reproductive age (15-49 years) during the 2014 outbreak in Sierra Leone. I used data on suspected, probable, and confirmed EVD cases from the SLED database. I used the ecological model as a framework, and used a cross-sectional

design. Examination of the relationship between potential risk factors and Ebola virus infection status in the study population would provide a better understanding of the dynamics of the 2014 Ebola virus epidemic, which could be used to reduce the risk of infection in the future. In addition, a better understanding of the relationships between Ebola infection status and potential demographic, behavioral, and sociocultural factors among the study population may be used to inform gender- and age-specific interventions for mitigating the spread of the disease. Furthermore, a better understanding of the way in which sociocultural and behavioral factors interact to influence vulnerability to Ebola virus infection among the study population may be used to inform preventive interventions that focus on social and cultural norms and behavior change. Findings may be used to assist policymakers and public health decision-makers in developing the most appropriate health intervention programs to fight the spread of the disease and foster a healthy and productive population (see Bower et al., 2016; WHO, 2014).

Purpose of the Study

The purpose of this quantitative, descriptive, cross-sectional study was to use the Ebola disease data set (SLED) on suspected, probable, and confirmed EVD cases in Sierra Leone to examine the relationship between demographic, sociocultural, and behavioral risk factors and Ebola virus infection among women and men ages 15 to 49 years during the 2014 Ebola outbreak in Sierra Leone. Previous studies did not address the EVD factors underlying Ebola disease infection status among the study population (Bower et al., 2016; Dietz et al., 2015; Senga et al., 2016; WHO Ebola Response Team,

2014). I used the ecological model as a framework to address this knowledge gap. Statistical evidence regarding the risk level of certain behaviors could be used to keep these women and men from engaging in risky behavior, and mitigating further spread of the disease. The study provided information on Ebola disease in this group to improve EVD prevention programs. Knowledge of the disease and potential risk factors in this population may be used to control and prevent EVD. Findings could also provide different perspectives that could lead to a better understanding of the disease in this population to improve and save human lives.

Dependent Variable

The main outcome of interest or dependent variable in the current study was a diagnosis of EVD (the number of people in each category, suspect/probable/confirmed, and not a case) determined by a confirmatory Ebola-positive RT-PCR blood result. Chi-square test of association and backward stepwise elimination logistic regression models were used to assess relationships between the dependent variable and independent variables. The change in R-squared was also used.

Independent Variables

The key explanatory variables or independent variables in the current study were behaviors (possible funeral attendance, funeral touch body, contact with sick person, prepare/ate primate), gender, age, and housewife/caretaker occupation.

Covariate Variables

The covariate variables included touch body fluids, traditional healer care, and traditional healer occupation. These were covariate variables because of the significant

differences between EVD and the various health determinants by these factors among women and men (see Creswell, 2009). These variables allowed for a direct examination of the relationship between demographic, sociocultural, and behavioral risk factors and EVD status in women and men ages 15 to 49 in a manner that had never before been done in Sierra Leone.

Research Questions and Hypotheses

The following research questions (RQs) provided the foundation for the study. I also present their corresponding hypotheses.

RQ1: Are there associations between sociocultural and behavioral factors and Ebola infection in women and men ages 15 to 49 during the 2014 Ebola outbreak in Sierra Leone?

H_o1: There are no statistically significant associations between sociocultural and behavioral factors and Ebola infection in women and men ages 15 to 49 during the 2014 Ebola outbreak in Sierra Leone

H_a1: There are statistically significant associations between the sociocultural and behavioral factors and Ebola infection in women and men ages 15 to 49 during the 2014 Ebola outbreak in Sierra Leone.

RQ2: What are the significant predicting sociocultural and behavioral risk factors (possible funeral attendance, funeral touched body, contact with sick person, preparation and consumption of primate activity), respondent's gender, respondent's age group, and housewife/caretaker occupation for Ebola disease status among women and men ages 15 to 49 during the 2014 outbreak in Sierra Leone?

H_o2: There are no statistically significant predicting sociocultural and behavioral risk factors (possible funeral attendance, funeral touched body, contact with sick person, preparation and consumption of primate activity), respondent's gender, respondent's age group, and housewife/caretaker occupation for Ebola disease status among women and men ages 15 to 49 during the 2014 outbreak in Sierra Leone.

H_a2: There are statistically significant predicting sociocultural and behavioral risk factors (possible funeral attendance, funeral touched body, contact with sick person, preparation and consumption of primate activity), respondent's gender, respondent's age group, and housewife/caretaker occupation for Ebola disease status among women and men ages 15 to 49 during the 2014 outbreak in Sierra Leone.

Theoretical Framework

As Glanz et al. (2008) and Creswell (2009) stated, health behavior and intervention theory examine core principles that serve as the basis for making predictions and providing explanations for a particular phenomenon under investigation. Furthermore, such theories help increase knowledge of health behavior, direct research, facilitate the explanation of the relationship between variables in a scenario, and guide study designs in identifying target populations and outcome measurements (Creswell, 2009; Glanz et al., 2008). McLeroy, Bibeau, Steckler, and Glanz's (1988) ecological model is one of the behavioral models suggested by Glanz et al. (2008) that provides a broad theoretical framework for explaining multiple factors that influence health in a community.

According to reports by the WHO (2015, 2017), EVD is believed to be a behavioral disease because the transmission is influenced by the behavior of individuals, families, and communities. Also, Ebola is believed to be influenced by multiple determinants (e.g., housewife/caretaking and burial rituals). EVD requires a theoretical framework that focuses on multiple determinants of health rather than on only one determinant to solve the issues of EVD in this study population. In this study, I used a behavioral theory centered on behaviors such as caring for the sick (see Glanz et al., 2008; WHO, 2017). I employed the ecological model described by McLeroy et al. (1988) to examine Ebola virus risk among women and men ages 15 to 49 years in Sierra Leone. The ecological model was used to analyze the demographic, behavioral, and sociocultural factors associated with Ebola disease infection among women and men ages 15 to 49 years in Sierra Leone in the 2014 Ebola outbreak.

The ecological model is used to examine the intrapersonal or individual level, which focuses on the biological aspects of the person (e.g., age and gender); interpersonal or family level factors, which deal with the social and cultural aspects of the person (e.g., behavior of caring for Ebola patients); community-level factors; society-levels factors; and policy-level factors. All of these factors address the locality or districts in the various countries, including the availability of health clinics and allocation of health budget (Glanz et al., 2008). These factors affect the health of the community instead of the factors that affect individuals, and they are influential in understanding the spread of EVD in this study population in Sierra Leone. The core concept of this model is that behavior has multiple levels of influences and that health outcomes result from a

combination of intrapersonal or individual level factors, interpersonal or family-level factors, community-level factors, society-levels factors, and policy-level factors (Glanz et al., 2008; Harvey et al., 2016).

The ecological model was developed out of the work of a number of major contributors to the model including Lewin's (1951) ecological psychology theory, Bronfenbrenner's (1979) ecological systems theory, individual and environmental determinants in assessing behavior, and a reciprocal relation between behavior and natural environment (Glanz et al., 2008). Building on the work done by Bronfenbrenner and other ecological model pioneers, McLeroy et al. (1988) developed a more comprehensive version of the model in the ecological mode of health behavior promotion. McLeroy et al. postulated that social norms, cultural values, and environmental factors are influential in understanding the spread of the Ebola disease within a community.

This model is advantageous in that it does not require all of the dimensions within the domains to be utilized, and it provides flexibility in deciding what is most relevant in each domain as determined by the local community and arranging themes based on that (Glanz et al., 2008). In addition, the ecological model provides a comprehensive framework for understanding the interacting determinants of health behavior, such as caregiving, because at this model includes five levels of influence for health-related behaviors and conditions: intrapersonal factors (e.g., individual characteristics such as age and gender), interpersonal factors (e.g., social networks and support systems); organizational factors, community factors, and public policy factors (Glanz et al., 2008).

The model was used to address the research questions based on the ecological model's level of influence. For example, the interpersonal level addressed the risk factors (caretaking, funeral activities, and direct contact with infected patients), which were the variables the research questions for this study addressed.

Additionally, this model was a good fit for study because EVD seems to be centered around health behavior, and also involves a reservoir (Glanz et al., 2008; Shahabuddin et al., 2017; UNDG, 2015; WHO, 2015). According to Glanz et al. (2008), the model also emphasizes the population, unlike other theories that emphasize the individual. Knowing how factors at each of the model's levels influence the Ebola risk of women and men ages 15 to 49 may help in the reduction of these risks (see Glanz et al., 2008; McLeroy et al., 1988). For this study, the model provided a comprehensive framework to address the demographic, sociocultural, and behavioral factors that may be associated with Ebola infection in the study population in Sierra Leone. The model also was streamlined to only two major levels: the intrapersonal or individual-level factors and the interpersonal or family-level factors (see Glanz et al., 2008; McLeroy et al., 1988). These ecological levels and determinants are further discussed in Chapter 2.

Nature of the Study

The nature of this study was quantitative with a descriptive approach and cross-sectional design to examine the relationship between demographic, sociocultural, and behavioral risk factors and EVD associated with the 2014 confirmed cases of EVD in women and men ages 15 to 49 years in Sierra Leone (see Creswell, 2009). I analyzed secondary data from the Sierra Leone Ministry of Health and Sanitation combined survey

data, Sierra Leone Ebola disease (SLED data). This cross-sectional data set of the Sierra Leone population that suffered from the 2014 Ebola epidemic was managed by the government of Sierra Leone and credible stakeholders such as the WHO and CDC. Quantitative data on EVD among women and men ages 15 to 49 years were gathered, including their demographic characteristics, geographic location, laboratory results (confirmed Ebola case), and potential exposures to infection. These data on EVD morbidity and mortality are available via the SLED Research Data Center (Sierra Leone Ministry of Health and Sanitation/CDC).

This design was aligned with the problem statement in that it illuminated the main elements influencing the EVD status and risk factors in women and men ages 15 to 49 years in the country (see Creswell, 2009). The design was compatible with the research questions (see Creswell, 2009) because it helped clarify potential risk factor group differences in EVD status in women and men ages 15 to 49 years in Sierra Leone. Furthermore, this design was employed because the purpose of my study was to examine the relationship between the variables of interest using statistical methods. The design also provided a systematic process for getting measurable information and presenting this information in numerical form to describe and examine relationships (see Creswell, 2009; Frankfort-Nachmias & Nachmias, 2015).

Definitions

Behavioral factors: Personal or community behavior that increases the spread or transmission of the Ebola virus disease in the local population (UNDG, 2015; WHO, 2014).

Confirmed case: An individual with clinical illness and laboratory confirmation of infection or a probable case with laboratory confirmation of infection with a reverse-transcription polymerase chain reaction (RT-PCR) test specific for Ebola virus (Dietz et al., 2015; Fawole et al., 2016).

Culture: A set of values and practices that guide and condition perception, judgment, communication, and behavior in a particular society (Alexander et al., 2015).

Epidemic: A large, short-term outbreak of a disease (Nishiura & Chowell, 2014).

Gender: The socially constructed characteristics of men and women, which are attributed to a specific culture and context and change over a period (Nkangu et al., 2017).

Primary contact: Any individual who had direct face-to-face contact with a probable or a proven Ebola case, for example through riding in the same automobile, sleeping in the same bedroom, eating in the same container, caring for a Ebola patients, or participating in traditional burial ceremony of touching and kissing (Dietz et al., 2015; Fawole et al., 2016).

Probable case of Ebola virus disease: An individual living in the epidemic area who died after one or more days with two or more of the following symptoms and signs occurring between the Ebola outbreak dates November 13, 2014 and February 15, 2016 (headache, fever, stomach pain, vomiting, and bleeding). Times a probable case either had an injection or contact within the three preceding weeks with a probable or proven case of Ebola virus infection and clinically could not be assigned another diagnosis (Dietz et al., 2015; Fawole, 2016).

Risk and risk factors: Notions of statistical risk commonly associated with increasing the likelihood of negative outcomes or problem behaviors (Hutchinson et al., 2017).

Secondary contact: A person having face-to-face contact with a primary contact (Dietz et al., 2015).

Sex: The biological characteristics of men and women (Nkangu et al., 2017).

Assumptions

I assumed that the Ebola disease records in the Ebola holding centers, clinics, or hospitals in the various communities were representative of Ebola disease in the country from 2014 to 2016, and were not misdiagnosed as malaria disease. Studies have indicated that as a result of the similar symptoms between Ebola disease and malaria, and similar tests for the two, many cases diagnosed as Ebola may not be Ebola but malaria (Dietz et al., 2015; Haaskjold et al., 2016; WHO, 2015). A second assumption was that estimates of different Ebola cases, such as suspected case, probable case, or confirmed case were obtained with data for patients with recorded definitive clinical outcomes. Third, I assumed that some individuals who died before they could be admitted to the hospital to be tested and confirmed were not included in this data set because it is likely that due to health barriers such as distance from remote sections and villages, many Ebola virus disease patients may have died before getting a definitive diagnosis (see Dietz et al., 2015; Haaskjold et al., 2016; WHO, 2015). Fourth, because Ebola was first reported in 2013 and no transmission was reported after 2016, I assumed that Ebola confirmed cases

were only for patients admitted in clinics and that no transmission occurred before 2013 and after 2016.

Scope and Delimitations

I focused on sociocultural and behavioral risk factors of EVD among women and men ages 15 to 49 in Sierra Leone and did not provide information on other populations or age groups in the country. It was not the purpose of this study to establish causation; therefore, I did not conclude that the risky behaviors for Ebola engaged in by members of the study population caused the EVD epidemic. Also, because I used Ebola data collected during the 2014-2016 EVD outbreak in Sierra Leone, the study findings were generalized to Sierra Leone population and may not be generalized to other countries affected by the 2014 Ebola epidemic, including Guinea and Liberia. These countries may have different cultural, behavioral, social, and environmental influences. The study was also delimited to the availability of the data and the timing of collection because some of the behavioral, environmental, and social data used in this study were gathered before the Ebola struck Sierra Leone. Also, due to the deadly nature of the Ebola disease, the stigma and fear associated with it, the lack of knowledge of the epidemiology of the disease, and the urgency to educate community members about the disease, data were collected under tremendous fear and pressure. As a result, the data may be incomplete.

Limitations

This study has some limitations. First, data were collected under harsh conditions in a developing nation with a poor surveillance system in the heat of the Ebola epidemic. The main focuses were treating patients, contact tracing, and stopping the spread of the

disease transmission in the local community rather than conducting epidemiologic studies, so information may not be complete (WHO, 2014). Incomplete data or missing data can be a serious challenge because the study was conducted with secondary data (see Creswell, 2009). Second, sample selection bias may have resulted from focusing on women and men from a specific age group, so the results may not be generalizable to the entire population in the country (see Creswell, 2009; Lokuge et al., 2016). Third, the use of secondary data limits the researcher's ability to define variables and limits the strength of the data analysis. In addition, use of preexisting data may result in a study sample size that may not be representative of the general population and could threaten the study's external validity. Fourth, Ebola disease had never been diagnosed in the country before the 2014 outbreak, so cases at the beginning of the disease outbreak may not have been captured in the database.

Significance

Several researchers have established high Ebola virus infection rates among women and men in Sierra Leone during the 2014 Ebola epidemic (Bower et al., 2016; Dallatomasina et al., 2015; Dietz et al., 2015; MacDonald, 2016; Nkangu et al., 2017; WHO Ebola Response Team, 2015). However, researchers did not examine the demographic, sociocultural, and behavior factors that may contribute to elevated vulnerability to Ebola virus infection, particularly among women and men ages 15 to 49 years in the country. My study filled this gap through analysis of the relationship between demographic, sociocultural, and behavioral risk factors and Ebola virus infection status among women and men ages 15 to 49 years in Sierra Leone. Identifying the risk factors

associated with EVD in this group could assist in the creation of useful gender- and age-specific Ebola interventions and control processes for women and men in the nation (see CDC, 2014; Tambo, 2014; UNDG, 2015).

The study could also provide information that would help change the way health care personnel, family members, and the close friends care for the sick in the country, and may give policymakers the tools for developing public health and social policy for EVD control among women and men in the nation (see CDC, 2014; UNDG, 2015). Also, findings could be used to foster culturally sensitive Ebola control efforts in the country, such as the creation of social acceptance through health promotion and care coordination and collaboration with local communities leading to an understanding of social and cultural perspectives that have not been well addressed. Also, the study could help expose important gaps in Ebola virus research pertinent to outbreak situations (see Alexander et al., 2015; Moole et al., 2015).

Summary

The chapter covered EVD outbreak in Africa, especially Sierra Leone. I presented behavioral characteristics and pertinent information related to the 2013-2016 Ebola disease outbreak including the extent to which EVD is transmitted in local communities, especially among women caretakers. Relevant situations and scenarios demonstrating how, for example, these women sometimes engage in undesirable or risky behavior patterns such as traditional burial practice were presented. The background and epidemiology sections indicated that is important to understand the Ebola disease problem in affected countries, especially Sierra Leone, based on the literature, in

conjunction with the crucial gaps identified within EVD research. Also, this chapter provided an overview of the study problem, the purpose of the study, the theoretical foundation, the research questions, and the accompanying hypotheses. In addition, specific control methods were presented. The chapter also included the assumptions, delimitations, limitations, definition of terms, and significance of the study, which is the creation of gender- and age-specific Ebola prevention interventions and control processes for women and men ages 15 to 49 years in the nation (see CDC, 2014; Tambo, 2014; UNDG, 2015). The next chapter, the literature review section, covers such concepts as review methodology and synthesis of the literature. I also present a thorough review of the literature on this topic.

Chapter 2: Literature Review

Sierra Leone is a poor nation that has been plagued by major public health problems, including the recent 2014 Ebola virus disease epidemic that infected 14,122 people and claimed the lives of 3,955 people in the nation (Dietz et al., 2015; Henwood et al., 2017; Richards et al., 2015; WHO, 2015). According to Dietz et al. (2015), the UNDG (2015), and the WHO (2016), women and men ages 15 to 49 are among the groups affected most by EVD in Sierra Leone, accounting for 9,944 confirmed cases of EVD in the country. Qin et al. (2015) found that of 61 patients confirmed with EVD in Sierra Leone, 28 (45.9%) were male and 33 (54.1%) were female. Furthermore, in a recent study of more than 800 household members of EVD survivors in Sierra Leone, Bower et al. (2016) found that Ebola infection varied by age group: 43% for children and 60% for adults >30 years of age. Also, exposure risks were lower for people 5–9 (0.70), 10–14 (0.64), and 15–19 (0.71) years of age but not for children. Bower et al. also pointed out that most confirmed cases were people ages 15–49 years (62.8%), and in 94 households, 448 (48%) had contracted EVD. Furthermore, in Dietz et al.'s (2015), study, the median age in all confirmed EVD cases in Sierra Leone was 28 years, with 7.3% of those affected ages <5 years, 14.5% ages 5–14 years, 62.8% ages 15–49 years, and 15.3% ages ≥50 years. Adongo et al. (2016) and Bower et al. identified possible risk factors of EVD infection as caring for the sick, participation in traditional burial ceremonies, and hunting and consumption of bush meat such as gorillas and bats.

Although studies have provided insight into EVD and potential risk factors among women and men in Sierra Leone (Dietz et al., 2015; Henwood et al., 2017; Richards et

al., 2015; WHO, 2015), little is known about the relationship between sociocultural, behavioral, and demographic factors and Ebola virus infection status among women and men ages 15 to 49 in Sierra Leone. The purpose of this study was to assess relationships between sociocultural, behavioral, and demographic factors and Ebola virus infection status among women and men ages 15 to 49 during the 2014 Ebola virus epidemic in Sierra Leone to help inform Ebola prevention interventions in this population (e.g., gender- and age-specific prevention interventions). Also, determining the relationship between sociocultural, behavioral, and demographic risk factors and Ebola virus infection among this population could provide more insight into the relationship between Ebola and risk factors that would prevent future Ebola outbreaks in the country and around the world, thereby saving many lives.

Quantitative, qualitative, and mixed-methods studies have provided vital information to understand and address the EVD public health problem in Sierra Leone (Adongo et al., 2016; Bower et al., 2016; Dietz et al., 2015). Conducting an in-depth literature review for the current study was vital in identifying existing gaps in Ebola disease research, and contributed to identifying and understanding the 2014 Ebola disease experience among women and men ages 15 to 49 years in Sierra Leone and the determinants that are linked to the outbreak and rapid spread of the disease in this population.

This section entails the following review: (a) a description of the literature search strategy, then review of the theoretical framework of the study (b) Next, studies that present demographic, socio-cultural and behavioral factors that may increase women and

men's risk for Ebola virus contraction are reviewed, and finally, (c) the section concluded with a synthesis of the research studies, and summary for the type of research approaches used in the literature, summaries of the results found in this search and a description of a significant gap in the research that this current study has attempted to address.

The review of the relevant literature helped guide the scope of the two defined research questions for this study:

RQ1: Are there associations between sociocultural and behavioral factors and Ebola infection in women and men aged 15 to 49 during the 2014 Ebola outbreak in Sierra Leone?

RQ2: What are the significant predicting sociocultural and behavioral risk factors (possible funeral attendance, funeral touched body, contact with sick person, preparation and consumption of primate activity), respondent's gender, respondent's age group, and housewife/caretaker occupation for Ebola disease status among women and men aged 15-49 during the 2014 outbreak in Sierra Leone?

Literature Search Strategy

To gather valuable evidence before this study, an extensive and comprehensive search of the literature was conducted online to identify and gather pertinent information on the Ebola virus disease outbreak. This literature search was conducted utilizing the databases of Web of Science, Walden library database, Embase, Medline, PsycINFO, PubMed, ERIC, CINAHL, the Cochrane Library, and Google Scholar to access contemporary journal articles on infectious disease, especially, Ebola virus disease. Also, more articles were found by further looking through the bibliographies of the articles that

were collected from the initial search, abstracts, the use of summary information, and recent references from the articles identified. Furthermore, I searched these literature databases for theoretical frameworks applicable to study various health conditions, and Ebola disease outbreak, without limiting searches by publication date. Reviewing promising theoretical frameworks to support my study enabled me to choose an appropriate theoretical framework for this research. Conducting this analysis has helped to improve the study design of empirical research.

The main keywords used to explore the pertinent topics of interest in the search included various combinations of Ebola risk, Ebola virus disease outbreak, Ebola transmission, Ebola control, West Africa Ebola, Ebola case fatality, Ebola isolation, Ebola behavior change; Ebola epidemiology; Ebola gender dimensions, women and Ebola virus disease, Gender inequality Ebola disease, Ebola and poverty; Behavioral theories, health theories; culture and disease, tradition and disease; social factors and Ebola, Ebola virus disease outbreak, women and caregiving roles, women and Ebola virus disease

Stringent criteria were applied to this review. In terms of study inclusion criteria, studies were included in this review if they were published in English and measure the following: traditional, burial, caregiver, quarantine, fever, risky behavior, and Ebola reservoir, basically, all studies that clearly meet the WHO Ebola virus disease case definition, and its association with risk factors (WHO, 2015). Also, the research articles that defined the majority of the study population as either woman, men, health care workers, friends and family of Ebola patients, siblings of Ebola patients, Ebola burial

team, and doctors, were included in the review. I excluded studies that reported only malaria disease because it has been shown that symptoms for malaria and Ebola are similar and by using the same diagnostic test, many Malaria cases have been misdiagnosed as Ebola; studies published in other languages, and studies that were more than 5 years old, since Ebola outbreak in Sierra Leone began in 2013, even though some studies older than 5 years were included only if they provided vital Ebola epidemiologic background to this study. Finally, I excluded articles that only dealt with chronic diseases such as Diabetes, Tuberculosis, and HIV/AIDS since Ebola is considered a reemerging infectious disease. All the papers were selected from peer-reviewed journals, and other credible and recognized government agencies or other well-respected organizations.

For this study, I extracted the following information: study identifiers including author, and the year; the sample used, the methods utilized, such as data collection method, the theories, strengths, and limitations, and results which include the sample characteristics and Ebola virus control and risk factor behavior. To obtain a quality result, I ensured that all data were peer-reviewed articles. Peer-reviewed journals are known to be well written and organized and are easier to analyze. They can have diverse information about a specific study at hand. Furthermore, they are more valid, reliable and are widely utilized by renowned researchers.

Theoretical Foundation

Remerging infectious diseases such as Ebola virus disease are of increasing global concern in public health (WHO, 2016). Several major health determinants may underlie and influence Ebola disease among individuals in various communities in Sierra Leone,

such as participating in traditional burial rituals of kissing the dead (Adongo et al., 2016; Manguvo & Mafuvadze, 2015; Stehling-Ariza et al., 2016). This quantitative and cross-sectional study of demographic, socio-cultural and behavioral characteristics underlying Ebola disease in women and men aged 15 to 49 years in Sierra Leone requires the application of a sound theoretical framework. For this study I reviewed important theories for infectious disease causation.

According to Creswell (2009); Glanz, Rimer, and Viswanath (2008), various researchers have employed health behavior, determinants and intervention theories to determine which variables to measure and the relationships among those variables. Some of those theories reviewed for this current study include: The Epidemiologic triad of disease, which identifies three components necessary to initiate and propagate illness: a host (includes susceptible individual), an agent (a pathogen) and environment conducive for transmission of a disease-causing agent (Egger, Swinburn, & Rossner, 2003). The next theory, the Epidemiological theory of disease or the Web of Causation, postulates that various interconnected factors cause a particular disease and that no one factor can fully account for disease causation (Glanz et al., 2008). Furthermore, Glanz and colleagues indicate that this theory of multiple causations provides a multi-factorial insight into disease causation in populations. While these theories provide vital insights into the complex interaction of factors and events in the disease-causing process, they fail to clearly show the reciprocal relationship between these factors, according to Glanz et al. (2008); Wilcox and Echaubard (2017). Moreover, these theories fail to show that the spread of an infectious disease such as Ebola involves not an only infectious agent, mode

of transmission, susceptibility, but also social, cultural, demographic, and geographic factors (Creswell, 2009; Glanz et al., 2008; Wilcox & Echaubard, 2017).

Also, from my review, it is clear that simple epidemiological models like the epidemiological triad are good mainly for addressing diseases which are transmitted directly from person to person. According to Glanz et al. (2008); Pourrut et al. (2005); Stehling-Ariza et al. (2016), advance models must be used when there is transmission also by a reservoir of non- human agents, such as fruit bats and chimpanzees that are believed to be Ebola virus reservoirs. So for this study, the Ecological model by McLeroy, Bibeau, Steckler, and Glanz (1988) is best. The Ecological model assumes reciprocal relationships, multi-level analysis and is sensitive to cultural inputs (Glanz et al., 2008; Shahabuddin et al., 2017). Furthermore, this model has been utilized extensively in public health research to determine which variables to assess and the relationships among these unique variables (Glanz et al., 2008). Examples of reported studies guided by the Ecologic model are presented here:

Studies of the Ecological Model

Shahabuddin et al. (2017) used the Ecological model framework to study thirty married adolescent girls and their experiences related to pregnancy and delivery in Bangladesh. The authors found that the model considers the interaction of multiple levels of a social system, including interactions between individuals and the environment within this system. They also noticed that the model adequately facilitated the exploration of individuals' experiences, integrating their intrapersonal, partner-related, family, community and socio-cultural contexts to produce one behavioral outcome.

Other researchers, Wilcox and Echaubard (2017) applied the Ecological model to examine biomedical and ecological perspectives in research framing of liver fluke and cholangiocarcinoma in North East Thailand. In their study, the model identified biological and behavioral factors at the individual, interpersonal, community and societal levels. Wilcox and Echaubard, also found that the model fully investigated how the various levels interact and influence each other. Moreover, they agree that the model is broad and exploratory, and allows for the use of mixed, quantitative and qualitative methods of inquiry, including statistical applications. One study by Cassel (2010) in American Samoa used the Ecological Model as a research and intervention framework to understand and mitigate obesogenic factors in Samoan populations. In this study, Cassel showed that traditional Samoan culture views illnesses as the results of displeasing supernatural powers, gods or spirits. The author also found that sickness in this population was regarded as an imbalance among the spiritual, social, and personal aspects of one's life, so to treat illnesses, this indigenous population referred to the native priest for assistance (Cassel, 2010). This study findings, clearly confirm the African interpretation of diseases such as the Ebola virus disease and their reliance on traditional healers for care and to cure Ebola disease (Richards et al., 2015). A more recent study utilizing the Ecological model to predict Sub national Ebola virus disease epidemic dynamics from socio-demographic area-level characteristics found that the model can help predict epidemic factors such as demographics, education, and religious practices (Valeri et al., 2016).

Furthermore, a study out of Thailand examines rectal microbicide acceptability among young men who have sex with men and transgender women in Thailand. In this study, Newman, Roungprakhon, and Tepjan (2013) show that the model broadens health research and interventions beyond the individual level, and provide an overall conceptual framework for exploring multiple and intersecting levels of influence on human behavior. They noted that it takes into account individual, interpersonal and social structural levels, with particular attention to social, institutional and cultural contexts. Additionally, in applying the ecological model to evaluating substance use and risky sexual behaviors among young men working at a rural roadside market in Malawi, Jere et al. (2017), discovered some critical aspects of the factors in McLeroy et al.'s (1988) ecological model. The authors found that societal norms in the country provided a broad context in which opportunities for substance use and risky sex were made available for young people. Also, when Sharer, Cluver, Shields, and Ahearn (2016) applied the ecological model as a frame for examining multiple types of familial, social support in greater detail relates to depression, anxiety, and post-traumatic stress (PTS), they observed that caregiver emotional, social support was related to a lower number of depression, anxiety, and PTS symptoms and siblings emerged as the most consistent source of social support on mental health. In another investigation, Shahabuddin et al. (2017) recognized that the model provides several components that entail the environment and social influences for explaining disease outbreak.

The potential demographic, socio-cultural factors and risky behaviors, such as traditional burial rites in the local communities in Sierra Leone which may lead to Ebola

disease among women and men aged 15 to 49 were used to illuminate each of the level factors in McLeroy et al.'s (1988) ecological model, and help in determining the relationship between Ebola infection status and potential risk factors of Ebola in this population (Glanz et al., 2008; Shahabuddin et al., 2017). In this study, the Ecological Model provided a useful and a complete framework for achieving a better understanding of the multiple factors that impact Ebola infection behaviors, and to address the behavioral, social-cultural, and demographic factors associated with the spread of the Ebola virus among the study population and helped explain major determinants of health-related behavior in Sierra Leone (Glanz et al., 2008; Shahabuddin et al., 2017). It played a pivotal role in addressing the gap in research and scientific knowledge for Ebola virus disease transmission among the study population in the country. Furthermore, the model could provide guidance for developing gender and age-specific, culturally appropriate and sensitive prevention intervention strategies for women and men aged 15 to 49 years (Glanz et al., 2008; Shahabuddin et al., 2017).

Ebola virus infection risky behaviors among women and men aged 15 to 49 years are the result of interplay of personal, sociocultural, and demographic factors that can be categorized and described using the two major levels of influence conceptualized by the ecological model: Intrapersonal/individual level (gender, age, house wife/care taker occupation, traditional healer occupation). Interpersonal level (processes whereby sociocultural, social traditions, norms, and role expectations impact health practices; and patterns within family, groups, and friends. For example, burial attendance) (Glanz et al., 2008; Shahabuddin et al., 2017).

Studies of History and Epidemiology of the Ebola Virus Disease in Africa

The deadly and highly contagious Ebola virus disease (EVD) is believed to be caused by filovirus and spread among humans and primates (Dallatomasina et al., 2015; WHO, 2014). According to Dallatomasina et al. (2015); WHO (2014), the Ebola virus was first discovered in 1976 during simultaneous outbreaks of hemorrhagic fever in southern Sudan and northeastern Democratic Republic of Congo, Zaire, close to the Ebola River from which its name was derived. Furthermore, reports by Dallatomasina et al. (2015); McDonald (2016); WHO (2014) indicate that on August 2, 1979, the first Ebola patient was admitted to the Nzara hospital with Ebola-like symptoms such as, vomiting, diarrhea, and stomach bleeding, and died on 5 August. Shortly after His death, His caretakers at home and the Nzara hospital contracted the virus and died, leading to widespread of the disease to other individuals in the local community (Dallatomasina et al., 2015; McDonald, 2016; WHO, 2014).

This public health disaster prompted the government to enact quarantine and conduct regional surveillance in the affected districts (Dallatomasina et al., 2015; McDonald, 2016; WHO, 2014). Several researchers, including Dowell et al. (1999); McDonald (2016); WHO (2014), indicate that the 1976 outbreaks of the disease in Zaire was linked to the use of unsterile and contaminated needles between patients in the hospital, while the majority of person-to-person transmission was linked to close physical contact. Also, in Sudan, it was linked to contact among textile factory workers in the town of Nzara with Ebola-infected animals.

Studies have still not fully determined the main reservoir of the Ebola virus, but it has been previously established that Fruit bats and other primates such as Chimpanzees are the virus reservoir, which is then passed on to humans by contact with these infected living or dead animal (Dallatomasina et al., 2015; WHO, 2014). The primary mode of transmission of Ebola is shown to be through direct contact with infected bodily fluids including blood, breast milk, and saliva from living or dead bodies, and contaminated materials or objects (Dallatomasina et al., 2015; Dowell et al., 1999; Judson, Prescott, & Munster, 2015; WHO, 2014). Researchers have identified Ebola virus disease symptoms in humans to include, high fever, weakness, bleeding, fatigue, headache, muscle pain, soar-throat, profuse vomiting, diarrhea, rash, and failure of vital organs (CDC, 2014; Schieffelin et al., 2014; Yamin et al., 2015; WHO, 2015). Moreover, studies have found Ebola case fatality rates to be as high as 90% during past and current outbreaks, with an incubation period between 2-21 days (Dallatomasina et al., 2015; Schieffelin et al., 2014; WHO, 2014). Also, they note that the disease can be diagnosed by performing a simple blood test and swab, and Ebola specific RT-PCR procedures. Even though there is no definitive cure for Ebola, studies found that the disease can be controlled or prevented by early diagnosis, prompt isolation, medical care; speedy contact tracing through daily surveillance of contacts; simple and consistent practice of good hygiene; home disinfection and safe burial practices of the dead; and health promotion to ensure community acceptance of these measures (CDC, 2014; CDC, 2015; Rivers, Lofguren, Marathe, Eubank, & Lewis, 2014; Schieffelin et al., 2014; Tambo, 2014; WHO, 2015; WHO Ebola Response Team, 2014; Yamin et al., 2015). It is still not clear what factors

are responsible for the rapid spread of the Ebola virus in local communities in Africa, but studies by Chowell and Nishiura (2014); Rivers, Lofguren, Marathe, Eubank, and Lewis (2014); Schieffelin et al. (2014); Tambo (2014); WHO Ebola Response Team (2014); Yamin et al. (2015) acknowledge that certain socio-cultural factors and other deeply ingrained traditional practices such as participation in burial rituals of Ebola bodies may be responsible for it. So, I embarked on this study to examine the relationship between demographic, sociocultural and behavioral risk factora and Ebola virus infection status among women and men of reproductive age 15 to 49 years in Sierra Leone.

This study could provide valuable information and clear insight to the relationship between the demographic, sociocultural, behavioral risk factors and Ebola virus infection status in the country, especially among women and men aged 15 to 45. This is important in addressing the specific demographic, sociosultural and behavioural factors that increase Ebola vulnerability among this study group and how these factors may differ from other groups (WHO Ebola Response Team, 2014). Furthermore, results of this study may help public health officials design age and gender-relevant prevention efforts to modify Ebola risk behaviors and improve health in women and men aged 15 to 49 years in Sierra Leone.

Literature Review

Intrapersonal or individual level determinants/factors are biological, personal, and demographic factors including gender, age, housewife/care taker occupation, traditional healer occupation (Glanz et al., 2008; Shahabuddin et al., 2017).

Gender and Ebola

Studies have noted gender burden in the 2014 Ebola disease epidemic in Sierra Leone. Fawole, Bamiselu, Adewuyi, and Nguku (2016); United Nations Development Group (2015)'s studies examined Ebola characteristics in Sierra Leones and found that the proportion of Ebola Virus Disease (EVD) among women was 5,118 and men 4,823. Furthermore, in research published in the Journal of Clinical Infectious Diseases, Dietz et al. (2015) investigated the epidemiology and risk factors for Ebola virus disease in Sierra Leone from May 2014 to January 2015. In this study, they found that 8,056 persons had laboratory-confirmed Ebola virus disease, and 51.7% of those were female. Similarly, in a retrospective descriptive study, Haaskjold et al. (2016) used data from all patients admitted to the Ebola treatment center in the Moyamba District, Sierra Leone to examine clinical features of and risk factors for fatal Ebola virus disease. The authors demonstrated that, of 31 patients who were positive for Ebola virus disease, 14 (45%) were male and 17 (55%) female. Arranz et al. (2016) conducted another retrospective study at the same Moyamba Ebola clinic, Sierra Leone from December 2014-March 2015 to assess clinical features of suspected Ebola cases, focusing on challenges in the later stages of the 2014 outbreak. Arranz et al. found that of the seventy-five patients included in the study, 31 (41.3 %) were positive for Ebola, women (68 %) and men (28 %), $p = 0.001$) were Ebola virus disease positive. Also, a study in 2015, found that among 619 cases of Ebola, the proportion of female cases were 326 (52.7%) and males cases were 293 (47.3%) (Kouadio et al., 2015). Additionally, in a recent study, Bower et al. (2016) used histories of household members of Ebola virus disease survivors in Sierra

Leona to assess exposure-specific attack rates for Ebola Virus disease in Ebola-affected households, Sierra Leone. They found that 49% of Ebola virus disease infected case were female, and 46% males. Also, Schieffelin et al. (2014)'s study reviewed epidemiologic, clinical, and laboratory records of Ebola patients between May 25 and June 18, 2014, to investigate clinical illness and outcomes in patients with Ebola in Sierra Leone. In this study, Schieffelin and colleagues discovered that, in Ebola patients, males had a case fatality rate 73% and female 75%.

In a scoping review published in the Journal of Infectious Diseases of Poverty, Nkangu, Olatunde, and Yaya (2017) observe that, in the 1976 outbreak in the Democratic Republic of Congo, the mortality rate was 56% among women and 44% in men. Of the 315 Ebola cases reported in the 1995 Ebola outbreak, 53% were in women, and 47% were in men. In the 2014 outbreak in West Africa, Sierra Leone had 5118 cases for women and 4823 for men, while in Nigeria, women accounted for 55% of the cases, and men accounted for the remaining 45%.

Various factors may help explain this trend seen in Ebola for women and men in Africa. Studies have not shown the biological difference to increase women's risk for Ebola. The different social norms and cultural roles of female and male individuals in the country, for example, women/housewives as caregivers for sick family members, may have increased women's vulnerability and risk to the Ebola virus and resulted in the sexes being differently affected during this outbreak (Adongo et al., 2016; Fawole, Bamiselu, Adewuyi, & Nguku, 2016; Sia et al., 2016).

Despite the fact that these studies suggest a substantial proportion of Ebola infected women and men and that these women and men in Sierra Leone are at high risk of Ebola infection, and show some gender differences in Ebola virus risk, limited data exist on the relationship between gender and Ebola virus infection status, and the sociocultural and behavioral factors that increase Ebola vulnerability among women and men aged 15 to 49 in the country. This may hinder effective development of gender-specific targeted Ebola prevention interventions in the country. My study could fill this gap in information knowledge and understanding by conducting a more thorough and rigorous analysis of the relationship between potential gender risk factor and Ebola virus infection status among women and men ages 15 to 49 years in Sierra Leone. Recently, Nkangu et al. (2017) noted in a scoping review that gender is a determinant of health that has been given very minimal attention in medicine and the design of national and global health programs. They also, stressed that when gender is considered, it is most often from the perspective of women rather than both men and women. I therefore tested a possible relationship between gender and Ebola virus infection status among women and men aged 15 to 49 in Sierra Leone. Understanding these association in this specific group is vital to development of targeted interventions that could prevent or reduce future Ebola vulnerability, particularly among this study population. Also, in this study, I sought to provide analysis of such relationship for evidence-based programming by public health agencies and other stake holders in the country. The findings of this study may have implications for norm and behavioral change prevention interventions among women and men aged 15 to 49 years at high risk for Ebola virus infection in the country.

Age and Ebola

Several researchers including, Bower et al. (2016); Mulangu et al. (2016) agree that Ebola virus disease could be explained by age. Bower et al. (2016) found that the risk for Ebola infection was lowest for children 5–14 years of age but higher for children less than two years of age and for adults. They also showed that, the risk increased with age for adults up to ≈35 years of age and then leveled out for older adults, and young adults >30 years of age constitute one of the groups at highest risk of Ebola infection (60%) in Sierra Leone. A retrospective survey by Mulangu et al. (2016) in the Congo studied stored pygmy sera of 300 Efé pygmy aged ten years to assess seroprevalence to Ebola virus infection and possible risks factors. The results of this study revealed that the prevalence of anti-EBOV IgG increased significantly with age ($p = 0.023$).

Another study by Dietz et al. (2015), depicted that the median age in confirmed Ebola virus disease cases in Sierra Leone was 28 years with 7.3% of those affected aged <5 years, 14.5% aged 5–14 years, and highest 62.8% aged 15–49 years, and 15.3% aged ≥50 years. Similarly, a WHO Ebola Response Team (2014) surveillance study aiming to create a full picture of the rapid spread of Ebola virus disease in West Africa found that the median age of individuals with Ebola disease was 32 years, and the majority of persons with the disease (60.8%) were between 15 and 44 years of age. Olu et al. (2015) utilized a retrospective descriptive study to evaluate Ebola virus disease acquisition among Healthcare workers in Sierra Leone. The authors found that of 2,435 Healthcare workers in the country, the most affected Healthcare worker age groups were 26–35 and 36–45 years old. In another study assessing health care workers and Ebola, Kilmarx et al.

(2014) analyzed data on laboratory-confirmed cases in the national Viral Hemorrhagic Fever database in Sierra Leone. The result of this study shows that two (1.1%) Ebola cases were aged less than 15 years, the majority 82.0% were in aged 15–49 years, and 16.9% were in workers aged 50 years or older. Another study out of Sierra Leone by Haaskjold et al. (2016) provides more insight into the age dimension of Ebola disease in the country. The study found that of the 31 (38%) Ebola patients admitted to the Moyamba Ebola treatment center, eighteen (58%) were 21–45 years of age. Moreover, Schieffelin et al. (2014)'s study of clinical illness and outcomes in patients with Ebola in Sierra Leone, published in the New England Journal of Medicine found that patients between the ages of 21 and 45 years had an intermediate case fatality rate of 74%.

Although studies by (Bower et al., 2016; Dietz et al., 2015; Mulangu et al., 2016), have shown that Ebola virus infection could be explained by age, the question of whether, and to what extent, age is a risk factor for Ebola infection in women and men aged 15 to 49 years in Sierra Leone still remain unclear. Also, data on the relationship of age and Ebola virus infection risk remain unclear for specific age groups, and data gaps exist on the association between especially, age groups (15 to 19, 20 to 29, 30 to 39, and 40 to 49) and Ebola virus infection among women and men aged 15 to 49 in Sierra Leone. This has also limited the information available on the age factor that increase Ebola vulnerability among women and men aged 15 to 49 and how these factors may differ from other groups. This creates a need to understand this study age group. In fact, previous report from the WHO Ebola Response Team (2014), commented that most published data estimates of key epidemiologic parameters from the 2013 to 2016 Ebola epidemic in

West Africa have been based on patients of all ages. Thus this study sought to examine the relationship between age groups (15 to 19, 20 to 29, 30 to 39, and 40 to 49) years and Ebola virus infection among women and men aged 15 to 49 years in Sierra Leone, so as to contribute to filling such data gap by providing age- specific information on Ebola infection risk which could facilitate and direct age-specific Ebola prevention intervention programs, and risky Ebola behavior change for women and men, particularly, the study group in Sierra Leone. Furthermore, an understanding of age-related risk for Ebola virus infection is a giant step toward understanding the dynamics of the Ebola virus epidemic in this study population and assessing future trend in this group.

Housewife/careter occupation and Ebola. Fawole et al. (2016); Ravi and Gauldin (2014) agree that behavior and practice that may be correlated with the acquisition of Ebola virus disease in West Africa, particularly, Sierra Leone is caretaking of Ebola patients. Studies by Fawole et al. (2016); Ravi and Gauldin (2014) found that, during the 2014 Ebola outbreak in West Africa, and Sierra Leone, in particular, women were mostly responsible for caring for the sick relatives at home and in health care settings, which may have increased their exposure to the Ebola virus. They also believe that Sierra Leone's deeply rooted family social and cultural norms of caregiver role given to women have been associated with behavioral changes about an increased Ebola disease risk and higher exposure among women. Guan and So (2016) found that People who had a stronger social identity with a given social group such as a family perceived greater social support from the group, and were willing to engaging in a health-related behavior expected from the group. So, this could explain why the need for women to be in close

contact with the sick members of their community has the potential to greatly expose them to Ebola disease (Nishiura & Chowell, 2015; UNDG, 2015). Studies suggest that the Ebola virus is transmitted by direct contact with contaminated bodily fluids of people with Ebola, and other contaminated materials (Fawole, Bamiselu, Adewuyi, & Nguku, 2016). According to Richards et al. (2015); Nkangu et al. (2017), families across communities in Sierra Leone are seen as self-reliant, trustworthy, and dependable for survival. So social dependency, such as caring for the sick help explain important aspects to understanding the Ebola disease characteristics in these local communities. An important finding of Olu et al. (2015)'s retrospective descriptive study of Ebola acquisition among Healthcare workers in Sierra Leone is that of the 2,435 Healthcare workers in the country, 12 % had Ebola virus disease, and nearly half them believed that they contracted the virus in a hospital setting, while caring for patients. Others believed that they were exposed in the home (48, 19 %) while caring for a family member (Olu et al., 2015). Also, a recent systematic review and meta-analysis of 31 reports conducted by Brainard, Hooper, Pond, Edmunds, and Hunter (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). Also, in the 2000–2001 Ugandan Ebola outbreak, caregiving, responsibility mainly by women was linked to the high rate of infection in women (67%) of Ebola cases in the country (Alexander et al., 2015). Hewlett and Hewlett (2005) conducted Qualitative and quantitative studies in Uganda and the Republic of Congo utilizing open-ended and semi-structured interviews with a broad range of individuals and focus groups.

They observed that, providing care by health workers and household members was a risk factor for infection, and that nursing care was performed often without wearing proper protective gear, such as hand gloves. They also found that the majority of nursing care was given by family members who sometimes slept in the same bed as the patient. Recently, Stehling-Ariza et al. (2016) assessed the impact of active surveillance and health education on an Ebola virus disease cluster in Kono District, Sierra Leone. They claim that among 50 confirmed Ebola cases, caring for or contact with sick patients was the likely source for 19 (38.0 %) Ebola disease infection. In another recent study out of Guinea, Faye et al. (2015) found that overall, 72% (105 of 145) of transmissions occurred between family members, while providing care in the home. Similar to other studies, a 2016 retrospective observational study to evaluate patterns responsible for Ebola transmission in Guinea, Liberia, and Sierra Leone found that overall, 87% of exposures occurred between family members (WHO Ebola Response Team, 2016). In this same study, more than 90% of cases reported involve contact with bodily fluids and direct physical contact with Ebola patients, and 38% were reported as occurring in a household. According to a WHO (2015) report, several of the health care workers in Guinea, Liberia, and Sierra Leone were infected during the Ebola outbreak, and nearly 700 were infected by the end of 2015 alone. Also, more than half of them had died of Ebola virus disease. A more recent research conducted by Annan et al. (2017) to assess healthcare workers poor preparedness for Ebola outbreak in Ghana, found that early in 2014, Guinea encountered more than 491 (58.7%) deaths of Healthcare workers from 839 Ebola virus infections, and demonstrated that Healthcare workers are at high risk of being infected with the

disease due to their caretaking responsibilities. Furthermore, 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% confidence interval (CI) 26–38%]. However, risk of disease transmission between household members without direct contact was low (1%; 95% CI 0–5%). They believe that taking care of an Ebola patient in the community, especially until death, was strongly associated with acquiring the disease. According to Richards et al. (2015), a prominent traditional female healer who had cared for Her infected Ebola brother in Fogbo village, Sierra Leone got infected and died. Several individuals in the villagers who helped care for Her during Her illness also contracted Ebola and died (Richards et al., 2015).

Despite the fact that studies (Brainard et al., 2016; WHO Ebola Response Team, 2016), have shown that caretaking of Ebola patients activity is linked to Ebola transmission, there is still no well documented relationship between house wife/care taking risky behavior and Ebola virus infection status, specifically among women and men aged 15 to 49 in Sierra Leone, thus creating such data gaps in this study group, and slowing down this Ebola risk behavior prevention intervention efforts in the country. This creates an urgent need to understand this study group and Ebola risk factor characteristics, thus this study therefore contribute to filling such data gap by providing house wife/caretaker information on Ebola infection risk which could facilitate and direct gender and caretaker specific Ebola prevention intervention programs, and risky Ebola behavior change for women and men, particularly, the study group in Sierra Leone.

Traditional healer occupation and Ebola. Previous studies have linked traditional healer practice to Ebola virus infection status in communities in Sierra Leone and elsewhere in Africa (Alexander et al., 2015; Manguvo & Mafuvadze, 2015). A study out of the Fogbo village, Sierra Leone found that the funeral of a prominent medicine woman who had contracted Ebola from caring for Her Ebola-infected brother triggered several deaths 17 women and one man (Richards et al., 2015). It was believed by researchers (WHO, 2015) that this Fogbo village incident may be the main event that triggered the widespread Ebola disease in Sierra Leone killing 3,589 people, causing 4,051 discharged cases, 8,704 cumulative cases, and 5,113. Most traditional healers use their bare hands, to apply topical medicine, mouths to suck blood from their patient's body, and sometimes use sharp instruments. Furthermore, some. This risky behavior, practices and beliefs exposes traditional healers to the Ebola virus. Additionally, they lack correct information on Ebola virus infection (Richards et al., 2015; WHO, 2015). Understanding the possible role of traditional healers in the 2014 Ebola epidemic in Sierra Leone is important. Clearly, to protect themselves and their clients traditional healers need the right information on Ebola virus infection

Several researchers have examined traditional healer activity as a risk factor for contracting Ebola virus in Sierra Leone and elsewhere in Africa. But, the association of this potential risk factor and Ebola virus status in women and men aged 15 to 49 years in the country remain unclear. I therefore sought to test the relationship between traditional healer occupation and Ebola status among women and men aged 15 to 49 years, in order to inform effective and efficient public health prevention intervention, such as the use of

proper protective gears (for example hand gloves) to carry out care activity (Richards et al., 2015; WHO, 2015).

Interpersonal-Level Determinants

According to Glanz et al. (2008), the interpersonal level takes into account how relationships with peers, partners, families, and social networks influence health, societal norms, cultures (example, funeral attending, traditional funeral rituals).

Funeral attendance and Ebola. Ebola transmission in Sierra Leone and elsewhere in Africa has been linked to funerals. In a recent study, WHO (2014) indicates that at least 20% of all new Ebola virus infections occur during burials of infected Ebola patients. In addition, a Retrospective Observational Study using data from 3,529 cases in Guinea, 5,343 in Liberia, and 10,746 in Sierra Leone to assess exposure patterns driving Ebola transmission in West Africa, found that funeral exposures were reported by 33% of Ebola cases (WHO Ebola Response Team, 2016). Another study analyzing internal service data and published reports from response agencies in Sierra Leone reported that the proportion of confirmed patients admitted to the Ebola centers increased from 19% to 37%, and funeral contact in those admitted was about 16% (Lokuge et al., 2016). Also, previous study in Uganda showed that the number of people who contracted Ebola during the 2003 outbreak potentially contracted the Ebola virus while at funeral and conducting traditional burial rituals. Furthermore, Lokuge et al. (2016) analyzed internal service data and published reports from response agencies in the Kialahun district, Sierra Leone and discovered that Ebola virus disease transmission was related to the funeral of a traditional female healer in contact with EVD patients from Guinea. They also, found that 365

Ebola-related deaths were linked to this single funeral before the outbreak spread throughout the country. A recent, Ebola data generated from an observational study, analyzing data from all confirmed and probable Ebola cases in Guinea during 2014 reported that 86% (95% CI 75–90) of exposure was at funerals (Faye et al., 2015). Moreover, a 2016 retrospective observational study to evaluate patterns responsible for Ebola transmission in Guinea, Liberia, and Sierra Leone found that 25% of cases reported exposures at funerals.

However, the association between attending funeral as potential risk factor for Ebola infection remains poorly understood in Sierra Leone, creating data gap and stifling Ebola disease prevention intervention progress. So, I embarked on this cross-sectional study to fully examine the relationship to properly inform public health prevention intervention in Sierra Leone.

Funeral touch body and Ebola. According to Alexander et al. (2015); Manguvo and Mafuvadze (2015), another significant high risk cultural and behavioral factor contributing to the transmission of Ebola virus disease in Africa entails traditional burial activities. Several studies suggest that most communities in West Africa have deeply ingrained traditional beliefs and funeral rites which require elaborate rituals at funeral and burial (Adongo et al., 2016; Alexander et al., 2015; Manguvo & Mafuvadze, 2015; Stehling-Ariza et al., 2016; WHO, 2017). Manguvo and Mafuvadze (2015) acknowledge that these traditional rituals are believed to honor the dead and create a smooth and peaceful transition for the dead to the spiritual and ancestral world.

Adongo et al. (2016) conducted a descriptive qualitative study in Ghana, using twenty-five focus group discussions to investigate the Socio-cultural practices that may affect the containment of Ebola disease efforts in Ghana. In this study, the authors found that socio-cultural practices such as washing and dressing the dead with bare hands were common in local communities. They also found that women suspected of committing adulatory in local communities are required to drink the water used to rinse the dead husband to prove her innocence in the death of the husband. Another study out of Sierra Leone show that a married woman is compelled to shave Her head and cover it with mud containing mixture of water from the washing of the dead husband's body to frees her from the dead husband's jealous spirit, and prepares her to be remarried to one of the dead husband's brothers, or to return to her own family (Richards et al., 2015).

Furthermore, Adongo et al. (2016); Manguvo and Mafuvadze (2015); Phua (2015); Richards et al. (2015) observed that some of the funeral rituals in Africa involve activities such as kissing the dead, and laying on top or beside dead bodies of prominent and highly respected members in the community, such as traditional healers, with the belief of acquiring certain healing powers from them.

According to Richardset al. (2015), women mostly prepare the body for burial by washing and dressing the body with bare hands, so putting them in direct physical contact with the dead body which may be infected with Ebola. Recent studies, and other accumulating evidence, suggest that primary means of transmission of the Ebola from person to person is via direct contact with infected body fluids, so such high-risk behaviors and practices can greatly contribute to the spread of the Ebola virus in the local

communities, especially for women (Manguvo & Mafuvadze, 2015; Sharareh et al., 2016; WHO, 2015; WHO, 2017). Furthermore, Ebola disease data show that Ebola patients in the later stage of the disease or newly dead exhibit highest virus load, and are the greatest contributors to Ebola virus disease spread (Phua, 2015). So, anyone who comes in direct contact with Ebola contaminated bodily fluids from these individuals has a greater risk of contracting the disease (Phua, 2015).

As Ravi and Gauldin (2014); Sharareh et al. (2016); WHO Ebola Response Team (2016) say, this may explain why engaging in the traditional burial ritual behavior of washing the Ebola-infected body and being in direct contact with the contaminated body poses serious threat and high Ebola risk to funeral attendees and increase the spread of Ebola in local communities. (Manguvo & Mafuvadze, 2015).

Moreover, a WHO study found that 60% or more of infections in Guinea could be related directly to participation in traditional funeral activities, involving washing and touching the dead from a high-infestation area of Guinea (2014b; 2015). The same study found that in Sierra Leone, about 80% of Ebola cases were also tied to the practice of traditional burial activities. Phua reported in a 2015 study that during the Ebola Epidemic in Guinea in late December 2014 and early January 2015, 85 Ebola virus disease cases were linked to the traditional funeral ceremony. Also, a recent study in Sierra Leone by Stehling-Ariza et al. (2016) found that among 50 confirmed Ebola cases, unsafe funeral practices were the likely sources of infection for 27 (54.0 %) cases. Also, a 2016 retrospective observational study out of Guinea, Liberia, and Sierra Leone found that 65% of Ebola cases reported touching the infected body, with this proportion being

greatest for Guinea (71%) and least for Liberia (61%), and (WHO Ebola Response Team, 2016).

In Uganda, similar traditional burial practices of an Ebola-infected body contributed to 63% of all presumptive Ebola cases in Uganda in women (Hewlett & Amola, 2003). Like Uganda, in Fogbo village, Sierra Leone, the funeral of a prominent medicine woman who had contracted Ebola from caring for Her Ebola-infected brother triggered several deaths 17 women and one man (Richards et al., 2015). According to a WHO (2015) report, this Fogbo village incident may be the main event that triggered the widespread Ebola disease in Sierra Leone killing 3,589 people, causing 4,051 discharged cases, 8,704 cumulative cases, and 5,113 suspected Ebola cases, that rated the country as the nation with the most Ebola cases in history.

Despite the increasing body of literature that show that burial cultural practices amplified the 2014 Ebola virus disease outbreak in Sierra Leone, much less and unclear data is available on the relationship between traditional burial rites behavior and Ebola virus infection status, specifically among women and men aged 15 to 49 in Sierra Leone. Previously, Tiffany et al. (2017) recommended more research in order to better understand the variation of risk for Ebola virus transmission related to distinct care practices both before and after death. This lack of proper information may slow down public health Ebola prevention intervention programs in the country.

I therefore, embarked on this retrospective cross-sectional study to fill this information knowledge gap and provide enhanced information, understanding and evidence for the relationship between burial cultural practices and Ebola virus infection

among women and men aged 15 to 49 in Sierra Leone which could be used to promote this risky Ebola behavioral modification or change among this at risk population in Sierra Leone.

Contact with sick person and Ebola. Studies by (Dietz et al., 2015; Dowell et al., 1999; Francesconi et al., 2003; WHO Ebola Response Team, 2016). Brainard et al. (2015) assessed risk factors for transmission of Ebola virus disease and found that, among household contacts who reported directly touching a case, the attack rate was 32% [95% confidence interval (CI) 26–38%]. But, risk of disease transmission between household members without direct contact was low (1%; 95% CI 0–5%). Furthermore, Levine et al. (2015)'s retrospective study of patient data collected during routine clinical care at the Bong County Ebola Treatment Unit in Liberia, identified variable independently predictive of laboratory-confirmed Ebola virus disease as sick contact, 0.75 (95% confidence interval 0.70 to 0.80). Similarly, Dietz et al. (2015) reported that among the 58.8% (4885 of 8311) with confirmed cases who responded to the question on contact with a suspected case patient or sick person within 1 month of symptom onset, 47.9% (2340 of 4885) reported having contact with such a person. They also mentioned that 52.1% (2545 of 4885) were recorded to have had no contact with someone with suspected EVD or any sick person. In Dowell et al. (1999)'s Ebola and potential risk factor cross-sectional design study, of 95 family members who had direct physical contact with an ill family member, either at home in the early phase of illness or during the hospitalization, 28 became infected, whereas none of 78 family members who did not touch an infected person during the period of clinical illness were infected ($P < .001$).

According to Dowell et al. (1999), Ebola virus is transmitted mainly by direct physical contact with an ill person or their body fluids during the later stages of illness.

Although these studies have provided some relevant data on the relationship of contact with sick person and Ebola virus infection risk in the general population, nevertheless, the relationship between this potential risk factor and Ebola virus infection status and the mechanisms that give rise to these relationship among women and men aged 15 to 49 years in Sierra Leone are poorly under stood and remains unclear. Therefore, I embarked on thoroughly assessing the relationship between contact with a sick person and Ebola virus status among the study population, in effort to provide full and better information that would help improve the implementation of Ebola health prevention interventions such as barrier control measures (wearing gloves during patient contact to reduce Ebola transmission). This may be very effective in preventing or reducing the spread of Ebola virus in this at-risk population in Sierra Leone, and also, helping combat the current Ebola outbreak in the Democratic Republic of the Congo (Dowell et al., 1999; WHO, 2014; WHO, 2015).

Preparation and consumption of primate and Ebola. Alexander et al. (2014); Nkangu et al. (2017); Phua (2015); Kunii, Kita, and Shibuya (2001) believe that another critical social and cultural factor that places individuals in danger of contracting Ebola virus disease relate to the practice of preparing and consuming bush meat, such as bats and monkeys, which have been identified as animal reservoirs of various zoonotic viruses, including the Ebola virus. A study published by Kunii et al. (2001) uses interviews with 20 villagers and two traditional healers to assessed cultural factors related

to the Ebola outbreaks in Gabon, West Africa. They found that during all three epidemics in the country the cases had prepared or consumed chimpanzee's meat, believed to be Ebola reservoir. Furthermore, a literature review by Nkangu et al. (2017) analyzed previous studies on Ebola outbreaks since 1976. The study found that, since the first Ebola outbreak in Africa in 1976, all the first cases of Ebola have been traced to the hunting of bush meat or exposure to dead animals in the bush. These authors believe that in most communities in Africa, especially Sierra Leone, bushmeat is a source of protein and source of income for many families.

A recent study from the Republic of Congo revealed that 88% of households interviewed reported eating bush meat (Alexander et al., 2015). Furthermore, researchers believe that, during cutting and preparation of bushmeat for cooking and consumption, women and men could expose themselves to fluids such as Ebola virus-infected blood and tissue and potentially increase their risk of contracting the Ebola virus, especially when open wounds are present (Alexander et al., 2015; Nkangu et al., 2017; Phua, 2015). Ebola is believed to spread by direct contact with infected bodily fluids or tissue. So, contact with these infected animals via hunting and preparing activities tremendously puts individuals in direct contact with animals that could harbor the virus and increase its transmission from these animals to humans, especially women (Beeching et al., 2014). Women's traditional role of cooking and activities related to handling animal tissues that may be infected with the Ebola virus, thus puts them at an increased risk of Ebola virus infection in local communities around Africa, particularly Sierra Leone (Alexander et al., 2015; Beeching et al., 2014; Nkangu et al., 2017; Phua, 2015).

Although these studies have provided some information on the link between bushmeat hunting, preparation and consumption practices and Ebola virus infection in populations in Siera Leone and else where in Africa, the relationship has still not been confirmed and clearly established, specifically among women and men aged 15 to 49 in Sierra Leone. This may impede community Ebola prevention intervention for this group. There is certainly compelling need to fully establish and confirm the link between bushmeat activity risk and Ebola infection in the study population. I therefore tested bishmeat risk and Ebola infection relationship by embarked on this study to provide enhanced information, better understanding of and evidence that could confirm the association between bushmeat butchering, preparation and consumption cultural and behavioral practices and Ebola virus infection among women and men aged 15 to 49 in Sierra Leone which could be used to promote this risky Ebola behavioral modification or change among this at risk population, and to ensure proper messages in Sierra Leone. It could also strengthen Ebola virus disease prevention campaigns in the country.

Touch body fluids and Ebola. The behavior of touching body fluids was examined in research studies that assessed the factors that lead to the emergence of Ebola outbreaks in Sierra Leone, Guinea, Liberia, and Uganda (Alexander et al., 2015; WHO, 2014, WHO, 2015). Dowell et al. (1999)'s cross sectional study from Kikwit, Democratic Republic of the Congo demonstrated that reported touching the body fluids of an ill person (RR, 3.6; 95% confidence interval [CI], 1.9–6.8), was strongly predictive of Ebola infection status.

Although it has been shown that the variable touch body fluids of sick person is potentially connected with Ebola status, the characteristics explaining such relationship among women and men aged 15 to 49 years in the country have not been fully and systematically evaluated. Thus, this slows down Ebola preventive intervention efforts in this area. I therefore tested the relationship between the variable touch body fluids and Ebola status to provide the relevant information public health officers and other stakeholders could use to evoke Ebola risk factor behavioral change in the community around Sierra Leone (Alexander et al., 2015; WHO, 2014, WHO, 2015).

Traditional healers care and Ebola. According to Mueller (2014); WHO (2017), another important cultural practice that contributes to the transmission of Ebola virus in Africa is dependence on traditional healers for care, a practice that has been utilized in local communities in Africa, several years before the 2014 Ebola outbreak in West Africa. Several scholars acknowledge that most communities in Africa still attribute cause of disease to practices related to witchcraft, and punishment for disobeying Gods or anger from ancestral spirits, and that traditional healers possess special powers to cure the individual (Alexander et al., 2015; Manguvo & Mafuvadze, 2015) Also, Alexander et al. (2015) say that across communities in Cote d'Ivoire and Ghana, 70% of the population relies heavily on traditional medicine for care, while in Burkina Faso and the DRC, it is approximately 80% of the population. This trust and high respect for traditional healers may explain why various individuals in the local community in Africa rely heavily on traditional healer practices for a cure (Alexander et al., 2015; Manguvo & Mafuvadze, 2015). Report from the United Nations Development Group (UNDP) (2015) indicate that

during the 2014 Ebola epidemic in Sierra Leon, many people believe Ebola is a curse visited on those people who break customary laws, and that traditinal healers have the gift to remove the curse and cure the disease and so they seek traditional healer care instead of seeking medical care. There by increasing Ebola infection or transmission. They also mentioned that many individuals abstained from seeking medical services from health clinics and Ebola health facilities due to lack of proper Ebola knowledge and fear of contracting Ebola from health care workers and might have resorted to seeking care from traditional village healers.

Interestingly, the majority of traditional healers engages in high-risk behaviors and practices that are result in exposure to blood (Mueller, 2014). For example, in Uganda, traditional healers practice cutting and sucking, and rubbing mixture of ashes from leaves, and tree backs into the wound of individuals, potentially exposing themselves to the patient's blood in an attempt to heal the sick, including Ebola patients (Alexander et al., 2015; Manguvo & Mafuvadze, 2015). However, this high-risk behavior is usually performed without utilizing proper protective gear (Manguvo & Mafuvadze, 2015). According to Manguvo and Mafuvadze (2015); WHO (2014); WHO (2015), human-to-human transmission of Ebola occurs via direct contact with body fluids of the infected. So it is likely why several people including traditional healers themselves contract Ebola through these high-risk practices and spreading the virus to their patients (Manguvo & Mafuvadze, 2015; WHO, 2014; WHO, 2015).

Previous interviews with traditional healers in various communities in Africa, revealed that such risky practice may have also been contributory factors in the infection

and deaths of traditional healers and several other individuals during previous Ebola outbreak in Uganda, and the recent 2014 epidemic in Guinea and Sierra Leone (Kunii, Kita, & Shibuya, 2001; WHO, 2014; WHO, 2015; WHO, 2017). A study that was published in 2003 described traditional healers of EVD in Northern Uganda. The author found that behavior of a traditional medicine female healer who died of Ebola led to the death of more than ten people in the local community (Hewlett & Amola, 2003).

The heavy burden of Ebola among women and men population during the 2014 Ebola epidemic in Sierra Leone, indicate that understanding the link between traditional healer care risky behavior and Ebola virus infection is essential to preventing future Ebola outbreak. However, few studies with comprehensive and such pertinent information exist, particularly for relationship between traditional healer care behavior and Ebola virus infection among women and men aged 15 to 49 in Sierra Leone, slowing down Ebola preventive interventions for this risk factor in this group. Therefore, I sought to fill this information knowledge gap by examining the relationship between this variable and Ebola virus infection status in the study population to offer better information to improve Ebola health behaviors promoting programs among this population.

Research Methodologies Found

Most of the research literature reviewed to address the current research questions presented methodologies that utilized qualitative techniques including interviews and community observations to understand the reasons for various decisions and actions. Some utilized quantitative techniques and applied statistical analysis based on secondary

data collected by credible organizations, healthcare care facilities, or governments to determine their results, while a few conducted systematic reviews and meta-analysis studies examining previously published research to look at the complex issue and identify trends and determine the depth and reliability of various results. Also, other techniques utilized mixed methods to gather in-depth information about a particular phenomenon at hand. While these approaches provided vital information, they also had advantages and disadvantages. Some examples of each type of study are presented in this discussion section.

Qualitative studies enable researchers to reach and involve various women who, could not afford to visit Ebola health centers due to transportation, financial constraints or fear of contracting Ebola virus in these centers, to understand the meaning of their experiences, cultures with Ebola in their local communities (Kuehne et al., 2016; Ly et al., 2016; United Nations Development Group, 2015). This type of studies also has the advantage of allowing household members who were present at the time Ebola was affecting their household to be interviewed for pertinent Ebola information to get further explanations of complex Ebola occurrences in the community (Bower et al., 2016). However, this approach is limited by the number of individuals who can be included in a study due to the high cost, researcher time and availability. Also, these studies are usually restricted to a single location (Bower et al., 2016; Creswell, 2009; Frankfort-Nachmias & Nachmias, 2008). They may also require elaborate IRB paperwork (Creswell, 2009; Frankfort-Nachmias & Nachmias, 2015).

Quantitative studies generally have the advantage of providing larger numbers of participants, opportunity for researchers to do proper statistical analyses to examine the relationships between variables of Ebola disease, and present results using graphs and tables to summarize large information for clarity as well as to support generalizations regarding Ebola phenomenon (WHO Ebola Response Team, 2016; Creswell, 2009; Dietz et al., 2015). It also helps provide numerical information about the quantity or amount of what is being investigated such as Ebola disease. But they have the disadvantage of excluding or under-represent the certain population of individuals, for example, those women who choose not to utilize Ebola health centers (WHO Ebola Response Team, 2016; Dietz et al., 2015). Also, large-scale quantitative studies usually utilize secondary data from previous government or international organizations such as the WHO data collection efforts as the basis for their studies (Dietz et al., 2015). This limits the specific data items that can be utilized in the analysis to those collected in the prior survey (Creswell, 2009; Dietz et al., 2015; Frankfort-Nachmias & Nachmias, 2015; Senga et al., 2016).

The Systematic review and Meta-analysis studies did one overview of individual studies based on their content to draw large-scale conclusions about the issue, such as Ebola (Brainard et al., 2016; Cresweill, 2009; Nkangu et al., 2017). These studies mostly covered two or more countries, and a wide range of time, so the results of individual studies had to be evaluated carefully for consistency of measurement and content (Brainard et al., 2016; Nkangu et al., 2017). Systematic reviews and Meta-analysis studies have the advantage of providing extensive and comprehensive literature and are

usually considered the highest quality of evidence. They can also help address complex issues, increase the precision of certain estimates, and help resolve discrepancies. But, conducting them can be difficult, particularly, when each study analyzed uses different methodologies, diverse populations and samples, and different research questions (Brainard et al., 2016; Cresweill, 2009; Nkangu et al., 2017).

Summary and Conclusions

Relevant Factors Identified in the Literature

The effects of the 2014 Ebola virus disease epidemic in West Africa, particularly Sierra Leone are based on several possible factors identified in the literature. These include socio-cultural, behavioral, and demographic factors (Adongo et al., 2016; WHO Ebola Response Team, 2016; Alexander et al., 2015; Bower et al., 2016; CDC, 2015; Dietz et al., 2015; UNDG, 2015). Several studies including, Fawole et al. (2016); Nkangu et al. (2017); UNDG (2015), noted that women and men had high proportions of Ebola cases during the 2014 Ebola virus disease in Sierra Leone. Furthermore, various factors of gender inequality in Ebola virus disease infection were identified in the literature. More than ten studies examined socio-cultural and behavioral factors, including close contact with Ebola patients in the later stages of infection; caring for a sick person; preparing the recently deceased for burial, and preparing and consumption of contaminated bush meat, as potential Ebola virus disease determinants in African populations, particularly Sierra Leonean populations. Some of these studies include Alexander et al. (2015); Brainard et al. (2016); Fawole et al. (2016); Manguvo and Mafuvadze (2015); Ravi and Gauldin (2014).

The participation of women in the risky behavior of the burial ritual of Ebola-infected corps, 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 per taking in culturally specific risk behavior compared to men in the local community, and due to these culturally-specific behaviors, women are at a greater risk of contracting Ebola disease. Studies have not shown the biological difference to increase women's risk for Ebola (Fawole et al., 2016; Nkangu et al., 2017; Sia et al., 2016). The information about Ebola disease incident among individuals of all ages during the Ebola virus disease outbreak in the country was also very useful (Dietz et al., 2014; WHO Ebola Response Team, 2014).

Studies identified key research methodologies that include qualitative techniques, quantitative techniques, and systematic review and meta-analysis studies used to investigate health outcomes such as Ebola virus disease (WHO Ebola Response Team, 2016; Brainard et al., 2016; Dietz et al., 2015; Kuehne et al., 2016; Ly et al., 2016; Nkangu et al., 2017). Moreover, reviewed literature on McLeroy, and colleagues' (1988) proposed Ecological model frame revealed that more than five scholars acknowledge that a key to understanding infectious diseases such as the Ebola disease in women and men is the recognition that the determinants of Ebola occur on multiple levels, from the individual woman, man to His or Her household, to the community, and policies (Glanz et al., 2008). Alexander et al. (2015) and several other researchers focused on

establishing that Ebola virus disease, due to its nature of transmission, is particularly influenced by cultural and behavioral practices that occur at the household and community levels and within a hospital setting.

Furthermore, the review revealed few studies that benefited from utilizing McLeroy, and colleagues' (1988) Ecological model which provides a broad theoretical framework for explaining multiple factors that influence health in a community. The model helped them examine the intrapersonal or individual level factors; interpersonal or family level factors; community-level factors; society levels factors, and policy levels factors that affect the health of the community instead of the factors that affect individuals (Cassel, 2010; Glanz et al., 2008; Jere et al., 2017; Wilcox & Echaubard, 2017). Findings from this review confirmed Glanz et al. (2008)'s belief that this model is suited for providing an overarching framework for understanding diseases such as Ebola disease characteristics among a population such as women and men aged 15 to 49 in Sierra Leone.

Gaps in the Research

The 2014 Ebola outbreak devastated Sierra Leone, and a number of studies have established high Ebola virus infection proportion among women and men in Sierra Leone during the 2014 Ebola epidemic (Ravi & Gauldin, 2014). The determinants of Ebola disease may vary among women and men aged 15 to 49 years in Sierra Lone and required a thorough evaluation. Understanding and addressing the various Ebola risk behaviors in this population could help improve healthcare delivery and research efforts around the disease in Sierra Leone. This may help to inform gender and age-specific interventions

for mitigating the spread of the disease and can assist policymakers and public health decision-makers to organize the most appropriate health intervention programs to prevent or fight the spread of the disease. According to WHO Ebola Response Team (2016), public health efforts and measures to minimize community-based transmission might gain from awareness of sex-specific differences in Ebola disease.

Previous studies of Ebola virus disease among women and men in Sierra Leone focused oddly on the broader attention to the disease (Alexander et al., 2015; Dietz et al., 2015). Some of the studies provided less and unclear data on the characteristics of the disease in the community around the country. Almost no research was identified that specifically investigated the relationship between potential socio-cultural, behavioral, and demographic factors and Ebola virus disease status among women and men aged 15 to 49 years in Sierra Leone. To address this knowledge gap observed in the literature and to provide up to date information on the problem associated with Ebola in this study population, I used data from the Sierra Leone Ebola disease data (SLED) data and performed cross sectional study analysis to fully characterize and quantify the extent to which particular social-cultural, behaviors, and demographic factors may increase or decrease the likelihood of contracting the disease in this specific population. The following chapter presents a complete description of the methodology used in researching the stated research questions.

Chapter 3: Research Method

The purpose of this quantitative, descriptive, cross-sectional study was to examine relationships between sociocultural, behavioral, and demographic factors and EVD infection status among women and men ages 15 to 49 years in Sierra Leone, with a plan to recommend appropriate public policy and other responses for future Ebola disease outbreaks. In this study, I attempted to answer the following research questions: Are there associations between sociocultural and behavioral factors and Ebola infection in women and men ages 15 to 49 during the 2014 Ebola outbreak in Sierra Leone? What are the significant predicting sociocultural and behavioral risk factors (possible funeral attendance, funeral touched body, contact with sick person, preparation and consumption of primate meat), respondent's gender, respondent's age group, and housewife/caretaker occupation for Ebola disease status among women and men ages 15 to 49 during the 2014 outbreak in Sierra Leone?

The ecological model was used as a framework to guide the study. Chapter 2 addressed pertinent literature on Ebola disease in women and men to lay the foundation for what is known about the 2014 EVD outbreak in Africa. The literature did not address determinants of Ebola status among women and men ages 15 to 49 years in the country, a gap the current study addressed. A better understanding of Ebola predictor and risk factors that impact this population can be useful to guide public health policy and practices, improve health care quality, and prevent future Ebola infection in this at-risk population. Chapter 3 includes detailed descriptions of the steps that were followed to conduct the study. I also present the research questions and hypotheses, variables,

research design and approaches, research methodology, study population and locations, steps that were followed to safeguard participants, data management, data analysis (Chi-square test of association and backward elimination logistic regression), reliability and validity, and dissemination of the study results.

Research Design and Rationale

Study Variables

This study's measured categorical dependent variable (outcome) was a diagnosis of EVD status (suspect, probable, Ebola confirmed, or not a case) determined by a Ebola-specific RT-PCR blood result (see Creswell, 2009, WHO, 2015). The measured categorical independent (explanatory or predictor) variables were certain behaviors (possible funeral attended, funeral touch body, contact with sick person, hunted/touched/ate primate) and demographic factors including gender, age, and housewife/caretaker status. The associated covariate variables for this study included touch body fluids, traditional healer care, and traditional healer occupation. These were covariate variables because of the significant differences between Ebola disease and the health determinants by these factors among women and men (see Creswell, 2009; Frankfort-Nachmias & Nachmias, 2008).

These particular variables allowed for a direct analysis and thorough comparison of the Ebola disease status and risk factor in women and men aged 15 to 49 years in Sierra Leone (Creswell, 2009; Frankfort-Nachmias & Nachmias, 2008). I used the certain behaviors (possible funeral attendance, funeral touched body, contact with sick person, preparation and consumption of primate activity), and demographic factors respondent's

gender, respondent's age group, and housewife/caretaker occupation risk factor of respondents as the independent variable since they are not manipulated by the person conducting the research, in addition to the major assumption made that these factors are going to have an impact on Ebola disease or diagnosis of the disease (Creswell, 2009; Frankfort-Nachmias & Nachmias, 2008).

The data for this cross-sectional study was obtained from the Sierra Leone Ministry of Health and Sanitation combined survey data, Sierra Leone Ebola disease (SLED data), conducted in 2014 to 2015 by the CDC, WHO, France, England, Canada, and the government of Sierra Leone. This data helped answer the two research questions, and each possible determinant used in this study was standardized for data analysis. The data obtained for this study was manipulated to create new variables to make it possible to make a comparison and to be able to answer the research questions for this current study (Creswell, 2009; Frankfort-Nachmias & Nachmias, 2008).

Research Design

According to Creswell (2009); Frankfort-Nachmias and Nachmias (2008), the research design systematically helps plan and align study problem to the research, and shows the appropriate data and method of collection and analyzing it to answering the research question at hand. So, this study utilized a quantitative, descriptive, retrospective cross-sectional study design approach to investigate and to compare the possible demographic, behavioral and socio-cultural risk factors associated with 2014 suspect, probable, confirmed cases and not a case of the Ebola virus disease epidemic among women and men ages 15 to 49 years in Sierra Leone. I analyzed secondary data from the

2014 Ebola outbreak in Sierra Leone (the Sierra Leone Ministry of Health and Sanitation combined survey data, Sierra Leone Ebola disease (SLED) data) to test associations between the independent and dependent variables as well as the predictive ability for Ebola infection. As Creswell (2009); Frankfort-Nachmias and Nachmias (2008) noted, secondary data analysis is using existing data previously collected by another individual, government agent or organization and includes survey data, statistics, and records. It was a good fit for this study since secondary data are mainly quantitative, and this study required large data sets to establish potential associations (Creswell, 2009; Frankfort-Nachmias and Nachmias, 2008). The possible determinants of Ebola transmission in this population was gathered from this credible survey. Creswell (2009); Frankfort-Nachmias and Nachmias (2008) defined quantitative research as a systematic and scientific inquiry of specific data, such as the (SLED data), with the purpose of examining the relationship between variables or prediction. The authors noted descriptive, correlational, quasi-experimental, and experimental studies as examples of quantitative designs commonly utilized in social science, health science, and in this cross-sectional study.

Rationale for the Design

The cross-sectional study design is done to estimate a population parameter such as the proportion of some disease, for example, Ebola in a community. It is vital in helping to answer the evaluative and descriptive research questions for characterizing Ebola in this study population in Sierra Leone, and also illustrate various aspects of the Ecological model. It provides a better opportunity for examining the relationship between different variables, such as Ebola status and funeral attendance activity with the use of

appropriate statistical analysis software (Creswell, 2009). Furthermore, scholars have noted that the design is capable of using the smaller sample to make inferences about very larger groups that would otherwise be too expensive and even very harder to study (Creswell, 2009; Frankfort-Nachmias & Nachmias, 2008).

The Ebola virus disease data was available through the Ministry of Health and Sanitation, Sierra Leone and CDC, as this information was collected by credible international agencies such as CDC, WHO, other stakeholders and the Sierra Leone government from clinics, hospitals, and interviewing patients or family members. Creswell (2009); Frankfort-Nachmias and Nachmias (2008) mentioned that national survey databases, such as the one that was used for this study, gather data on large populations, capable of been representative of the general population, and allows for generalizability of study results. They also acknowledged that secondary data provide vital information on previous activities and behaviors on large samples or populations, saves time and money, and provide reliability and validity. Furthermore, large studies have utilized secondary data, chi-square, logistic regression, and different statistical methods to analyze the risk factors and the effect of various infectious diseases such as Ebola in communities in Africa (Bower et al., 2016; Dietz, Jambai, Paweska, Yoti, & Ksaizek, 2015; Haaskjold et al., 2016). Also, based on the aim of this study, the cross-sectional analysis of secondary data utilizing simple descriptive statistics, chi-square, and backward logistic regression was most appropriate to compare the possible socio-cultural and behavioral factors of the Ebola virus disease among women and men aged 15 to 49 years in Sierra Leone.

According to Creswell (2009), the type of descriptive study, as the one used for this current study are advantageous in that majority of the time; the data are already available and thus saves time and money to utilize. Furthermore, few ethical barriers exist for their use. However, descriptive studies have important limitations. For example, temporal associations between likely causes and effects might be unclear, and a major pitfall is that the researchers might attempt to draw causal inferences when none exist (Creswell, 2009; Frankfort-Nachmias & Nachmias, 2008). Additionally, utilizing secondary data analysis poses the challenge of possible limitations such as incomplete or missing data that renders it unusable for the secondary data analysis (Creswell, 2009; Frankfort-Nachmias & Nachmias, 2008). This descriptive and cross-sectional study design helped assess the Ebola disease health status of women and men aged 15 to 49 years in Sierra Leone and helped us search for clues of Ebola disease, and used the information to make better decisions regarding policy and program directions in Sierra Leone.

Time and Resource Constraints

For this particular study, I analyzed secondary data from existing national survey from the 2014 Ebola outbreak in Sierra Leone (the Sierra Leone Ministry of Health and Sanitation combined survey data, Sierra Leone Ebola disease (SLED data) so time and resources were not of a major constraint. As Creswell (2009) emphasized, a unique advantage of secondary data analysis is the fact that majority of the time, the data are already available and thus saves time and money, especially providing the opportunity to access electronically stored data remotely using internet technology. But sometimes, the

process of obtaining approval from the authors of the original survey may take time and delay the process of data analysis (Creswell, 2009; Frankfort-Nachmias & Nachmias, 2008). Fortunately, in this study, I did not encounter delays since application for SLED dataset was conducted electronically and the SLED protocol allows students to use the data for secondary analysis. Furthermore, since the data was collected by other entities, I did not pay for data collection, so it did not require large resources to be conducted. Therefore time and resources were basically not constraints for this study.

Methodology

Target Population and Size

Sierra Leone is a small and developing country with a population of approximately 6.5 million people and was the focus of this study (Dietz et al., 2015; Senga et al., 2016; UNDG, 2015). In 2014, Ebola disease affected several individuals in the country, especially women and men aged 15 to 49 years. However, not much data is available characterizing Ebola disease, socio-cultural, behavioral, and demographic factors in this specific population in the country. Since this research focused on examining Ebola characteristics and potential risk factors in women and men ages 15 to 49 years in Sierra Leone during the 2014 Ebola epidemic, the target population consisted of all women and men 15 to 49 years with a suspected, probable, confirmatory Ebola-positive RT-PCR blood result, and not a case during the 2014 Ebola epidemic in Sierra Leone. All these individuals in the database were included. These population, were at high risk for Ebola infection, possibly due to engaging in risky Ebola health behavior and socio-cultural activities (Bower et al., 2016).

Data Collection Associated With the Secondary Data Set

The data source for addressing this quantitative research problem and answering the research questions for this study was secondary data collected by the Ministry of Health and Sanitation of Sierra Leone and credible international agencies combined data (SLED) data, from 2014 to 2015. This database includes all Ebola virus disease incidence and case records for individuals of all ages and sex in Sierra Leone. I used the most current EVD data available from the Sierra Leone Ministry of Health and Sanitation (SLED) data. Patient demographic information including age, sex, and occupation, and risk factors or possible determinants of transmission for all persons who had suspected, probable, laboratory-confirmed EVD, which was identified by reverse-transcription polymerase chain reaction (RT-PCR), and not a case were collected from this data. The Sierra Leone Ebola disease (SLED) data is a reputable source of data because it ensures standardization and comparability of surveys across the various districts in the country and time. Moreover, trained interviewers, healthcare workers, including phlebotomists, surveillance officers, nurses, physicians, and Red Cross volunteers were utilized to complete case investigation forms. These professionals and other individuals interviewed patients or relatives utilizing a standardized case investigation form and measurement techniques, and a similar core set of survey questions and collected information, such as address, age, sex, occupation, date of symptom onset, possible exposures, and symptoms (Cori et al., 2017; Dietz et al., 2015; McNamara et al., 2016). The current study was exempted from ethical committee review as a result of the

anonymous nature of this data, and public access to it. But, permission from the Ministry of Health and Sanitation, Sierra Leone was needed to access the dataset for use.

Sample and Sampling Procedure for Current Study

Quantitative methods allow researchers to utilize smaller groups of people to make inferences about larger groups that would normally be too expensive to study according to (Creswell, 2009; Frankfort-Nachmias & Nachmias, 2008). So, obtaining the appropriate sample required to infer research results back to a population of interest is vital for effective study. The sample size is one of the components of a study design that can influence the detection of significant differences, interactions, and relationships. Therefore sample size selection is one of the tools needed to properly conduct successful research (Creswell, 2009; Frankfort-Nachmias & Nachmias, 2008). For this study, the sampling frame was the list of all women and men ages 15 to 49 years who participated in the SLED surveillance 2014 to 2015 surveys. In the sample, I included all the participants who met all the relevant inclusion criteria set in this study since all the data were available and could easily be analyzed. Inclusion of all eligible participants increased the methodologic rigor of my study, and increased power and population validity. It also increased statistical significant difference.

Trained healthcare workers, such as nurses completed standardized case investigation form by interviewing patients or family members and collected information, such as address, age, sex, occupation, date of symptom onset, possible exposures, and symptoms. Information from this form was entered 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 entered into the patient's case record in the VHF surveillance system as results were reported to the various organizations 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 data, the SLED database, which was available through the Sierra Leone Ministry of Health and Sanitation and the CDC this year.

This study assessed 2014-2015 Ebola data that was compiled by the Ministry of Health and Sanitation, CDC and made available April 2019. This was the most updated and comprehensive data that was available for Ebola in the country. The exclusion of data from before 2014 and after 2015 is based on the fact that, no official Ebola outbreak was declared by the government of Sierra Leone and WHO until 2014 and the deadly Ebola disease was officially declared over in 2015. Furthermore, death situations for which no Ebola diagnosis was made was excluded, this may result in missing data for patients who died before getting to the clinic or may have died of disease such as malaria or HIV/AIDS other than Ebola. Demographic variables which were extracted from the Ebola database included patient age, sex, and occupation.

Sample Frame: Inclusion and Exclusion Criteria

The inclusion criteria utilized for this study was that: sample was selected if the participant was female or male; aged 15 to 49 years; were tested for Ebola virus and had an Ebola result diagnosed with Ebola case (confirmed case), suspected, probable, and not a case, and patients data was for patients treated in Ebola clinics set up in Sierra Leone

from 2014 to 2015 Ebola outbreak period. Inclusion of all eligible participants increased the methological rigor of this. This group 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; Senga et al., 2016; WHO Ebola Response Team, 2016). 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 body1, contact sick person, hunt touched ate primate), and demographic factors gender, person's age, and House wife/care taker.

The exclusion criteria that was used for this study were: patient data at the hospitals or clinics before 2014 was excluded, since the Ebola outbreak was first reported and documented in 2014 and information before this period were not included in the database; data for all malaria patients misdiagnosed for Ebola at the hospitals or clinic from 2014 to 2015, since malaria symptoms were similar to Ebola symptoms, resulting in many malaria patients been misdiagnosed for Ebola and this could potentially affect the result. So, after diligently applying the inclusion and exclusion criteria for this study, total of 17,230 women and men aged 15 to 49 years in the 2014 to 2015 Ebola survey who were interviewed and had an Ebola specific RT-PCR test result were eligible for inclusion in the current study.

Sample Size Calculation and Power Analysis

A well-developed study design requires proper computation of power and sample size. In social science and public health research, it is vital to show a meaningful

statistical significant difference between groups, and calculating sample size help accomplish this, according to Faul, Erdfelder, Lang, and Buchner (2007). Also, Creswell (2009); Faul et al. (2007); Frankfort-Nachmias and Nachmias (2008) indicated that the power of a statistical test is the probability that the stated null hypothesis would be rejected when it is false, and power analyses are vital for rational statistical scientific decisions. Therefore, vital and meaningful tests should have the statistical power that would enable them to reliably discriminate between the null hypothesis and the alternative hypothesis of interest, according to Creswell (2009); Faul et al. (2007); Frankfort-Nachmias and Nachmias (2008). These authors also, noted that control focuses on the probability of rejecting the null hypothesis that sample estimates do not statistically differ between study groups in the target population.

According to Faul et al. (2007), setting the significant value of power to 80% or .80 or higher is appropriate for well-developed research, since it increases the probability of detecting any difference between study groups. This value is also a classical number frequently utilized in social science and public health research (Faul et al., 2007). In general, the higher the power, the higher the sample size would be, as Faul et al. (2007) noted. An alpha level of 0.05 was used for this study since this number is commonly utilized in determining the sample size for academic research studies (Faul et al., 2007; Frankfort-Nachmias & Nachmias, 2008). Alpha is the probability of making the wrong decision when the null hypothesis is true, and could take the form of Type I error where by the alternative hypothesis is supported when in fact the null hypothesis is true. It also entails Type II error which is failing to support the alternative hypothesis when in fact the

alternative hypothesis is true (Faul et al., 2007; Frankfort-Nachmias & Nachmias, 2008). Also, the effect size parameter was set at 0.15, which is considered as medium effects size for social science studies. Most researchers have found that a good and useful method of calculating the effect size is to utilize Cohen's method since this method is well established (Faul et al., 2007; Frankfort-Nachmias & Nachmias, 2008). The effect size, as noted by Faul et al. (2007; Frankfort-Nachmias & Nachmias (2008) provides an indication of the strength of a relationship.

Therefore, this cross-sectional study used the open-source statistical power application or software, G*Power 3.1.9.2 (a general power analysis program) to conduct a power analysis to help determine appropriate sample size for the study. This software is free and can be downloaded from the internet. Furthermore, this item provides a user-friendly interface and give researchers the opportunity to perform several types of power analyses (Faul et al., 2007; Kimberlin & Winterstein, 2008). Researchers have also found that the program allows for graphical display of the relation between any of the relevant variables, and it offers the opportunity to calculate the effect size measures from simple parameters defining the alternative hypothesis (Faul et al., 2007; Kimberlin & Winterstein, 2008). G*Power is utilized for many statistical tests commonly used in the social, behavioral, and biomedical sciences.

Furthermore, since this current study utilized backward elimination logistic regression statistical test, it is emphasized that researchers use methods to determine the sample size that incorporates effect size (Faul et al., 2007; Kimberlin & Winterstein, 2008). So G power is a good fit for this study since it estimates minimum sample size as

a function of effect size as well as the number of predictors (Faul et al., 2007; Kimberlin & Winterstein, 2008).

After application of the inclusion and exclusion criteria, the sample size for this study was 17,230 women and men aged 15 to 49 years, of which 8,305 were females and 8,925 were males from the SLED surveys. To calculate the required minimum sample size for this particular cross-sectional study, a G power analysis was used based on the parameters of Effect size (0.15) medium, (alpha 0.05), power (0.80 or 80%), and some predictors (7) yield about 103. Thus, this procedure helped improve the methodological rigor of the study and to guarantee a better result (Creswell, 2009). According to Creswell (2009); Frankfort-Nachmias and Nachmias (2008), using the appropriate sample in addition to high-quality secondary data, such as the (SLED) data can result in more reliable, valid, and generalizable results, in addition to causing significant resource and time savings.

In general, two important decisions should be considered before conducting sample size analysis: 1. Knowing the type of statistical test that would be used for the study, and 2. knowing the independent or predictor variables in the study. The type of statistical test for this study was determined by the number of dependent and independent variables in the study and their levels of measurement. Also, the independent variables were determined by assessing what variables were exerting influence on the dependent variable (Ebola virus disease status) (Creswell, 2009; Frankfort-Nachmias & Nachmias, 2008; Frankfort-Nachmias, Nachmias, & DeWaard, 2015; Faul et al., 2007). Sampling was a major influential component of conducting this research in this study population, so

I ensured that it was properly designed to prevent biased results that would mislead other researchers, policymakers, and practitioners (Creswell, 2009).

Permission to Access Data

The SLED data set are stored by the SLED survey program which is managed by Ministry of Health and Sanitation Sierra Leone with support from CDC. To access the SLED data set, I submitted a research proposal form and a RDC-Student Advisor Agreement form through online to the Ministry of Health and Sanitation Sierra Leone and CDC for access to data. Then I completed a rigorous SLED and CDC certification process to ensure appropriate use of the data after my proposal was approved. I was granted permission via email to use the dataset for the national SLED survey. Once data was available, I abstracted individual data for all eligible participants.

Data Management

Once the Ebola database becomes available, I identified the variables of interest for this study. The statistical software SPSS version 25.0 (IBM) was used to conducted data cleaning and screened the data for accuracy, missing data, and outliers to ensure inclusion of data sets that fully met the inclusion criteria set for this study. The total number of cases women and men aged 15 to 49 that were in the SLED file was 34,715. During data cleaning and review, I discovered that the missing data value 9 had not been defined. So, I defined it as a discrete missing value using transform method to allow for exclusion of the missing value 9 from any SPSS analysis. After this, the total number of cases remaining were 17,230 women and men aged 15 to 49 years, of which 8,305 were females and 8,925 were males from the VHF surveys. This study analysis was conducted

on this final data set that excluded missing data and met the criteria set for this study. Furthermore, I created dummy variables and grouped variable levels using transform method for variables that had more than two levels for backward elimination multiple logistic analysis purposes. I recoded and created a dummy variable for the dependent variable Estatus to nEstatus. The new Ebola status variable had two groups and was coded as 0 for not a case and 1 for suspect/probable/confirmed (Field, 2013, Frankfort-Nachmias , Nachmias & DeWaard, 2015. Green & Salkind, 2014, Wamala et al., 2010). I also recoded the independent variable age into a new variable nAge with two groups (that included two age groups 15-29, 30-49). These two age group variables were coded as 1= 15-29, and 2 = 30-49. Then, I used the new recoded variable for this cross-sectional study analysis on the final data. Furthermore, frequencies, graphs, and charts were generated for further analysis of the data. Also, strict confidentiality of the data information was maintained, and data was available only to my chair and committee members.

Instrumentation and Operationalization of Constructs

Data for the SLED survey was collected using trained interviewers, healthcare workers, including phlebotomists, surveillance officers, nurses, physicians, and Red Cross volunteers were utilized to complete case investigation forms. These professionals and other individuals interviewed patients or family members utilizing a standardized case investigation form and measurement techniques, and a similar core set of survey questions and collected information, such as address, age, sex, occupation, date of symptom onset, possible exposures, and symptoms (Cori et al., 2017; Dietz et al., 2015; McNamara et al., 2016).

Ebola virus infection testing was performed. For this procedure, whole blood from live patients and oral swab specimens from corpses were tested utilizing Ebola virus–specific RT-PCR–based testing in designated laboratories in Sierra Leone to identify Ebola virus infection disease (Dietz et al., 2015; McNamara et al., 2016). Ebola disease was normally detected within 72 hours after symptom onset in patients with EVD, and for symptomatic persons whose blood sample yielded indeterminate or negative results were recommended to have a second specimen collected ≥72 hours after symptom onset and tested (Dietz et al., 2015; McNamara et al., 2016).

Validity and Reliability of the Instruments

Validity and reliability were ensured in the SLED standard questioner used in the 2014 SLED survey. The reliability entails the degree to which an assessment tool produces stable and consistent answers regardless of who asks the question, when, and where (Creswell, 2009; Frankfort-Nachmias & Nachmias, 2008; Frankfort-Nachmias, Nachmias, & DeWaard, 2015; Faul et al., 2007). While as validity in data collection signifies that study findings truly represent the phenomenon one claims to measure, and that question asked would elicit a true and accurate response of the desired measure (Creswell, 2009; Frankfort-Nachmias & Nachmias, 2008; Frankfort-Nachmias, Nachmias, & DeWaard, 2015; Faul et al., 2007). In the SLED's, translation of the questionnaires into the major local languages of Sierra Leone for example English, in which interviews conducted, and pre-testing of the tools prior to administration was done to ensure validity and reliability. The use of translated questionnaires minimized errors that could easily arise when interviewers attempted to translate of questions Creswell,

2009; Frankfort-Nachmias & Nachmias, 2008; Frankfort-Nachmias, Nachmias, & DeWaard, 2015; Faul et al., 2007).

Variables and Measures

My variables are derived from the literature and ecological model, and the Sierra Leone Ebola Database (SLED) VHF Data Dictionary was used to identify and score both independent and dependent variables for this study.

Dependent variable. This study's measured dependent variable (outcome) is: EpiCaseDef (Ebola status): In the SLED survey, they obtained Ebola virus status (dependent variable) through Ebola-specific RT-PCR blood testing result for Ebola, and not a case result was coded 0, Ebola confirmed result was coded 1, probable was coded 2, and suspect; blank was coded 3. (that is the number of people in each category).

Independent variables. The measured independent (explanatory or predictor) variables are the following:

- Gender (Gender): Information on gender of the respondent was obtained by asking what is the sex of the patient, and was categorized, male =1; female =2, and blank = 9
- Age u (Age): Age as identified in SLED survey was assessed with four age-group items as follows: 15 to 19 years; 20 to 29 years; 30 to 39 years; and 40 to 49 years. This information was obtained by asking the question on how old were you at last birthday?

- Funeral (Funeral Attended) Yes = 1, No = 2, and, Blank = 9. This information was obtained by asking the question on whether the patient attended a funeral within one month of the date of symptom onset.
- FuneralTouchBody1 (Participation in funeral): Yes = 1, No = 2, and, Blank = 9. This information was obtained by asking the question on whether the patient participated in the funeral within one month of the date of symptom onset, by carrying or touching the dead.
- Contact (Contact with a sick person): Information on contact with a sick person was obtained by asking, whether the patent had contact with at least one sick person the last month prior to his or her symptom onset, whether the sick person was a known case, suspect case, or not a case, and was categorized yes =1; no = 2, Unknown, no, yes, and blank = 9
- Contact11 (Touch body fluids): Information on touch body fluids was obtained by asking, whether the patent touched the body fluids (blood, vomit, saliva, urine, feces) of the first sick person that the patient was exposed to within one month before the patient became ill, and was categorized True = 1, False = 2, Blank = 9.
- TradHealer (Traditional healer care): Information on traditional healer care was obtained by asking, whether the case patent consulted a traditional healer before becoming ill, and was categorized Yes =1, No =2, Blank = 9
- AnimalPrimates (Hunt touch ate primate): Information on preparation and consumption of primate activity was obtained by asking, whether the patent

hunted, touched, ate, or had any other kind of direct contact with primates (monkeys), and was true = 1, false = 2, Blank = 9

- Housewife (Housewife): This information was obtained by asking the question on what is the main occupation of the patient, and was categorized into three areas as follows: true = 1, false =2, blank = 9.
- TraditionalHealer (Traditional healer): Traditional healer occupation status was categorized into three areas as follows: True = 1, False = 2, blank = 9. This information was obtained by asking the question on what is the main occupation of the patient?

Covariate variables: For this study, based on the integrated ecological model developed by MacLory and colleagues (Glanz et al., 2008), and on previous research (Creswell, 2009; Field, 2013; Forthofer, Lee, & Hernandez, 2007; Frankfort-Nachmias & Nachmias, 2015), the associated covariates are touch body fluids, traditional healer care, and traditional healer occupation.

Rationale for Including Potential Covariates

They have a potential effect on the outcome of the study since Ebola disease status (dependent or outcome variable) depend on these factors. Also, they are predictors of Ebola disease outcome at the individual or interpersonal level. Some of them may be different than factors (Creswell, 2009; Field, 2013; Forthofer, Lee, & Hernandez, 2007; Frankfort-Nachmias & Nachmias, 2015; Glanz, Rimer, & Viswanath, 2008; Green & Salkind, 2014).

Data Collection

For this study of Ebola in women and men in Sierra Leone, the analysis was limited to women and men ages 15– 49 years with Ebola specific RT-PCR results of confirmed case, suspected, probable, and not a case as outcomes of interest in the SLED database, containing all data from the 2014 Ebola outbreak. Trained healthcare workers, such as nurses completed standardized case investigation form by interviewing patients or family members and collected information, such as address, age, sex, occupation, date of symptom onset, possible exposures, and symptoms. Information from this form was entered 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 entered into the patient's case record in the VHF surveillance system as results were reported to the various organizations CDC, WHO, and other surveillance groups in each health district (Dietz et al., 2015, Henwood et al., 2017; McNamara et al., 2016). Representatives from the Ministry of health and sanitation Sierra Leone, and the CDC compiled all the district data into one data, the SLED database. I used this secondary data for this study after obtaining approval from the Ministry of Health and Sanitation in Sierra Leone and the Walden IRB department (IRB approval number for this study is 03-14-19-0598302).

.

Data Analysis Plan

Research Questions and Hypotheses

Secondary data from the Sierra Leone Ministry of health and Sanitation 2014 to 2015 Ebola virus disease survey (SLED) database was used as a credible source to conduct the analysis. The dataset was obtained through application on line through (the NCHS Research Data Center, RDC/CDC). These data source is comprehensive and thus provides a more current number. I analyzed the SLED database using SPSS statistical software version 25.0 (IBM). In this data, I analyzed all suspected, probable, confirmed cases and not a case by sex, age, housewife occupation, reported attendance at a funeral, participation in funeral ritual, preparation and consumption of primates, contact with a suspected case patient or sick person during the month before symptom onset. Also, the covariates touch body fluids, traditional healer care, and traditional healer occupation were analyzed. The following present the research questions and associated hypothesis that provided guidance and the foundation for the empirical study procedure, and the organizing principle for the report for the current study. It also presents their corresponding hypothesis:

RQ1: Are there associations between sociocultural and behavioral factors and Ebola infection in women and men aged 15 to 49 during the 2014 Ebola outbreak in Sierra Leone?

H_o1: There are no statistically significant associations between sociocultural and behavioral factors and Ebola infection in women and men aged 15 to 49 during the 2014 Ebola outbreak in Sierra Leone

H_a1: There are statistically significant associations between the sociocultural and behavioral factors and Ebola infection in women and men aged 15 to 49 during the 2014 Ebola outbreak in Sierra Leone.

RQ2: What are the significant predicting sociocultural and behavioral risk factors (possible funeral attendance, funeral touched body, contact with sick person, preparation and consumption of primate activity), respondent's gender, respondent's age group, and housewife/caretaker occupation for Ebola disease status among women and men aged 15-49 during the 2014 outbreak in Sierra Leone?

H_o2: There are no statistically significant predicting sociocultural and behavioral risk factors (possible funeral attendance, funeral touched body, contact with sick person, preparation and consumption of primate activity), respondent's gender, respondent's age group, and housewife/caretaker occupation for Ebola disease status among women and men aged 15-49 during the 2014 outbreak in Sierra Leone.

H_a2: There are statistically significant predicting sociocultural and behavioral risk factors (possible funeral attendance, funeral touched body, contact with sick person, preparation and consumption of primate activity), respondent's gender, respondent's age group, and housewife/caretaker occupation for Ebola disease status among women and men aged 15-49 during the 2014 outbreak in Sierra Leone.

Statistical Analysis

The Ecological Model framework proposed by Maclorye and collegues 1988 was specified a priori to guide the cross sectional study analyses. Data were analyzed with SPSS statistical software version 25.0 (IBM). SPSS is a comprehensive system for

analyzing data which is capable of analyzing data to generate tabulated reports, charts, and plots of distributions and trends, descriptive statistics, and complex statistical analysis (Green & Salkind, 2014). It also allows for sample strata, and weighing frequency. Descriptive statistics were used to describe characteristics of the study sample and included frequencies and percentages for nominal (categorical/dichotomous) data and also ordinal (age group) data. Ebola suspected, probable, confirmed cases and not a case by sex, age, housewife occupation, reported attendance at a funeral, participation in funeral ritual, preparation and consumption of primates, contact with a suspected case patient or sick person during the month before symptom onset were analyzed. Furthermore, the covariates touch body fluids, traditional healer care, and traditional healer occupation were analyzed. Proportions were compared using chi-square test of association/independence between potential Ebola virus risk factors and Ebola virus disease infection status for women and men aged 15 to 49 years, based on the categorical nature of these variables. The following sections describe additional statistical analysis procedures for each research question this study was based on. There related hypotheses are stated in null and alternative form.

Research Questions and Hypotheses

Statistical Analysis for Research Question 1

RQ1: Are there associations between sociocultural and behavioral factors and Ebola infection in women and men aged 15 to 49 during the 2014 Ebola outbreak in Sierra Leone?

H_o1: There are no statistically significant associations between sociocultural and behavioral factors and Ebola infection in women and men aged 15 to 49 during the 2014 Ebola outbreak in Sierra Leone

H_a1: There are statistically significant associations between the sociocultural and behavioral factors and Ebola infection in women and men aged 15 to 49 during the 2014 Ebola outbreak in Sierra Leone.

To examine the first research question, bivariate chi-square test was used to assess the associations between possible Ebola risk factors and Ebola virus status for women and men aged 15 to 49 years, based on the categorical nature of these variables. A chi-square statistics test was also appropriate because the number of dependent variable for the study is 1 and nominal in nature, and the nature of independent variables is 1 with 2 or more levels (independent groups), nominal or ordinal. This process also, assisted in identifying potential risk factors for inclusion in the backward stepwise elimination multiple logistic regression model analysis. In bivariate analysis, the chi-square, degrees of freedom (df), sample size (N), chi-square value, and the probability value ($P \leq 0.05$), were used for the measurement of associations between proportions, and reporting association with Ebola status. Comparisons were made using Pearson's chi-square for trend. The chi-square analysis was used to test the null hypothesis that implied that there are no statistically significant associations between sociocultural and behavioral factors and Ebola infection in women and men aged 15 to 49 during the 2014 Ebola outbreak in Sierra Leone. Statistical significance was set at alpha or ($P \leq 0.05$).

Statistical Analysis for Research Question 2

RQ2: What are the significant predicting sociocultural and behavioral risk factors (possible funeral attendance, funeral touched body, contact with sick person, preparation and consumption of primate activity), respondent's gender, respondent's age group, and housewife/caretaker occupation for Ebola disease status among women and men aged 15-49 during the 2014 outbreak in Sierra Leone?

H_o2: There are no statistically significant predicting sociocultural and behavioral risk factors (possible funeral attendance, funeral touched body, contact with sick person, preparation and consumption of primate activity), respondent's gender, respondent's age group, and housewife/caretaker occupation for Ebola disease status among women and men aged 15-49 during the 2014 outbreak in Sierra Leone.

H_a2: There are statistically significant predicting sociocultural and behavioral risk factors (possible funeral attendance, funeral touched body, contact with sick person, preparation and consumption of primate activity), respondent's gender, respondent's age group, and housewife/caretaker occupation for Ebola disease status among women and men aged 15-49 during the 2014 outbreak in Sierra Leone.

To examine the second research question, I constructed backward elimination logistic regression models to identify the best potential significant predicting sociocultural and behavioral risk factors for Ebola virus infection utilizing models that included all variables that were significantly associated with Ebola virus infection status in the bivariate analysis (funeral attendance, funeral touched body, contact with sick person, respondent's gender, housewife/caretaker occupation) ($P \leq 0.05$). Also, based on

agreement with previous studies and the congruence with the determinants of ecological model, I decided to include the variables that were not found to be statistically significant in the chi-square analysis age group; preparation and consumption of primates. Moreover, I included the three covariates touch bodily fluids, participated in traditional healer care, and traditional healer occupation, in the backward stepwise logistic regression analysis, while controlling for potential confounders and variables (Bower et al., 2016; Dietz et al., 2015; Dowell et al., 1999; Green & Salkind, 2014). I made adjustment for confounders to isolate the specific effect of a particular variable, and to assess whether potential confounders made significant contributions to the prediction of Ebola virus disease status (Field, 2013, Frankfort-Nachmias , Nachmias & DeWaard, 2015. Green & Salkind, 2014). I used backward stepwise elimination regression analysis (enter method) with a p-value set to 0.1 to determine which variables were included in the multivariate model. P-value of 0.1 was chosen to balance the development of a rigorious model while still including those potential variables that were of borderline significance (Field, 2013, Frankfort-Nachmias , Nachmias & DeWaard, 2015. Green & Salkind, 2014). The Backward elimination method involves entering all the outcome and independent or predictor variables simultaneously into the statistical software or model. Then variables are excluded or eliminated one at a time, with the variable that has the largest probability of F (that is p-value) removed until all the variables have a p-value equal to or less than 0.10 (criterion), (Field, 2013, Frankfort-Nachmias , Nachmias & DeWaard, 2015. Green & Salkind, 2014). So each predictor variable is evaluated in terms of what it contributes to prediction of the dependent variable, Ebola infection disease,

(criterion), which is different from the predictability offered by all the other predictor variables (Field, 2013, Frankfort-Nachmias , Nachmias & DeWaard, 2015. Green & Salkind, 2014). A final model was then obtained by removing all potential risk factors with $p>0.1$ from the fully adjusted model in a backward-stepwise fashion. The F test was used to assess whether the set of independent variables in this study collectively predicts the dependent variable. R^2, the multiple correlation coefficient of determination, is reported and used to determine how much variance in the dependent variable can be accounted for by the set of independent variables. Beta coefficients are used to determine the extent of prediction for each independent variable. Statistical significance was set at alpha or ($p \leq 0.05$), and variables in the backward elimination logistic regression models were considered to be significant contributors to the model if $p \leq 0.05$.

Before conducting the backward stepwise elimination regression analysis, I assessed the main assumptions of backward multiple regression, linearity, (the relationship between each of the predictor variables and the dependent variable is linear) with the Normal P-P Plots and the assumption was met; Homoscedasticity (same variance, constant variance) was assessed with residuals plots or examination of scatter plots, and the assumption was met, and the absence of multicollinearity (that two or more predictor variables are not related or significantly cororrelated with each other) was assessed using variance inflation factors (VIF). VIF values over 10 would suggest the presence of multicollinearity (Field, 2013, Frankfort-Nachmias, Nachmias & DeWaard, 2015. Green & Salkind, 2014). In this study, regression diagnostic procedures produced no evidence of multicollinearity. In running backward regression, the researcher hopes to

get a non-biased result and generalize the sample model to the entire population. To achieve this, some of the assumptions of the regression analysis needs to be met. Violating these assumptions, could prevent the generalizing conclusion to the target population because the results might be biased or misleading (Field, 2013, Frankfort-Nachmias , Nachmias & DeWaard, 2015. Green & Salkind, 2014). Furthermore, it is important to address multicollinearity, since it can cause R square to be large but none of the individual beta weights are statistically significant, and producing strange beta weight estimates, such as wrong direction (Field, 2013, Frankfort-Nachmias , Nachmias & DeWaard, 2015. Green & Salkind, 2014).

Based on multiple level nature of the dependent variable Ebola status and the independent variable age, I created dummy variables and grouped variable levels using transform method for variables that had more than two levels for backward elimination multiple logistic analysis purposes. I recoded and created a dummy variable for the dependent variable Estatus to nEstatus. The new Ebola status variable had two groups and was coded as 0 for not a case and 1 for suspect/probable/confirmed (Field, 2013, Frankfort-Nachmias , Nachmias & DeWaard, 2015. Green & Salkind, 2014, Wamala et al., 2010). Furthermore, I recoded the independent variable age into a new variable nAge with two groups (that included two age groups 15-29, 30-49). These two age group variables were coded as 1= 15-29, and 2 = 30-49. Then, I used the new recoded variable for this cross-sectional study analysis on the final data. Also, to account for missing value, I defined the missing data value 9 as a discrete missing value using transform

method to allow for exclusion of the missing value 9 from any SPSS analysis (Field, 2013; Green & Salkind, 2014).

It is vital to perform the appropriate statistical test to determine the p-value for the statistic. According to Field (2013); Green and Salkind (2014), if the p-value is significantly small, then, the null hypothesis should be rejected, and the alternative hypothesis should be accepted. Vice versa. The significance level shows the point for a decision to accept or reject the null hypothesis (Field, 2013; Green & Salkind, 2014). Multiple regression is a statistical method for studying the relationship between a single dependent variable and one or more independent variables (Field, 2013; Frankfort-Nachmias , Nachmias & DeWaard, 2015; Green & Salkind, 2014). Such analysis is appropriate when the goal is to assess the extent of a relationship among a set of dichotomous or interval/ratio predictor variables or an interval/ratio criterion variable (Field, 2013; Frankfort-Nachmias , Nachmias & DeWaard, 2015; Green & Salkind, 2014). Also, it was useful to test whether potential confounders made significant contributions to the prediction of outcome such as Ebola virus disease (Bower et al., 2016; Dietz et al., 2015; Dowell et al., 1999). In order to properly examine the nature of the association between sociocultural and behavior risks and Ebola virus infection it was necessary to control for the confounding effects of other correlates of Ebola using backward stepwise multivariate analysis.

Multiple logistic regression was used because the dependent variable (Ebola disease status in women and men) was constructed to be a binary outcome. It provided an interpretable linear model for a binary/dichotomous nature dependent variable, Ebola

disease status in women and men aged 15 to 49 and also allowed the testing of the significance influence of a given predictor while controlling for all other predictors in the model (Field, 2013, Frankfort-Nachmias , Nachmias & DeWaard, 2015. Green & Salkind, 2014). It allows for the adjusting of odds ratios and other statistics for possible confounding factors. The independent variables are categorical by nature. Furthermore, it allowed for calculation of confidence intervals (CI) 95% which allows for generalization of study result to the whole of the population from which the survey data was taken, for example, to all of Sierra Leone (Field, 2013; Green & Salkind, 2014; Institute for Digital Research & Education, 2014; Laureate Education, 2012). Moreover, other studies, including those by (Dietz et al., 2015; Dowell et al., 1999) with similar designs and similar kinds of variables and similar operational definitions for those variables have used chi square tests and multiple regression techniques successfully.

Materials

For this study, I used a quantitative, cross-sectional study design with secondary data collected through the Ministry of Health and Sanitation of Sierra Leone for the 2014 to 2015 Ebola virus disease epidemic in Sierra Leone. These databases contain information on all Ebola cases in the country from 2014 to 2015. Data were compiled by each Ebola center in the country using a standardized reporting system established by the World Health Organization, the CDC and the Ministry of Health and Sanitation of Sierra Leone. The data are then merged into one database known as the Sierra Leone Ebola virus disease data (SLED) data and submitted to the Ministry of Health and Sanitation of Sierra Leone. The submissions of reports from these Ebola treatment center and clinics are

mandatory by the World Health Organization (Dietz et al., 2015; McNamara et al., 2016; WHO, 2014), and administrators maintain these Ebola disease records at the Ministry of Health and Sanitation Sierra Leone.

Threats to External and Internal Validity

Validity for this study is vital for obtaining good study result. External validity is simply the extent to which research findings are generalizable to the larger population (Campbell & Stanley, 1963; Cresweill, 2009; Frankfort-Nachmias & Nachmias, 2015). The threat to external validity for this study entails the specificity of variables in which the study was conducted using a specific group of individuals in Sierra Leone at a specified period and setting. This causes the threat that such research findings may not be generalizable to other groups at different times and in different places (Campbell & Stanley, 1963; Cresweill, 2009; Frankfort-Nachmias & Nachmias, 2015). I addressed this threat by using a large sample, which may increase power and population validity (Cresweill, 2009; Frankfort-Nachmias & Nachmias, 2015). .

The empirical validity or predictive validity was ensured by looking at its relationships with past measures of the similar construct, and peer-reviewed empirical literature can also be utilized to validate this study results and its constructs (Cresweill, 2009; Frankfort-Nachmias & Nachmias, 2015; Kimberlin & Winterstein, 2008). A major test for empirical validity in this study was the establishment of whether things like the family arrangement, predict Ebola disease risky behavior among the study population in their local communities, and the outcome can be compared to past results from other empirical studies to assess the level of validity (Kimberlin & Winterstein, 2008). All

elements for this study were thoroughly investigated for their effectiveness, and to also ensure that the research questions are addressed well (Creswell, 2009; Frankfort-Nachmias & Nachmias; Kimberlin & Winterstein, 2008).

Furthermore this secondary data analysis study also suffers from internal threats to validity, due to the quantitative nature and cross-sectional design of the study which does not allow for establishing of causal relationship of the study results. Also, the Sierra Leone Ministry of Health and Sanitation team utilized survey questionnaires to collect their data, and the answers were recorded according to individuals' responses, and were hard to sometimes objectively be verified. Investigators relied on the respondents' self-reported answers, which could be subjective in nature, and the degree of under-reporting or over-reporting of perceived beliefs were difficult to determine. Furthermore, internal validity is known to be weaker with correlation design. Hence this study being a correlational design involved internal validity threat.

Ethical Procedures/Considerations

This study utilized data collected during the 2014 Ebola disease surveillance and response activities in Sierra Leone. All pertinent information on individual patients has been anonymized or stripped of patient identifiers for presentation (Cori et al., 2017; Dallatomasina et al., 2015). I obtained approval from the Walden University IRB before starting the study. Furthermore, I submitted a copy of my proposal for this study and Walden University supporting document from my Chair to the Sierra Leone Ministry of Health and Sanitation to ask for permission to utilize the dataset. Even though this study used existing (secondary data), from the Sierra Leone Ministry of Health and Sanitation

database, subject's data was checked thoroughly to ensure they are deidentified, to ensure personal data cannot be linked to the specific Ebola case.

Ebola virus disease entails sensitive topics, so all demographic information such as occupation was anonymous, kept private and confidential to protect subjects from negative experience such as community ostracism and stigma from the community. Ethical standards and IRB guidelines were strictly followed for clearance to use data and for the dissemination of this study results (Dallatomasina et al., 2015; Frankfort-Nachmias & Nachmias, 2015). Moreover, the limitations of this study were clearly stated in the discussion section of the study to inform stakeholders so they can make informed decisions properly.

Dissemination of Results

To my knowledge, scarce data are available on likely socio-cultural and behavioral factors associated with Ebola virus disease specifically in women and men ages 15 to 49 years in Sierra Leone. Dissemination of this Ebola research findings is vital to getting benefit from the study by members of the local community, especially the study population in Sierra Leone. The results of this study are expected to provide valuable information to local and state policymakers, health professionals, academics, and other stakeholders for Ebola prevention efforts and interventions, and also, this could help in fostering efficient use of limited health care resources in the country. Dissemination of this research findings would be done primarily via local newspapers, local radio stations, and town hall meetings composed of students, local community members, religious leaders, community leaders, health professionals, and other

stakeholders. Also, a copy of the report would be submitted to the Minister of Health and Sanitation of Sierra Leone. Furthermore, I would disseminate the study findings with the sierra Leone Ministry of Health and Sanitation as agreed during the time of request for the data, including submitting copy for subsequent scientific journal publications and other Ebola or public health journals.

Study Limitations

This study was limited by the likelihood of sample selection bias as a result of focusing only on analyzing data on laboratory-confirmed cases in the SLED database, so the results of the study may not be generalizable to the all the population in the entire country. (Creswell, 2009; Kimberlin & Winterstein, 2008) The study may also have some weakness due to the fact that it was focused specifically on women and men age 15 to 49 years, so the results of the study may not be generalizable to the all Individuals in other age groups. Also, this study employed secondary data analysis of the Sierra Leone Ebola virus disease data and therefore is potentially limited by the type of variables investigated by the primary data collectors (Creswell, 2009). Moreover, this study may not be generalized to other age groups of their respective general populations and could could threaten its internal validity as well. A further limitation of this analysis may come from limited data quality, with cases not being entered into the database, or cases are not reporting exposures (McNamara et al., 2016; WHO Ebola Response Team, 2016).

Summary

In summary, this chapter on research methodologies discusses the design, the research methodologies, data analysis processes, and ethical considerations involved in

conducting the study. The study employed secondary data from the Sierra Leone Ministry of Health and Sanitation 2014 Ebola disease survey data to conduct quantitative cross-sectional research design study to assess the relationship among the dependent, independent, and covariate variables relating to the research questions pertaining to the 2014 Ebola outbreak in Sierra Leone for women and men aged 15 to 49 years. Also, the study used G-power analysis to determine the minimum sample size required for the study, with the best statistical power for the analysis. Data management and analysis, and dissemination of the study results were also addressed in this segment of the study. Furthermore, in this study, the Ecological Model provided a complete framework to address the demographic, behavioral, and social-cultural factors associated with the spread of the Ebola virus among women and men ages 15 to 49 years in Sierra Leone, and help explain the characteristics seen in this population in the country. Chapter 4 discusses the results of the data analyses conducted in Chapter 3.

Chapter 4: Results

The purpose of this quantitative secondary data analysis study was to examine the relationship between sociocultural and behavioral risk factors and Ebola virus infection status among women and men ages 15 to 49 in Sierra Leone during the 2014 Ebola epidemic. I obtained the secondary data (SLED 2014 to 2015) to assess the associations between the factors and Ebola virus status from the Sierra Leone Ministry of Health and Sanitation. The ecological model was used to guide the study, and a quantitative cross-sectional design was used to analyze 17,230 samples of the secondary data. Descriptive statistics were used to analyze the data. Furthermore, chi-square test of association was conducted to evaluate the association between Ebola virus disease status and sociocultural and behavioral risk factors. Then, a backward stepwise elimination logistic regression analysis was conducted to predict the most prominent risk factors for the dependent variable while controlling for potential confounders and testing for effect modification. Covariates used in this study included touch body fluids, traditional healer care, and traditional healer occupation. The three covariates were selected for inclusion in the study because Dowell et al. (1999) and the WHO (2014, 2015) identified them as influencing Ebola outcomes in Ebola risk factor studies. Also, the ecological model levels identified them as having been influential in Ebola outcomes (Glanz et al., 2008). Data analysis was conducted using SPSS Version 25.0 and the results are included in this chapter. Results of this study may inform public health officials' prevention intervention efforts, together with comprehensive surveillance of the risk factors of the Ebola epidemic to improve health in Sierra Leone. Furthermore, health providers of Ebola virus

infection prevention may use the findings of my study to select evidence-based interventions best suited for their local community's needs. Also, this study's results may be used to fight the ongoing Ebola outbreak in the Democratic Republic of the Congo.

This chapter includes four sections. The first section details the data collection procedure. The second section includes a description of the study sample's sociodemographic characteristics including suspect/probable and confirmed Ebola disease status and descriptive statistics (frequencies and percentages for the independent variables and the covariates). The third section presents data analyses including chi-square tests of association and backward elimination stepwise logistic regressions analysis done to test the hypotheses from each of the two research questions. The notable research questions and hypotheses were generated from the extensive literature review on EVD and potential risk factor studies.

Research Questions and Hypotheses

RQ1: Are there associations between sociocultural and behavioral factors and Ebola infection in women and men aged 15 to 49 during the 2014 Ebola outbreak in Sierra Leone?

H_o1: There are no statistically significant associations between sociocultural and behavioral factors and Ebola infection in women and men aged 15 to 49 during the 2014 Ebola outbreak in Sierra Leone

H_a1: There are statistically significant associations between the sociocultural and behavioral factors and Ebola infection in women and men aged 15 to 49 during the 2014 Ebola outbreak in Sierra Leone.

RQ2: What are the significant predicting sociocultural and behavioral risk factors (possible funeral attendance, funeral touched body, contact with sick person, preparation and consumption of primate activity), respondent's gender, respondent's age group, and housewife/caretaker occupation for Ebola disease status among women and men aged 15-49 during the 2014 outbreak in Sierra Leone?

H_o2: There are no statistically significant predicting sociocultural and behavioral risk factors (possible funeral attendance, funeral touched body, contact with sick person, preparation and consumption of primate activity), respondent's gender, respondent's age group, and housewife/caretaker occupation for Ebola disease status among women and men aged 15-49 during the 2014 outbreak in Sierra Leone.

H_a2: There are statistically significant predicting sociocultural and behavioral risk factors (possible funeral attendance, funeral touched body, contact with sick person, preparation and consumption of primate activity), respondent's gender, respondent's age group, and housewife/caretaker occupation for Ebola disease status among women and men aged 15-49 during the 2014 outbreak in Sierra Leone.

Data Collection

I conducted a secondary data analysis using data from Sierra Leone Ministry of Health and Sanitation (SLED) 2014 to 2015 database accessed from the CDC in SPSS file format. This reliable data set has been used by social science and public health researchers to conduct credible studies in the past. I abstracted this credible data from the file that contained information from the female questionnaire, the male questionnaire and the Ebola virus specific RT-PCR test result file. The file contained all variables from the

survey that I requested in my Ebola data proposal. Then I identified the variables of interest for this study. The statistical software SPSS version 25.0 (IBM) was used to conducted data cleaning and screened the data for accuracy, missing data, and outliers to ensure inclusion of data sets that met the inclusion criteria set for this study, namely, participants must have reported their gender as female or male, must have been aged 15 to 49, and have confirmed Ebola specific RT-PCR result test, or classified as suspect, probable, and not a case. The total number of cases women and men aged 15 to 49 that were in the SLED file was 34,715.

During data cleaning and review, I noted that the missing data value 9 had not been defined. So, I defined it as a discrete missing value using transform method to allow for exclusion of the missing value 9 from any SPSS analysis. After this, the total number of valid cases remaining were 17,230 women and men aged 15 to 49 years, of which 8,305 were females and 8,925 were males from the VHF surveys. This study analysis was conducted on this final data set that excluded missing data. Furthermore, I created dummy variables and grouped variable levels using transform method for variables that had more than two levels for backward elimination multiple logistic analysis purposes. I recoded and created a dummy variable for the dependent variable Estatus to nEstatus. The new Ebola status variable had two groups and was coded as 0 for not a case and 1 for suspect/probable/confirmed (Field, 2013; Frankfort-Nachmias, Nachmias, & DeWaard, 2015; Green & Salkind, 2014; Wamala et al., 2010). I also recoded the independent variable age into a new variable of Age with two groups (that included two age groups 15-29, 30-49). These two age group variables were coded as 1= 15-29, and 2 = 30-49.

Then, I used the new recoded variable for this cross-sectional study analysis on the final data.

Results

Statistical analysis for each research question presented in chapter 1, 2, and 3 are presented in this section, including descriptive statistics, chi-square tests, and backward stepwise logistic regression.

Univariate Analysis (Descriptive Statistics)

Sociocultural and behavioral factors. sociocultural and behavioral factors comprised six variables: funeral attendance, funeral touched body, contact with sick person, preparation and consumption of primate activity, including the covariates, touch bodily fluids, and traditional healer care.

Funeral attended. Socio-cultural practices such as attending funeral during the last month before symptom onset was assessed (Table 1). Of the total sample of 21,514 patients who responded to this question, 1,831 (8.5%) reported having attended a funeral within 1 month before symptom onset while 19,683 (91.5%) reported not attending a funeral within 1 month before symptom onset. Recent epidemiologic data suggest that funerals are known to be a high-risk factor for infection (Manguvo & Mafuvadze, 2015; Sharareh et al., 2016; WHO, 2015; WHO, 2017), suggesting great need for continuous public health monitoring of funeral engagements.

Funeral touched the body. Socio-cultural practices such as participating in funeral rituals, such as touching the body during the last month which, according to the literature review are believed to be widespread in Sierra Leone, were found to be

common in this study as expected. Table 1 depicts information on whether the case patient being investigated had touched the body at a funeral within 1 month before symptom onset. In the total sample of 1205 participants who responded to this question, 782 (64.9%) reported touching the body, while 423 (35.1%) reported not touching the body. Previous data suggest that primary means of transmission of the Ebola from person to person is via direct contact with infected body fluids, so such high-risk behaviors and practices can greatly contribute to the spread of the Ebola virus in the local communities (Manguvo & Mafuvadze, 2015; Sharareh et al., 2016; WHO, 2015; WHO, 2017). Therefore, individuals who take part in funeral rituals should be a major focus of intervention efforts. Intervention should reduce their Ebola virus risk behaviors

Contact with sick person. In addition, a total sample of 10,975 participants responded to the question on contact with a suspected case patient or sick person within 1 month of symptom onset as presented in table 1. A total of 1,791 (16.3%) reported having contact with a sick person within 1 month of symptom onset while 9,184 (83.7%) were recorded to have had no contact with such a sick person within 1 month of symptom onset. Recent studies, and other accumulating evidence, suggest that primary means of transmission of the Ebola from person to person is via direct contact with sick person (WHO, 2015; WHO, 2017). This could explain the high frequency of Ebola infection risk seen in this group.

Preparation and consumption of primate. For this social and cultural factor variable, a total sample of 34,711 participants responded to the question on bush meat preparation and consumption within 1 month of symptom onset as presented in table 1. A

total of 0 (0%) reported having engaged in bush meat activity within 1 month of symptom onset while 34,711 (100) reported not having engaged in bush meat activity within 1 month of symptom onset. This finding may be attributed to the fact that high stigma and ostratisation was associated with Ebola and risky behavior during the Epidemic in the country (Alexander et al., 2015; Dietz et al., 2015; Nkangu et al., 2017; Phua, 2015).

Touch body fluids. Information was collected on whether the case patient being investigated had touch bodily fluids of sick person 12 months before the onset of the disease (Table 1). The descriptive frequency statistics indicate that a total of 28,238 respondents responded to the question on touch body fluids for the 2014 Ebola epidemic period. 525 (1.9%) reported touching the bodily fluid of sick person, while 27,713 (98.1%) reported not engaging in such a behavior. The high frequency of Ebola virus infection observed in this group could be attributed to an observation Dowell et al. (1999) made, namely that potential risk factors, such as touching bodily fluids, potentially exposes individuals to the Ebola virus. This suggests re-enforcement of use of proper protective gears such as hand gloves when interaction or handling potentially Ebola contaminated bodily fluids such as blood in house hold setting or hospital setting (WHO, 2014).

Traditional healer care. Socio-cultural practices such as consultation with traditional healer, during the last month which, according to the literature review are believed to widespread in Sierra Leone, were found to be common in this study as expected. A total sample of 3,497 participants responded to the question on consultation

with traditional healer within 1 month of symptom onset as presented in table 1. A total of 119 (3.4%) reported having sought a traditional healer for treatment within 1 month of symptom onset while 3,378 (96.6%) reported not having visited a traditional healer for treatment within 1 month of symptom onset. This finding could be attributed to the fact as several scholars acknowledge that most communities in Africa still attribute cause of disease to the violation of supernatural laws, and that traditional healers possess special abilities to solve such problems (Alexander et al., 2015; Manguvo & Mafuvadze, 2015). So sick individuals in the community go to traditional healers for cure. But the majority of traditional healers are believed to engaged in high-risk behaviors, such as using unsterile instruments which could expose individuals to Ebola contaminated blood (Alexander et al., 2015; Manguvo & Mafuvadze, 2015; Mueller, 2014; WHO, 2014; WHO, 2015).

Table 1

Socio Cultural and Behavioral Demographic Characteristics of Study Participants

Variable	Frequency	Percent (%)
Funeral attended		
Yes	1831	8.5
No	19683	91.5
Funeral touch body		
Yes	782	64.9
No	423	35.1
Contact sick person		
Yes	1791	16.3
No	9184	83.7
Hunt ate primate		
True	0	0
False	34711	100
Touch body fluids		
True	525	1.9
False	27713	98.1
Traditional healer care		
Yes	119	3.4
No	3378	96.6

Demographic Factors

Demographic factors included: respondent's gender, respondent's age group, and housewife/caretaker occupation. I also included the covariate traditional healer occupation.

Gender. Table 2 present frequencies of total sample by gender. The descriptive frequency statistics indicate that a total of 17,230 respondents responded to the question on sex for the 2014 Ebola epidemic period and there were nearly equal proportions of cases, male cases 8,925 (51.8%), females 8,305 (48.2%) cases. The Ebola proportion among cases by female and male results of this study indicate and confirm that women

and men are at high risk for Ebola virus infection, which suggest that Ebola virus prevention and control for the study group are urgently needed.

Age. Age was categorized with four age-group items (1) 15-19 years, (2). 20-29 years, (3). 30-39 years, and (4). 40-49 years. The results in Table 2 indicated that, a total of 17,341 respondents responded to the question on age, with 2,024 (11.7%) of those affected aged 15 to 19 years, 5,711 (32.9%) aged 20 to 29, 5,506 (31.8%) aged 30 to 39 years, and 4,100 (23.6%) aged 40 to 49. The group of 20-29 years and 30 to 39 old were the most affected (Table 2). This could be associated with behavioral factors and cultural norms which may increase participant's risk of acquiring Ebola virus infection, including immature care taker responsibility in the family setting, which might lead to more risky activity such as treating Ebola patient without protective hand gloves. Therefore, there are still opportunities for prevention among the age groups. There is concern for age-specific intervention prevention programmers to address this urgent concern.

Housewife/caretaker. Information was collected on whether the case patient being investigated was a housewife/caretaker. For the variable of housewife/care taker occupation shown in (Table 2), the descriptive frequency statistics indicate that a total of 34,715 respondents responded to the question on housewife occupation for the 2014 Ebola epidemic period, and 2,241 (6.5.1%) were reported being housewives/care takers, while 3,247 (93.5%) reported not being house wives/care takers. This observation may be attributed to the fact that this group who also shoulder the traditional norm of caregiver of the sick in the family, are also likely to have direct physical contact with sick Ebola patients, including contact with infected body fluids, such as blood (Dowell et al. (1999).

These traditional cultural beliefs, social and cultural norms, values, and customs in the local communities that calls for the housewives/caretakers to engage in risky behaviors may increase their vulnerability to the Ebola virus. So clearly, this suggests that, for prevention control purposes, public health prevention measures to reduce local community-based transmission might benefit greatly from awareness of sex-specific differences.

Traditional healer occupation. For the variable of traditional healer occupation shown in (Table 2), the descriptive frequency statistics indicate that a total of 17,374 respondents responded to the question on this occupation for the 2014 Ebola epidemic period, and 17(0.1%) were traditional healers while 17,357 (99.9%) were not. The results shown in these data is similar to other findings of Ebola studies (WHO, 2014, WHO, 2015). The high proportion or frequency of Ebola seen in this group could be attributed to the fact that traditional healers have some practices and beliefs, such as the use of the mouth for sucking potentially Ebola infected blood, and the use of sharp instruments without proper protective gear, risky behaviors that warrant public health prevention intervention focus in Sierra Leone.

Table 2

Demographic Characteristics of Study Participants

Variable	Frequency	Percent (%)
Gender		
Male	8925	51.8
Female	8305	48.2
Age (y)		
15-19	2024	11.7
20-29	5711	32.9
30-39	5506	31.8
40-49	4100	23.6
House wife/caretaker		
True	2241	6.5
False	32474	93.5
Traditional healer		
True	17	0.1
False	17357	99.9

Ebola Virus Status

On the dependent variable Ebola virus infection status, the SLED data set had 34,715 total women and men ages 15 to 49 years respondents who were administered Ebola specific RT-PCR testing and had their Ebola virus test results. Of these, 22,869 (65.9%) were not a case, 6,244 (18%) were confirmed cases, 1,036 (3%) were probable, and 4,566 (12.2%) were suspected cases. When grouped, 11846 (34.1%) Suspected/ Probable/Confirmed cases, and 22869 (65.9%) were laboratory negative and classified as not a case. With a large sample of over 11,000 people, the analysis did provide better results for the study. The greater the sample size of the population, the better the power, effect size and result.

Bivariate Analysis and Hypothesis Testing

Association between study factors and Ebola disease status. The following research questions and hypotheses of the study were generated from the literature review on Ebola virus infection and risk factor characteristics research.

RQ1: Are there associations between sociocultural and behavioral factors and Ebola infection in women and men aged 15 to 49 during the 2014 Ebola outbreak in Sierra Leone?

H_o1: There are no statistically significant associations between sociocultural and behavioral factors and Ebola infection in women and men aged 15 to 49 during the 2014 Ebola outbreak in Sierra Leone

H_a1: There are statistically significant associations between the sociocultural and behavioral factors and Ebola infection in women and men aged 15 to 49 during the 2014 Ebola outbreak in Sierra Leone.

To examine the first research question and to test my hypothesis 1 whether there are statistically significant association between potential socio-cultural and behavioral factors (funeral attendance, funeral touched body, contact with sick person, preparation and consumption of primate activity), and Ebola virus infection status, I conducted a bivariate chi-square test analysis, due to the categorical nature of the dependent and independent variables. I also including respondent's gender, age, and housewife/caretaker occupation, and the three covariates: traditional healer occupation, touch bodily fluids, and traditional healer care, due to their potential effect on Ebola outcome (WHO, 2014). Statistical significance for this study was set at alpha = 0.05. The assumptions of cross

tabulation and chi-square test were assessed and met (there are adequate sample size of over 40 cases and adequate cell count, a minimum of five cases or counts per cell, no cells in the cross tabulations had an expected count of less than 5 (Green & Salkind, 2014).

Bivariate analysis attended a funeral and Ebola virus status. To examine the association between attending funeral and Ebola virus status, I conducted a chi-square test between the two variables. Table 3 presents a summarized cross-tabulation table for proportion of funeral attendees and having suspects/probable/ Ebola confirmed case. As observed 1451 (79.2%) of respondents who attended a funeral within the last 12 months before Ebola onset had suspected/probable/confirmed case, compared to those who did not attend a funeral, 6353 (32.3%). The results of the chi-square test of association between attended a funeral and Ebola virus status Tables 4 shows that there was a statistically significant association between attended a funeral and Ebola virus status chi square (1, N = 21,514) = 1598.756, p = .001. This result could be attributed to the fact that funeral attendees may be likely to also interact with or have direct physical contact with individuals who participated in traditional funeral rituals and touched bodily fluids that are known to be high risk factors for Ebola (Adongo et al., 2016; Alexander et al., 2015; Manguvo & Mafuvadze, 2015; Stehling-Ariza et al., 2016; WHO, 2017). Participating in funeral rituals is also believed to be potential risk factor for Ebolan (Alexander et al., 2015; Manguvo & Mafuvadze, 2015. This association may need further research.

Table 3

*Crosstabulation of Funeral Attend and Ebola Status (*N=*21514)*

Funeral attended	Ebola status		$\chi 2$
	Not a case	Suspect/probable/ confirm	
True	380 20.8%	1451 79.2%	1598.75***
False	13330 63.7%	6353 32.3%	

Note. ***= *p* .001. Percent within funeral attend appear below group frequencies.

Table 4

Chi-Square for Funeral Attend and Ebola Infection Status

Variable	Chi-square	df	P
Funeral attended	1598.756	1	0.001

Bivariate analysis touched the body at a funeral and Ebola virus status. To establish if there is an association between touched the body at a funeral and suspected/probable/Ebola confirmed case status, I conducted a chi-square test between the potential risk factor participation in funeral rituals and Ebola status. Table 5 presents a summarized cross-tabulation table for touched the body at a funeral and suspected/probable/Ebola confirmed cases combined status. As observed 640 (81.8%) of respondents who reported participating in funeral rituals within the last 12 months before Ebola onset had suspectes/probable/confirmed cases combined, compared to those who did not participate in funeral rituals 323 (76.4%) that had suspected/probable/Ebola confirmed cases combined status. The results of the chi-square test of association

between touched the body at a funeral and Ebola suspected/probable/Ebola confirmed case status showed that there was a statistically significant relationship between touched the body at a funeral and Ebola virus status among patients: chi square (1, N = 1,205) = 5.140, p = .023 (Table 6). The significant association or difference shown here may be attributed to the funeral activity cultural norms for example washing and dressing the body of the dead, contribute to greater vulnerability to Ebola infection in Sierra Lone (Adongo et al., 2016; Alexander et al., 2015; Manguvo & Mafuvadze, 2015; Stehling-Ariza et al., 2016; WHO, 2017). This raises the question that funeral activity cultural norms for the study population to dress the dead may be underlying factors that drive the adoption of Ebola risk behaviors and can be regarded as critical determinants of vulnerability to Ebola virus infection in Sierra Leone (WHO, 2017).

Table 5

*Crosstabulation of Funeral Touched Body and Ebola Status (*N = *1205)*

Funeral Touch Body	Ebola status		$\chi 2$
	Not a case	Suspect/probable/ confirm	
Yes	142 18.2%	640 81.8%	5.140*
No	100 23.6%	323 76.4%	

Note. *= p .023. Percent within funeral touch body appears below group frequencies.

Table 6

Chi-Square for Funeral Touch Body and Ebola Infection Status

Variable	Chi-square	df	P
Funeral touch body	5.140	1	0.023

Bivariate analysis contact with a sick person and Ebola virus status. Ebola case-patients were asked whether they had had any form of contact with a sick person known to have suspected or confirmed Ebola. In the SLED data set, 1317 (73.5%) of participants who reported having any form of contact with a sick person before becoming sick had suspect/probable/confirmed Ebola case, while 2754 (30%) of participants who reported not having such contact had suspected/probable and Ebola confirmed case (Table 7). The results of the chi-square test of association between the two variables Tables 8 indicates that there was a statistically significant association between contact with a person known to have suspected or confirmed Ebola before becoming sick and Ebola virus status: chi square (1, N = 10,975) = 1218.021, p = .001. This finding indicates urgent need for public health prevention intervention programmers to focus on contact with a sick person.

Table 7

*Crosstabulation of Contact with Sick Person and Ebola Status (*N = *10975)*

Contact with sick Person	Ebola status		$\chi 2$
	Not a case	Suspect/probable/ confirm	
Yes	474 26.5%	1317 73.5%	1218.02***
No	6430 70.0%	2754 30.0%	

Note. ***= *p* .001. Percent within contact with sick person appear below group frequencies.

Table 8

Chi Square for Contact With Sick Person and Ebola Infection Status

Variable	Chi-square	df	P
Contact with sick person	1218.02	1	0.001

Bivariate analysis preparation and consumption of primate in the last 12 months and Ebola virus status. To examine the association between preparation and consumption of primate and suspected/probable/confirmed Ebola status, I conducted a chi-square test between the two variables. The results of the chi-square test of association between bush meat preparation and consumption and Ebola virus status showed that there was no statistically significant relationship between bush meat Preparation and Consumption behavior and Ebola virus status among patients with suspected/probable and confirmed Ebola status: chi square (1, N = 34713) = 3.861, p = 0.116 (Table 9). This

finding is surprising however, it is consistent with a similar cross-sectional Ebola study out of Uganda in which Wamala et al. (2010) reported no significant association for bushmeat activity and Ebola status p< 0.8.

Table 9

Chi-Square for Preparation and Consumption of Primate and Ebola Infection Status

Variable	Chi-square	df	P
Hunt prepared ate primate	3861	1	.116

Bivariate analysis gender and Ebola virus status. To examine the association between gender and Ebola virus status, I conducted a chi-square test between the two variables. Table 3 presents a summarized cross-tabulation table for gender and, proportion of participants that were suspect/probable/ confirmed cases, and not a case for Ebola virus. In the SLED data set, there were nearly equal proportion of female and male ages 15 to 49 years who were tested for Ebola and met the Ebola classification status. As observed, 2976 (33.3%) of male participants have suspect/probable/confirmed cases combined. While similarly 2896 (34.9%) of female participants have suspect/probable/confirmed cases combined (Table 10). The results of the chi-square test of association between gender and Ebola virus status Tables 4 indicates that there was a statistically significant association between gender and Ebola virus status: chi square (1, N = 17,230) = 4.459, p = .035 (Table 11). The differences among group were significant. The association depicted between these variables has been shown in other studies (Dietz et al., 2015). This suggests that, for prevention control purposes, public health prevention measures to prevent future outbreak in local communities might benefit significantly

from awareness of gender differences in Ebola. Thus, Ebola virus prevention and control for the study group are urgently needed.

Table 20

*Crosstabulation of Gender and Ebola Status (*N *= 17230)*

Gender	Ebola status		$\chi 2$
	Not a case	Suspect/probable/ confirm	
Male	5949 66.7%	2976 33.3%	4.459*
Female	5409 65.1%	2896 34.9%	

Note. *= *p* .035. Percent within gender appear below group frequencies.

Table 31

Chi Square for Gender and Ebola Infection Status

Variable	Chi-square	df	P
Gender	4.459	1	0.035

Bivariate analysis age and Ebola virus status. To examine the association between age and Ebola virus status, I conducted a chi-square test between the two variables. The results of the chi-square test of association between age and suspected/ Probable/confirmed cases indicated that age was not significantly associated with Ebola virus status: chi square (3, N = 34,715) = 4.084, $p = 0.252$ (Table 12). My finding is consistent with Wamala et al. (2010) 's study out of Uganda in which age of respondents was not significantly associated with having Ebola ($p = 0.4$). Even though other researchers including Mulangu et al. (2016) found a significant relationship between age

and Ebola status (p = 0.023). This descripiancies could be related to methodological differencies and so warrant further study.

Table 42

Chi Square for Age and Ebola Infection Status

Variable	Chi-square	df	P
Age	4.084	3	0.252

Bivariate analysis housewife/caretaker and Ebola virus status. To examine the association between housewife/care taker and suspect/probable/Ebola confirmed status, I conducted a chi-square test between the two variables. Table 13 presents a summarized cross-tabulation table for housewife and Ebola virus status proportion of participants. As observed, 862 (38.5%) of housewives/caretakers had suspected/probable and confirmed case combined, compared to non- housewives 10984 (33.8%). The results of the chi-square test of association between housewife and Ebola virus status Tables 14 indicates that there was a statistically significant association between housewives and Ebola virus status: chi square (1, N = 34,715) = 20.086, p = .001. Ebola virus infection risk has also been associated with housewives in previous studies (Dowell et al., 1999). The care taker norms for women in Sierra Leone may be attributed to the result observed here, and this raises the question that care taker activity social norms for house wives may be critical factors that promote 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 (WHO, 2014, WHO, 2015).

Table 53

*Crosstabulation of Housewife/Caretaker and Ebola Status (*N = *34715)*

Housewife/ Caretaker	Ebola status		$\chi 2$
	Not a case	Suspect/probable/ confirm	
True	1379 61.5%	862 38.5%	20.086***
False	21490 66.2%	10984 33.8%	

Note. ***= *p* .001. Percent within housewife/caretaker appear below group frequencies.

Table 64

Chi Square for Housewife/Caretaker and Ebola Infection Status

Variable	Chi-square	df	P
House wife/caretaker	20.086	1	0.001

Touch body fluids in the last 12 months and Ebola virus status. To assess the association between touched the body fluids and suspected/probable/Ebola confirmed cases combined status, I conducted a chi-square test between the potential risk factor touch body fluids and Ebola status. Table 15 presents a summarized cross-tabulation table for touch body fluids and suspected/probable/Ebola confirmed cases combined status and chi square test results. In the SLED data set, more than twice 426 (81.1%) of patients who reported touching bodily fluids of sick person before they became sick have suspected/probable/Ebola confirmed case combined, compared to those who reported not touching bodily fluids 10933 (39.5%) (Table 15). The results of the chi-square test of

association between touched the body fluids and Ebola suspected/probable/Ebola confirmed cases combined status showed that there was a statistically significant relationship between touched the body fluids and Ebola virus status among participants chi square (1, N = 28,238) = 372.475, p = 0.001 (Table 16). The significant association shown here may be attributed to wide claims that bodily fluids are a high-risk factor for Ebola infection. Previous studies have shown contact with the patient's body fluids (PPR= 4.61%, 95% confidence interval 1.73 to 12.29) to be strongly associated with Ebola (Francesconi et al., 2003, Alexander et al., 2015; Manguvo & Mafuvadze, 2015; Stehling-Ariza et al., 2016; WHO, 2017).

Table 75

*Crosstabulation of Touched Bodily Fluids and Ebola Status (*N *= 28238)*

Touch Body Fluids	Ebola status		$\chi 2$
	Not a case	Suspect/probable/ confirm	
True	99 18.9%	426 81.1%	372.47***
False	16780 60.5%	10933 39.5%	

Note. ***= p .001. Percent within touched bodily fluids appear below group frequencies.

Table 86

Chi Square for Touch Body Fluids and Ebola Infection Status

Variable	Chi-square	df	P
Touch bodily fluid	372.475	1	0.001

Bivariate analysis traditional healer care in the last 12 months and Ebola virus status. To examine the association between the covariate traditional healer care and Ebola suspected/probable/confirmed Ebola status, I conducted a chi-square test between the two variables. Table 17 presents the results of the chi-square test of association between consultation with traditional healer and Ebola virus status. The table depicts that traditional healer care activity within 12 months before illness onset was not significantly associated with suspected/probable/confirmed Ebola status. Chi square (1, N = 3,497) = 0.861, p = 0.353. This finding is also consistent with Wamala et al.'s (2010) studies of Ebola and similar potential risk factors (p= 0.06).

Table 97

Chi Square for Consultation with Traditional Healer and Ebola Infection Status

Variable	Chi-square	df	P
Consultation with traditional healer	.861	1	0.353

Traditional healer occupation. To examine the association between the covariate traditional healer occupation and suspected/probable/Ebola confirmed cases combined status, I conducted a chi-square test between the potential risk factor traditional healer occupation and Ebola status. Table 18 presents a summarized cross-tabulation table for traditional healer occupation and suspected/probable/Ebola confirmed cases combined status. In the SLED secondary data set, 16 (76.2%) of participants who reporting practicing traditional healing occupation have suspected/probable/Ebola confirmed cases combined status compared with those who did not work as traditional healers 5915 (34.2%) (Table 18).The results of the chi-square test of association between

traditional occupation and Ebola suspected/probable/Ebola confirmed cases combined status showed that there was a statistically significant relationship between traditional healer care and Ebola virus status among patients chi square (1, N = 17,341) = 16.472, *p* = .001 (Table 19). The statistically significant association shown here may be attributed to the fact that traditional healers engage in the risky behavior of cutting, sucking patient's blood, thus exposing them to the Ebola virus from contaminated bodily fluids such as blood (Alexander et al., 2015). Also, previous studies have shown contact with the patient's body fluids (PPR= 4.61%, 95% confidence interval 1.73 to 12.29) to be strongly associated with Ebola infection (Francesconi et al., 2003, Alexander et al., 2015; Manguvo & Mafuvadze, 2015; Stehling-Ariza et al., 2016; WHO, 2017).

Table 108

*Crosstabulation of Traditional Healer Occupation and Ebola Status (*N *= 17374)*

Traditional Healer Occupation	Ebola status		$\chi 2$
	Not a case	Suspect/probable/ confirm	
True	15 15%	16 76.2%	16.47***
False	11405 65.8%	5915 34.2%	

Note. ***= *p* .001. Percent within traditional healer occupation appear below group frequencies.

Table 119

Chi-Square for Traditional Healer Occupation and Ebola Infection Status

Variable	Chi-square	df	P
Traditional healer occupation	16.472	1	0.001

Hypothesis 1 Results

I rejected the Null Hypotheses (H_0) that stated: There are no statistically significant associations between sociocultural and behavioral factors and Ebola infection in women and men aged 15 to 49 during the 2014 Ebola outbreak in Sierra Leone. Using SLED survey data from Sierra Leone, I tested the hypothesis that there are statistically significant associations between sociocultural and behavioral factors and Ebola infection in women and men aged 15 to 49 during the 2014 Ebola outbreak in Sierra Leone. I conducted a chi square test of association to test the association between four potential sociocultural and behavioral risk factors for Ebola virus infection status (funeral attendance, funeral touched body, contact with sick person, preparation and consumption of bushmeat activity), and Ebola virus infection status, I conducted a bivariate chi-square test analysis, due to the categorical nature of the dependent and independent variables. I also including demographics respondent's gender, age, and housewife/caretaker occupation, and the three covariates: traditional healer occupation, touch bodily fluids, and traditional healer care, due to their potential effect on Ebola outcome (WHO, 2014). The chi square and cross- tabulation results indicated that reported touching dead body at a funeral chi square (1, N = 1,205) = 5.140, p = .023; having attended a funeral chi square (1, N = 21,514) = 1598.756, p = .001; contact with a sick person chi square (1, N =

10,975) = 1218.021, p = .001; gender chi square (1, N = 17,230) = 4.459, p = .035; house wife/care taker: chi square (1, N = 34,715) = 20.086, p = .001 in the last month before Ebola onset had statistically significant association with Ebola infection status. The covariates touching bodily fluids: chi-square square (1, N = 28,238) = 372.475, p = 0.001; traditional healer occupation chi square (1, N = 17,341) = 16.472, p = .001 were also statistically significantly associated with Ebola virus infection status. By contrast, these tests demonstrated that hunt prepared and ate primates chi square (1, N = 34713) = 3.861, p = 0.116; age chi square (3, N = 34,715) = 4.084, p = 0.252; and the covariate traditional healer care Chi square (1, N = 3,497) = 0.861, p = 0.353; were not significantly associated with Ebola virus infection.

There were statistically significant differences in the potential risk factors by individuals who engaged in those particular behaviors and those who did not participate in those risky behaviors as shown by their p values, reported touching dead body at a funeral p = .023; having attended a funeral p = .001; contact with a sick person p = .001; touching bodily fluids, p = 0.001; traditional healer occupation p = .001; gender p = .035; house wife/care taker p = .001. On the other hand, there were no statistically significant differences in age groups p = 0.252; individuals who participated in traditional healer care p = 0.353; and hunt prepared and ate primates p = 0.116 compared to those who did not participated in those behaviors.

Therefore, there is sufficient evidence to reject the null hypothesis when predicting Ebola virus status and sociocultural and behavioral determinants, reported touching dead body at a funeral; having attended a funeral; and contact with a sick person

as a total set of associators among women and males aged 15 to 49 years in the 2014 Ebola epidemic.

Factors Predictive of Ebola Virus Disease

RQ2: What are the significant predicting sociocultural and behavioral risk factors (possible funeral attendance, funeral touched body, contact with sick person, preparation and consumption of primate activity), respondent's gender, respondent's age group, and housewife/caretaker occupation for Ebola disease status among women and men aged 15-49 during the 2014 outbreak in Sierra Leone?

H_o2: There are no statistically significant predicting sociocultural and behavioral risk factors (possible funeral attendance, funeral touched body, contact with sick person, preparation and consumption of primate activity), respondent's gender, respondent's age group, and housewife/caretaker occupation for Ebola disease status among women and men aged 15-49 during the 2014 outbreak in Sierra Leone.

H_a2: There are statistically significant predicting sociocultural and behavioral risk factors (possible funeral attendance, funeral touched body, contact with sick person, preparation and consumption of primate activity), respondent's gender, respondent's age group, and housewife/caretaker occupation for Ebola disease status among women and men aged 15-49 during the 2014 outbreak in Sierra Leone.

To assess research question two and to test my hypothesis 2, I performed Backward elimination multiple regression analyses using model that included all variables that were statistically significantly associated in the bivariate analysis (funeral attendance, funeral touched body, contact with sick person, respondent's gender,

housewife/caretaker occupation) ($p \leq 0.05$). Furthermore, based on agreement with other analyzes and the congruence with the determinants of ecological model, I decided to also include the variables that were not found to be statistically significant in the chi-square analysis age groups $p = 0.252$; hunt prepared and ate primates $p = 0.116$. I also included the three covariates touch bodily fluids, participated in traditional healer care, and traditional healer occupation, in the backward stepwise logistic regression analysis. I entered all the dependent variable and the predictor variables simultaneously in the model. In preliminary analysis, the main assumptions of multiple regression, the relationship between each of the predictor variables and the dependent variable is linear, the error or residual is normally distributed and uncorrelated with the predictors, and homoscedasticity, the absence of multicollinearity were checked and fulfilled (Green & Salkind, 2014). Both collinearity and tolerance were met with values 1.0 and 1.0 respectively. The beta weights and significance values for the best models is presented in Table 22. *Results of* backward stepwise elimination multiple regression analysis revealed that the backward regression model was statistically significant, and *the* model with the most parsimonious predictor variable includes case's funeral attended, $F (1, 287) = 4.727$, $p = .031$, $R^2 = .016$, adjusted $R^2 = .013$. This demonstrates that the model of the one independent variable effectively predicted Ebola virus infection status, and also indicates that (R^2) 1.6% of the variance in Ebola virus infection status or in predicting Ebola can be explained by this model (variable) which, according to Cohen (1988) is a small effect, but has profound practical and clinical implication given the deadliness of the Ebola virus disease in women and men aged 15 to 49 years in Sierra Leone (Faul et al., 2007; Field,

2013; Frankfort-Nachmias & Nachmias, 2008; Green & Salkind, 2014). The equation for the model was Ebola virus infection status = 1.653 - .826 case's funeral attend + e. After backward elimination, funeral attended emerged as the only significant risk factor associated with being a suspect/probable/confirmed case-patient and that statistically significantly contributed uniquely to the final model (t = 1 or VIF =1.001, p = .031). These findings have tremendous and profound practical and clinical implications *for community educators promotion for this identified potential risk factor, health care programmers, and public health Ebola virus message designers that are discussed in chapter 5.*

Table 20

*Backward Multiple Regression Analysis Summary Predicting Ebola Virus Infection from Predictor Variables (*N=*289)*

Model	B	SEB	β	R^2	ΔR^2	t	VHF	P
Funeral attended	-.826	.386	-.127	.016	-.009	1.0	1.0	.031

Hypothesis 2 Results

The null hypothesis which states that there are no statistically significant predicting sociocultural and behavioral risk factors (possible funeral attendance, funeral touched body, contact with sick person, preparation and consumption of bushmeat activity), respondent's gender, respondent's age group, and housewife/caretaker occupation for Ebola disease status among women and men aged 15-49 during the 2014 outbreak in Sierra Leone is rejected in favor of the alternative hypothesis. Based on the

backward stepwise logistic regression results presented in Table 22, funeral attend (β= -.127, t= 1 or VIF =1.001, p = .031), F (1, 287) = 4.727, p = .031, adjusted R^2 = .013 or 1.3%. The model of the single independent variable effectively predicted Ebola virus infection in women and men aged 15 to 49. The predictor accounted for (R^2) = .013 or 1.3% of the variance in Ebola virus infection acquisition in the study population, which, according to Cohen (1988), is a small effect, but may have tremendous clinical and practical implication for Ebola prevention in the study population (Faul et al., 2007; Field, 2013; Frankfort-Nachmias & Nachmias, 2008; Green & Salkind, 2014). The only individual predictor in the model that presented a statistically significant, unique contribution to the final model was funeral attend (t= 1 or VIF =1.001, p = .031. Therefore, there is sufficient evidence to reject the null hypothesis when predicting Ebola virus status and sociocultural and behavioral determinants among women and males aged 15 to 49 years in the 2014 Ebola epidemic.

The data from this study highlight the urgent need for a renewed and continuous Ebola prevention strategy, and clearly indicated that Ebola infection research, prevention and education programs be prioritized and be geared towards the potential risk factors found in this cross-sectional study for women and men aged 15 to 49 years. Furthermore, rigorous and comprehensive multi-factoral intervention prevention programming approach must be designed and implemented specifically for this at- risk population in order to modify Ebola risk behaviors such as attending funeral of Ebola deaths and to prevent future Ebola disease outbreak and spread in the country. The Ministry of Health and Sanitation health care professionals, nurses and various doctor’s community and the

newly elected government of Sierra Leone are in a strategic position to promote prevention intervention. The findings of this study supported the Ecological mode's level, individual factors (for example gender), and interpersonal (for example, attending funeral) that predispose individuals like women and men aged 15 to 49 years to being infected with disease, such as the Ebola virus (Glanz et al., 2008).

Summary

This cross-sectional study sought to examine whether there are association between sociocultural and behavioral risk factors and Ebola virus infection among women and men aged 15 to 49 years in Sierra Leone? In addition, the study sought to evaluate the significant predicting sociocultural and behavioral risk factors (possible attended funeral, funeral ritual, preparation and consumption of bush meat, contact with sick person), respondent's gender, age, and house wife/care taker for Ebola disease among women and men ages 15 to 49 years in Sierra Leone? I also included three covariates, touch body fluids, traditional care, and traditional healer occupation in the analysis due to their effects on Ebola outcome as indicated by previous literature and the ecological model's construct (Glanz et al., 2008; Wamala et al., 2010). I used a chi-square test of association to examine the association between the independent variables and the dependent variable. Then I used backward stepwise logistic regression to assess the predictability of the independent variables on Ebola outcome. The results of the study are presented in this chapter.

A principle finding of this study from the chi square analysis was that reported touching dead body at a funeral chi square (1, N = 1,205) = 5.140, p = .023; having

attended a funeral chi square (1, N = 21,514) = 1598.756, p = .001; contact with a sick person chi square (1, N = 10,975) = 1218.021, p = .001; gender chi square (1, N = 17,230) = 4.459, p = .035; and house wife/care taker occupation: chi square (1, N = 34,715) = 20.086, p = .001 in the last month before Ebola onset had statistically significant association with Ebola infection status. Also, the covariates, touching bodily fluids: chi-square square (1, N = 28,238) = 372.475, p = 0.001; and traditional healer occupation chi square (1, N = 17,341) = 16.472, p = .001 were statistically significant. On the other hand, these tests demonstrated that age chi square (3, N = 34,715) = 4.084, p = 0.252, hunt prepared and ate primates chi square (1, N = 34713) = 3.861, p = 0.116; and the covariate traditional healer care Chi square (1, N = 3,497) = 0.861, p = 0.353 were not significantly associated with Ebola virus infection. The null hypothesis: H01 was rejected because the findings showed differencies among groups and statistical significance association between sociocultural factors and behavioral risk factors (reported touching dead body at a funeral p = .023; having attended a funeral p = .001; and contact with a sick person p = .001), gender p = .035; and house wife/care taker: p = .001 in the last month before Ebola onset. The covariates touching bodily fluids: p = 0.001, and traditional healer occupation p = .001 also had statistically significant association with Ebola infection status.

A second principle finding of this study from the backward elimination logistic regression was that the only individual predictor in the model that presented a statistically significant, unique contribution to the final model was funeral attend (t= 1 or VIF =1.001, p = .031). Therefore, there is sufficient evidence to reject the null hypothesis when

predicting Ebola virus status and sociocultural and behavioral determinants among women and males aged 15 to 49 years in the 2014 Ebola epidemic.

The following chapter summarized this Ebola cross-sectional study and presented conclusions about the study findings. In Chapter 5, I discuss the findings, and interpret the analysis of this study. Furthermore, I discussed the positive social change implications of these study results, the limitations of this study, and future recommendations for continued research in the area of Ebola disease infection and socio cultural and behavioral risk factors among women and men aged 15 to 49 years in Sierra Leone.

Chapter 5: Discussion, Conclusions, and Recommendations

Sierra Leone is the country hardest hit by the 2014 Ebola virus epidemic. Women and men were greatly affected (WHO, 2015). Women accounted for 5,118 (52%) of the 9,944 EVD cases reported in the country (WHO, 2015). Furthermore, Bower et al. (2016) found that Ebola infection varied by age group: 43% for children and 60% for adults >30 years of age. This problem is often attributed to sociocultural and behavioral factors such as attendance at a funeral, participation in funeral rituals, and contact with a suspected or sick person (Bower et al., 2016; Dietz et al., 2015). Bower et al. found that in 94 households, 448 (48%) had contracted EVD, and EVD risk ranged from 83% for touching a corpse to 8% for minimal contact. Studies have not addressed women's risk for Ebola. The social and cultural roles of women and men in the country (e.g., women as caregivers for sick family members) may have increased women's vulnerability and risk to the Ebola virus and resulted in the sexes being differently affected during this outbreak (Adongo et al., 2016; Fawole et al., 2016; Sia et al., 2016). It is necessary to understand the sociocultural and behavioral risk factors that increase the risk of women and men ages 15 to 49 years acquiring Ebola virus so that behavioral preventive interventions can be designed for the study population. Also, focused prevention interventions may be a cost-effective approach to preventing future Ebola outbreaks or controlling Ebola transmission in Sierra Leone and elsewhere in Africa (Adongo et al., 2016; Fawole et al., 2016; Sia et al., 2016).

Researchers in previous Ebola virus infection studies combined women and men of all ages together (Dallatomasina et al., 2015; Dietz et al., 2015; MacDonald, 2016;

Nkangu et al., 2017; WHO Ebola Response Team, 2015) and did not address women and men ages 15 to 49 years despite the heavy burden of Ebola among this population during the 2014 Ebola epidemic in Sierra Leone. Combining this at-risk population with the whole population has limited the information available on the sociocultural and behavioral factors that increase Ebola vulnerability among women and men ages 15 to 49 and how these factors may differ from other groups in the country. This may hinder development of effective Ebola programs and interventions. This gap in the literature may also be masking critical differences among individual risk factors, such as attending funeral, and may make it difficult to obtain comprehensive understanding of Ebola and risky behavior in this subgroup in Sierra Leone. Researchers did not examine why women and men ages 15 to 49 years were disproportionately affected by Ebola, making a population-based understanding of the health needs of this important segment of the Sierra Leone population difficult. Limited findings could lead to underestimation of Ebola virus health risks of funeral attendance, for example, among this population. There are gaps in understanding the relationship between sociocultural and behavioral factors and Ebola virus infection in the study population. Effective and efficient prevention and management strategies of Ebola depend on comprehensive knowledge of sociocultural and behavioral factors in Sierra Leone.

The purpose of this study was to examine and understand the relationship between the possible socio cultural and behavioral risk factors (funeral attend, participation in burial rituals, contact with sick person, preparation and consumption of bush meat), respondent's gender, age group, and house wife/care taker occupation independent

variables and dependent variable Ebola virus status in this study population in the country, using a quantitative method paradigm and cross-sectional study design to address the identified gap. I also included the following covariates: touching bodily fluids, traditional healer occupation, and traditional healer care, due to this effect on Ebola as suggested in the literature and the ecological model levels (Glanz et al., 2008; Wamala et al., 2010). The ecological model was used as a framework to guide this secondary data analysis of the (SLED). Information on Ebola disease and potential risk factors among the study population in Sierra Leone might prevent future transmission of Ebola virus, and could better inform and fully provide enough evidence necessary for planning effective and efficient gender and age-specific, burial preventive intervention programs for future Ebola outbreaks in Sierra Leone and other African countries. Furthermore, it may have tremendous clinical and practical implications for social and cultural norm change interventions among the study population at high risk for Ebola virus infection and could provide strategic and new options for prevention to modify Ebola risk behaviors and improve health in women and men aged 15 to 49 years in Sierra Leone, and thus saving many valuable lives.

This study answers 2 important questions in the field of risk factors and Ebola virus infection disease: (1) Are there associations between sociocultural and behavioral factors and Ebola infection in women and men aged 15 to 49 during the 2014 Ebola outbreak in Sierra Leone? (2) What are the significant predicting sociocultural and behavioral risk factors (possible burial attendance, burial ritual activity, contact with Ebola patients, preparation and consumption of bushmeat), respondent's gender, age

group, and house wife/care taker occupation for Ebola disease among women and men aged 15-49 during the 2014 outbreak in Sierra Leone? I also, included the following covariates: touching bodily fluids, traditional healer occupation, and traditional healer care. I performed chi-square teat of association to assess association between socio-cultural and behavioral potential risk factors and Ebola status, and for the comparison of proportions. Then, risk factors significantly associated with Ebola (at *p*-less than or equals to 0.05) were evaluated in a backward elimination regression analysis, while controlling for confounders to assess the significant predicting sociocultural and behavioral risk factors. The chi-square test results revealed statistically significant associations between Ebola virus infection status and potential risk factors, reported touching dead body at a funeral, having attended a funeral, contact with a sick person in the last month before Ebola onset, gender, house wife/care taker. Also, the covariates touching bodily fluids, traditional healer occupation were found to be statically significant for Ebola status. However, the same tests showed that respondent's age, traditional healer care, and hunt prepared and ate primates were not significantly associated with Ebola virus infection status. Moreover, the backward elimination logistic regression depicted that the only individual predictor in the model that presented a statistically significant, unique contribution to the final model was funeral attend (t= 1 or VIF =1.001, $p < .031$). The results were presented to allow for confirmation or rejection of the 2 research questions and hypotheses. The null hypothesis for both question one and two were rejected in favor of the alternative hypothesis since there were sufficient

evidence for statistical relationships between the independent variables and the dependent variable.

In this chapter, I discussed my primary findings and make relevant recommendations for improving the current Ebola program in place for future Ebola disease outbreaks in Sierra Leone, and other nations. The review concludes by suggesting opportunities for improving our knowledge about and management of Ebola virus among the study population, including prevention opportunities for Ebola risky behavioral modification in this under-recognized highly vulnerable group at risk for Ebola transmission. It is expected that the findings and recommendations from this study would be paramount for addressing current Ebola effects and preventing and combating future Ebola outbreaks in the country and similar settings in Africa and the world.

Interpretation of the Findings

I have shown in this study that Ebola virus infection status is statistically and significantly associated with potential risk factors such as attended funeral, and that attended funeral is a statistically significant predictor of Ebola virus infection status among women and men aged 15 to 49 years in Sierra Leone. This important finding provided better opportunity for some estimation of the seriousness of Ebola risk associated with certain exposures, such as attending funerals in Sierra Leone, and provided better understanding of the epidemiological factors of the 2014 Ebola epidemic among the study population in the country. This study therefore provides important sociocultural and behavioral support for epidemiological observations that have been made previously regarding the Ebola virus transmission and risk factors in Sierra Leone

and elsewhere in Africa. My results from this study also confirm the magnitude of the Ebola epidemic, especially among women and men ages 15 to 49 years in Sierra Leone and are in line with the findings from most of the Ebola studies conducted in Africa (Bower et al., 2016; Dietz et al., 2015; Dowell et al., 1999; MacDonald, 2016; Senga et al., 2016; WHO Ebola Response Team, 2015; WHO Ebola Response Team, 2016). The findings also aligns with aspects of the ecological model, that health outcomes result from a unique combination of intrapersonal or individual level determinants, such as age, gender, and behavior, interpersonal determinants, example family, culture and tradition, caretaker behavior there by contextualizing the reciprocal interdependence of individuals and their environment (Glanz et al., 2008; Shahabuddin et al., 2017). My findings demonstrated that there is clearly a multidimensional relationship between the risk of Ebola virus infection status and several socio cultural and behavioral factors among women and men aged 15 to 49 years in Sierra Leone. The ecological model served as a framework for examining the relationship between the independent variables and the dependent variable. Interpretation of findings from this study and a comparison with previous literature in accordance to the two research questions are next.

Research Question 1

RQ1 asks whether there are associations between sociocultural and behavioral factors and Ebola infection in women and men aged 15 to 49 during the 2014 Ebola outbreak in Sierra Leone? The sociocultural and behavioral factors included touch body at funeral, attended funeral, contact with sick person, preparation and consumption of primates. Demographic factors respondent’s gender, age group, and house wife/care taker

occupation were included, in addition to the three covariates, touch body fluids, traditional healer care, traditional healer occupation. My first principal findings from this Ebola cross-sectional study suggest that the potential sociocultural and behavioral risk factors reported touching dead body at a funeral: chi square (1, N = 1,205) = 5.140, *p* = .023: having attended a funeral: chi square (1, N = 21,514) = 1598.756, *p* = .001; and Contact with a sick person: chi square (1, N = 10,975) = 1218.021, *p* = .001 in the last month before Ebola onset had statistically significant association with Ebola infection status. Furthermore, the demographic factors: gender: chi square (1, N = 17,230) = 4.459, *p* = .035 and house wife/care taker occupation: chi square (1, N = 34,715) = 20.086, *p* = .001 were statistically significant for Ebola status. The covariates touching bodily fluids: chi-square square (1, N = 28,238) = 372.475, *p* = 0.001, and traditional healer occupation: chi square (1, N = 17,341) = 16.472, *p* = .001; are statistically significantly associated with Ebola infection status among women and men ages 15 to 49 years. But, these tests demonstrated that age: chi square (3, N = 34,715) = 4.084, *p* = 0.252, hunt prepared and ate primates: chi square (1, N = 34713) = 3.861, *p* = 0.116, and the covariable traditional healer care: Chi square (1, N = 3,497) = 0.861, *p* = 0.353; were not significantly associated with Ebola virus infection among women and men ages 15 to 49 years. The results of this study provided sufficient evidence and support the alternative hypothesis that there are significant associations between sociocultural and behavioral factors, and demographic factors and Ebola infection in women and men aged 15 to 49 years and men during the 2014 Ebola outbreak in Sierra Leone. Therefore, I rejected the null hypothesis.

Comparison With Previous Studies

Compared with most previous studies of risk factors for Ebola virus infection in Sierra Leone populations and other African countries (Bower et al., 2016; Dietz et al., 2015; Dowell et al., 1999; MacDonald, 2016; Senga et al., 2016; WHO Ebola Response Team, 2015; WHO Ebola Response Team, 2016), my study has provided a more current, clear estimates, and more detailed information on socio cultural, behavioral, and demographic risky factors and patterns for Ebola among women and men 15 to 49 years in Sierra Leone. It confirmed several earlier theories about the important modes of transmission of Ebola virus in Sierra Leone and elsewhere in Africa (Bower et al., 2016; Dietz et al., 2015; Dowell et al., 1999; MacDonald, 2016; Senga et al., 2016; WHO Ebola Response Team, 2015; WHO Ebola Response Team, 2016), and it allowed for some estimation of the magnitude of risk associated with specific exposures such as contact with sick person among women and men in the country. Additionally, my study provided more detailed quantification of the Ebola risks associated with specific behavioral activities, such as attending funeral, participation in funeral rituals, and contact with sick person.

Statistically significant differences in high risk Ebola infection status behaviors found in this study support the earlier recommendation by Alexander et al. (2015), of the need to conduct a comprehensive assessment of Ebola and increased understanding of cultural and traditional risk factors in Sierra Leone to prepare for future Ebola virus disease outbreaks. In addition, Sharareh, Sabounchi, Sayama, and MacDonald (2016) concluded that future considerations of behavioral factors are urgently needed for an

effective and efficient response to outbreaks of deadly diseases such as the Ebola virus disease in Sierra Leone. Also, Tiffany et al. (2017) recommended additional research in order to better understand the variation of risk for EVD transmission related to distinct care practices both before and after death. My study result has provided enhanced understanding of potential Ebola risk factors such as funeral attendance, participation in funeral rituals, and contact with sick person among the study population in Sierra Leone.

Ebola and direct contact. The results of the chi-square test of association between the two variables indicates that there was a statistically significant association between contact with a person known to have suspected or confirmed Ebola before becoming sick and Ebola virus status ($p = .001$). This finding is consistent with other studies of the association (Dietz et al., 2015; Dowell et al., 1999; Francesconi et al., 2003; WHO Ebola Response Team, 2016). Brainard et al. (2015) assessed risk factors for transmission of Ebola virus disease and found that, among household contacts who reported directly touching a case, the attack rate was 32% [95% confidence interval (CI) 26–38%]. Risk of disease transmission between household members without direct contact was low (1%; 95% CI 0–5%). Furthermore, Levine et al. (2015)'s retrospective study of patient data collected during routine clinical care at the Bong County Ebola Treatment Unit in Liberia, identified variable independently predictive of laboratory-confirmed Ebola virus disease as sick contact, 0.75 (95% confidence interval 0.70 to 0.80). Similarly, Dietz et al. (2015) reported that among the 58.8% (4885 of 8311) with confirmed cases who responded to the question on contact with a suspected case patient or sick person within 1 month of symptom onset, 47.9% (2340 of 4885) reported having

contact with such a person. They also mentioned that 52.1% (2545 of 4885) were recorded to have had no contact with someone with suspected EVD or any sick person. In Dowell et al. (1999)'s Ebola and potential risk factor cross-sectional design study using logistic regression similar to mine, of 95 family members who had direct physical contact with an ill family member, either at home in the early phase of illness or during the hospitalization, 28 became infected, whereas none of 78 family members who did not touch an infected person during the period of clinical illness were infected ($p < .001$). According to Dowell et al. (1999), Ebola virus is transmitted mainly by direct physical contact with an ill person or their body fluids during the later stages of illness.

As such, implementation of barrier control measures, such as wearing gloves during patient contact to reduce Ebola transmission may be very effective in reducing the spread of Ebola virus (Bärnighausen et al., 2007; Dowell et al., 1999). Furthermore, because of the risk to other family members, it is preferable to minimize contact between house wife/caregivers and Ebola patents. Certainly, limiting contact between Ebola infected patients and family members/caregivers whenever possible to minimize risk and to reduce Ebola transmission may be very effective in reducing the spread of Ebola virus. Care givers can also follow instructions, including appropriate use of personal protective equipment (WHO, 2014; WHO, 2015).

Ebola and attended funeral. A statistically significant association between Ebola infection status and attended funeral activity risk factor among women and men aged 15 to 49 years was also identified in this study ($p = .001$). In common with my study, recently, Ebola data generated from an observational study, analyzing data from all

confirmed and probable Ebola cases in Guinea during 2014 reported that 86% (95% CI 75–90) of exposure was at funerals (Faye et al., 2015). Individuals who reported attending funeral find an association with Ebola while those who reported not attending did not find an association (Faye et al., 2015). Ebola transmission in Sierra Leone and elsewhere in Africa has been linked to funerals. In a recent study, WHO (2014) indicates that at least 20% of all new Ebola virus infections occur during burials of infected Ebola patients. In addition, a Retrospective Observational Study using data from 3,529 cases in Guinea, 5,343 in Liberia, and 10,746 in Sierra Leone to assess exposure patterns driving Ebola transmission in West Africa, found that funeral exposures were reported by 33% of Ebola cases (WHO Ebola Response Team, 2016). Another study analyzing internal service data and published reports from response agencies in Sierra Leone reported that the proportion of confirmed patients admitted to the Ebola centers increased from 19% to 37%, and funeral contact in those admitted was about 16% (Lokuge et al., 2016).

This result could be attributed to the fact that funeral attendees may be likely to also interacting with and being in direct physical contact with individuals who participated in traditional funeral rituals and touched bodily fluids that are known to be high risk factors for Ebola (Adongo et al., 2016; Alexander et al., 2015; Manguvo & Mafuvadze, 2015; Stehling-Ariza et al., 2016; WHO, 2017).

My findings in this study signals a need for better and continued Ebola control and prevention efforts in the country that may depend on identification of risk factors, instilling long-term cultural changes (e.g. traditional funeral practices) that are widely spread in local communities across the country (Bower et al., 2016; Dietz et al., 2015;

Dowell et al., 1999). Also, in the absence of proven vaccination for Ebola, the primary control measure for Ebola virus infections should remain the early identification of cases, contact tracing and subsequent quarantine and care of in order to prevent Ebola infection or stop future spread of the disease within this community (Bower et al., 2016; Dietz et al., 2015; Dowell et al., 1999; MacDonald, 2016; Senga et al., 2016; WHO Ebola Response Team, 2015; WHO Ebola Response Team, 2016).

Ebola and touched body at funeral rituals: The results of the chi-square test of association between touched the body at a funeral and Ebola suspected/probable/confirmed cases combined status showed that there was a statistically significant relationship between touched the body at a funeral and Ebola virus status among individuals (p = .023). The statistically significant association for the exposure reported in this study, contact with corpses and touching of bodies at funerals is consistent with those reported in other outbreaks (WHO, 2014b; 2015). Wamala et al. (2010) used similar methods like mine to assess relationship between Ebola and similar risk factors as mine and found that participation in funeral rituals was statistically significantly associated with Ebola status (p< 0.001). They also found that most transmission was associated with handling of dead persons without appropriate protection (adjusted odds ratio 3.83, 95% confidence interval 1.78–8.23). In another study out of Moyamba District, Sierra Leone, Curran et al. (2016) assessed funeral attendees and Ebola relationship among the 28 persons and found that the 28 persons who attended the funeral and later developed Ebola, 23 (82%) were family members and 18 (64%) were male. 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). A WHO study found that 60% or more of infections in Guinea could be related directly to participation in traditional funeral activities, involving washing and touching the dead from a high-infestation area of Guinea (2014b; 2015). Dietz et al. (2015) reported that 55.6% of those with confirmed cases (4621 of 8311), 66.2% (518 of 782) reported touching the body. According to Alexander et al. (2015); Manguvo and Mafuvadze (2015), another significant high risk cultural and behavioral factor contributing to the transmission of Ebola virus disease in Africa entails traditional burial activities rituals.

Ebola disease data show that Ebola patients in the later stage of the disease or newly dead exhibit highest virus load and are the greatest contributors to Ebola virus disease spread (Phua, 2015). So, anyone who comes in direct contact with Ebola contaminated bodily fluids from these individuals has a greater risk of contracting the disease (Phua, 2015).

Better Ebola control and prevention in the country may depend on identification of risk factors, instilling long-term cultural changes (e.g. traditional funeral practices) that are widely spread in local communities across the country (Bower et al., 2016; Brainard et al., 2016; Dietz et al., 2015; Dowell et al., 1999; MacDonald, 2016; Senga et al., 2016; WHO Ebola Response Team, 2015; WHO Ebola Response Team, 2016). Implementation of these measures is essential for preventing or controlling future Ebola virus outbreaks in Sierra Leone.

Ebola and primate bushmeat. In this study, hunting, preparation, and eating primate activities and Ebola virus status among respondents with suspected/probable/confirmed Ebola status ($p = 0.116$) was not significant. This finding is surprising, however, it is consistent with a similar cross-sectional Ebola study out of Uganda in which Wamala et al. 2010 reported no significant association for bushmeat activity and Ebola status $p< 0.8$.

Researchers believe that, bush meat activities such as cutting and cooking involves contact with potentially Ebola infected meat, and individuals could expose themselves to fluids such as Ebola virus-infected blood and tissue and potentially increase their risk of contracting the Ebola virus, especially when open wounds are present (Alexander et al., 2015; Nkangu et al., 2017; Phua, 2015). The finding from this study warrants further study.

Ebola and gender. In my finding, the proportion of women who had suspected/probable/confirmed Ebola infection status was similar to that of men. As observed, 2976 (33.3%) of male participants have suspect/probable/confirmed cases combined. While similarly 2896 (34.9%) of female participants have suspect/probable/ confirmed cases combined. This finding is consistent with other Ebola and risk factors studies conducted in sierra Leone and elsewhere in Africa (Arranz et al., 2016; Bower et al., 2016; Dietz et al., 2015; Haaskjold et al., 2016; Kouadio et al., 2015; Nkangu, Olatunde, and Yaya, 2017; Schieffelin et al., 2014). Dietz et al. (2015)'s study in Sierra Leone found that about half (51.7%) of those with confirmed cases were female. Similarly, Haaskjold et al. (2016) in Moyamba District, Sierra Leone demonstrated that,

of 31 patients who were positive for Ebola virus disease, 14 (45%) were male and 17 (55%) female. According to Nkangu, Olatunde, and Yaya (2017) of the 315 Ebola cases reported in the 1995 Ebola outbreak, 53% were in women, and 47% were in men. In the 2014 outbreak in West Africa, Sierra Leone had 5118 cases for women and 4823 for men, while in Nigeria, women accounted for 55% of the cases, and men accounted for the remaining 45%.

Moreover, the results of the chi-square test of association between gender and Ebola virus status indicates that there was a statistically significant association between gender and Ebola virus status (p = .035). This finding is consistent with other studies (Arranz et al., WHO, 2014; WHO, 2015). Arranz et al. found differences in gender group. Of the seventy-five patients included in their study, 31 (41.3 %) were positive for Ebola, and more women (68 % vs. 28 %, $p = 0.001$) were Ebola virus disease positive. Various factors may help explain this trend seen in Ebola for women and men in Africa. Women in Sierra Leone generally have strong care taker responsibilities norms from the cultural (Adongo et al., 2016; Fawole et al., 2016). According to Fawole et al. (2016), Women are the main caretakers of the sick, children and elderly members in the family in the country. So, women are greatly exposed to infection such as Ebola (UNDG, 2015).

The observed higher infection cases for Ebola in women ages 15 to 49 were not specifically attributable to their gender but rather were likely attributable mainly to differences in exposure to risky care taker behaviors. According to Nkangu et al. (2017), there is no evidence related to biological differences in female or male sex that increases

Ebola virus transmission and vulnerability; rather, there are differences in the level of exposure between men and women.

This finding has important policy implications, suggests that Ebola prevention in this group may require introduction of measures that ensure empowerment through relaxed social norms and more equitable opportunities for women to give them freedom of choice, especially home labor, such as caring for the sick (Adongo et al., 2016; Fawole et al., 2016; Nkangu et al., 2017). The findings also support growing calls for gender-transformative Ebola prevention efforts, including legislation to ensure women's rights in the country (Adongo et al., 2016; Fawole et al., 2016; Nkangu et al., 2017; UNDG, 2015).

Ebola and age. In this study, age ($p = 0.252$), was not significantly associated with Ebola virus infection status among women and men ages 15 to 49 years. This result is consistent with patterns seen in other studies in Sierra Leone and other countries (Wamala et al. 2010). In a similar cross-sectional study out of Uganda, Wamala et al. 2010, reported that age of respondents was not significantly associated with having Ebola ($p = 0.4$). Even though other researchers including Mulangu et al. (2016) found a significant relationship between age and Ebola status ($p = 0.023$). This discrepancy could be related to methodological differences and so warrant further study.

Ebola and housewife/careter occupation. My study demonstrates that there was a statistically significant association between housewives/caretaker and Ebola virus status ($p = .001$), in women aged 15 to 49 years. This finding is consistent with studies conducted earlier in Sierra Leone. For example, Brainard et al. (2016), 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). Similarly, in a similar cross-sectional study design, using logistic regression, Dowell et al. 1999 found that being an adult family member (RR, 4.6; 95% CI, 2.0–10.3), was associated with Ebola infection status. A 2016 retrospective observational study in Guinea, Liberia, and Sierra Leone found that overall, 87% of exposures occurred between family members (WHO Ebola Response Team, 2016). In this same study, more than 90% of cases reported involve 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); Ravi and Gauldin (2014) agree that behavior and practice that may be correlated with the acquisition of Ebola virus disease in West Africa, particularly, Sierra Leone is caretaking of Ebola patients. Studies by Fawole et al. (2016); Ravi and Gauldin (2014). They also believe that Sierra Leone's deeply rooted family social and cultural norms of caregiver role given to women have been associated with behavioral changes about an increased Ebola disease risk and higher exposure among women. Studies suggest that the Ebola virus is transmitted by direct contact with contaminated bodily fluids of people with Ebola, and other contaminated materials (Fawole, Bamiselu, Adewuyi, & Nguku, 2016). Furthermore, in the 2000–2001 Ugandan Ebola outbreak, caregiving, responsibility mainly by women was linked to the high rate of infection in women (67%) of Ebola cases in the country (Alexander et al., 2015). Stehling-Ariza et al. (2016) study in Kono District, Sierra Leone, claim that among 50

confirmed Ebola cases, caring for or contact with sick patients was the likely source for 19 (38.0 %) Ebola disease infection. In another recent study out of Guinea, Faye et al. (2015) found that overall, 72% (105 of 145) of transmissions occurred between family members, while providing care in the home.

Because caretaker populations may play a critical role in Ebola outbreak, prevention efforts should focus on this group. Also, because my study and studies elsewhere have shown significant gender differences in Ebola risks (Brainard et al., 2016; Dowell et al., 1999), there is a need to critically examine contextual factors that influence how house wife/caretaking activity risks overlap with other risk factors among women caretakers.

Touched body fluids. Furthermore, the three covariates were assessed: In this study the behavior of touching body fluids was statistically significantly associated with Ebola suspectes/probable/confirmed cases combined status among the sample population (p = .001). My finding is consistent with research studies that examined the factors that lead to the emergence of Ebola outbreaks in Uganda. In Dowell et al. (1999)'s cross sectional study out of Kikwit, Democratic Republic of the Congo found that risk factors reported contact with the body fluids of an ill person (RR, 3.6; 95% confidence interval [CI], 1.9–6.8), was strongly predictive of Ebola infection status.

This certainly justified my decision to include this variable as a covariate in my analysis and supports the ecological model levels (Glanz et al., 2008; Wamala et al., 2010). My study finding indicate that to prevent Ebola, public health officers and other stakeholders have to include touch body fluids-specific initiatives so to evoke Ebola risk

factor behavioral change in the community around Sierra Leone (Alexander et al., 2015; WHO, 2014, WHO, 2015).

Ebola and traditional healer care. In this study traditional healer activity was not shown to be associated with suspected/probable/confirmed Ebola status among the sample population (p = 0.353). This finding is also consistent with Wamala et al. 2010‘s study of Ebola and similar potential risk factors in Uganda (p= 0.06). There is however, need to determine the specific mechanisms underlying traditional healer care vulnerability to Ebola among women and men aged 15 to 49 years in the country.

Ebola and traditional healer occupation practice. In this study traditional healer activity was statistically significantly associated with Ebola suspected/probable/ confirmed cases combined status among the sample population (p = .001). My finding is consistent with research studies that examined the factors that lead to the emergence of the 2014 outbreak (Alexander et al., 2015). In Ebola infection, traditional healer has been shown to be associated with Ebola (Alexander et al., 2015; Manguvo & Mafuvadze, 2015). A study out of the Fogbo village, Sierra Leone depicted that the funeral of a prominent medicine woman who had contracted Ebola from caring for Her Ebola-infected brother triggered several deaths 17 women and one man (Richards et al., 2015). It was believed by researchers (WHO, 2015) that this Fogbo village incident may be the main event that triggered the widespread Ebola disease in Sierra Leone killing 3,589 people, causing 4,051 discharged cases, 8,704 cumulative cases, and 5,113. Most traditional healers use their bare hands, to apply topical medicine, mouths to suck blood from their patient’s body, and sometimes use sharp instruments. Furthermore, some. This

risky behavior, practices and beliefs exposes traditional healers to the Ebola virus. Furthermore, they lack correct information on Ebola virus infection (Richards et al., 2015; WHO, 2015). Understanding the possible role of traditional healers in the 2014 Ebola epidemic in Sierra Leone is important. Clearly, to protect themselves and their clients, traditional healers need the right information on Ebola virus infection. This indicates urgent prevention intervention and good collaboration between traditional healers and medical professionals, including helping traditional healers to work with and refer patients to hospitals, use proper protective gears such as hand gloves to carry out care (Richards et al., 2015; WHO, 2015). Also, Ebola education must be given to all groups in Sierra Leone including traditional healers, their patients and general public. The Ministry of Health Sierra Leone and other stake holders should focus on the safety of traditional healer practices as a possible mode of transmission of Ebola infection in Sierra Leone (Richards et al., 2015; WHO, 2015). It was also certainly justified to include this covariate in my study analysis.

Research Question 2

RQ2 asks the following question: What are the significant predicting sociocultural and behavioral risk factors (possible funeral attendance, funeral touched body, contact with sick person, preparation and consumption of bushmeat activity), respondent's gender, respondent's age group, and housewife/caretaker occupation for Ebola disease status among women and men aged 15-49 during the 2014 outbreak in Sierra Leone?

My second principal findings from this Ebola cross-sectional study was that attended funeral statistically significantly predicted Ebola infection outcome among

women and men ages 15 to 49 years during the 2014 outbreak in Sierra Leone: F (1, 287) = 4.727, p = .031, adjusted R^2 = .013 or 1.3%. The model of the single independent variable effectively predicted Ebola virus infection in women and men aged 15 to 49. The predictor accounted for (R^2) = .013 or 1.3% of the variance in Ebola virus infection acquisition in the study population, which, according to Cohen (1988) , is a small effect (Faul et al., 2007; Field, 2013; Frankfort-Nachmias & Nachmias, 2008; Green & Salkind, 2014). The only individual predictor in the model that presented a statistically significant, unique contribution to the final model was funeral attend (t= 1 or VIF =1.001, p = .031), indicating Ebola virus infection status decreased by -.127 units. My finding in this study is in line with other studies of the association (WHO, 2014; WHO, 2015). A recent Ebola data generated from an observational study, analyzing data from all confirmed and probable Ebola cases in Guinea during 2014 reported that 86% (95% CI 75–90) of exposure was at funerals (Faye et al., 2015). Furthermore, to assess exposure patterns driving Ebola transmission in West Africa, Agua-Agum et al. (2016) retrospectively analysed data from 3,529 cases in Guinea, 5,343 in Liberia, and 10,746 in Sierra Leone and found that the proportion of cases reporting a funeral exposure (r = 0.35, $p < 0.001$)

This finding has significant practical and clinical implication and is important for public health control measures (Dowell et al., 1999), since it might be used to identify at-risk individuals for future treatment strategies in Sierra Leone (WHO, 2014; WHO, 2015). Furthermore, it is important for programmers, policy makers, and practitioners to integrate the attend funeral predictor into safer Ebola risk behavior education messages

targeting women and men, especially women and men 15 to 49 years (WHO, 2014; WHO, 2015).

Study Findings in Context of Conceptual Model

The Ecological model was used as the theoretical framework to guide this quantitative and secondary analysis study of Ebola infection and potential risk factors among women and men ages 15 to 49 year during the 2014 Ebola epidemic in Sierra Leone. The Ecological model is a multiple level theory that provides better visualization and comprehensive explanation and understanding of the interaction between individual determinants and group or population level determinants that influence health outcome and health behaviors such as Ebola disease (Glanz et al., 2008; Shahabuddin et al., 2017). The model has been used by social science researchers and health researchers in past research to explain possible associations and predictive ability between levels (individual, interpersonal, intrapersonal, and the community) involved in the accusation of infectious disease, such as Ebola (Glanz et al., 2008; Shahabuddin et al., 2017). The Ecological model's core concept is that health outcomes, such as Ebola result from a unique combination of intrapersonal or individual level determinants, such as age, gender, and behavior; interpersonal/network determinants, example family, social support, culture and tradition there by contextualizing the reciprocal interdependence of individuals and their environment (Glanz et al., 2008; Shahabuddin et al., 2017). Understanding the contributors to Ebola virus disease provides tremendous opportunity to tackle determinants of Ebola risk and outcomes. Another important principle of the ecological model is that the model is most useful to guiding research and interventions when they

are tailored to specific health behaviors. This study examined specific health behaviors for Ebola virus infection such as funeral activities. Also, in this model, factors can span levels and therefore the boundaries between levels may be understood as porous rather than distinct (Glanz et al., 2008; Shahabuddin et al., 2017). For the purpose of this study, I streamlined the Ecologic model and I investigated only the intrapersonal or individual level determinants and the interpersonal level determinants, since these levels contain my variables of interest.

Intrapersonal or Individual-Level Determinants

For this study, the individual level determinants for Ebola virus status include age, gender, house wife/care taker, and also the covariate traditional healer occupation behavior. These are thought to impact Ebola virus disease outcomes (Glanz et al., 2008; Shahabuddin et al., 2017). Within the framework of my study, the individual level is referred to gender, age, house wife/care taker, and traditional healer behavior. These factors all of which could cause the spread of the diseases such as Ebola infection. The study findings are consistent with the variables of the Ecological model framework levels (for example age, gender, house wife/care taker).

Gender. My examination of the association between the individual level determinant, gender factor (Table 11) and Ebola infection status using chi-square test show that 2976 (33.3%) of male participants have suspect/probable and confirmed cases combined. While similarly 2896 (34.9%) of female participants have suspect/probable and confirmed cases combined. The results of the chi-square test of association between gender and Ebola virus status Tables 9 indicates that there was a statistically significant

association between gender and Ebola virus status: chi square (1, N = 17,230) = 4.459, *p* = .035. The differences were significant. This association could be attributed to the ecological model's individual level social and cultural norms (Glanz et al., 2008; Shahabuddin et al., 2017). According to Adongo et al. (2016), women's traditional role of care taking may put them in close contact with Ebola sick, which may increase their vulnerability to Ebola infection. Individuals can spread news about Ebola virus infection awareness in Sierra Leone to prevent Ebola.

Age. My examination of the individual level determinant, age factor (Table 12) using chi-square test show that age was not significantly associated with Ebola virus status: chi square (3, N = 34,715) = 4.084, *p* = 0.252 (See Table 8). This finding is consistent with Wamala et al. 2010 's study out of Uganda in which age of respondents was not significantly associated with having Ebola (*p* = 0.4). Even though other researchers including Mulangu et al. (2016) found a significant relationship between age and Ebola status (*p* = 0.023), and the ecological model level note this variable as a determinant in disease such as Ebola (Glanz et al., 2008; Shahabuddin et al., 2017).This descripiancies could be related to methodological differencies (Cresweill, 2009). So further studies are warranted.

Traditional healer occupation behavior. As indicated by chi-square test (table 19), the covariate traditional healer activity was statistically significantly associated with Ebola risk among women and men aged 15 to 49 years in the SLED secondary data set: 16 (76.2%) of participants who reporting practicing traditional healing occupation have suspected/probable and Ebola confirmed cases combined status compared to those who

did not work as traditional healers 5915 (34.2%) (Table 9). Chi square (1, N = 17,341) = 16.472, p = .001 (Table 19). Other researchers have previously reported similar finding (Alexander et al., 2014; Nkangu et al., 2017; Phua, 2015; Kunii, Kita, and Shibuya, 2001). This is probably because this behavior is consistent with engaging in the high risk behavior of cutting and sucking blood which may be contaminated with Ebola virus which are known to pose high risk for Ebola (Alexander et al., 2014; Nkangu et al., 2017; Phua, 2015; Kunii, Kita, and Shibuya, 2001).

Housewife/caretaker occupation behavior determinant. My examination of the individual level determinant, house wife/caretaker behavior (Table 14) 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. Ebola virus infection risk has also been associated with housewives in previous studies (Dowell et al., 1999). The care taker norms for women in Sierra Leone may be attributed to the result observed here, and this raises the question that care taker activity social norms for house wives 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. Sierra Leone cultural norms favor care taking caretaking responsibility for women more than men (Fawole et al., 2016; Glanz et al., 2008; Shahabuddin et al., 2017; Ravi and Gauldin, 2014). Caretaking behavior among women has been linked to exposure to the Ebola virus and an increased risk of Ebola infection (Fawole et al., 2016). These findings highlight the importance of considering the implication of traditional social norms that drives the

women population when investigating health outcomes (Fawole et al., 2016; Shahabuddin et al., 2017; Ravi and Gauldin, 2014). Furthermore, the result indicate that caretaker risk behaviors associated with increased exposure to the Ebola infection are more likely to occur among women than men hence there is a need to have women targeted prevention intervention to prevent or to reduce Ebola proportion among women in Sierra Leone. Further analysis to establish if there is any association between the individual level determinant as associated with Ebola status s recommended to inform development of evidence-based program.

Interpersonal determinants. The ecological model also considers how interpersonal determinants, or relationships with peers, family members, culture and tradition, behavior and the immediate social milieu influence health outcomes. For this study, the interpersonal level determinants for Ebola virus status include (contact with a sick person, attended funeral, funeral touch body, preparation and consumption of primate, the covariates traditional healer care activity, and touch body fluids). These are thought to impact Ebola virus disease outcomes (Glanz et al., 2008).

Contact with a sick person and Ebola virus status. My **e**xamination of the interpersonal level determinant contact with a sick person using chi-square test show that there is statically significant association between contact with a person known to have suspected or confirmed Ebola before becoming sick and Ebola virus status: chi square (1, N = 10,975) = 1218.021, p = .001 (Table 8). This finding indicates urgent need for public health prevention intervention programmers to focus on contact with a sick person.

Attended a funeral and Ebola virus status. My examination of the interpersonal level determinant attended funeral (Table 4) using chi-square test show that there is statically significant association between attended a funeral and Ebola virus status chi square (1, N = 21,514) = 1598.756, p = .001. This result could be attributed to the fact that funeral attendees may be likely also be interacting with and being in direct physical contact with individuals who participated in traditional funeral rituals and touched bodily fluids that are known to be high risk factors for Ebola (Adongo et al., 2016; Alexander et al., 2015; Manguvo & Mafuvadze, 2015; Stehling-Ariza et al., 2016; WHO, 2017). Participating in funeral rituals is also believed to be potential risk factor for Ebolan. This may need more research (WHO, 2014; WHO, 2017).

Funeral touch body behavior determinant. My examination of the interpersonal level determinant, funeral touch body behavior (Table 6) using chi-square test show that there is statically significant association between touched the body at a funeral and Ebola virus status among patients: chi square (1, N = 1,205) = 5.140, p = .023. The significant association shown here may be attributed to the funeral activity cultural norms for example washing and dressing the body of the dead, contribute to greater vulnerability to Ebola infection in Sierra Lone (Adongo et al., 2016; Alexander et al., 2015; Manguvo & Mafuvadze, 2015; Stehling-Ariza et al., 2016; WHO, 2017). This raises the question that funeral activity cultural norms for the study population to dress the dead may be underlying factors that drive the adoption of risk behaviors and can be regarded as ‘determinants’ of vulnerability to Ebola virus infection in Sierra Leone (WHO, 2015; WHO, 2017).

Preparation and consumption of primate. An examination of the interpersonal level determinant, bush meat consumption behavior, showed that there is no statistically significant relationship between bush meat Preparation and Consumption behavior and Ebola virus status among patients with suspected/probable and confirmed Ebola status: chi square (1, N = 34713) = 3.861, $p = 0.116$. This finding is surprising however, it is consistent with a similar cross-sectional Ebola study out of Uganda in which Wamala et al. 2010 reported no significant association for bushmeat activity and Ebola status $p< 0.8$. Bushmeat (example bats) consumption have previously been discussed as potential social and cultural risk factor for Ebola virus outbreaks Alexander et al. (2014); Nkangu et al. (2017); Phua (2015); Kunii, Kita, and Shibuya (2001).

Traditional healer care. My examination of the interpersonal level determinant, cofactor traditional healer care depicts that traditional healer care activity within 12 months before illness onset was not statistically significantly associated with suspected/probable and confirmed Ebola status. Chi square (1, N = 3,497) = 0.861, $p = 0.353$ (Table 17). This finding is also consistent with Wamala et al. 2010 ‘s studies of Ebola and similar potential risk factors ($p= 0.06$). But it may need further investigation.

Touch body fluids. My examination of the interpersonal level cofactor determinant touched body fluids showed that there was a statistically significant relationship between touched the body fluids and Ebola virus status among participants chi square (1, N = 28,238) = 372.475, $p = 0.001$ (Table 16). The significant association shown here may be attributed to wide claims that bodily fluids are a high-risk factor for Ebola infection. Previous studies have shown contact with the patient’s body fluids

(PPR= 4.61%, 95% confidence interval 1.73 to 12.29) to be strongly associated with Ebola (Francesconi et al., 2003, Alexander et al., 2015; Manguvo & Mafuvadze, 2015; Stehling-Ariza et al., 2016; WHO, 2017).

Furthermore, in the backward elimination logistic regression, my examination of the individual level and interpersonal level determinant for their predictive ability for Ebola status show that the only individual predictor in the model that presented a statistically significant, unique contribution to the final model was funeral attend (t= 1 or VIF =1.001, $p < .031$), indicating Ebola virus infection status decreased by -.127 units (table 12).

The findings of the study emphasizes the significance of the interaction of the various levels of the ecological model to influence Ebola outcome.in the study population in Sierra Leone. It is clear that all levels of influence are important. So multilevel studies of determinants such as mine should explain behaviors better than studies of one level, and multilevel interventions generally should be more effective than single level interventions (Glanz et al., 2008; Shahabuddin et al., 2017). Thus, this study provides Sierra Leone pertinent data for the ongoing effort to address the previous Ebola epidemic and prevent future outbreak in the country, especially among the study population. Also, this significant study data could impact the current Ebola virus disease outbreak in the Democratic Republic of the Congo. Strategies for promoting Ebola outcome equity, based on ecological model level of influence would be valuable for public health in Sierra Leone and elsewhere in Africa.

Limitations of the Study

While data from this study provide 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 my results, and the data in this study should be interpreted with caution. First, secondary data were used, thereby limiting the researcher to variables collected by the survey. Second, due to the cross-sectional nature of the analysis, I cannot make inferences about causal relationships between Ebola virus infection 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. So, there is need for longitudinal studies to establish the exact causal direction between Ebola virus infection and many of the investigated variables. The interpretation of the results, therefore, limits it to associations between variables rather than cause-and-effect relationships (Creswell, 2009; Frankfort-Nachmias & Nachmias, 2008). Corsweill, 2009). Third, the information collected during the survey was self-reported, which was subject to recall errors and biases which could lead to likely underestimation, and may make generalizability of the study finding difficult or may limit the study's external validity(Cori et al., 2017; Creswell, 2009; Frankfort-Nachmias & Nachmias, 2008; McNamara et al., 2016). Additionally, there is uncertainty of data as many who died were buried immediately and no information 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, I limited this research analysis to confirmed Ebola virus disease cases, therefore, results may not be generalizable to other populations. A final limitation is 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 SLED data, survey was not a national population based Ebola prevalence surveys, so cannot be used for Ebola *prevalence estimates* (Cori et al., 2017; Creswell, 2009; Frankfort-Nachmias & Nachmias, 2008; McNamara et al., 2016). It 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 this potential risk factors. Incorporating Ebola surveillance into population-based surveys such as Demographic and Health Surveys (DHS) or antenatal health clinics surveys can provide useful information on disease prevalence levels and distribution to capture the full burden of Ebola in the future. Despite these limitations, my data described Ebola and risk factor characteristics of an important population in Sierra Leone with many needs. It also 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.

Recommendations

This cross sectional and secondary data analysis study demonstrated that touching dead body at a funeral (p = .023); having attended a funeral chi square (p = .001); contact with a sick person (p = .001), gender (p = .035); house wife/care taker (p = .001); and the

covariates touching bodily fluids (p = 0.001); traditional healer occupation (p = .001) in the last month before Ebola onset had statistically significant association with Ebola infection status. On the other hand, the chi-square tests demonstrated that respondent's age (p = 0.252); hunt prepared and ate primates (p = 0.116); and the covariate traditional healer care (p = 0.353) were not significantly associated with Ebola virus infection status. Also, the backward elimination logistic regression indicated that the only individual predictor in the model that presented a statistically significant, unique contribution to the final model was funeral attend (t= 1, VIF =1.001, p < .031) among women and men ages 15 to 49 years in Sierra Leone.

In this context there is need to: 1. target these underlying potential risk factors to improve Ebola infection prevention, and to determine and compare unique predictors of Ebola infection in women and men aged 15 to 49 years in the country. This may contribute to risky behavior change in the country, especially in the study population; 2. Further examination is needed on the interpersonal level of the Ecological model, specifically with variable funeral attended. This was the only individual predictor in the model that offered a statistically significant, unique contribution to Ebola outcome status, emphasizes the importance and strong need urgent attention of the policy makers, and programmers. Hence this may improve the design of targeted intervention strategies for Ebola in this setting. Targeted intervention is a vital prevention strategy for Ebola risky behavior change (Adongo et al., 2016; WHO Ebola Response Team, 2016; Alexander et al., 2015; Bower et al., 2016; CDC, 2015; UNDG, 2015). 4. Also, I recommend that Sierra Leone use the Ecological model as a conceptual framework for ongoing

comprehensive Ebola infection behavioral surveillance in the country. Since the framework includes types of behaviors to monitor, such as risk behaviors (funeral attend, burial rituals, house wife/care taker), and it is a multilevel and a well-tested model; 5. This study was strictly quantitative, so more in-depth investigation of the impact of Ebola infection-related stigma among the study population, Ebola survivors and health care workers was not possible. Therefore, a qualitative or mixed-methods study that included interviews or focus groups could provide pertinent information and in depth understanding of attitudes, stigmatization, behavior, and impacts on prevention of risky behavior such as attended Ebola patient funeral in the study population; 6. Similar ongoing studies in other African countries are needed to assess the relationship between potential Ebola risk factors and Ebola infection status in women and men 15 to 49 years sub groups to ensure that the risks of particularly vulnerable populations are understood and to provide insights into the epidemiologic context of Ebola transmission in these sub populations. 7. Future research should prioritize filling knowledge gaps in Ebola risk factor epidemiology among women and men 15 to 49 years in Sierra Leone and other areas in Africa on a large scale bases. 8. Similar risk factor and Ebola infection studies targeted at other populations in Sierra Leone and elsewhere in Africa are needed to prevent Ebola outbreak or decrease the spread of the Ebola epidemic in the future. 9. There is need for additional studies to clarify age, traditional healer care, and hunt prepared and ate primates trends that were not found to be significantly associated with Ebola infection status. 10. Ongoing behavioral research efforts is needed to gain better understanding of this risk factors and unveil more factors unique to the transmission of

Ebola virus to this study group. Nevertheless, the results from this study have very important significance to the study population, public health and healthcare professionals as shown in the next section.

Implications

The purpose of this quantitative cross- sectional study was to examine the potential risk factors for Ebola virus infection, and also to determine the factors that predict Ebola virus infection among women and men 15 to 49 years during the 2014 Ebola epidemic in Sierra Leone, using the Ecological model as a framework. This study has filled a huge data gap identified in the literature by providing compelling evidence regarding the relationship between sociocultural, behavioral, demographic risk factor variables and Ebola virus infection status in the study population. This study demonstrates statistically significant associations between Ebola virus infection status and potential risk factors, reported touching dead body at a funeral (p = .023); having attended a funeral chi square (p = .001); contact with a sick person (p = .001); house wife/care taker (p = .001); Gender (p = .035); and the covariates touching bodily fluids (p = 0.001); traditional healer occupation (p = .001); in the last month before Ebola onset had statistically significant association with Ebola infection status. On the other hand, the chi-square tests demonstrated that age group (p = 0.252); hunt prepared and ate primates (p = 0.116); and the covariable traditional healer care (p = 0.353); were not significantly associated with Ebola virus infection. Furthermore, the backward elimination logistic regression indicated that the only individual predictor in the model that presented a

statistically significant, unique contribution to the final model was funeral attend (t= 1 or VIF =1.001, p = .031, among women and men ages 15 to 49 years in Sierra Leone.

Certainly, these valuable results can be a significant step toward understanding the enormity of Ebola virus infection among this at- risk and vulnorable population, and in designing the appropriate Ebola prevention intervention strategies for this group in Sierra Leone. My results have several clinical and practical positive implications for the design and implementation of Ebola virus infection prevention interventions and public health educational campaigns in Sierra Leone and other African countries. Additionally, it can inform, increase knowledge and awareness on high-risk behaviors, such as attended funeral and their consequences and thus help in creating positive social change at the individual/intrapersonal, family and communities, and policy levels that would evoke behavioral change and reduce the risk of women and men aged 15 to 49 years getting Ebola infected and future Ebola outbreak.

Intrapersonal/Individual Level

Ebola virus prevention intervention that takes into account that choices and actions may be constrained for example by gender roles, and cultural norms is vital and essential in preventing Ebola virus infection (Alexander et al., 2015; Bower et al., 2016; UNDG, 2015). My result can be used to provide Ebola virus prevention education and develop risk reduction skills program to educate and empower, promotes Ebola at-risk women's perspectives. Furthermore, at the individual level, positive social change from my study is that the finding could guide the development of effective target specific patterns of risk based on gender behavior change prevention intervention program that

focus on at-risk individuals and the predictors of Ebola infection identified in this study, funeral attend. Programmers, public health officers, and other stakeholders would recognize the vulnerability of women. For example, female of reproductive age, require special programs for the potential risk factor house wife/care identified in this study. House wife/care taker risk behaviors may place females at greater risk than males because they are more vulnerable and likely to contract Ebola virus infection from unprotected care taking of Ebola patients (Fawole et al., 2016; Nkangu et al., 2017; UNDG, 2015). Also, females' Ebola risk behaviors, such as care, place their unborn children at risk (Nkangu et al., 2017). Providing Ebola virus infection prevention interventions that are gender-tailored can reduce women's vulnerability to Ebola by enhancing Ebola preventive behaviors, knowledge, awareness, attitudes, beliefs, and risk-reduction skills in this group, and may prevent or reduce mother to child infection and general population women. It may also prevent Ebola deaths in this group that may produce high numbers of orphans, who could end up in streets or juvenile delinquents. Furthermore, this can empower women who are tied to traditional norms to take proper Ebola precaution to improve their lives. The results could lead to behavioral change in the form of women reducing their number of engagement in care taking activities at home and use health clinics instead. Moreover, this study results have brought attention to a previously lumped Ebola virus risk group and their potential driving role in the 2014 Ebola epidemic, demonstrating the need for sensitive and targeted prevention interventions. Ebola risk behaviors among women 15 to 49 years are a public health problem of major concern (CDC, 2015; Dietz et al., 2015; UNDG, 2015).

Interpersonal Level (Family and Community Level)

The 2014 Ebola virus epidemic in Sierra Leone was the worst and most compelling Ebola disease public health crisis in the world. Achieving important and meaningful preventions in future Ebola case in the country requires evidence-based approaches to prevention that mobilize communities to respond to this disease. Changing community norms to increase awareness of Ebola virus and reduce Ebola-related stigma has the potential to prevent future outbreak of Ebola infection in the country.

Data from this study indicate that attended funeral was statistically significantly independently associated with Ebola infection. The findings of this study have implications for positive social change if popular and well-liked members of the local community such as music artists, national soccer players can be engaged to endorse and advocate attended funeral risk-reduction behavior change and their benefits to peers, family members, and survivors, and targeting groups that practice this high-risk behavior. Furthermore, my results can be used to mobilize community leaders, businesses, organizations, and individuals to give of their time and effort to spread attended funeral Ebola risk prevention messages in their communities that focus on creating awareness among the population of the risk factors of the development of Ebola. Decreases in attended funeral risk behavior may be possible and thus prevent Ebola infection. Also, at the family and community level, my study findings could benefit the community by educating and empowering the community leaders with information to help them assess cultural practices like risky burial ritual practices, traditional role of women that confine them to caring for the sick, traditional healer practices that expose the individuals to the

Ebola virus and possibly instill cultural norms that prohibit such practices to prevent Ebola outbreak. From the result on house wife/care taking, community leaders can systematically incorporate empowerment into the ecological model theory-based prevention interventions for persons at risk for Ebola, particularly women aged 15 to 49 years. Also, the results of this study could educate and provide knowledge of all the risk factors identified in this study to inform and empower women in the local community to take strong stance against deeply ingrained traditional norms that increase this exposure to the Ebola virus infection in the family and local community.

Cenciarelli et al. (2015); UNDP (2015) noted that during the 2014 Ebola epidemic in Sierra Leone, many individuals experienced discrimination, stigmatization, and marginalization, which may have placed members of this study population at an increased risk for Ebola virus infection, and hampered Ebola virus education efforts and Ebola surveillance in communities in the country. For example, individuals stopped visiting health clinics with the fear of contracting Ebola from health care workers, revert to traditional healers or family members for care, and failing to notify authorities of possible infection because of the potential negative response of their neighbors and community (Cenciarelli et al., 2015; UNDP, 2015). Also, health care workers were rejected by their communities and families, were believed to be responsible for spreading the virus (Dietz et al., 2015; WHO Ebola Response Team, 2015). Most importantly, many Ebola survivors were rejected by their communities once the names were publicly released (Cenciarelli et al., 2015; UNDP, 2015). Similarly, Nyakarahuka et al. (2017)'s study out of Uganda to gain a communities' knowledge and attitude towards Ebola virus

disease, found that respondents reported fear and stigma suffered by survivors, their families and the broader community due to Ebola disease. Clearly, this beliefs, fear, distrust, discrimination, and stigmatization between the parties are largely in part from a lack of strong Ebola risk factor and predictor knowledge, and understanding of Ebola and risk factor characteristics, and are a major barrier to ongoing Ebola surveillance, prevention, interventions, control and management. Cenciarelli et al. (2015); Kpanake et al. (2016); Nyakarahuka et al. (2017); UNDP (2015) recommended that the public health sector should enhance this community knowledge gap to empower them more by supplying educational materials for epidemic preparedness in future using appropriate communication channels as proposed by the communities. Thus, for positive social change community leaders, government, health care providers, public health entities, policy makers, and other stakeholders can use information from my result to develop appropriate Ebola risk factor prevention intervention communication and education programs that are culturally and traditionally sensitive; sensitive to local cultural beliefs, create an open and honest discussion of the issue and facilitate the process of rebuilding trust between the various segments; develop nurses' health education program in Sierra Leone to increases Ebola virus infection knowledge and reduces fear increasing nurses' knowledge in all aspects (Cenciarelli et al., 2015). Furthermore, the government and national and local health officials could incorporate my results into ongoing psychosocial support, and family and community reunification programs to reduce these barriers (Cenciarelli et al., (2015); UNDP, 2015). Also, to strengthen future Ebola response, survivors who might have some immunity to the same virus strain can be trained using

my findings to serve as community educators promoting messages that seeking treatment improves the chances for survival and that persons who survived Ebola can help their communities. Kpanake et al. (2016); Nyakarahuka et al. (2017); UNDP (2015) believe this could also overcome the misconceptions about Ebola in Africa, especially Sierra Leone. People can trust the health system and seek treatment from hospital instead of traditional healer and there by prevent Ebola infection or reduce contracting Ebola. This could lead to behavioral change and can improve the health of Sierra Leoneans, especially the study population and bring about positive social change in the country.

Moreover, more than two years after the 2014 Ebola virus epidemic, Ebola preparedness remains a high priority for the government of Sierra Leone. In this study, backward stepwise elimination logistic regression analysis identified 1variables independently predictive of Ebola virus disease status, funeral attend (t= 1 or VIF =1.001, $p < .031$) among women and men ages 15 to 49 years in Sierra Leone. This result can be used by clinicians as an adjunct to current Ebola virus disease case definitions to risk-stratify patients with suspected Ebola virus disease. Also, clinicians can use this new tool for the purpose of cohorting patients within the suspected-disease room of an Ebola treatment unit or community-based isolation center to prevent further infection or as a triage tool when patient numbers overwhelm available capacity, for example in the current Ebola outbreak in the Democratic Republic of the Congo.

Furthermore, at the community level, possible positive social change includes incorporating my findings into The World Health Organization and Centers for Disease Control and Prevention guidelines and using them to educate and implement Ebola

emergency hospital preparedness training programs for frontline public health workers, such as emergency room staff, doctors, and nurses to improve ongoing Ebola public health emergence preparedness. For example, training health care workers in Ebola virus screening and case detection and managing isolation units using these guidelines approach can prevent or reduce Ebola virus transmission. Also, knowledge of sociocultural and behavioral risk factors identified in this study can help physicians improve accuracy in diagnosing Ebola patients in future outbreak. Koenig, Majestic, and Burns (2014); and a UNDP (2015) report emphasized the need to educate emergency physicians, and all healthcare workers involved in care of EVD patients on risk factors, such as direct handling of animals from outbreak areas. Moreover, community health departments can use my result to train local members to act as standby capacity in an Ebola epidemic in the community to handle large-scale emergencies. Additionally, can improve the government's ability to evaluate and respond to other public health threats such as Tuberculosis, AIDS, and Malaria and can also provide the opportunity for ongoing collaborations among local public health agencies. Other countries in Africa (including those that do not yet have good plans for funeral attend) could benefit from such plans drawn up by Sierra Lone. These can promote health and prevent Ebola disease.

Additionally, the overall preparation process for Ebola outbreaks can also help reduce Ebola panic in the country and around the world. Public health education regarding Ebola and risk factors characteristics is not only needed urgently in Africa but, increasingly, around the world (Cenciarelli et al., 2015; Chan, 2014; UNDP, 2015). In the

US, public panic escalated when Ebola patients from Liberia and Sierra Leone arrived in the US during the 2014 Ebola virus epidemic (Chan, 2014; CDC, 2014; CDC, 2015). Once my study results are disseminated and communicated through radio, television, and social media platforms such as Facebook, it would provide communities, health care workers, especially women and men at high risk for Ebola virus infection in the country with factual information and improved understanding of the behavioral risk factors related to Ebola. Thus, this would guide proper management of Ebola risk, tailored to the target population, reduce panic, and ultimately, contribute to positive social change, especially among sierra Leoneans, and women and men 15 to 49 years. Positive norms can mitigate the risk level for Ebola infection within the community. For example, interventions focused on establishing hand glove use norms at funerals or caretaking can prevent Ebola.

Societal and Policy Level

Ongoing surveillance of Ebola disease has been priority in Sierra Leone, since the devastating 2014 Ebola epidemic in the country. My study demonstrated that, the only individual predictor in the model that offered a significant, unique contribution to the explanation of Ebola infection in women and men 15 to 49 years was funeral attend (t= 1 or VIF =1.001, p = .031 among women and men ages 15 to 49 years in Sierra Leone. This study can contribute to positive social change by providing reliable and high-quality Ebola data on funeral attend risk behavior that can contribute to the understanding of Ebola infection dynamics, make existing data adequate in both quality and quantity, and also provides data that can help strengthen ongoing comprehensive surveillance of Ebola

in the country to provide an accurate understanding of the magnitude and determinants of Ebola virus transmission which can inform Ebola prevention programming to prioritize high-risk populations target for allocating scarce resources for Ebola education and prevention, such as Ebola vaccination, and also help monitor and track trends in Ebola knowledge levels, attitudes, risk behaviors, specific Ebola prevention, in defined subpopulations, particularly women and men 15 to 49 years over time in the country, and evaluate Ebola prevention effectiveness and care activities, to help ensure a firm evidence base for Ebola virus infection prevention and control policies and programs (Government of Sierra Leone, 2013; UNDP, 2015). As Government of Sierra Leone, 2013 report; Shaman, Yang, and Kandula (2014) puts it, Ongoing evaluation of the epidemiological characteristics and future course of the Ebola outbreak is needed to stay abreast of any changes to its transmission dynamics, as well as the success or failure of prevention and intervention effort. Similarly, Alexandrer et al. (2015) emphasized the need for funeral attend investigation and areas of increased risk identified as best as possible for purposes of future outbreak prevention. Consideration of behavior and culture in disease transmission is critical to control and understanding transmission dynamics (Alexander et al., 2015). Additionally, the government and communities can use this result in campaign communication and in policy-making address Ebola prevention as an educational priority.

Moreover, public health officers and programmers can use my data from this study to describe trends in key behavioral risk indicators and evaluate current Ebola virus prevention programs. This information in turn can be used to identify gaps in prevention

services and target new prevention activities with the goal of preventing future Ebola infections in Sierra Leone. Furthermore, my findings indicate that individual, and interpersonal level factors were statistically significantly associated with Ebola infection among women and men aged 15 to 49 years in Sierra Leone. These findings suggest the need to intervene not solely on individual risk level behaviors but on interpersonal level determinants that drive Ebola infection, and also to develop creative, culturally appropriate and community-sponsored prevention programs that make substantive Ebola risk behavior changes on multiple levels. This could reduce the risk of acquiring Ebola virus infection, which has important policy implications in this resource-limited setting in Sierra Leone. I used the ecological model to guide this study that provided reliable results. Thus, my study offers this well-tested, proven and comprehensive framework of health behavior change. Policy makers, programers, and researchers can promote positive social change at the societal/policy level by incorporating the model into Ebola infection research and prevention intervention design process targeting groups that practice high-risk behavior identified in this study for women and men 15 to 49 years. They can also use this promising theoretical framework to guide further studies and prevention interventions related to Ebola infection among women and men 15 to 49 years in Sierra Leone.

The model contextualizes individuals' behaviors using dimensions including intrapersonal, interpersonal/network, community, and public policy to provide a framework for describing the interactions between these levels (Glanz et al., 2008). This approach may expand the knowledge base and facilitate the development of better

prevention intervention strategies, such as community-level interventions, policy initiatives, and institutionally based programmes (Glanz et al., 2008). It can also help modify Ebola risk behavior, preventive and further prevent Ebola infection among study population (Glanz et al., 2008). Thus, public health level Ebola prevention interventions geared towards preventing or reducing women's Ebola infection risk can be strengthened, and also create new options for Ebola prevention. Thus, this can bring about positive social change.

I have provided relevant and improved data on both individual level and interpersonal level that can enhance the understanding of multiple levels of Ebola virus risk and would help policy makers utilize multiple level approach to target Ebola interventions and prevention at both individual level risks and interpersonal levels of the model. This approach may expand the knowledge base and facilitate the development of a broader array of intervention strategies, such as community-level interventions, policy initiatives, institutionally based programmes, and macro-level societal changes (Glanz et al., 2008).

My study presents a more comprehensive and vivid Ebola potential risk factor perspective for women and men aged 15 to 49 years in Sierra Leone during the 2014 Ebola outbreak. It presents evidence of differences in the Ebola disease process between the various risk factors, such as funeral attend and not attended. The government can taking such differences between the risk factors, for example funeral attendees and non funeral attendees, men and women into account, could improve the understanding of the epidemiology and the clinical course and outcome of Ebola diseases, aid in their

detection and treatment, and increase public participation in and the effectiveness of prevention and control activities. This could bring about positive social change in the country.

Conclusion

The 2014 Ebola virus disease epidemic in Sierra Leone was a major public health disaster. The proportion of women affected 5,118 (52%) out of 9,944 of the cumulative total number of Ebola virus infection cases reported in the country was high (WHO, 2015). This raises major public health concern For Ebola virus disease in the country. However, little data exist on Ebola and risk factor characteristics for women and men 15 to 49 years in Sierra Leone, making them an invincible group for health programs (WHO, 2015). This is a problem because, such information might be used to focus Ebola infection interventions on those at greatest risk of infection, the study population. Furthermore, the absence of such a pertinent data has stifled progress in this area.

The purpose of this cross-sectional study was to fill a gap in the literature by examining the relationship between sociocultural, behavioral, demographic risk factors and Ebola infection among women and men ages 15 to 49 years in Sierra Leone, using the ecological model framework and the SLED data set. This can inform prioritization of Ebola virus infection research for this study population, promote Ebola risk behavior change, improve Ebola virus disease prevention programs, prevent Ebola infection, and thus promote positive social change.

In this study, I found strong evidence of statistical significant association between reported touching dead body at a funeral (p = .023); having attended a funeral (p = .001);

and contact with a sick person (p = .001) and Ebola virus infection status in the last month before Ebola onset. Furthermore, the demographic factors: gender (p = .035); and house wife/care taker (p = .001) are statistically significantly associated with Ebola infection status among women and men ages 15 to 49 years, in addition with the covariates touching bodily fluids (p = 0.001); traditional healer occupation (p = .001). But, these tests demonstrated that age (p = 0.252), hunt prepared and ate primates (p = 0.116), and the covariate traditional healer care (p = 0.353) were not significantly associated with Ebola virus infection among women and men ages 15 to 49 years. Furthermore, backward elimination logistic regression revealed that attended funeral statistically significantly predicted Ebola infection outcome among women and men ages 15 to 49 years during the 2014 outbreak in Sierra Leone: F (1, 287) = 4.727, p< .031, adjusted R^2 = .013 or 1.3%. The model of the single independent variable effectively predicted Ebola virus infection in women and men aged 15 to 49. The predictor accounted for (R^2) = .013 or 1.3% of the variance in Ebola virus infection acquisition in the study population, which, according to Cohen (1988) , is a small effect (Faul et al., 2007; Field, 2013; Frankfort-Nachmias & Nachmias, 2008; Green & Salkind, 2014). The only individual predictor in the model that presented a statistically significant, unique contribution to the final model was funeral attend (t= 1 or VIF =1.001, p < .031. My finding in this study is in line with other studies of the association (WHO, 2014; WHO, 2015). A recent Ebola data generated from an observational study, analyzing data from all confirmed and probable Ebola cases in Guinea during 2014 reported that 86% (95% CI 75–90) of exposure was at funerals (Faye et al., 2015). Furthermore, to assess

exposure patterns driving Ebola transmission in West Africa, Agua-Agum et al. (2016) retrospectively analysed data from 3,529 cases in Guinea, 5,343 in Liberia, and 10,746 in Sierra Leone and found that the proportion of cases reporting a funeral exposure ($r = 0.35$, $p < 0.001$)

Findings on the socio cultural and behavioral risk behaviors as related to Ebola infection among the study population provided meaningful implications for Ebola virus prevention interventions. My findings also provide early support for adoption of ecological mode for Ebola multi-level prevention intervention as a strategy for evoking Ebola risky behavior change or modification and Ebola prevention in Sierra Leone. Most importantly, my findings can be used in Sierra Leone and elsewhere in Africa as a resource for social change, including combating the current Ebola outbreak in the Democratic Republic of the Congo.

In the light of these results, I can recommend the need to utilize a multilevel prevention intervention approach to effectively prevent and combat future Ebola infection in the country. Incorporating safe burial team into the health infrastructure of the country to prevent increased future Ebola outbreak. The skills of traditional healers and doctors need to be continuously monitored and improved through Ebola risk education and trained on safety practice to avoid Ebola misdiagnosis or Ebola transmission in the future. Bush meat control and health education need to be stepped up and be more focused at all levels in the health care system. Women who are tied to traditional norms need to be empowered urgently. Risk reduction strategies should be introduced during the preteen years. Community interventions geared at making the population aware of the risk factors

should be devised. Ongoing research is needed to monitor the predictor attended funeral to ensure evidence interventions for the target group. There is however need for more studies to confirm these findings in other sub-Saharan African settings.

Furthermore, the findings suggest that the home environment and local community provides excellent opportunities for programmers to develop and to reach women and men 15 to 49 years with age and gender specific multilevel Ebola virus infection prevention interventions that focus on the identified potential risk factors and predictor including changing cultural norms, which increase women's vulnerability to getting infected with Ebola. Also, such efforts may be a useful point of Ebola risk prevention intervention with this population. Clearly if the government is to succeed in combating Ebola in this group, it must develop and integrate theory targeted evidence based multilevel interventions (Creswell, 2009; Glanz et al., 2008), and adopting the ecological model as a guide. This study of Ebola in women and men 15 to 49 years in Sierra Leone has brought attention to a previously neglected or marginalized Ebola infection risk group and their potential driving role in the 2014 Ebola epidemic in the country, demonstrating the need for sensitive and targeted prevention interventions. Preventing Ebola in women and men 15 to 49 years may not only serve to help prevent the disease from spreading from high-risk groups to the general population in the country, but also to the next generation by reducing mother-to-child-transmission among this most intensive childbearing group (UNDG, 2015; WHO, 2015b); WHO, 2017). These would improve the health of the people in the local communities in the country and prevent

Ebola infection in the group at most risk, the study population. It would also reduce Ebola threats around the world.

References

Adongo, P. B., Tabong, P. T.-N., Asampong, E., Ansong, J., Robalo, M., & Adanu, R. M. (2016). Preparing towards preventing and containing an Ebola virus disease outbreak: What socio-cultural practices may affect containment efforts in Ghana? *PLOS Neglected Tropical Diseases*, *10*(7), e0004852.

ttps://doi.org/10.1371/journal.pntd.0004852

Alexander, K. A., Sanderson, C. E., Marathe, M., Lewis, B. L., Rivers, C. M., Shaman, J., … Eubank, S. (2015). What factors might have led to the emergence of Ebola in West Africa? *PLOS Neglected Tropical Diseases*, *9*(6), e0003652. https://doi.org/10.1371/journal.pntd.0003652

Annan, A. A., Yar, D. D., Owusu, M., Biney, E. A., Forson, P. K., Okyere, P. B., …Owusu-Dabo, E. (2017). Health care workers indicate ill-preparedness for Ebola virus disease outbreak in Ashanti Region of Ghana. *BMC Public Health*, *17*(1). https://doi.org/10.1186/s12889-017-4474-6

Aregawi, M., Smith, S. J., Sillah-Kanu, M., Seppeh, J., Kamara, A. R. Y., Williams, R. O., … Alonso, P. (2016). Impact of the mass drug administration for malaria in response to the Ebola outbreak in Sierra Leone. *Malaria Journal*, *15*(1). https://doi.org/10.1186/s12936-016-1493-1

Arranz, J., Lundeby, K. M., Hassan, S., Zabala Fuentes, L. M., San José Garcés, P., Haaskjold, Y. L., … Riera, M. (2016). Clinical features of suspected Ebola cases referred to the Moyamba ETC, Sierra Leone: Challenges in the later stages of the 2014 outbreak. *BMC Infectious Diseases*, *16*(1). https://doi.org/10.1186/s12879-

016-1609-9

Bah, E. I., Lamah, M.-C., Fletcher, T., Jacob, S. T., Brett-Major, D. M., Sall, A. A., … Fowler, R. A. (2015). Clinical presentation of patients with Ebola virus disease in Conakry, Guinea. *New England Journal of Medicine, 372*(1), 40–47. https://doi.org/10.1056/NEJMoa1411249

Barrat, A., & Weigt, M. (2000). On the properties of small-world network models. *European Physical Journal B, 13*(3), 547–560. https://doi.org/10.1007/s100510050067

Bausch, D. G. (2015). The year that Ebola virus took over West Africa: Missed opportunities for prevention. *American Journal of Tropical Medicine and Hygiene*, *92*(2), 229–232. https://doi.org/10.4269/ajtmh.14-0818

Beeching, N. J., Fenech, M., & Houlihan, C. F. (2014). Ebola virus disease. *BMJ, 349*, g7348. https://doi.org/10.1136/bmj.g7348

Betancourt, T. S., Brennan, R. T., Vinck, P., VanderWeele, T. J., Spencer-Walters, D., Jeong, J., … Pham, P. (2016). Associations between mental health and Ebola-related health behaviors: A regionally representative cross-sectional survey in post-conflict Sierra Leone. *PLOS Medicine, 13*(8), e1002073. https://doi.org/10.1371/journal.pmed.1002073

Bower, H., Johnson, S., Bangura, M. S., Kamara, A. J., Kamara, O., Mansaray, S. H., … Glynn, J. R. (2016). Exposure-specific and age-specific attack rates for Ebola virus disease in Ebola-affected households, Sierra Leone. *Emerging Infectious Diseases, 22*(8), 1403–1411. https://doi.org/10.3201/eid2208.160163

Brainard, J., Hooper, L., Pond, K., Edmunds, K., & Hunter, P. R. (2016). Risk factors for transmission of Ebola or Marburg virus disease: A systematic review and meta-analysis. *International Journal of Epidemiology*, *45*(1), 102–116. https://doi.org/10.1093/ije/dyv307

Briand, S., Bertherat, E., Cox, P., Formenty, P., Kieny, M.-P., Myhre, J. K., … Dye, C. (2014). The international Ebola emergency. *New England Journal of Medicine, 371*(13), 1180–1183. https://doi.org/10.1056/NEJMp1409858

Caluwaerts, S., Fautsch, T., Lagrou, D., Moreau, M., Modet Camara, A., Günther, S., …Van Herp, M. (2016). Dilemmas in managing pregnant women with Ebola: 2 case reports: Table 1. *Clinical Infectious Diseases*, *62*(7), 903–905. https://doi.org/10.1093/cid/civ1024

Campbell, D. T., & Stanley, J. C. (1963). *Experimental and quasi-experimental designs for research*. Chicago, IL: Rand McNally.

Cassel, K. D. (2010). Using the social-ecological model as a research and intervention framework to understand and mitigate obesogenic factors in Samoan populations. *Ethnicity & Health*, *15*(4), 397–416. https://doi.org/10.1080/13557858.2010.481330

Centers for Disease Control and Prevention. (2014). *Ebola outbreak in West Africa-case counts, 2014.* Retrieved from https://www.cdc.gov/vhf/ebola/outbreaks/2014-west-africa/case-counts.html

Centers for Disease Control and Prevention. (2015). Ebola virus disease fact sheet. Retrieved from http://www.who.int/mediacentre/factsheets/fs103/en/2015)

Cenciarelli, O., Pietropaoli, S., Malizia, A., Carestia, M., D'Amico, F., Sassolini, A., … Gaudio, P. (2015). Ebola Virus Disease 2013-2014 Outbreak in West Africa: An analysis of the epidemic spread and response. *International Journal of Microbiology*, *2015*, 1–12. https://doi.org/10.1155/2015/769121

Chan, M. (2014). Ebola Virus Disease in West Africa — No early end to the outbreak. *New England Journal of Medicine*, *371*(13), 1183–1185. https://doi.org/10.1056/NEJMp1409859

Cho, D., & Park, C. L. (2017). Smoking and sedentary behavior changes from adolescence to emerging adulthood: A multilevel modeling perspective. *Preventive Medicine*, *101*, 223–228. https://doi.org/10.1016/j.ypmed.2016.12.047

Chowell, G., & Nishiura, H. (2014). Transmission dynamics and control of Ebola virus disease (EVD): a review. *BMC Medicine*, *12*(1). https://doi.org/10.1186/s12916-014-0196-0

Cori, A., Donnelly, C. A., Dorigatti, I., Ferguson, N. M., Fraser, C., Garske, T., … Blake, I. M. (2017). Key data for outbreak evaluation: Building on the Ebola experience. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *372*(1721), 20160371. https://doi.org/10.1098/rstb.2016.0371

Creswell, J. (2009). Research design: Qualitative, quantitative, and mixed methods Approaches (Laureate Education, Inc., custom Ed.). Thousand Oaks, CA: Sage Publications

Dallatomasina, S., Crestani, R., Sylvester Squire, J., Declerk, H., Caleo, G. M., Wolz, A., … Zachariah, R. (2015). Ebola outbreak in rural West Africa: epidemiology,

clinical features and outcomes. *Tropical Medicine & International Health*, *20*(4), 448–454. https://doi.org/10.1111/tmi.12454

Dean, N. E., Halloran, M. E., Yang, Y., & Longini, I. M. (2016). Transmissibility and Pathogenicity of Ebola Virus: A Systematic Review and Meta-analysis of Household Secondary Attack Rate and Asymptomatic Infection. *Clinical Infectious Diseases*, *62*(10), 1277–1286. https://doi.org/10.1093/cid/ciw114

DeBate, R. D., Pyle,G. F., (2004). The behavioral Ecological Model: A framework for early WIC participating. *American Journal of Health Studies*: 19(3).

Deen, G. F., McDonald, S. L. R., Marrinan, J. E., Sesay, F. R., Ervin, E., Thorson, A. E., … on behalf of the Sierra Leone Ebola Virus Persistence Study Group. (2017). Implementation of a study to examine the persistence of Ebola virus in the body fluids of Ebola virus disease survivors in Sierra Leone: Methodology and lessons learned. *PLOS Neglected Tropical Diseases*, *11*(9), e0005723. https://doi.org/10.1371/journal.pntd.0005723

Dietz, P. M., Jambai, A., Paweska, J. T., Yoti, Z., & Ksaizek, T. G. (2015). Epidemiology and risk factors for Ebola Virus disease in Sierra Leone—23 May 2014 to 31 January 2015. *Clinical Infectious Diseases*, civ568. https://doi.org/10.1093/cid/civ568

Dowell, S. F., Mukunu, R., Ksiazek, T. G., Khan, A. S., Rollin, P. E., Peters, C. J., … the Commission de Lutte contre les Epidémies à Kikwit. (1999). Transmission of Ebola Hemorrhagic Fever: A Study of risk factors in family members, Kikwit, Democratic Republic of the Congo, 1995. *The Journal of Infectious Diseases*,

179(s1), S87–S91. https://doi.org/10.1086/514284

Dynes, M. M., Miller, L., Sam, T., Vandi, M. A., &Tomczyk, B. (2015). Perceptions of the risk for Ebola and health facility use among health workers and pregnant and lactating women: Kenema district, Sierra Leone, September 2014. Centers for Disease Control and Prevention: *Morbidity and Mortality Weekly Report* 63(5152), 1226-1227

Egger, G., Swinburn, B., & Rossner, S. (2003). Dusting off the epidemiological triad: could it work with obesity? *Obesity Reviews*, *4*(2), 115–119. https://doi.org/10.1046/j.1467-789X.2003.00100.x

Evans, D. K., & Popova, A. (2015). West African Ebola crisis and orphans. *The Lancet*, *385*(9972), 945–946. https://doi.org/10.1016/S0140-6736(15)60179-9

Fairhead, J. (2016). Understanding social resistance to the Ebola response in the forest region of the Republic of Guinea: An Anthropological perspective. *African Studies Review*, *59*(3), 7–31.

Fallah, M. P., Skrip, L. A., Gertler, S., Yamin, D., & Galvani, A. P. (2015). Quantifying poverty as a driver of Ebola transmission. *PLOS Neglected Tropical Diseases*, *9*(12), e0004260. https://doi.org/10.1371/journal.pntd.0004260

Fauci, A. S. (2014). Ebola — Underscoring the global disparities in health care resources. *New England Journal of Medicine*, *371*(12), 1084–1086. https://doi.org/10.1056/NEJMp1409494

Faul, F., Erdfelder, E., Land, A., and Buchner, A. (2007).G*Power 3: A flexible tatistical power analysis program for the social, behavioral, and biomedical sciences.

Behavior Research Methods, 39(2), 175-191

Fawole, O. I., Bamiselu, O. F., Adewuyi, P. A., & Nguku, P. M. (2016). Gender dimensions to the Ebola outbreak in Nigeria. *Annals of African Medicine, 15*(1), 7. https://doi.org/10.4103/1596-3519.172554

Faye, O., Boëlle, P.-Y., Heleze, E., Faye, O., Loucoubar, C., Magassouba, N., … Cauchemez, S. (2015). Chains of transmission and control of Ebola virus disease in Conakry, Guinea, in 2014: an observational study. *The Lancet Infectious Diseases*, *15*(3), 320–326. https://doi.org/10.1016/S1473-3099(14)71075-8

Fitzgerald, F., Naveed, A., Wing, K., Gbessay, M., Ross, J. C. G., Checchi, F., … Yeung, S. (2016). Ebola Virus Disease in children, Sierra Leone, 2014–2015. *Emerging Infectious Diseases*, *22*(10), 1769–1777. https://doi.org/10.3201/eid2210.160579

Francesconi, P., Yoti, Z., Declich, S., Onek, P. A., Fabiani, M., Olango, J., … Salmaso, S. (2003). Ebola Hemorrhagic Fever transmission and risk factors of contacts, Uganda1. *Emerging Infectious Diseases*, *9*(11), 1430–1437. https://doi.org/10.3201/eid0911.030339

Frankfort-Nachmias, C., & Nachmias, D. (2008). Research methods in the social sciences Worth publisherss, New York, N.Y

Fumanelli, L., Ajelli, M., Manfredi, P., Vespignani, A., & Merler, S. (2012). Inferring the structure of social contacts from demographic data in the analysis of infectious diseases spread. *PLoS Computational Biology*, *8*(9), e1002673. https://doi.org/10.1371/journal.pcbi.1002673

Furuse, Y., Fallah, M., Oshitani, H., Kituyi, L., Mahmoud, N., Musa, E., … Bawo, L.

(2017). Analysis of patient data from laboratories during the Ebola virus disease outbreak in Liberia, April 2014 to March 2015. *PLOS Neglected Tropical Diseases*, *11*(7), e0005804. https://doi.org/10.1371/journal.pntd.0005804

Gamma, A. E., Slekiene, J., von Medeazza, G., Asplund, F., Cardoso, P., & Mosler, H.-J. (2017). Contextual and psychosocial factors predicting Ebola prevention behaviours using the RANAS approach to behaviour change in Guinea-Bissau. *BMC Public Health*, *17*(1). https://doi.org/10.1186/s12889-017-4360-2

Glanz, K., Rimer, B. K., and Viswanath, K. (2008). Health behavior and health education Theopr, Research, and Practice (4th ed). San Francisco, CA. Jossey-Bass

Green, S., B., & Salkind, N., J. (2014). Using SPSS for windows and macintosh: analyzing and understanding data. Pearson, Edition 7

Guan, M., & So, J. (2016). Influence of social identity on self-efficacy beliefs through perceived social support: A social identity theory perspective. *Communication Studies*, *67*(5), 588–604. https://doi.org/10.1080/10510974.2016.1239645

Haaskjold, Y. L., Bolkan, H. A., Krogh, K. Ø., Jongopi, J., Lundeby, K. M., Mellesmo, S., … Blomberg, B. (2016). Clinical features of and risk factors for fatal Ebola virus disease, Moyamba District, Sierra Leone, December 2014–February 2015. *Emerging Infectious Diseases*, *22*(9), 1537–1544. https://doi.org/10.3201/eid2209.151621

Harman, S. (2016). Ebola, gender and conspicuously invisible women in global health governance. *Third World Quarterly*, *37*(3), 524–541. https://doi.org/10.1080/01436597.2015.1108827

Hartley, M.-A., Young, A., Tran, A.-M., Okoni-Williams, H. H., Suma, M., Mancuso, B., … Faouzi, M. (2017). Predicting Ebola infection: A malaria-sensitive triage score for Ebola virus disease. *PLOS Neglected Tropical Diseases*, *11*(2), e0005356. https://doi.org/10.1371/journal.pntd.0005356

Hayden, E. C., (2015) Ebola's lasting legacy one of the most devastating consequences of the Ebola outbreak will be its impact on maternal health. *NATURE*. (519). Retrieved August 10, 2017 from https://www.nature.com/polopoly_fs/1.17036.1426068794!/menu/main/topColumns/

Henwood, P. C., Bebell, L. M., Roshania, R., Wolfman, V., Mallow, M., Kalyanpur, A., & Levine, A. C. (2017). Ebola Virus Disease and pregnancy: A retrospective cohort study of patients managed at 5 Ebola treatment units in West Africa. *Clinical Infectious Diseases*, *65*(2), 292–299. https://doi.org/10.1093/cid/cix290

Ibeneme, S., Maduako, V., Ibeneme, G. C., Ezuma, A., Ettu, T. U., Onyemelukwe, N. F., … Fortwengel, G. (2017). Hand hygiene practices and microbial investigation of hand contact swab among physiotherapists in an Ebola endemic region: Implications for public health [Research article]. https://doi.org/10.1155/2017/5841805

International Ebola Response Team, Agua-Agum, J., Ariyarajah, A., Aylward, B., Bawo, L., Bilivogui, P., … Yoti, Z. (2016). Exposure patterns driving Ebola transmission in West Africa: A retrospective observational study. *PLOS Medicine*, *13*(11), e1002170. https://doi.org/10.1371/journal.pmed.1002170

Jamieson, D. J., Uyeki, T. M., Callaghan, W. M., Meaney-Delman, D., & Rasmussen, S. A. (2014). What obstetrician–gynecologists should know about Ebola: A perspective from the Centers for Disease Control and Prevention. *Obstetrics & Gynecology*, *124*(5), 1005–1010. https://doi.org/10.1097/AOG.0000000000000533

Jere, D. L., Norr, K. F., Bell, C. C., Corte, C., Dancy, B. L., Kaponda, C. P. N., … Levy, J. A. (2017). Substance use and risky sexual behaviors among young men working at a rural roadside market in Malawi. *Journal of the Association of Nurses in AIDS Care*, *28*(2), 250–265. https://doi.org/10.1016/j.jana.2015.07.003

Judson, S. D., Fischer, R., Judson, A., & Munster, V. J. (2016). Ecological contexts of index cases and spillover events of different ebolaviruses. *PLOS Pathogens*, *12*(8), e1005780. https://doi.org/10.1371/journal.ppat.1005780

Kamali, A., Jamieson, D. J., Kpaduwa, J., Schrier, S., Kim, M., Green, N. M., … Mascola, L. (2016). Pregnancy, labor, and delivery after Ebola Virus Disease and implications for infection control in obstetric services, United States. *Emerging Infectious Diseases*, *22*(7), 1156–1161. https://doi.org/10.3201/eid2207.160269

Kilmarx, P. H., Clarke, K. R., Dietz, P. M., Hamel, M. J., Husain, F., McFadden, J. D., … Jambai, A. (2014). Ebola virus disease in health care workers--Sierra Leone, 2014., Ebola Virus Disease in health care workers — Sierra Leone, 2014. *MMWR. Morbidity and Mortality Weekly Report, MMWR. Morbidity and Mortality Weekly Report*, *63*, *63*(49, 49), 1168, 1168–1171.

Kimberlin, C. L., & Winterstein, A. G. (2008). Validity and reliability of measurement

instruments used in research. *American Journal of Health-System Pharmacy*, *65*(23), 2276–2284. https://doi.org/10.2146/ajhp070364

Kleinman, A. (2010). Four social theories for global health. *The Lancet*, *375*(9725), 1518–1519. https://doi.org/10.1016/S0140-6736(10)60646-0

Kouadio, K. I., Clement, P., Bolongei, J., Tamba, A., Gasasira, A. N., Warsame, A., … Nshimirimana, D. (2015). Epidemiological and surveillance response to Ebola Virus Disease outbreak in Lofa County, Liberia (March-September, 2014); Lessons Learned. *PLoS Currents*. https://doi.org/10.1371/currents.outbreaks.9681514e450dc8d19d47e1724d2553a5

Kuehne, A., Lynch, E., Marshall, E., Tiffany, A., Alley, I., Bawo, L., … Gignoux, E. (2016). Mortality, morbidity and health-seeking behaviour during the Ebola epidemic 2014–2015 in Monrovia results from a mobile phone survey. *PLOS Neglected Tropical Diseases*, *10*(8), e0004899. https://doi.org/10.1371/journal.pntd.0004899

Kunii, O., Kita, E., & Shibuya, K. (2001). [Epidemics and related cultural factors for Ebola hemorrhagic fever in Gabon]. *[Nihon koshu eisei zasshi] Japanese journal of public health*, *48*(10), 853–859.

Lado, M., Walker, N. F., Baker, P., Haroon, S., Brown, C. S., Youkee, D., … Leather, A. J. M. (2015). Clinical features of patients isolated for suspected Ebola virus disease at Connaught Hospital, Freetown, Sierra Leone: a retrospective cohort study. *The Lancet Infectious Diseases*, *15*(9), 1024–1033. https://doi.org/10.1016/S1473-3099(15)00137-1

Lamunu, M., Olu, O. O., Bangura, J., Yoti, Z., Samba, T. T., Kargbo, D. K., … Aylward, R. B. (2017). Epidemiology of Ebola Virus Disease in the Western Area region of Sierra Leone, 2014–2015. *Frontiers in Public Health*, *5*. https://doi.org/10.3389/fpubh.2017.00033

Li, J., Duan, H.-J., Chen, H.-Y., Ji, Y.-J., Zhang, X., Rong, Y.-H., … Wang, F.-S. (2016). Age and Ebola viral load correlate with mortality and survival time in 288 Ebola virus disease patients. *International Journal of Infectious Diseases*, *42*, 34–39. https://doi.org/10.1016/j.ijid.2015.10.021

Lokuge, K., Caleo, G., Greig, J., Duncombe, J., McWilliam, N., Squire, J., … Glass, K. (2016). Successful control of Ebola Virus Disease: Analysis of service based data from rural Sierra Leone. *PLOS Neglected Tropical Diseases*, *10*(3), e0004498. https://doi.org/10.1371/journal.pntd.0004498

Ly, J., Sathananthan, V., Griffiths, T., Kanjee, Z., Kenny, A., Gordon, N., … Kraemer, J. D. (2016). Facility-Based delivery during the Ebola Virus Disease epidemic in rural Liberia: Analysis from a cross-sectional, population-based household survey. *PLOS Medicine*, *13*(8), e1002096. https://doi.org/10.1371/journal.pmed.1002096

Manguvo, A., & Mafuvadze, B. (2015). The impact of traditional and religious practices on the spread of Ebola in West Africa: time for a strategic shift. *The Pan African Medical Journal*, *22*(Suppl 1). https://doi.org/10.11694/pamj.supp.2015.22.1.6190

Manivannan, A. (2015). Gender inequalities in access to information about Ebola as gender-based violence. *Harverd Human Right Journal Online*. 1-6. Retrieved

October 7, 2017 from http://harvardhrj.com/wp-content/uploads/2015/06/Gender-Inequalities-in-Access-to-Information-about-Ebola-as-Gender-Based-Violence.pdf

McDonald, J. (2016). Will the Ebola epidemic serve to make reform of the broken health research and development framework go viral? *Indiana Journal of Global Legal Studies*, *23*(2), 865–892. https://doi.org/10.2979/indjglolegstu.23.2.0865

McLeroy, K. R., Bibeau, D., Steckler, A., & Glanz, K. (1988). An ecological perspective on health promotion programs. *Health Education Quarterly*, *15*(4), 351–377. https://doi.org/10.1177/109019818801500401

McNamara, L. A., Schafer, I. J., Nolen, L. D., Gorina, Y., Redd, J. T., Lo, T., … Knust, B. (2016). Ebola surveillance—Guinea, Liberia, and Sierra Leone. *MMWR Supplements*, *65*(3), 35–43. https://doi.org/10.15585/mmwr.su6503a6

McPake, B., Witter, S., Ssali, S., Wurie, H., Namakula, J., & Ssengooba, F. (2015). Ebola in the context of conflict affected states and health systems: case studies of Northern Uganda and Sierra Leone. *Conflict and Health*, *9*(1). https://doi.org/10.1186/s13031-015-0052-7

Moole, H., Chitta, S., Victor, D., Kandula, M., Moole, V., Ghadiam, H., … Lynch, T. (2015). Association of clinical signs and symptoms of Ebola viral disease with case fatality: a systematic review and meta-analysis. *Journal of Community Hospital Internal Medicine Perspectives*, *5*(4), 28374. https://doi.org/10.3402/jchimp.v5.28374

Moon, S., Sridhar, D., Pate, M. A., Jha, A. K., Clinton, C., Delaunay, S., … Piot, P.

(2015). Will Ebola change the game? Ten essential reforms before the next pandemic. The report of the Harvard-LSHTM Independent Panel on the Global Response to Ebola. *The Lancet*, *386*(10009), 2204–2221. https://doi.org/10.1016/S0140-6736(15)00946-0

Moreau, M., Spencer, C., Gozalbes, J., Colebunders, R., Lefevre, A., Gryseels, S., … Camara, A. (2015). Lactating mothers infected with Ebola virus: EBOV RT-PCR of blood only may be insufficient. *Eurosurveillance*, *20*(3), 21017. https://doi.org/10.2807/1560-7917.ES2015.20.3.21017

Mueller, K. (2014). Turning to traditional healers to help stop the Ebola outbreak in Sierra Leone. International Federation of Red Cross and Red Crescent Societies.

Mulangu, S., Borchert, M., Paweska, J., Tshomba, A., Afounde, A., Kulidri, A., … Van der Stuyft, P. (2016). High prevalence of IgG antibodies to Ebola virus in the Efé pygmy population in the Watsa region, Democratic Republic of the Congo. *BMC Infectious Diseases*, *16*(1). https://doi.org/10.1186/s12879-016-1607-y

Newman, P. A., Roungprakhon, S., & Tepjan, S. (2013). A social ecology of rectal microbicide acceptability among young men who have sex with men and transgender women in Thailand. *Journal of the International AIDS Society*, *16*(1), 18476. https://doi.org/10.7448/IAS.16.1.18476

Nielsen, C. F., Kidd, S., Sillah, A. R., Davis, E., Mermin, J., Kilmarx, P. H., & Centers for Disease Control and Prevention. Improving burial practices and cemetery management during an Ebola virus disease epidemic - Sierra Leone, 2014. *MMWR. Morbidity and mortality weekly report*, *64*(1), 20–27.

Nishiura, H., & Chowell, G. (2014). Early transmission dynamics of Ebola virus disease (EVD), West Africa, March to August 2014. *Eurosurveillance, 19*(36), 20894. https://doi.org/10.2807/1560-7917.ES2014.19.36.20894

Nkangu, M. N., Olatunde, O. A., & Yaya, S. (2017). The perspective of gender on the Ebola virus using a risk management and population health framework: a scoping review. *Infectious Diseases of Poverty, 6*, 135. https://doi.org/10.1186/s40249-017-0346-7

Nordenstedt, H., Bah, E. I., de la Vega, M.-A., Barry, M., N'Faly, M., Barry, M., … Ingelbeen, B. (2016). Ebola Virus in breast milk in an Ebola Virus–positive mother with twin babies, Guinea, 2015. *Emerging Infectious Diseases*, *22*(4), 759–760. https://doi.org/10.3201/eid2204.151880

Olu, O., Kargbo, B., Kamara, S., Wurie, A. H., Amone, J., Ganda, L., … Kasolo, F. (2015). Epidemiology of Ebola virus disease transmission among health care workers in Sierra Leone, May to December 2014: a retrospective descriptive study. *BMC Infectious Diseases, 15*(1). https://doi.org/10.1186/s12879-015-1166-7

Phua, K.-L. (2015). Meeting the challenge of Ebola virus disease in a holistic manner by taking into account socioeconomic and cultural factors: The experience of West Africa. *Infectious Diseases: Research and Treatment*, *8*, IDRT.S31568. https://doi.org/10.4137/IDRT.S31568

Pourrut, X., Kumulungui, B., Wittmann, T., Moussavou, G., Délicat, A., Yaba, P., … Leroy, E. M. (2005). The natural history of Ebola virus in Africa. *Microbes and*

Infection, 7(7–8), 1005–1014. https://doi.org/10.1016/j.micinf.2005.04.006

Qin, E., Bi, J., Zhao, M., Wang, Y., Guo, T., Yan, T., … Zhong, Y. (2015). Clinical features of patients with Ebola Virus Disease in Sierra Leone. *Clinical Infectious Diseases, 61*(4), 491–495. https://doi.org/10.1093/cid/civ319

Quiner, C. A., & Nakazawa, Y. (2017). Ecological niche modeling to determine potential niche of Vaccinia virus: a case only study. *International Journal of Health Geographics, 16*(1). https://doi.org/10.1186/s12942-017-0100-1

Ravi, S. J., & Gauldin, E. M. (2014). Sociocultural dimensions of the Ebola Virus Disease outbreak in Liberia. *Biosecurity and Bioterrorism: Biodefense Strategy, Practice, and Science, 12*(6), 301–305. https://doi.org/10.1089/bsp.2014.1002

Richards, P., Amara, J., Ferme, M. C., Kamara, P., Mokuwa, E., Sheriff, A. I., … Voors, M. (2015). Social pathways for Ebola Virus Disease in rural Sierra Leone, and some implications for containment. *PLOS Neglected Tropical Diseases, 9*(4), e0003567. https://doi.org/10.1371/journal.pntd.0003567

Rivers, C. M., Lofgren, E. T., Marathe, M., Eubank, S., & Lewis, B. L. (2014). Modeling the impact of interventions on an epidemic of Ebola in Sierra Leone and Liberia. *PLoS Currents, 6*. https://doi.org/10.1371/currents.outbreaks.4d41fe5d6c05e9df30ddce33c66d084c

Rohwerder, B. (n.d.). Impact and implications of the Ebola crisis, 10.

Schieffelin, J. S., Shaffer, J. G., Goba, A., Gbakie, M., Gire, S. K., Colubri, A., … Garry, R. F. (2014). Clinical Illness and Outcomes in Patients with Ebola in Sierra Leone. *New England Journal of Medicine, 371*(22), 2092–2100.

https://doi.org/10.1056/NEJMoa1411680

Senga, M., Pringle, K., Ramsay, A., Brett-Major, D. M., Fowler, R. A., French, I., … Bausch, D. G. (2016). Factors underlying Ebola Virus infection among health workers, Kenema, Sierra Leone, 2014–2015. *Clinical Infectious Diseases, 63*(4), 454–459. https://doi.org/10.1093/cid/ciw327

Shahabuddin, A., Nöstlinger, C., Delvaux, T., Sarker, M., Delamou, A., Bardají, A., … De Brouwere, V. (2017). Exploring maternal health care-seeking gehavior of married adolescent girls in Bangladesh: A social-ecological approach. *PLOS ONE, 12*(1), e0169109. https://doi.org/10.1371/journal.pone.0169109

Sharareh, N., S. Sabounchi, N., Sayama, H., & MacDonald, R. (2016). The Ebola crisis and the corresponding public behavior: A system dynamics approach. *PLoS Currents, 8*. https://doi.org/10.1371/currents.outbreaks.23badd9821870a002fa86bef6893c01d

Sia, D., Onadja, Y., Hajizadeh, M., Heymann, S. J., Brewer, T. F., & Nandi, A. (2016). What explains gender inequalities in HIV/AIDS prevalence in sub-Saharan Africa? Evidence from the demographic and health surveys. *BMC Public Health, 16*(1). https://doi.org/10.1186/s12889-016-3783-5

Skrable, K., Roshania, R., Mallow, M., Wolfman, V., Siakor, M., & Levine, A. C. (2017). The natural history of acute Ebola Virus Disease among patients managed in five Ebola treatment units in West Africa: A retrospective cohort study. *PLOS Neglected Tropical Diseases, 11*(7), e0005700. https://doi.org/10.1371/journal.pntd.0005700

Stanturf, J. A., Goodrick, S. L., Warren, M. L., Charnley, S., & Stegall, C. M. (2015). Social vulnerability and Ebola Virus Disease in rural Liberia. *PLOS ONE*, *10*(9), e0137208. https://doi.org/10.1371/journal.pone.0137208

Stehling-Ariza, T., Rosewell, A., Moiba, S. A., Yorpie, B. B., Ndomaina, K. D., Jimissa, K. S., … Manso, D. (2016). The impact of active surveillance and health education on an Ebola virus disease cluster — Kono District, Sierra Leone, 2014–2015. *BMC Infectious Diseases*, *16*(1). https://doi.org/10.1186/s12879-016-1941-0

Strong, A., & Schwartz, D. A. (2016). Sociocultural aspects of risk to pregnant women during the 2013–2015 multinational Ebola virus outbreak in West Africa. *Health Care for Women International*, *37*(8), 922–942. https://doi.org/10.1080/07399332.2016.1167896

Tambo, E. (2014). Non-conventional humanitarian interventions on Ebola outbreak crisis in West Africa:health, ethics and legal implications. *Infectious Diseases of Poverty*, *3*, 42. https://doi.org/10.1186/2049-9957-3-42

Tenkorang, E. Y. (2017). Ebola-related stigma in Ghana: Individual and community level determinants. *Social Science & Medicine*, *182*, 142–149. https://doi.org/10.1016/j.socscimed.2017.03.060

Tiffany, A., Dalziel, B. D., Kagume Njenge, H., Johnson, G., Nugba Ballah, R., James, D., … McClelland, A. (2017). Estimating the number of secondary Ebola cases resulting from an unsafe burial and risk factors for transmission during the West Africa Ebola epidemic. *PLOS Neglected Tropical Diseases*, *11*(6), e0005491.

https://doi.org/10.1371/journal.pntd.0005491

UNICEF, FOCUS 1000, CRS (2014). Study on public knowledge, attitudes, and practices relating to Ebola Virus Disease (EVD) prevention and medical care in Sierra Leone. Retrieved from http://reliefweb.int/sites/reliefweb.int/files/resources/Ebola-Virus-Disease-National-KAP-Study-Final-Report_-final.pdf

United Nations Development Group (UNDG), (2015). Socio-economic impact of Ebola virus disease in West African countries

Valeri, L., Patterson-Lomba, O., Gurmu, Y., Ablorh, A., Bobb, J., Townes, F. W., … Harling, G. (2016). Predicting subnational Ebola Virus Disease epidemic dynamics from sociodemographic indicators. *PLOS ONE*, *11*(10), e0163544. https://doi.org/10.1371/journal.pone.0163544

Vaux, A. (1988). *Social support: Theory, research, and intervention*. New York, NY, England: Praeger Publishers.

Vogel, G. (2014). Genomes reveal start of Ebola outbreak. *Science*, *345*(6200), 989–990. https://doi.org/10.1126/science.345.6200.989

Wamala, J. F., Lukwago, L., Malimbo, M., Nguku, P., Yoti, Z., Musenero, M....Okware, S. I. (2010). Ebola Hemorrhagic Fever associated with novel virus strain, Uganda, 2007–2008. *Emerging Infectious Diseases*, 16(7), 1087-1092. https://dx.doi.org/10.3201/eid1607.091525.

Watts, D. J., & Strogatz, S. H. (1998). Collective dynamics of ‘small-world’ networks *Nature*, *393*(6684), 440–442. https://doi.org/10.1038/30918

Wells, C., Yamin, D., Ndeffo-Mbah, M. L., Wenzel, N., Gaffney, S. G., Townsend, J. P.,… Galvani, A. P. (2015). Harnessing case isolation and ring vaccination to control Ebola. *PLOS Neglected Tropical Diseases, 9*(5), e0003794. https://doi.org/10.1371/journal.pntd.0003794

WHO Ebola Response Team. (2014). Ebola Virus Disease in West Africa — the first 9 months of the epidemic and forward projections. *New England Journal of Medicine*, *371*(16), 1481–1495. https://doi.org/10.1056/NEJMoa1411100

WHO Ebola Response Team. (2016). Ebola Virus Disease among male and female persons in West Africa. *New England Journal of Medicine, 374*(1), 96–98. https://doi.org/10.1056/NEJMc1510305

WHO Ebola situation report. (2015). Retrieved from http://apps.who.int/ebola/en/ebola-situation-report/situation-reports/ebola-situation-report-11-february-2015

Wilcox, B. A., & Echaubard, P. (2017). Balancing biomedical and ecologicalperspectives in research framing of liver fluke and cholangiocarcinoma in NE Thailand. *Parasitology International*, *66*(4), 372–377. https://doi.org/10.1016/j.parint.2016.10.002

World Health Organization. (2015). Factors that contributed to undetected spread of the Ebola virus and impeded rapid containment. Retrieved September, 2016 from http://www.who.int/csr/disease/ebola/one-year-report/factors/en/

World Health Organization. (2017). Factors that contributed to undetected spread of the Ebola virus and impeded rapid containment one year into the Ebola epidemic. Retrieved March 12, 2015 from int/csr/disease/ebola/one-year-

report/factors/en …, 2017

Yamin D et al, (2015). Harnessing case isolation and ring vaccination to control Ebola *Journal of Infectious Disease*. 2(6):265-268. Retrieved November 2, 2015 from http://www.ncbi.nim.gov/pubmeded/11103018 https://doi.org/10.1016/j.parint.2016.10.002

Yi, F., Yang, P., & Sheng, H. (2016). Tracing the scientific outputs in the field of Ebola research based on publications in the Web of Science. *BMC Research Notes*, *9*(1). https://doi.org/10.1186/s13104-016-2026-2

Zulu, A., Sipangule, C., Siboonde, M., Musumali, M., Chituta, F., Kagulula, S., … Mufunda, J. (2016). Preparedness of response to deadly outbreaks: Lessons learnt from Zambia's deployment to the 2014 African Ebola outbreak. *Medical Journal of Zambia*, *43*(2), 105–108.