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Geographic Variations in Antenatal Care Services in Sierra Leone

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2018

Abstract

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Despite antenatal care presenting opportunities to identify and monitor women at risk, use of recommended antenatal care services remains. Barriers preventing use of antenatal services vary between countries, and limited knowledge exists about the link between geographical settings and antenatal service use. The objective of this cross-sectional quantitative study was to explore geographical variations and investigate how social demographic characteristics affect use of antenatal care for women in Sierra Leone using the Andersen behavioral model. The data used were from the 2016 maternal death surveillance report of the whole counrty (N =706). Logistic regression analysis was used to determine the individual predictor effects on antenatal care, including geographical location, the age of women, marital status, parity, and institution of birth impact. Southern, Northern, and Eastern women had significantly lower odds of attending the recommended antenatal services compared to women in the Western region (OR = .517, p = .019; OR = .497, p = .021; OR = 0.014, p = .041, respectively). The odds of married women attending the recommended antenatal services was 7.3 times more than that of the single women (OR = 7.397). Also, significantly associated with less uptake of recommended antenatal visits was lower education level among women (OR = .517). This study will contribute to positive social change by highlighting inequities in antenatal care use among women, thus allowing for accurate targeting of health promotion programs and ultimately saving lives of mothers and children of Sierra Leone through more inclusive policies.

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Dedication

I dedicate this dissertation to my family for putting up with my busy schedule. I dedicate this study to my children, Joash and Jasmine, who endured many days without a mother. To my sisters, Bilha, Joyceline, Cess, and brothers Steve and John, who had to deal with taking care of my kids as well as my putting up with school frustrations and sitting with me during wee hours of the night for moral support as I completed assignments. A special dedication to my parents, Rachel and George Chege, for being my number one supporters. Your support made me forge ahead despite a feeling of giving up. Hope I have made you proud parents. To my nieces Shantel, Raphael, and Raquel, your questions helped my determination to see the end. To all the members of the Wandore and Gathuma families, I say thank you for all your support and encouragement. I am well aware that the achieving this level of education in my community is very rare as such I hope that I have set the example for all the people in my community for educational pursuits.

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I thank God Almighty for the many blessings and mercies He has showered on me in my life and throughout my pursuit of this doctorate degree at Walden University. He is indeed a mighty God.

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Without all your support this dissertation would not have come into being. Finally to my family I say it is great to have you all in my life and I appreciate all you have done and keep doing for me. I am forever grateful.

God bless you all.

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Chapter 1: Introduction

Sierra Leone currently has the highest maternal mortality indicators in the world, with 1,360 deaths per 100,000 live births (World Health Organization [WHO], 2015). Maternal health services are used as a proxy to assess the overall health services for the population with regard to access and equity. This is because maternal health encompasses a variety of essential health services which form a continuum of care for women and children that ensure safety for mother and child throughout pregnancy, early years, and preadolescence (WHO, 2011). A major component of the continuum of care are adolescent, prepregnancy, pregnancy, childbirth, postnatal period, child health care, family planning services and community support (Kerber et al., 2007). Use of antenatal care (ANC) being part of the continuum of care is a key element for women; however, the uptake of ANC care is challenging. Researchers have highlighted one major limitation in the use of ANC as poor service delivery by health care workers, whereby only some interventions are given (Conrad et al., 2011). In Sierra Leone, approximately 75% of women receive at least four ANC visits (Statistics Sierra Leone & ICF International, 2014). The introduction of free health care for special groups has been in force for 7 years now, yet variations in ANC care are recorded in some rural settings of the country (Kanu, Tang, & Liu, 2014; Sharkey et al., 2017). This study is the first in Sierra Leone to assess how geographical variations of the country interfere with the use of ANC among the population.

In Chapter 1, I examine the background of ANC and highlights the major literature gaps that exist. I then address the problem statement, the purpose of the study, and research questions supported by the hypothesis of the study. I then give a brief background of the theoretical framework that guides the study, along with study limitations, assumptions scope of the study, and the policy direction and social change to which the study will contribute.

Background

In 2015, an estimated 303,000 women died from pregnancy-related causes: 2.7 million babies died during the first 28 days of life and 2.6 million babies were stillborn (WHO, 2017). ANC is a core component of the continuum of care that should be given to expectant women so as to enhance good health for themselves and their babies. The goal of the ANC package as defined by Partnership for Maternal, Newborn and Child Health (PMNCH, 2010) is to prepare for birth and parenthood by preventing, detecting, alleviating, or managing the health problems that affect mothers and babies, including complications of pregnancy, preexisting conditions that worsen during pregnancy, and effects of unhealthy lifestyles.

Although this care is essential for expectant women, only 64% of women globally receive ANC four or more times throughout their pregnancy (WHO, 2017). Finlayson and Downe, (2013) argued that the global implementation of strategies designed to encourage antenatal attendance is based on the assumption that provision of high-quality services will entice people to come for the services. The role that geographical settings play in ANC attendance still remains a major knowledge gap,

especially in low-resource countries. According to Kieffer, Alexander, and Mor, (1992) mortality, morbidity, and their contributing factors are not uniformly distributed among populations or geographic areas. According to Sharkey et al., (2017), ANC was used but often not timely due to distance and cultural norms in Sierra Leone. The study, however, could not be generalized to the whole population as purposive sampling had been used. A further understanding and exploration of the interrelationships of the characteristics of a willingness of women to take up ANC in the country are therefore necessitated.

Problem Statement

Poor use of ANC services in rural Sierra Leone has been attributed to cost and distance, but this challenge varies between geographical areas (Kanu et al., 2014). ANC presents opportunities to identify pregnancy risks and to monitor and support the general health care of women and their babies who may be susceptible to a range of potentially fatal pathologies including HIV, anemia, malnutrition, tuberculosis, and malaria (Finlayson & Downe, 2013). Understanding the variations in access and use of ANC between all the regions will be the first of its kind in Sierra Leone. The place-specific perspective into ANC research would better identify local risks and may further improve maternal and infant health (Shoff, Chen, & Yang, 2014). This argument reinforces the need for skilled health personnel in all maternal health problems. Research has demonstrated a positive correlation of ANC with health facility delivery (Berhan & Berhan, 2014). Assessing whether the same applies for Sierra Leone will help bridge the gap through ensuring that ANC is available throughout the country. Kogan, Alexander, Jack, and Allen, (1998) argued that ANC use can serve as a good avenue for

identification and targeted interventions to women who are at risk for not obtaining well-child care or defaulting from routine immunizations for their children. I, therefore, sought to fill in the gap in the literature to understand this link. The study will assist policy makers and health workers in the provision of standardized ANC for women throughout the country. Standardization of care will help promote equity in service provision and better ANC services in the country, thus reducing the proportion of the potential burden of morbidity and mortality in women and children. The independent variables in this study were geographical setting, the age of women, marital status, parity, the institution of birth, mode of delivery, and education; the dependent variable was ANC.

Research Questions

Research Question: To what extent, if any, are ANC visits by Sierra Leone women related to the district of residence, age, marital status, parity, the institution of birth, mode of delivery, and education among maternal death cases?

$H_0$1: ANC visits are not related to the district of residence for Sierra Leone women after controlling for age, marital status, parity, the institution of birth, mode of delivery, and education among maternal death cases.

H_a1: ANC visits are related to the district of residence for Sierra Leone women after controlling for age, marital status, parity, the institution of birth, mode of delivery, and education among maternal death cases.

$H_0$2: ANC visits are not related to mother's age after controlling for the district of residence, marital status, parity, the institution of birth, mode of delivery, and education among maternal death cases.

H_a2: ANC visits are related to mother's age after controlling for the district of residence, marital status, parity, the institution of birth, mode of delivery, and education among maternal death cases.

H_03: ANC visits are not related to marital status after controlling for the district of residence, age, marital status, parity, the institution of birth, mode of delivery, and education among maternal death cases.

H_a3: ANC visits are related to marital status after controlling for the district of residence, age, marital status, parity, the institution of birth, mode of delivery, and education among maternal death cases

Purpose of the Study

In this study, I aimed to understand how geographical location, the age of women, marital status, parity, and institution of birth impact on ANC services in Sierra Leone. I used a quantitative study using secondary data to study the gap in knowledge and practice. I used the Andersen behavioral model to determine the effects of geographical setting, age, marital status, parity, and place of birth on ANC access and use among the women of Sierra Leone (Andersen, 1968). The independent variables were geographical setting, the age of women, marital status, parity, the institution of birth, mode of delivery, and education; the dependent variable was ANC.

Framework

I used the Andersen behavioral model, which was created in 1968 to empirically test hypotheses about inequality of access to health services in the United States (Andersen, 1968). The Andersen behavioral model can be applied in Sierra Leone as it

has been used in an African setting in a study that looked at the uptake of health services for adolescent girls in Nigeria (Azfredrik, 2015). ANC is a strategy used to encourage women to attend health checkups during pregnancy in which specific interventions are carried out to help anticipate a healthy mother and a live baby at birth. According to Jahangar et al., (2012), the Andersen behavioral model (ABM) of health care use suggests that people's use of health services is a function of their predisposition to use services, factors that enable or impede use, and their need for care, thus providing a way to conceptualize these variations in use rates and consumption of medical resources. According to Babitsch et al., (2011), use of health care is also supply-induced making it dependent on the structures of the health care system, and differences in health care use have been recorded based on patients' social characteristics. Application of this model helped understand the issues that arise in regard to access, use and resources available for ANC, and ultimately for delivery in the country.

Nature of Study

I used secondary data from maternal death surveillance systems collected at the district level in the country. I assessed variation in ANC visits among maternal death cases in Sierra Leone. The data were provided from all the districts by the Sierra Leone Ministry of Health and Sanitation. I used geographical setting, the age of women, marital status, parity, the institution of birth, mode of delivery, and education as the independent variables, whereas the dependent variable was ANC

Definition of Variables

Dependent Variable

Antenatal care: This is the number of contacts a pregnant woman has had with a health worker since becoming pregnant. The visits are categorized as < 4 and 4>.

Independent Variables

Geographical setting: This is defined as one of the four political divisions in Sierra Leone, namely Western Area and Northern, Eastern, and Southern Provinces from where the maternal death data were collected.

Age: This is the number of years a woman has lived up to the time she got pregnant

Marital status: This is defined as being in or not being in a relationship at the time death. Dichotomized as single or married.

Parity: This refers to the number of live births a pregnant woman had prior to her death.

Mode of delivery: This refers to how the woman delivered her baby if she died after delivery. It is categorized as caesarean section, vaginal delivery, and not delivered.

The institution of birth: This is classified as the institution where the birth took place for the women who died during or after delivery. It is categorized as government hospital, private hospital, community health center (CHC), community and other facilities that had few deliveries including faith-based hospital, community health post (CHP), and maternal and child health post (MCHP).

Education: This is the level of formal education attained by a woman at the time of being pregnant.

Assumptions

I that all the districts followed the disease and events surveillance protocol by reporting all maternal deaths that occurred in all health facilities in all communities. I also assumed that the maternal death review committees investigated all the deaths and submitted all reports to the ministry of health.

Scope and Delimitation

The data were collected from the maternal death surveillance throughout the country from January to December 2016. The main area of interest how ANC is affected by geographic setting, age, marital status, parity, the institution of delivery, mode of delivery, and education status. The data was collected from the whole country; therefore, it is generalizable as it reflects the population of Sierra Leone.

Limitations

A major limitation of the study was the misclassification of some maternal deaths. The Internal Classification of Diseases, Tenth Revision (ICD-10), classifies maternal death as any death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes (WHO, 2017). Although the definition seems straightforward, its application in practice creates problems when medical certification of the cause of death is unavailable or of inadequate quality, or when deaths occur at home (University of Queensland, 2010; Merdad, Hill, & Graham, 2013). Another limitation was the absence of some cases that qualify as maternal deaths, especially in cases where illegal abortions

were being carried out, because not all information would be disclosed. Incomplete data and missing variables from the data would also limit the study because it would reduce the sample size. Another limitation was that because the data were being collected following a death, a woman may have had other factors that contributed to the ANC uptake, but this information would not have been known by other people. Another limitation was that the family members may not have been cooperative during the maternal death review, especially if the death occurred at home for fear of retribution, thus withholding vital information.

Significance

The 2014 Sierra Leone demographic health survey indicated that 76% of women who had a live birth in the 5 years preceding the survey reported, making ANC visits at least four times during pregnancy. This was an improvement compared to the demographic health survey of 2008, when only 56% of women were reported as attending four or more ANC visits. The Ebola virus disease (EVD) may have contributed to a further reduction of access and use of ANC services due to a community's mistrust of health facilities and workers who were seen as the point of Ebola disease exposure (Scott et al., 2016). Limited studies have been carried out in Sierra Leone to assess whether there are variations in access and use of ANC within a different geographical setting. In their study, Sharkey et al., (2017) looked at only four of 13 districts in Sierra Leone and concluded that traditional practices were the major impeding factor to access of health care services for women in Sierra Leone. I focused on rural districts and not urban districts, thus making it difficult to generalize the study to the whole country. I

anticipate that the study will contribute to a positive social change by reducing inequity in health care access and provision of health services for women, ultimately saving lives of mothers and children of Sierra Leone.

Summary and Transition

Sierra Leone has one of the worst statistics of maternal death of 1,360 deaths per 100,000 live births (WHO, 2015). The country has been classified as making insufficient progress towards reduction of maternal deaths, despite the free health care initiative that has been in place since April 2010. One major gap is the use of ANC services which currently ranges from 74.6% in the rural population to 79.9% of the urban population (Statistics Sierra Leone & ICF International, 2014). ANC is a vital service that should be available and rendered to all pregnant women in a population; however, this does not always happen, due to various social demographic reasons. To better understand the magnitude of the problem, I pursued to exploration of some social demographic factors that are likely to contribute to poor ANC use in the country. In Chapter 1, I focused on the description of the study topic and delineate the problem statement, the purpose of the study, the research questions to be explored, and possible limitations of the study. In Chapter 2, I provide a detailed review of literature in terms of scope, search strategy, variables of interest, and methodology that I used in the various studies.

Chapter 2: Literature Review

Introduction

Underuse of ANC has been a major challenge in low- and middle-income countries, especially sub-Saharan Africa where only 44% of women receive four or more antenatal visits (UN, 2011). Access to health care services in rural areas and financial burden associated with maternal services contribute to poor use of services (Mugo, Dibley, & Agho, 2015). In some rural parts of Sierra Leone, cultural norms, practices, and distance from health facilities have been linked with poor uptake of antenatal services (Sharkey et al., 2017). The poor use of antenatal services limits some mothers and children from all the benefits of free health care services that are available for all expectant women and for children under 5 years old. Geographical variations in ANC uses have been investigated by researchers with social demographic factors, health system factors and external factors being attributed to the poor use (Trinh, Dibley, & Byles, 2007). Understanding variation is critical for researchers to examine the relations between policy decisions and clinical decisions giving rise to important questions concerning the efficiency and effectiveness of health care in a country (Wennberg, 2011). The analysis of the variation serves as a key step toward ensuring equity in health care provision by addressing the disparities. Little is known about the association between access and use of ANC within the geographical setting in Sierra Leone. Therefore, I investigated the possible risk factors associated with poor uptake of ANC services. I focused on geographical setting, the age of women, marital status, parity, the institution of birth, mode of delivery, and education.

Search Strategy

An online search strategy was conducted to ascertain the ANC studies worldwide using the same variables. The search was widened to the whole world as limited papers within Sierra Leone or Africa were found. The primary databases that I used were Google Scholar, Centers for Disease Control and Prevention, PubMed, ProQuest, Medline, and World Health Organization. The documents were accessed electronically via the Walden University Library website, with one recent paper outsourced directly from the author. The researcher excluded duplicate studies and investigations that were not reported in English and narrowed the search by selecting filters that allowed only the relevant articles by keywords and specified publication dates. The databases delivered journal articles published between 2000 and 2016 that were peer-reviewed are official records from governmental agencies. The search also included unpublished material from Sierra Leone Ministry of Health and Sanitation and local partners. The search terms were as follows: *ANC, geographic variations, access to health care, use of health services, Andersen Behavioral Model, the age of women, marital status, parity, the institution of birth, birth interval, mode of delivery*, and *education of women*.

Inclusion Criteria

Literature material used for this examination had to meet the following requirements:

1. Research publication dates ranged from 2000 to 2017 (except for several relevant, significant documents).
2. Peer-reviewed journal articles or governmental agency reports.
3. Journal articles that met the particular population.

Exclusion Criteria

Literature resources were not used if they fell into the following criteria:

1. The literature did not reinforce this study.
2. The literature did not meet the inclusion criteria.
3. The literature did not comply with the specified population.

Theoretical Framework

The theoretical approach guided this study is based on the Andersen behavioral model (Andersen, 1968). The theory has been applied widely by researchers in studies dealing with health care use within families. The model was later modified to assess health care use of individuals wherein the family forms part of the determinants (Andersen, 1995). The ABM suggests that human beings' need for health use are determined by external environment, predisposing factors, enabling factors, and need factors (Andersen, 1995). The ABM also suggests that one's environment, social structure, service availability, and motivation are vital to the use of health services. The model was chosen because it would highlight different levels of decision making in seeking care for expectant women.

Application of theory. The Andersen application theory will be factored into the modified model in Figure 1.

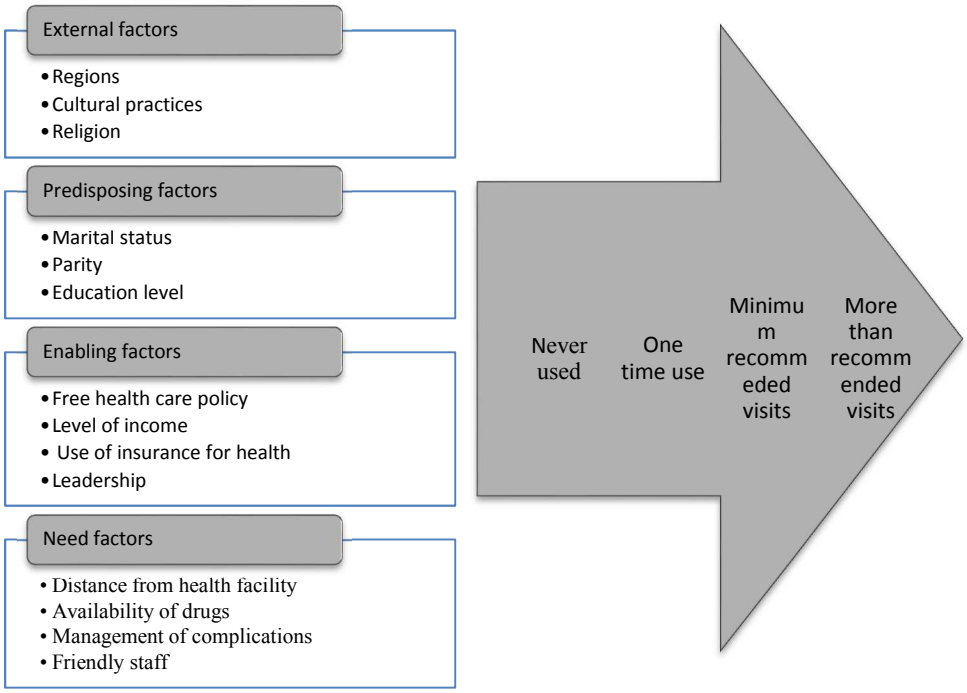

Figure 1. ABM to assess geographical variations on ANC services in Sierra Leone. Adapted from "Revisiting the Behavioral Model and Access to Medical Care: Does It Matter?" by R. M. Andersen, 1995, *Journal of Health and Social Behavior, 1,* 1-10. Reprinted with permission from Ronald M. Andersen.

Similar studies' use of the Andersen Behavioral Model

Azfredrik, (2016) applied the ABM in a quantitative design to access the level of uptake of health services for adolescent girls in Nigeria. A total of 3,065 adolescents from 33 schools were sampled. The objective of the author was to access how the predisposing, enabling, and need factors affect reproductive health services in adolescents and the relationship between the variables. The research demonstrated that parental support and communication did not determine the adolescents' use of reproductive services but rather their age, emotional condition, and the type of services required.

In another study, Trinh et al., (2007) employed the ABM in a quantitative investigation of factors associated with the use of ANC in three districts of Vietnam. The author's assessments evaluated a cross section of 1,335 women and used multivalent regressions to determine the ANC use. The study revealed regional variations in ANC use and poor use of ANC services for high-risk women. The study also demonstrated the need to improve the quality of ANC services so as to attract better use.

Researchers Mugo et al., (2015) used the ABM in their study to assess the factors that determine the use of health care services by pregnant women in South Sudan. The authors evaluated 16 risk factors using multiple regression analysis from a stratified cluster sample of 3,504 women. The study presented that level of education of the women played a key role in their decision to seek ANC. Poor access to health facilities and weak economic status of women also contributed to poor use of the ANC services.

Healthcare system in Sierra Leone

The government of Sierra Leone has the sole responsibility of providing health care for its people. The health care system is divided into primary and secondary levels of care whereby there are hospital services and primary health care facilities which are comprised of three levels of peripheral health centers including maternal and child health post, community health post, community health center. The hospitals are divided into three levels including district, regional and tertiary care hospitals. Sierra Leone has health financing which is mainly provided by external partners with payments being made through a cost recovery policy and service user charges; however, out-of-pocket

payments through community loan arrangements exist within different communities (WHO, 2014).

A free health care policy for special groups including pregnant women, lactating women, children under 5 years of age, and the disabled seeking health care in all public health facilities was launched in 2010 (Witter, 2016). The free health care initiative was aimed at bridging the gap in the Sierra Leone Millennium Development Goals 4 and 5. Access to health care for these special groups has improved; however, not all of the needs have been fulfilled over the years as the system is constantly characterized by stock outs of essential drugs (Moszynski, 2011). The transition of the millennium goals to sustainable development has put more pressure on performance by demanding political and financial accountability for maternal and child health (WHO, 2015). Despite the challenges that exist, the free health care initiative has helped to increase both ANC uptake and facility-based deliveries in Sierra Leone, with the poorest ANC patients benefiting (Sharkey et al., 2017). While there has been some improvement in uptake of ANC services, research conducted in rural Sierra Leone demonstrated that the rural population still does not understand what is in the free health care package and what they are entitled to (Kanu et al., 2014). As such, they continue to get exploited by being asked to pay for services. This contributes negatively, as those who cannot afford to pay to choose to shy away from seeking the services with serious detriment. As part of the President's Recovery Priorities following a 2014 Ebola outbreak, a health sector recovery plan was developed aimed at strengthening the health services which had been brought to a near halt and to rebuild trust from the population. One of the key areas of concern of the

presidential priorities is achieve and sustain a resilient zero. That goal is to be achieved through a development of a surveillance system which could prevent, detect, and respond to epidemics timely and protect the lives of 600 women and 5,000 children by 2018 through various life-saving interventions for maternal and child health (The President's Recovery Priorities, 2016).

Ebola and maternal health in Sierra Leone

Understanding the effect of an Ebola outbreak is important for the conceptualization of the ANC use in the country. Sierra Leone was among the West African countries affected by the 2014-2015 Ebola outbreaks. The EVD outbreak contributed negatively to maternal health in Sierra Leone due to fear of contracting other infections when accessing health facilities (Menendez, Munguambe, and Langer, 2015). The situation was further highlighted by Brolin Ribacke et al., (2017) in their systemic review research of 22 articles related to the West African Ebola outbreak of which 19 articles were peer-reviewed. The review demonstrated that health services use and provision of services was interrupted significantly in all the affected countries (Brolin Ribacke et al., 2017). A retrospective observational cohort study carried out in Guinea to assess the trends of attendance of maternal, newborn, and child health (MNCH) services demonstrated a reduction of attendance for the three ANC (95% CI −485 to −242) and first ANC (95% CI −535 to −300) during the outbreak, reinforcing the detriment of maternal health services during the outbreak (Delamou, et al., 2017). After the outbreak, efforts have been made to rebuild the confidence of the population in health services,

improve surveillance, strengthen infection prevention, and control measures in all health facilities.

Literature Review Related to Key Concepts and Variables

This fundamental study concept is the uptake of ANC for women in different geographical settings in Sierra Leone. The variables of interest are geographical setting, the age of women, marital status, parity, the institution of birth, mode of delivery education, and ANC. This section will expand the literature that has the same variables.

Antenatal Care

ANC is one of the evidence based, life-saving, cost-effective interventions aimed at helping in the reduction of maternal and perinatal deaths (Madaj et al., 2017). The current WHO ANC model has recommended between 4 to 8 contacts for pregnant women with a health care provider as a means of increasing the detection and management rate of potential problems, as well as improving communication between the pregnant women and their care providers (WHO, 2017). ANC coverage (at least 4 visits) in Sierra Leone ranges between 74.6% in the rural population to 79.9% in the urban population; the highest ANC coverage is when women are between 4 and 5 months pregnant (44.5%) with the lowest being when the women are 8 months and above (0.7%) and at 1 month (1.9%) of pregnancy (Statistics Sierra Leone, & ICF International, 2014). This finding is despite the free health care initiative which covers pregnant women and a vast distribution of health facilities in the country. Late initiation of ANC services has also been recorded in Ethiopia as women waited 4 to 5 months into their pregnancies before they could start their ANC care (Gudayu, Woldeyohannes, & Abdo, 2014;

Belayneh, Adefris & Andargie, 2014). A similar study carried out in Cameroon revealed that only 6 % of women started their ANC during the first trimester with 15% of women beginning their ANC during the third trimester (Halle et al., 2015). Researchers Heredia-Pi et al., (2016) carried out a population-based cross-sectional household survey in Mexico that demonstrated that ANC care increased the likelihood of women using skilled birth attendants at birth. The study results concluded that 71.5% women (95% CI: 69.7 to 73.2) who had received adequate ANC services were delivered by skilled health personnel. The fusion of culture, beliefs, and social economic issues in the population play pivotal roles in the women's decisions to seek care during pregnancy. Cultural practices in Sierra Leone of keeping a pregnancy secret for up to three months have contributed to poor use of ANC clinics in the first trimester (Sharkey et al., 2017). In Nigeria investigation into the role of culture in the uptake of ANC showed that when cultural preference was acceptable there was an increase of ANC intake ($t = 1.961$, $p<0.05$ (Ibor et al., 2011). The indicators that assess quality of care for ANC, however, are very low. The number of babies born with low birth weight is at 7% and only 54% of all babies born in Sierra Leone are put onto the breast within the first hour of birth (Statistics Sierra Leone, & ICF International, 2014). The quality of care given at the ANC clinic is characterized by variations being recorded in the districts; for example, the uptake of intestinal parasitic drugs ranges from 43% in Kono to 88% in Bo and overall from 71% in rural settings to 76% in urban settings. (Statistics Sierra Leone, & ICF International, 2014). The disadvantage of the women within the rural setting as compared to the women from the urban settlements was also documented by Tawiah, (2011) in his

study in Ghana, Kenya, Nigeria, Zambia, and Uganda where the likelihood of not accessing ANC care for the rural women was 7.7 times higher than that for urban women. The rural/urban differences are attributed to physical inaccessibility to health facilities in rural areas, whereas the urban differences are attributed to public and private health care allocation and inequitable distribution of social amenities that contribute to maternal well-being (Tawiah, 2011).

Geographical settings of Sierra Leone

Sierra Leone is located on the west coast of Africa and covers an area of about 72,000 square kilometers (28,000 square miles) extending from latitude 7 degrees north to 10 degrees north and from longitude 10 degrees west to 14 degrees west. The Republic of Guinea borders it on the north and northeast, and the Republic of Liberia borders it on the east and southeast. On the west and southwest, the Atlantic Ocean extends approximately 340 kilometers. Sierra Leone is divided into four administrative regions which are further divided into districts, and each district is divided into chiefdoms. Overall, there are 14 districts and 149 chiefdoms (Statistics Sierra Leone, & ICF International, 2014). The country is mountainous with about 50% of the terrain covered by mountains including the capital, Freetown. Geographical settings in the African rural settings lack good roads and have weak means of transportation and poor distribution of health facilities, yet these are the motivating factors to the use of health services. Agriculture is the main occupation for the people of Sierra Leone with rice being the major crop.

Economic capacity within regions contributes to the use of health services. Financial constraints have been largely associated with poor access to maternal health care services (Jehan et al., 2012). Sierra Leone has a tropical climate with two distinct seasons: the dry season from November to April and the rainy season from May to October, with July and August being the wet months of the year. Sierra Leone is a former British colony and gained her independence from Britain on 27 April 1961.The country became a multiparty state in 1991, with two main political parties: the Sierra Leone Peoples Party (SLPP) and the All Peoples Congress (APC). The country, however, went through a 10-year civil conflict that began in 1991 and ended in 2002. It has 15 ethnic groups with the main religions being Islam (60%), indigenous religions (30%) and Christianity 10%) (CIA, nd).

Sierra Leone has a population of 7,075,641 of which 49.0% are male and 50.9% female and an annual growth rate of 3.2% (Statistics Sierra Leone, 2016). Statistics from the last census reveal that there is an increment in the total fatality rate from 4.9 children per woman in 2013, to 5.2 children in 2016 with regional variations of 5.4 in the eastern region, 5.6 in the northern region, 5.5 in the southern region and 4.0 in the western area (Statistics Sierra Leone, 2016). The Human Development Index, 2016 ranks Sierra Leone 179 out of 188 countries with a life expectancy of 51.3 years at birth (UNDP, 2016). The CIA, (nd) indicates that Sierra Leoneans at birth is 57.79 years, a total dependency of 81.9% with low literacy levels of 44.4%. The situation is more acute for women, whose literacy level is 33.6% as compared to 55.5% for the men. The impact of war on Sierra Leone and the recent Ebola outbreak has contributed to low life expectancy, poor health

care, lack of education, and poor agriculture resulting in food shortage, malnutrition, and corruption. Addressing disparities in the access to health services, income generation, and education whilst trying to rebuild the country is a significant burden for Sierra Leone. Sharkey et al., (2017) in their mixed study carried out in 4 of the 14 districts in Sierra Leone to assess the relationship between pregnancy, childbirth, newborn care, and social norms highlighted that geographical setting and cultural practices are contributing factors to poor access to maternal health services. The cultural influence of health-seeking behavior is further highlighted by Chama-Chiliba and Koch, (2015) and Kowalewski, Jahn and Kimatta, (2000) who concluded that, by and large, individual decisions in the African setting are influenced by the communities in which people reside. These services are also essential services which often require deliberate political effort and commitments from government.

Figure 2. 2013 Sierra Leone Demographic and Health Survey.

The age of women, education, marital status

Age in pregnancy is a key factor as it helps determine whether the woman is categorized as being at risk due to her age, thus contributing to better planning of the birth plan to mitigate any complications that could arise. Younger women are more likely to start their ANC visits early, unlike the older women (Gudayu,et al., 2014). Similar results from a cross-sectional study in China showed that women between the ages of 25 and 30 had an adjusted odds ratio of 2.2 with a 95% CI of a likelihood to use ANC as

compared to women older than 30 (AOR=1.9, 95%CI=1.1-3.2) (Zhao et al., 2009). Evidence has also demonstrated that teenage mothers are more likely to have stillbirths, low birth weight, and neonatal deaths due to poor use of ANC services as compared to older women (WHO, 2005; WHO et al., 2010), partly due to low use of maternal health systems (MHS) compared to older pregnant women aged 20-29 years (Pallikadavath, Foss, & Stones, 2004).

Use of ANC has been attributed to an increase in the woman's education ($t = 2.666$, $p<0.05$) (Ibor et al., 2011). Women with a higher income tend to adhere to initiation of ANC before the end of the first trimester, as compared to women with lower income (Zhao et al., 2009, Gudayu, et al., 2014, Tawiah, 2011 and Gitonga, 2017). Similar results from Osun State, Nigeria, show that education was found to be significant ($p<0.05$.) to the use of ANC services (Onasoga et al., 2012).

Marital status of women determines the use of ANC due to the support given from a partner: the additional income thus contributes to the decision to seek care for pregnant women. In her research conducted in Tharaka-Nithi County, Kenya, targeting 345 women, Gitonga, (2017) sought to assess the determinants of focused ANC and concluded that being married increased the likelihood of women taking up ANC threefold (OR = 2.77, $p< 0.01$, CI 1.556-4.966). Single women and those women with little support from the family or their other social structures are more likely to use ANC poorly. This was demonstrated in a population-based research carried out by Rurangirwa, et al., (2017) in Rwanda which indicated that single, divorced, widowed, or separated women were at a higher risk of poor use of ANC services as compared to married women (OR

2.99 (95% CI: 1.83, 4.75). Women with no family, relatives, or friends to support them when in need were at a higher risk of poor use of ANC services as compared to women who had support (OR 1.71; 95% CI 1.09, 2.67).

Parity, the institution of birth, mode of delivery, and birth interval

Parity of the women has been attributed to ANC use, with women with higher parity attending ANC more than those with lower parity (Emelumadu et al., 2014). In their cross-sectional study of 310 women carried out in southeast Nigeria, Emelumadu et al., (2014) found that parity was significantly associated with the number of ANC visits and time of ANC booking, and they found that grand multiparous women were more likely to schedule ANC after the first trimester ($\chi^2 = 5.9$, $P = 0.05$). The study also highlighted that age ($\chi^2 = 14.8$, $P < 0.01$), level of education ($\chi^2 = 32.6$, $P < 0.001$), marital status ($\chi^2 = 12.2$, $P < 0.01$), and parity ($\chi^2 = 11.5$, $P = 0.02$) were determinants of place of delivery for women. The study showed that women who are single and have a lower educational status are likely not to deliver in a health facility (Emelumadu et al., 2014). A similar study of 401 women in upcountry Uganda reinforced the notion, as parity was significantly seen to influence place of delivery ($\chi^2 = 18.9506$, $P = 0.000$) whereby most multiparous women were delivered from health facilities while the primigravidas tend to deliver from traditional birth attendants' (TBA) homes (Kawungezi et al., 2015). Gitonga, (2017) also concluded that women with reduced parity tend to use ANC services more than those with a higher parity (OR 0.73, p <0.032, CI 0.560-0973). Contrary to that evidence, a systemic review carried out between 1990 and 2006 concluded that parity had a statistically negative effect on ANC attendance, as

women with high parity tend not to use ANC services (Simkhada et al., 2008).

A relaxed environment, friendly nursing staff, supportive spouse, and a woman's awareness of the risk factors all contribute to the mode of delivery (Bryanton et al., 2008). Most of the factors mentioned are cultivated during ANC visits where the woman gets to have contact with the nursing staff and is able to plan her delivery, thus contributing to an appropriate mode of delivery based on the presenting circumstances. A study conducted in India for 200 women concluded that there was a significant difference in the mode of delivery for women, with the women who had adequate ANC delivering normally, as compared to those with inadequate ANC having a caesarean section (P <0.0001) (Kakati, Barua, and Borah, 2016). Birth interval is the time taken by a woman before she can conceive another baby after her previous pregnancy. The recommended interval between births to the next pregnancy is 24 months, and an interval of 6 months between a miscarriage and pregnancy is recommended to prevent poor maternal, perinatal, and infant outcomes (WHO, 2006). A study conducted in Nepal using the Cox hazard model to determine the effects of use of maternal health care services in child spacing concluded that use of ANC and longer birth intervals were positively associated (Paudel and Gautam, 2014). This relationship could be attributed to the health education that the women receive during the ANC sessions. A comparison of demographic health surveys from 24 African countries to assess their birth intervals and fertility trends demonstrated that the reduction in the widening of birth intervals is attributed to the uptake of family planning services, age, and parity of the women (Moultrie, Sayi, and Timæus, 2012).

Literature review

Author and Year	Title	Study Design	Study Population	Independent Variables	Dependent Variables	Results
Alibekova, R., Huang, P. J and Chen Y. H (2013)	Kessner Index (KI) (combines three variables: the start of prenatal care, the total number of consultations, and the length of pregnancy) and own index (OI) based on 7 quality indicators found in current national and international guideline	Retros pective cohort	Study of 15,056 women with an infertility diagnosis and 60,224 randomly selected women without infertility matched to the study sample by maternal age.	Number of ANC care visits, initiation of ANC care, and use of major ANC visits	Infertility	There was a statistically significant difference in the number of major ANC care visits made between the 2 study cohorts (p <0.0001), and the mean number of total ANC care visits was significantly higher in the infertility-diagnosed cohort compared to unaffected women (8.2 vs. 7.9, respectively, p <0.0001). A diagnosis of infertility was independently associated with a lower likelihood of attending ANC care <6 times (OR 0.89, 95% confidence interval (CI) 0.86~0.93). Infertile women who had <6 ANC care visits
Azfredrick, E (2016)	Using Andersen's model of health service use to examine use of	Cross-section al study	3,065 adolescent girls	Age of the participants was examined as a	Reproductive health services for adolescent girls	Type of health centre increases the odds that an adolescent girl will visit a reproductive health centre twice, when other variables are controlled [OR = 2.0, 95% CI:

	services by adolescent girls in south-eastern Nigeria			predisposing factor. Enabling factors are parental support, parental communicati on, and type of reproductive health facility. Need factors are feelings of inadequacy (not being good at all) and positive attitude about self.		1.7, 2.3]. Age of the adolescent girl increases the odds that she will visit a reproductive health centre .8 times, when other variables are controlled [OR = .78, 95% CI: .64, .95]. Parental support, parental communication, and positive attitude about self-do not predict the odds of adolescent girls visiting the reproductive health centre.
Berhan, Y., & Berhan, A. (2014).	ANC as a means of increasing birth in the health facility and reducing maternal mortality: a systematic review.	Compa rative literatu re review		Total fertility rate, contraceptive unmet need, adult literacy rate and level of income	Maternal, foetal, and perinatal mortalities	The regression analysis demonstrated increased risk of stillbirths (r = 0.5; $P < 0.0001$), neonatal (r = 0.6; $P < 0.0001$), and maternal mortality (r = 0.6; $P <$ 0.0001) with increased total fertility rate (TFR). The increased adult literacy rate was associated with increased ANC (r = 0.56; $P =$

						0.001) and a skilled person attending delivery (r = 0.58; $P <$ 0.0001).
Bassani, D. G ., Surkan,P. J., Olinto,T A,M., (2009)	Inadequate use of ANC services among Brazilian women: the role of maternal characteristics	A cross-sectional study	Study 611 women from 3 different hospitals	Social and demographic variables, parity, pregnancy planning, abortion attempts, satisfaction with pregnancy, and satisfaction with the relationship with the child's father	Women's use of ANC care was adequate, partially inadequate, or inadequate.	Unplanned pregnancy and dissatisfaction with the pregnancy was associated with inadequate care (odds ratios, 2.0 and 2.1, respectively).
Emelumadu, O., Ukegbu, A., Ezeama, N., Kanu, O., Ifeadike, C., & Onyeonoro, U. (2014).	Socio-demographic determinants of maternal health-care service use among rural women in Anambra State, southeast Nigeria	Cross-sectional design	310 women of reproductive age	Socio-demographic factors (age, marital status, educational status, parity, the pattern of ANC and natal service use, and	Maternal health services use	Parity was significantly associated with a number of ANC visits, grand multiparous women were more likely to book for ANC after the first trimester ($\chi^2 = 5.9$, $P =$ 0.05). Age ($\chi^2 = 14.8$, $P < 0.01$), level of education ($\chi^2 = 32.6$, $P <$ 0.001), marital status ($\chi^2 =$ 12.2, $P < 0.01$), and parity ($\chi^2 =$ 11.5, $P = 0.02$) were determinants

				outcome of pregnancy during their most recent confinement.		of place of delivery for women, with women who are single and have a lower educational status likely not to deliver in a health facility.
Gitonga E (2017)	Determinants of focused ANC uptake among women in Tharaka-Nithi County, Kenya	A descriptive cross-sectional survey	345 women	Age, level of education, marital status, type of employment, household income, gravida, and parity	Focused ANC uptake	Women with reduced parity tend to use ANC services more than those with a higher parity (OR 0.73, p <0.032, CI 0.560-0973), being married increases the likelihood of women taking up ANC threefold (odds ratio = 2.77, p < 0.01, CI 1.556-4.966).
Gudayu, Woldeyohannes, & Abdo (2014)	Timing and factors associated with first ANC booking among pregnant mothers in Gondar Town; North West Ethiopia	A cross-sectional study	407 pregnant mothers	Age, mother's age at marriage, marital status, place of residence, family income, educational status, occupation, educational status of the husband, the occupation of the husband,	Timing of ANC	Women waited until four to five months before they could start their ANC care. [(AOR (95% CI)) maternal age ≤ 25 (1.85 (1.10, 3.09)), age at marriage ≥20 years (2.21 (1.33, 3.68)), pregnancy recognition by urine test (2.29 (1.42, 3.71)), mothers who perceived the right time to start ANC within first trimester (3.93 (2.29, 6.75)) and having decision power to use ANC (2.43 (1.18, 4.99))] were significantly associated with timely commencement to ANC.

				the age difference between the mother and the husband, distance from the health facility, family size, and obstetrics variables		
Heredia-Pi, et al. (2016)	Measuring the adequacy of ANCcare: a national cross-sectional study in Mexico	Cross-sectional	A population-based household survey, based on a national population of 115,170,278.	Social demographic factors related to pregnancy	The four dimensions of continuity and adequacy of ANC were: (i) skilled health care (ANC provided by a nurse or a physician); (ii) timely (initial ANC visit during the first trimester of pregnancy); (iii) sufficient (at least four	71.5% of women (95% CI: 69.7 to 73.2) with access to services delivered by skilled health personnel received adequate ANC; 1.6% (95% CI: 1.2 to 2.0) received no ANC; and 27.0% (95% CI: 25.3 to 28.7) received inadequate ANC.

					ANC visits during the pregnancy); and (iv) appropriate in content (an indicator summarizing the procedures and processes of care provided during ANC).	
Kawungezi, P. C, AkiiBua D, Aleni C, Chitayi M, Niwaha A, Kazibwe A, Sunya E, Mumbere EW, Mutesi C, Tukei C. (2015).	Attendance and use of ANC (ANC) services: multi-centre study in upcountry areas of Uganda	A cross-sectional study design with mixed methods	400 women	Social-demographic, obstetric and cultural factors	Adequacy of ANC	Religion ($\chi 2$= 12.8890, P = 0.045), occupation ($\chi 2$=14.0202, P = 0.007), level of education ($\chi 2$= 4.9277, P = 0.553), and parity ($\chi 2$= 18.9506, P = 0.000) were found to influence place of ANC attendance, number of ANC visits, and booking time.
Mugo N, Dibley M, Agho K	Prevalence and risk factors for non-use of ANC visits: analysis	A Cross-sectional	504 women aged 15-49 years who had given	16 factors grouped into four categories:	Non-use of ANC services: those women	The study concluded that the main factors that pose risks to non-use of ANC services were geographical region, the

	of the 2010 South Sudan household survey	study	birth within two years preceding the survey.	external environment, predisposing factors, enabling resources, and the need for care.	who had ANC checks by non-skilled providers, and those who had no ANC; those who had between 1 to 3 ANC checks by skilled providers, and those who attended 4 or more ANC checks by skilled providers.	husband's polygamy status, women's literacy, and place of residence.
Rurangirwa, A.A., Mogren, I., Nyirazinyoye, L., Ntaganira, J, and Krantz.G. (2017)	Determinants of poor use of ANC services among recently delivered women in Rwanda; a population based study	A cross-sectional population-based study	922 women	Age, number of people in the household, marital status, women's relationship with household head, household	Number and timing of ANC visits	The risk of poor use of ANC services was higher among women aged 31 years or older (AO*R*, 1.78; 95% CI: 1.14, 2.78), among single women (AOR, 2.99; 95% CI: 1.83, 4.75) and women with poor social support (AOR, 1.71; 95% CI: 1.09, 2.67).

				income, assets in the household.		
Trinh, L. T. T., Dibley, M. J., & Byles, J. (2007)	Determinants of ANC use in three rural areas of Vietnam.	Cross-sectional surveys in 1998–1999.	Data from 1,335 eligible women	ANC, gestational age at entry to ANC, the number of visits	Overall ANC use in the three provinces of Long An, Ben Tre, and Quang Ngai	There was significant variability in the use of ANC existing between provinces and between subsets of women in each province.
Sharkey, A., Yanseneh, A., Bangura, P., Kabona, A., Brady, E., Yumkella, F and Diaz, T. (2017)	Maternal and newborn care practices in Sierra Leone: a mixed study of four underserved districts	Cross sectional	6,000 households	Related social norms	Pregnancy, childbirth, the newborn period	ANC was high (84.2%, 95% CI: 82.0–86.3%) but not timely due to distance, transport, and social norms to delay care-seeking until a pregnancy is visible, particularly in the poorer districts of Kambia and Pujehun. Skilled delivery rates were lower (68.9%, 95% CI: 64.8–72.9%), particularly in Kambia and Tonkolili where TBAs are considered effective. Clean cord care, delaying first baths, and immediate breastfeeding were inadequate across all districts. Timely postnatal checks were common among women with facility deliveries (94.1%, 95% CI: 91.9–96.6%) and their newborns (94.5%, 95% CI: 92.5–96.5%).

						Fewer women with home births received postnatal checks (53.6%, 95% CI: 46.2–61.3%) as did their newborns (75.8%, 95% CI: 68.9–82.8%). TBAs and practitioners are well-respected providers, and traditional beliefs impact much behaviour.
Vieira, C.L., C.M. Coeli, R.S. Pinheiro, E.R. Brandao, K.R. Camargo Jr, F.P. Aguiar (2012)	Modifying effect of prenatal care on the association between young maternal age and adverse birth outcomes	A cross-sectional study	Women up to 24 years of age who gave birth to live children in 2002 in the city of Rio de Janeiro	Maternal age	Very premature birth, low birth weight, and 5-minute Apgar score	Significant additive interaction was observed between prenatal care and maternal age for all the outcomes including very premature birth (OR 1.7, CI 0.9-3.0), premature birth (OR 1.4 , CI 1.0-1.8) , low birth weight (OR 1.7, CI 1.2-1.5) and 5-minute Apgar score (OR 2.2, CI 1.3- 3.8).

Critique of Methodology

Retrospective cohort study

Alibekova, Huang, and Chen, (2013) conducted a retrospective cohort study to investigate the association between ANC and adverse pregnancy outcomes in women with a history of infertility in Taiwan. The nationwide study used the data from two national bodies including the National Health Insurance (NHI) Research Database and National Birth Certificate Registry. The outcome variables were the number of prenatal care visits, initiation of ANC, and use of major ANC visits while the independent variable was infertility diagnosis. The authors identified a robust sample selection with a total of 213,206 women with singleton live births who were pregnant and attended ANC visits in the NHI program in 2005. Of these women, 15,056 had been diagnosed with infertility and had at least two consensus diagnoses within three years prior to the current delivery, ensuring the validity of the diagnosis. A comparison cohort of 60,224 women was randomly selected from the remaining 198,150 women. Four women in the control group were selected for every woman with infertility treatment and assigned to the study cohort by age categories to ensure validity. Ethical approval was given by the university review board, and all identifiers were removed in line with Belmont principles of research.

Alibekova, et al., (2013) used logistic regression for their analysis, and their study revealed that there was a statistically significant difference in the number of major ANC visits made between the two study cohorts ($p<0.0001$) with more visits being recorded in the infertility-diagnosed cohort (8.2) as compared to unaffected women (7.9). Having a

diagnosis of infertility was independently associated with a lower likelihood of attending ANC (OR 0.89, CI 0.86~0.93), initiating the first ANC visit after 12 weeks of gestation (OR 0.74, CI 0.70~0.78), and receiving ≤2 major ANC visits (OR 0.56, CI, 0.48~0.66). The inadequate number of ANCvisits was associated with a 15-fold increased risk of having a very low birth weight (VLBW) baby (AOR 15.09, CI 8.82~25.82), and a 2-fold increased risk of a low birth weight (LBW) or preterm baby (AOR 2.12, CI 1.81~2.49).

Cross-sectional studies

Azfredrick, (2016) conducted a cross-sectional study using students recruited from thirty-three schools in three randomly selected states out of the five of southeastern Nigeria. The sample size was 3,065 adolescent girls who were selected through multistage sampling, thus ensuring representativeness of the sample. The authors used the ABM to assess how predisposing, enabling, and need factors contribute to use of reproductive health services by the adolescent girls. Ethical approval was granted by the ethical committee of University of Ibadan/University College Hospital (UI/UCH). A written consent was sought from parents of all participating students, and a further clearance by the school authority was given to carry out the study thus ensuring the protection of the minors.

Azfredrick, (2016) used Pearson product-moment correlation and binary logistic regression analysis. Their investigation revealed that the odds of adolescents using reproductive health services are predicted by their age [OR = .78, 95% CI: .64, .95], emotional condition [OR = 1.8, 95% CI: 1.4, 2.4], and type of reproductive health facility [OR = 2.0, 95% CI: 1.7, 2.3]. In her study, Azfredrick, (2016) determined the need for

further research that would explore the reproductive health aspects between boys and girls. The study did not, however, document any limitations of the study.

Bassani, Surkan, and Olinto, (2009) carried out a cross-sectional study in one of the public maternity hospitals in Porto Alegre, southern Brazil, with a sample population of 611 women who had delivered between May and December of 2002. Approval was sought from the ethical body and all participating women signed a consent form before their participation. The dependent variable was adequacy of ANC while the independent variables were social and demographic variables including income, completed years of education, age, race, number of births, family support, parity, pregnancy planning, abortion attempts, satisfaction with pregnancy, and satisfaction with the relationship with the child's father.

The Bassani et al., (2015) study used multinomial logistic regression to carry out their analysis and concluded that higher parity women were significantly more likely than lower parity women to report inadequate ANC (OR 2.5), and not living with the child's father during pregnancy was associated with significantly higher odds of inadequate use of ANC than living in a household in which the child's father was present (odds ratio, 2.7). The authors highlighted some limitations of their study including the lack of their ability to assess for quality of ANC for the women and that the study was only targeted to a low-income population, thus it could not be generalized to the whole population of Brazil. Further research was called for in relation to women who had attempted having an abortion and use of ANC, as their sample size was too small to reach statistical significance.

Emelumadu, et al., (2014) used a cross-sectional study to explore the pattern of maternal health services use and the socio-demographic factors influencing it in Anambra State, southeast Nigeria. The sample size was a total of 310 women of reproductive age with a previous history of gestation attending ANC services between September 2007 and August 2008 in three selected Primary Health Centers with primigravidas being excluded from the study. The outcome variable was ANC use, and the independent variables were socio-demographic characteristics including age, marital status, educational status, and parity, the pattern of ANC and natal service use, and outcome of pregnancy during their most recent confinement. Ethical approval for the study and verbal consent from the study subjects were given. Multinomial logistic regression and $\chi 2$ –test were used to carry out statistical analysis of the study.

In their study, Emelumadu et al., (2014) concluded that parity was significantly associated with a number of ANC visits and time of ANC booking as grand multiparous women were more likely to book for ANC after the first trimester ($\chi 2=5.9$, $P = 0.05$) and to have attended ANC fewer than 4 times prior to delivery ($\chi 2=9.50$, $P = 0.05$). The likelihood of women using the hospital for delivery services was more likely to be determined by age ($P < 0.01$, OR = 2.06; CI = 1.08-3.92) and education status of the mothers ($P < 0.001$, OR= 3.18; CI = 1.53-6.63). The study did not highlight any limitations or future research needs.

Gitonga, (2017) conducted a cross-sectional study to assess the determinants of uptake of focused ANC among women in Tharaka-Nithi County, Kenya. The dependent variable was focused ANC, and the independent variables were age, the level of

education, marital status, type of employment, household income, gravida, and parity. The study employed a robust sampling technique whereby a stratified sampling was used to select participating health facilities while a systematic sampling was used where every fourteenth client attending maternal/child health clinics in the sampled facilities for the study, making the sample size to be 345 women. Gitonga, (2017) used Chi-square, Fisher's exact test, and logistic regression to analyze their data and concluded that women with reduced parity tend to use ANC services more than those with a higher parity (OR 0.73, p <0.032, CI 0.560-0.973). Being married increased the likelihood of women taking up ANC threefold (odds ratio = 2.77, p < 0.01, CI 1.556-4.966) while focused ANC uptake was eight times higher in women with formal employment (OR 8.049, p < 0.006, CI 1.821-35.567) and two times higher for women with an increase in household income (OR 2.184, p <0.0001, CI 1.821-35. 567). An increase in parity reduces the likelihood of attending four or more ANC visits by 0.7 times the visits (OR 0.738, p <0.032, CI 0.560-0.973).

Gudayu, et al., (2014) carried out a cross-sectional study from April to June 2012 in the town of Gondar, Ethiopia, to determine the proportion of women who were booked at the recommended time and identify factors contributing for timely entry to ANC. The outcome variable was timing of the ANC, and the independent variables were age, mother's age at marriage, marital status, place of residence, family income, educational status, occupation, husband's educational status, husband's occupation, age difference between the mother and the husband, distance from health facility, family size, and obstetrics variables. A total of 407 pregnant mothers were interviewed at their exit from

the antenatal clinic by using a structured and pretested questionnaire. Ethical approval and consent from the health authorities and from clients was sought.

Gudayu, et al., (2014) used bivariate and multivariate for their data analysis and their findings concluded that women waited until four to five months into their pregnancies before starting their ANC care, and the mean gestational age during first ANC booking was 17.7 weeks. The commencement of ANC was attributed to age, whereby the pregnant mothers aged 25 and below were two times more likely to commence ANC within the recommended time compared to their older counterparts (OR 1.85, CI 1.10, 3.09). The study also demonstrated that married women above the age of 20 years were more likely to start ANC services within three months than those who got married in their teenage years (OR 2.21, CI 1.33, 3.68). The ability of women to have decision-making power over their health issues was significantly associated with timely ANC initiation (OR 2.43, CI 1.18, 4.99). The authors highlighted that the major limitation of the study was that not all ANC users were reached and, as such, a community-based survey would be appropriate in the future to enable all women to be reached for better generalizability of findings.

Heredia-Pi et al., (2016) conducted a cross-sectional study to understand the adequacy of ANC for women in the context of the population and geography of Mexico. The study used data from the Mexican National Health and Nutrition Survey of 2012 (ENSANUT) using a sample size of 115,170,278 from all 32 states of the country including rural/urban stratum, thus increasing the external validity. A further random subsample or 23, 056 women aged 12-49 years that had given birth after 2006 were

interviewed. The dependent variables were the four dimensions of continuity and adequacy of ANC, including timely and sufficient skilled health care and an indicator summarizing the procedures and processes of care provided during ANC. The independent variables included social demographic factors related to pregnancy. The authors used ordinal multivariate logistic regression to identify the correlates of ANC adequacy. The probability analysis revealed that of all the women that had been delivered by a skilled attendant, only 71.5% (95% CI: 69.7 to 73.2) had received adequate ANC, 1.6% (95% CI: 1.2 to 2.0) received no ANC, and 27.0% (95% CI: 25.3 to 28.7) received inadequate ANC. Heredia-Pi et al., (2016) demonstrated the existence of disparities in social economic issues, as women who received ANC had had more years of schooling, were older, and had fewer children at the time of their last delivery ($P < 0.001$). The study highlighted major limitations of the study including recall bias and lack of regular supplies at facilities which limited the quality of ANC given. Heredia-Pi et al., (2016) highlighted the need for further research to assess ANC quality of care indicators for the country.

Kawungezi et al., (2015) conducted a cross-sectional study using mixed methods in a bid to identify factors associated with late booking and inadequate use of ANC services in upcountry areas of Uganda. The outcome variable was adequacy of ANC, and the independent variables are social-demographic, obstetric, and cultural factors. Four hundred participants were selected from ANC clinics from four regions, whereby each clinic represented one region to ensure validity. Religion ($\chi2= 12.8890$, $P = 0.045$), occupation ($\chi2=14.0202$, $P = 0.007$), level of education ($\chi2= 4.9277$, $P = 0.553$), and

parity ($\chi 2$= 18.9506, P = 0.000) were found to influence place of ANC attendance, the number of ANC visits, and booking time. Qualitative analysis demonstrated that most multiparous women were delivered from health facilities while the primigravidas delivered from TBAs' homes, as it was the wish of the husbands. There was also poor knowledge of the recommended number of visits a woman should have. Distance, poor terrain, and shame for teenagers also contributed to a poor uptake of services. There was no mention of limitations of the study, and it was unclear whether the respondents had been required to give consent for the study despite the ethical approval having been given.

A secondary analysis of the 2010 household survey in South Sudan was undertaken by Mugo et al., (2015) to assess the ANC determinants. ABM was used to assess the ANC use. A total of 3,505 women between the ages of 15-49 years old that had a live birth two years prior to the survey were selected through a multistage sampling technique to ensure representativeness and avoid bias. The dependent variable was nonuse of ANC services, and the independent variables included ANC nonuse risk factors. The researchers applied the ABM to categorize variables as follows: external environment including health services, characteristics of the regions and living in rural/urban, predisposing factors such as maternal characteristics that existed before the onset of the need for ANC services, enabling factors that facilitate the pregnant women to receive ANC services, and need factors that indicate the potential for adverse ANC outcomes.

Mugo et al., (2015) sought ethical approval for their study and used univariate and bivariate logistic regression, with adjustment for effects of the sampling design and weighting. The study concluded that geographical region was significantly associated with women's nonuse of ANC services in South Sudan. Women who resided in the regions of Jonglei [AOR = 1.76; 95% CI: (1.19, 2.60), $P = 0.005$], Warab [AOR = 1.66; 95% CI: (1.16, 2.23), $P = 0.127$], and Unity [AOR = 1.42; 95% CI: (0.90, 2.23), $P = 0.127$] were more likely not to use ANC services compared to other regions of South Sudan. Age was a determining factor to use of ANC services, with women of ages 35-49 years (CI 12.3, 18.5, $p < 0.0156$), women experiencing their third pregnancy (CI 17.0, 31.6, $p < 0.001$), women with a parity of five and above (CI 15.8, 20.9, $p < 0.1245$) and those who were single (CI 9.4, 20.6, $p < 0.0022$) were all likely to not use ANC services.

The Rurangirwa et al., (2017) cross-sectional study included 921 women who had given birth within the past 13 months in the Northern Province and in the city of Kigali. The selection of the two sites offered a comparison of both rural and urban populations. The outcome variable is the number and timing of ANC visits, and the independent variables are age, number of people in the household, marital status, women's relationship with household head, household income, and assets in the household. Rurangirwa et al., (2017) used bi- and multivariable logistic regression for their analysis. The study findings concluded that poor use of ANC was linked to being single (AOR, 2.99; 95% CI: 1.83, 4.75), older than 31 years of age (AOR, 1.78; 95% CI: 1.14, 2.78), and having a poor support network (AOR, 1.71; 95% CI: 1.09, 2.67). Being married to a husband aged 41 years or more was highly associated with poor use of ANC services

(OR 2.69, CI 1.58–4.57). A major limitation of the study cited was self-reporting bias. Although the information collected was self-reported, it was controlled by requesting an ANC card to verify the number of visits, thus minimizing the bias. Recall bias was also reported as a limitation, but it was not deemed minimal as the study took place within 13 months after the pregnancies.

Sharkey et al., (2016) conducted a household clustered survey in four districts of Sierra Leone in 2012 using mixed methods in four underserved districts, yet it could not be generalized to the whole population. The aim of the study was to serve as a baseline for informing priority programmatic strategies that were to be undertaken in Sierra Leone as part of the multi-country Health for the Poorest Populations (HPP) project. The quantitative study employed two-stage sampling, whereby 200 clusters were selected from the four districts using the population size and from which 6,000 households were randomly sampled for the study. The qualitative study employed a purposive sampling of study subjects, thus reducing generalizability. There was ethical approval sort from the counties ethical board and consent was given either verbal or written based on the level of education of participants. The outcome variables were pregnancy, childbirth, the new-born period while the independent variables were personal experiences and understandings of social norms for maternal, new-born, and child health.

Sharkey et al., (2016) concluded that ANC was high (84.2%, 95% CI: 82.0–86.3%), with only half the women seeking ANC during their first trimester (49.5 %, 46.8–52.4). This was attributed to distance, transport, and social norms to delay care-seeking until a pregnancy is visible. Skilled delivery rates were lower (68.9%, 95% CI:

64.8–72.9%), particularly in Kambia and Tonkolili where TBAs are considered effective. Timely postnatal checks were common among women with facility deliveries (94.1%, 95% CI: 91.9–96.6%) and their newborns (94.5%, 95% CI: 92.5–96.5%). Fewer women with home births received postnatal checks (53.6%, 95% CI: 46.2–61.3%) as did their newborns (75.8%, 95% CI: 68.9–82.8%). One major limitation of the study was education, as the level of education of women in the four districts was not the same, thus serving as a confounder to the study.

Trinh et al., (2007) used a cross-sectional survey to examine the correlates of ANC use in three rural areas of Vietnam. The study employed the ABM with the outcome variables being any ANC use, entry into ANC, ANC visits attended, and overall ANC use and with the independent variables related to the external environment, predisposing characteristics, enabling resources, and care needs. A sample population of 1,335 women who had given birth in the 4 years prior to the survey was selected through a multistage cluster sampling technique. Trinh et al., (2007) used univariate and multivariate logistic regressions for their analysis and showed that factors related to the external environment and women's characteristics had a statistically significant association with any ANC use and the gestational age at the first visit: education level, OR = 4.9, 95% CI [3.0, 8.1], $p < .001$; ethnicity, OR = 0.2, 95% CI[0.1, 0.5], $p < .01$; and number of children, OR = 0.6, 95% CI [0.4, 0.9], $p < .01$. Factors resulting from women's interaction with ANC services had a statistically significant association with ANC compliance. These factors included the number of ANC services received, OR = 4.9, 95% CI [3.0, 8.1], $p < .001$; having health insurance, OR = 1.4, 95% CI [1.0, 2.0], $p <$

.001; and women's satisfaction with ANC services, $p < .001$. Women's characteristics and external environment were also significant determinants of any ANC use, while the health system determinants played a role in ANC compliance.

Vieira et al., (2012) carried out a cross-sectional study in Rio de Janeiro to investigate the prevalence of adverse birth outcomes according to maternal age range and to evaluate the association between maternal age range and adverse birth outcomes using additive interaction to determine whether adequate ANC can attenuate the harmful effect of young age on pregnancy outcomes. A total of 40,111 records of women up to 24 years of age who had given birth to live single children in 2002 in the city were selected. The study used an attributable proportion to measure additive interaction when using odds ratio instead of the relative risk. The findings established that an association between maternal age and adverse outcomes was observed only in adolescent mothers with inadequate prenatal care, and significant additive interaction was observed between ANCand maternal age for all the outcomes including very premature birth (OR 1.7, CI 0.9-3.0), premature birth (OR 1.4, CI 1.0-1.8), low birth weight (OR 1.7, CI 1.2-1.5) and 5-minute Apgar score (OR 2.2, CI 1.3- 3.8). The authors clearly outline both the strength and limitations of the study.

Literature review

Only one study used literature review to estimate the effect of selected socioeconomic and cultural factors on maternal mortality, stillbirths, and neonatal mortality in Ethiopia. Berhan and Berhan, (2014) carried out the review between 1995 and 2011, and the outcome variables were maternal, stillbirths, and neonatal mortality,

while independent variables were total fertility rate, the unmet contraceptive need, and the adult literacy rate of Ethiopia. These variables were then were compared with other African countries using bivariate Pearson correlation coefficients and regression lines with one meta-analysis carried out using only data from Ethiopia. In their study, Berhan and Berhan, (2014) demonstrated an increased risk of stillbirths ($r = 0.5$; $p < 0.0001$), neonatal ($r = 0.6$; $p < 0.0001$) and maternal mortality ($r = 0.6$; $p < 0.0001$) with increased TFR. The increased adult literacy rate was associated with increased ANC ($r = 0.56$; $P = 0.001$) and skilled person attended delivery ($r = 0.58$; $p < 0.0001$). The authors in their study methodology did not outline the numbers of study that were reviewed from Ethiopia or from the other sub-Saharan countries, thus reducing the validity of the study. The authors did not highlight any confounders or limitations that affected their study, nor were there future research recommendations given.

Knowledge gap

The literature review undertaken confirmed that many studies on ANC use have been undertaken. Most of the researchers used a cross-sectional method for their researchers (Azfredrick, 2016; Bassani et al., 2009; Emelumadu et al., 2014; Gitonga 2017; Gudayu et al., 2014; Heredia-Pi et al., 2016; Kawungezi et al., 2015; Mugo et al., 2015; Rurangirwa, et al., 2017; Trinh et al., 2007 and Vieira et al., 2012). Researchers Alibekova et al., (2013) and Berhan and Berhan, (2014) used cohort and literature review studies respectively. The rationale of most researchers using cross-sectional study design is that it provides a summation of the frequency of a disease within a population at a given point in time (Reyolds, 2007). Furthermore, cross-sectional studies are used to

assess the burden of diseases in a given population, thus informing planning and health resource allocation (Frankfort-Nachmias & Nachmias, 2008). The reviewed studies used different sample sizes to assess their variables. Seven of the studies had sample sizes between 300 and 1,000 (Azfredrick, 2016; Berhan & Berhan, 2014; Bassani et al., 2009; Emelumadu et al., 2014; Gitonga, 2017; Gudayu et al., 2014; Kawungezi et al., 2015; Mugo et al., 2015; Rurangirwa, et al., 2017; Trinh et al., 2007 and Vieira et al., 2012). The largest samples consisted of 15,056 women with infertility diagnosis (Alibekova et al., 2013) and 115,170,278 women who had live births (Heredia-Pi et al., 2016). The ABM was used to demonstrate the need to assess health care use using external, predisposing, enabling, and need factors, which formed a good background for this study (Alibekova et al., 2013; Mugo et al., 2015 and Trinh et al., 2007).

The bulk of the studies in my review sought to assess several aspects of ANC including timing, uptake, and adequacy as their outcome variables against social demographic variables (Bassani et al., 2009; Gitonga, 2017; Gudayu et al., 2014; Heredia-Pi et al., 2016; Kawungezi et al., 2015; Mugo et al., 2015; Rurangirwa, et al., 2017 and Trinh et al., 2007). Two studies, however, pursued the associated outcomes of pregnancy in relation to ANC adherence of women (Alibekova et al., 2013 and Vieira et al., 2012). Sharkey, et al., (2017) and Emelumadu et al., (2014) used the social demographic challenges that relate to maternal and child health service use, while Azfredrick, (2016) focused on adolescents and health use. Berhan and Berhan, (2014) used maternal, stillbirth, and child mortalities as the outcome variable to explore how socioeconomic and cultural factors contribute to the mortalities. The statistical analysis

methods applied by the majority of the researchers were a multivariate logistic regression while chi-square, descriptive statistics, and Pearson correlation coefficient methods were also used. Logistic regression may have been the favorite of the statistical methods, as it helps in comparison of multiple predictors on the outcome variables.

Summary and conclusion

The review has demonstrated that recent research on ANC use exists. Social demographic and cultural factors have been highlighted as the major deterrents for ANC uses in many parts of the world. That notwithstanding, there is limited research on the ANC outcomes and understanding of how ANC is affected within geographical areas, especially in Sierra Leone. My research will employ maternal mortality data to determine the ANC use against geographical locations of the deceased to assess for any variations using the ABM which will be the first of its kind in the country. This cross sectional study will give more understanding of any inequality that exists within different regions in Sierra Leone in relation to reproductive health.

Chapter three will explain the methodology and research design used to explore the research questions, and the hypotheses mentioned previously, by examining the geographical variation in ANC visits among maternal death cases in Sierra Leone.

Chapter 3: Research Methodology

Introduction

The purpose of the study was to understand how geographical variations and social demographic characterizations affect use of ANC for women in Sierra Leone. Access and use of ANC are critical for women because it helps improve birth outcomes through early detection of women at risk, prevention of conditions, and provision of health information on nutrition, hygiene, and recommended the place of delivery. Specific studies have highlighted that inequality in service provision for women exists in the rural Sierra Leone (Kanu et al., 2014; Sharkey et al., 2017). In analyzing the maternal death data, I was able to measure the magnitude of geographical variations of ANC use and determine trends of inequality of ANC. Six social demographic variables including age, marital status, parity, the institution of birth, mode of delivery, and education along district of residence to determine geographical variations on ANC use were measured..

In Chapter 3, I examine the research design suitable to investigate the variables as well as reinforced the research questions highlighted in Chapter 1. I also explain the data collection, population, and sampling methods that I used for the study. I then address measurement and validity of the study with an explanation of how I addressed the ethical issues.

Research Design and Rationale

Limited knowledge exits about poor use of ANC and maternal health services among women in Africa (Bassani et al., 2009; Gitonga, 2017; Gudayu et al., 2014; Heredia-Pi et al., 2016; Kawungezi et al., 2015; Mugo et al., 2015; Rurangirwa, et al.,

2017; Trinh et al., 2007). I used a cross-sectional secondary data analysis using data from the national health information system.

The aim of the study was to test the following hypotheses:

$H_0$1: The use of ANC among pregnant women in Sierra Leone is related to the district of residence after controlling for age, marital status, parity, the institution of birth, mode of delivery and education among maternal death cases.

H_a1: The use of ANC among pregnant women in Sierra Leone is not related to the district of residence after controlling for age, marital status, parity, the institution of birth, mode of delivery and education among maternal death cases.

$H_0$2: The use of ANC among pregnant women in Sierra Leone is related to the mother's age after controlling for the district of residence, marital status, parity, the institution of birth, mode of delivery and education among maternal death cases.

H_a2: The use of ANC among pregnant women in Sierra Leone is not related to the mother's age after controlling for the district of residence, marital status, parity, the institution of birth, mode of delivery and education among maternal death cases.

$H_0$3: The use of ANC among pregnant women in Sierra Leone is related to the marital status after controlling for the district of residence, age, marital status, parity, the institution of birth, mode of delivery and education among maternal death cases.

H_a3: The use of ANC among pregnant women in Sierra Leone is not related to the marital status after controlling for the district of residence, age, marital status, parity, the institution of birth, mode of delivery and education among maternal death cases.

This research design was a cross-sectional approach, in which I used a secondary dataset, and the instrument was the integrated disease surveillance response report (IDSR). The theoretical framework for this research was the ABM with the maternal mortality data being used to assess the association of various contributory factors to poor ANC use.

Methodology

Setting. The study was undertaken in Sierra Leone, one of the West African countries (Figure 1). The recent population census indicated that the country has a population of 7,075,641 and an annual growth rate of 3.2% (Statistics Sierra Leone, 2016). The dataset used was derived from maternal death surveillance data that is reported from the whole country through the integrated disease and event surveillance report. Upon receiving the report, a team from the district maternal death review committee investigated the cause of death and classified the death before sending the reports to the national level. Use of national data allows the researcher to explore cause and effect within the chosen population as well as strengthens the external and internal validity (Frankfort-Nachmias & Nachmias, 2008).

Sampling methods. A cross-sectional design was used for the study. Cross sectional design is the most used design in social sciences (Frankfort-Nachmias & Nachmias, 2008). To ensure validity, all the available data from the maternal death surveillance from all the districts as maternal death is a rare event. I used the data collected between January, 2016 and December, 2016 from the maternal death surveillance system. The data from 2016 was used because at that the time a system was

set to report and investigate all maternal deaths in the country. The maternal death line listing data included all maternal demographic, social information, and health related information prior to their death.

Power Analysis

A general rule of a two-tailed, 95% confidence interval is usually applied to ensure study results are a true reflection of the population under study (Frankfort-Nachmias & Nachmias, 2008). The power of 0.80 is usually considered adequate, meaning the researcher is accepting an 80% chance of finding a statistically significant difference when it does exist and at the same time accepting a 20%chance of a Type II error (Frankfort-Nachmias & Nachmias, 2008). Power is the ability to find a difference when a real difference exists, and it is determined in a study by the sample size, the alpha level, and the effect size (Sullivan, 2012). An alpha, or the level of significance, of 0.05 is accepted in research meaning that there is a 5% probability of rejecting the null hypothesis when it is true (Sullivan, 2012). Power and sample size calculation was obtained through the G*Power 3.0.1.0 program (Fual, Erdfelder, Buchner, and Lung, 2009). Determining the right sample size for the study is critical to any study, my minimum sample size identified was 314. The 2016 maternal death surveillance data had a total of 706, I, therefore, decided to use the whole dataset.

Assumptions

The assumptions of the study were that the dependent variable is categorical and has two variables (Park, 2005). Another assumption is that there no multicollinearity or

significant outliers, and that the data is normally distributed (Frankfort-Nachmias & Nachmias, 2008).

Selection Criteria

For this research project, the sample size consisted of women who had died in 2016 and were classified as maternal deaths in Sierra Leone. A maternal death investigtaion of their deaths had to have been carried out and documented using a standadised reproting form.

Instrumentation

The variables used in this study were pulled from the 2016 maternal death surveillance report for Sierra Leone. The data was part of the weekly IDSR report which is mandatory from all districts. The decision to use these data was reached based on its reliability of being a national dataset and the fact that it is embedded into the disease and event surveillance system of the country which was revitalized after the EVD outbreak (Bower et al., 2016). The cost minimization aspect was also considered and the authorization protocols required to use the data were straight forward. These database contained information on all maternal deaths that occurred in the hospitals and community level (Sierra Leone HMIS, 2017). The data is compiled at each facility on a weekly basis using a standardized reporting template sent to the district level after which a team investigates the deaths and collates the monthly data, and submits to the headquarters (Sierra Leone HMIS, 2017).

Dependent Variable

The dependent variable in this research was ANC frequency which is an ordinal variable. This examination measured ANC in relation to a number of visits taken through out pregnancy. The recommended number of visits is four and above. The visits are categorized as <4 and 4>.

Independent Variables

The primary independent variables in this research project were geographical setting, the age of women, marital status, parity, the institution of birth, mode of delivery, and education level. For this project, the geographical setting was measured at the interval level since the difference between the values is meaningful (Prion & Adamson, 2013). Age was a ratio continuous variable because it can have any value within a range (Frankfort-Nachmias & Nachmias, 2008). Marital status was a nominal categorical variable that has it is a unique attribute (Frankfort-Nachmias & Nachmias, 2008). Parity was an ordinal continuous variable that has an exact rank order (Frankfort-Nachmias & Nachmias, 2008). The institution of birth was an ordinal categorical variable that has an inherent ordering (Frankfort-Nachmias & Nachmias, 2008). Mode of delivery was a nominal categorical variable was it is a unique attribute while education was an ordinal categorical variable that had an exact rank order (Frankfort-Nachmias & Nachmias, 2008).

Variable categorization and coding

ANC as the outcome variable had two categories with ANC visits below four as not recommended ANC visits coded 0 while four or more ANC visits was recommended ANC visits (reference category coded 1).

Geographical setting: This is defined as one of the four political divisions in Sierra Leone, namely and Southern region coded 1, Eastern region coded 2, Northern region coded 3, and Western Area (reference category coded 4) from where the maternal death data was collected.

Age: This is the number of years a woman has lived up to the time she got pregnant. This was recoded from 14-18 years coded 1, 19-24 years coded 2, 25-30 years coded 3, 31-35 coded 4, 36> coded 5 (reference category).

Marital status: This is defined as being in or not being in a relationship at the time death. Dichotomized as single or married (reference category).

Parity: This refers to the number of live births a pregnant woman had prior to her death. The categorization was as follows: primiparous coded 1, multiparous (two to four children) coded 2, grand multiparous (five to six children) coded 3, great grand multiparous (seven and above children) coded 4 (reference category).

Mode of delivery: This refers to how the woman delivered her baby if she died after delivery. It is categorized as not yet delivery coded 1, virginal delivery (reference category coded 2) and caesarean section coded 3.

The institution of birth: This is classified as the institution where the birth took place for the women who died during or after delivery. It is categorized as other facilities coded 1,

community health center (CHC) coded 2, community coded 3, government hospital coded 4 and private hospital (reference category coded 5).

Education: This is the level of formal education attained by a woman at the time of being pregnant. It is categorized as non-formal education coded 1, primary level coded 2, secondary level coded 3, certificate level coded 4, diploma level coded 5, degree level (reference category coded 6).

Data Analysis

This project employed logistic regression analysis to see the individual predictor effects (odd ratio) on ANC considered the following predictor variable: geographical location, the age of women, marital status, parity, and institution of birth impact on ANC services. The analysis of the predictors were performed at 5% level of significance, 80% power in an investigation, and 0.05 margin error. The descriptive statistics was ideal for quick interpolation of the magnitude of ANC use in the country as compared to the geographical distribution and age of the women. These assisted in providing a clear policy direction that would focus on reducing inequity in the target population access to ANC services. Inferential statistics would be used to make judgments of the probability and determine if the observed difference between groups was a dependable or it was from chance (Frankfort-Nachmias & Nachmias, 2008). A range of parametric and nonparametric tests were used to deduce conclusions for the results. Screening of data was to be carried out to ensure there is no missing data or outliers and to assess for linearity (Frankfort-Nachmias & Nachmias, 2008). The investigation included a sample size of 314 for a logistic regression model with a noncentral parameter is 3.617089, a

critical *t* of 1.967596, and a degree of freedom of 312. There were five predictors and the dataset had 706 maternal deaths cases.The outliers were detected using the median absolute deviation which was calculated as median +/- 2.5 times (Leys et al., 2013).

Validity

External

Creswell, (2008) pointed out that the external validity of the research is mainly about its generalizability and it occurs when the experimenter draws an incorrect inference from the sample data. The investigation of maternal deaths from all the districts allowed the findings to be generalizable to other groups of people, in different places and at a different time thus increasing the external validity (Drummond and Murphy-Reyes, 2017).

Internal

Internal validity threats are factors that threaten the researcher`s ability to draw correct inference from the data about the population (Creswell, 2009). The secondary data analysis reduced the internal validity threats in addition selection bias was eliminated by using the complete data set for the study. There is a chance that all the confounders may not be identified as the data set being used is not from primary data, however, use of statistical methods controled for the confounders (Tilaki, 2012)

Ethical Consideration

This research proposal had to be approved by Walden University IRB before the data could be reviewed to ensure the protection of participants' rights. The integrated disease surveillance and response data are a government data set considered acceptable for the use of research with proper approval. The approval is mainly done to help ensure the protection of the data and ensure confidentiality of respondents and their families. The study did not pose either biological or physical harm to participants since the data set was from deceased women; however, the subject of maternal death was a sensitive one that could have had emotional and cultural implications. The personal demographics, therefore were coded during the data organization and removed from the dataset before it was available for use. All personal identifiers had also been withdrawn before accessibility to eliminate harming the respondents.

Summary

This chapter provided the methodology that was used in this research. The study wwas a cross-sectional secondary data analysis from the maternal death surveillance data for 2016. A quantitative design was be used to determine ANC use deterrents among women in Sierra Leone. The study was generalizable in Sierra Leone as it targeted data from the whole population. The subsequent chapter comprised data collection and results of the analysis of the study.

Chapter 4: Results

Introduction

The purpose of the study was to understand how geographical variations affect ANC services in Sierra Leone. A quantitative study using secondary data derived from maternal death review for 2016 was used to study the gap in knowledge and practice. Logistic regression was used to predict the variations of the intervention variable (ANC) on five dependent variables (geographical location, the age of women, marital status, parity, and institution of birth). The stage at which the woman died and the cause of death were also evaluated as covariates in the logistic regression. These covariates were selected because they were identified in the ABM attributes as one's environment, social structure, service availability, and motivation to service use.

In Chapter 4, I present an analysis of data, which I conducted using IBM SPSS Statistic 24 software to answer the research question and hypothesis listed below:

Research Question: To what extent, if any, are ANC visits by Sierra Leone women related to the district of residence, age, marital status, parity, the institution of birth, mode of delivery, and education among maternal death cases?

$H_0$1: ANC visits are not related to the district of residence for Sierra Leone women after controlling for age, marital status, parity, the institution of birth, mode of delivery, and education among maternal death cases.

H_a1: ANC visits are related to the district of residence for Sierra Leone women after controlling for age, marital status, parity, the institution of birth, mode of delivery, and education among maternal death cases.

$H_0 2$: ANC visits are not related to mother's age after controlling for the district of residence, marital status, parity, the institution of birth, mode of delivery, and education among maternal death cases.

$H_a 2$: ANC visits are related to mother's age after controlling for the district of residence, marital status, parity, the institution of birth, mode of delivery, and education among maternal death cases.

$H_0 3$: ANC visits are not related to marital status after controlling for the district of residence, age, marital status, parity, the institution of birth, mode of delivery, and education among maternal death cases.

$H_a 3$: ANC visits are related to marital status after controlling for the district of residence, age, marital status, parity, the institution of birth, mode of delivery, and education among maternal death cases

Data Collection

The study data was collected by seeking permission form the ministry of health and sanitation to use their maternal death surveillance review data for 2016. The data was released to me after the final approval of IRB of Walden University (IRB approval number 12-01-17-0455658) and data release agreement with the ministry of health and sanitation.

Inclusion and Exclusion Criteria

The inclusion criterial of my study was that a maternal death investigataion of all the deaths had to have been carried out and documented using a standardised linelisting form. A total of 706 maternal deaths had been recorded as maternal deaths but the 57 investigations were not carried out due to poor cooperation of the community members for fear of retribution. As such 649 maternal death cases were used for the study.

Descriptive Statistics

There were 649 women that were included in the study. Table 1 shows the frequency of covariates, showing the western region had the largest number of women dying of maternal death (*n* = 227, 35%), followed by southern and northern regions with 162 (25%) women each, whereas the eastern region had the least deaths (*n* = 98, 15.1%). Almost half of the women were aged 36 years and older (*n* = 316, 48.7%), whereas women aged 19 to 24 years were close to a quarter (*n* = 150, 23.1%), followed closely by those aged 14 to 18 years old (*n* = 146, 22.5%) and 5.1% (*n* =33) for women between 25 and 30 years. The remaining 0.6% (*n* = 4) was from women aged 30 to 35 years. Of all the maternal deaths, 64.7% (*n* = 420) were married women, whereas 35.3% (*n* = 229) were single women. The largest number of maternal deaths was recorded from multiparous women 44.2% (*n* = 287), with primiparous women coming second with 22.5% (*n* = 146). Great grand multiparous women accounted for 18% (*n* = 117) and grand multiparous women were the least with 15.3% (*n* = 99). Off all the women who died, 62.9 % (*n* = 408) of deaths took place at a government hospital, and community and other facilities followed with 14.8 % (*n* = 98) and 14.5 % (*n* = 96), respectively.

Private facilities and community health centers recorded the least number of maternal deaths 4% (*n* = 26) and 3.9 % (*n* = 25) respectively. Maternal deaths after vaginal delivery accounted for slightly over half of the deaths (59.7 %, *n* =385) followed by women that had not delivered 23.1% (*n* = 150) and women that died after caesarian section came last with 17.7% (*n* = 115). Women with the highest education level accounted for the highest mortality 31.7% (*n* = 206) followed by those with a diploma 23% (*n* = 149) and certificate 20.6% *(n* = 134). Women with no formal education were fourth with17.4% (*n* = 113) while the least deaths were from women with secondary and primary education with 4.6% (*n* = 30) and 2.6% (*n*\ = 17) respectively.

Table 1

Frequency of Covariates

Variable	Frequency (*n*)	Percentage (%)
Geographical region		
Southern	162	25.0
Eastern	98	15.1
Northern	162	25.0
Western	227	35.0
Age category		
14-18 years	146	22.5
19-24 years	150	23.1
25-30 years	33	5.1
31-35 years	4	.6
36>	316	48.7
Marital Status		
Married		
Single	420	64.7
Parity	229	35.3
Primiparous		
Multiparous	420	64.7
Grand multiparous	229	35.3
Great grand multiparous	146	22.5
Institution of birth	287	44.2
Other facility		
CHC	94	14.5
Community	25	3.9
Govt.Hospital	96	14.8
Private	408	62.9
Mode of delivery	26	4.0
Not delivered		
CS	150	23.1
Vaginal delivery	115	17.7
Education level	384	59.2
No formal education	150	23.1
Primary	113	17.4
Secondary	17	2.6
Certificate	30	4.6
Diploma	134	20.6
Degree	149	23.0
	206	31.7

Table 2 shows results of the Chi-square analysis that revealed a significant association between geographic regions of residence and uptake of recommended ANC services [X^2 (3, N = 649) = 8.684, p = 0.034]. The percent receiving recommended services ranged from a low of 19.4 (Eastern Region) to a high of 30.4 in the western region. These percentages are not adjusted for the effects of other variables.

Table 2

Cross Tabulations and χ^2 Results for ANC Visits by Geographic Regions

			Not recommended visits	Recommended visits	Total	χ^2	*df*	*p*
Geographical region	Southern	Count	128 (79%)	34 (21%)	162	8.684[a]	3	.034
	Eastern	Count	79 (80.6%)	19 (19.4%)	98			
	Northern	Count	130 (80.2%)	32 (19.8%)	162			
	Western	Count	158 (69.6%)	69 (30.4%)	227			
Total		Count	495 (76.3%)	154 (23.7%)	649			

To test the hypothesis that the use of ANC among pregnant women in Sierra Leone is related to the mother's age a cross tabulation was performed as shown in table 3. The results of the Chi-square analysis revealed a non-significant association between age categories of women and uptake of recommended ANC services [X^2 (4, N = 649) =4.907, p = 0.297]. The percent receiving recommended services ranged from a low of 20 (19-24 years) age category to a high of 50 in the 31-36 years old age category. These percentages are not adjusted for the effects of other variables.

Table 3

Cross Tabulations and χ^2 Results for ANC Visits by Mother's Age

			Not recommended visits	Recommended visits	Total	χ^2	*df*	*p*
Age category	14-18 yrs	Count	138 (78.9%)	37 (21.1%)	175	4.765[a]	4	.312
	19-24 yrs	Count	96 (79.3%)	25 (20.7%)	121			
	25-30 yrs	Count	22 (66.7%)	11 (33.3%)	33			
	31-35 yrs	Count	2 (50%)	2 (50%)	4			
	36>yrs	Count	237 (75%)	79 (25%)	316			
Total		Count	495 (76.3%)	154 (23.7%)	649			

Table 4 shows the results of the Chi-square analysis that revealed a significant association between marital status of women and uptake of recommended ANC services [X^2 (4, N = 649) = 9.467, p = 0.050]. The percent receiving recommended services ranged from a low of 9.2 (Single women) to a high of 86.4 in the married women category. These percentages are not adjusted for the effects of other variables.

Table 4

Cross Tabulations and Chi-square Results for ANC visits by marital status

			Not recommended visits	Recommended visits	Total	χ^2	*df*	*P*
Marital Status	Married	Count	287(58%)	133(86.4%)	420	9.467a	4	.050
	Single	Count	208(90.8%)	21(9.2%)	229			
Total		Count	495(76.3%)	154(23.7%)	649			

Table 5 shows results of education level and use of ANC with the results of the Chi-square analysis revealed a significant association between education level and uptake of recommended ANC services [X^2 (5, N = 649) = 20.562, p = 0.001]. The percent receiving recommended services ranged from a low of 18.1 (diploma) to a high of 52.9 in the primary level of education. These percentages are not adjusted for the effects of other variables.

Table 5

Cross Tabulations and Chi-square Results for ANC visits by education level

			Not recommended visits	Recommended visits	Total	χ^2	*df*	*p*
Education level	No formal education	Count	75(66.4%)	38(33.6%)	113	20.562[a]	5	.001
	Primary	Count	8(47.1%)	9(52.9%)	17			
	Secondary	Count	20(66.7%)	10(33.3%)	30			
	Certificate	Count	109(81.3%)	25(18.7%)	134			
	Diploma	Count	122(81.9%)	27(18.1%)	149			
	Degree	Count	161(78.2%)	45(21.8%)	206			
Total		Count	495(76.3%)	154(23.7%)	649			

The results of the Chi-square analysis revealed a non-significant association between mode of delivery and uptake of recommended ANC services [X^2 (2, N = 649) = 1.253, p = 0.535]. The percent receiving recommended services ranged from a low of 20.9 (caesarean section) to a high of 26.7 in the women that had not delivered. These percentages are not adjusted for the effects of other variables. (See table 6).

Table 6

Cross Tabulations and Chi-square Results for ANC visits by mode of delivery

			Not recommended visits	Recommended visits	Total	χ^2	*df*	*p*
Mode of delivery	Not delivered	Count	110(73.3%)	40(26.7%)	150	1.253[a]	2	.535
	CS	Count	91(79.1%)	24(20.9%)	115			
	Vaginal delivery	Count	294(76.6%)	90(23.4%)	384			
Total		Count	495(76.3%)	154(23.7%)	649			

The results of the Chi-square analysis revealed a non-significant association between institution of birth and uptake of recommended ANC services [X^2 (3, N = 649) = 9.467, p = 0.050]. The percent receiving recommended services ranged from a low of

13.8 (other facilities) to a high of 32 in the women that had delivered at a community health center. These percentages are not adjusted for the effects of other variables, (See table 7).

Table 7

Cross Tabulations and Chi-square Results for ANC visits by institution of birth

			Not recommended visits	Recommended visits	Total	χ^2	*df*	*p*
Institution of birth	Other facility	Count	81(86.2%)	13(13.8%)	94	9.467[a]	4	.050
	CHC	Count	17(68.0%)	8(32.0%)	25			
	Community	Count	78(81.3%)	18 (18.8%)	96			
	Govt. Hospital	Count	301(73.8%)	107(26.2%)	408			
	Private	Count	18(69.2%)	8(30.8%)	26			
Total		Count	495(76.3%)	154(23.7%)	649			

The results of the Chi-square analysis revealed a non-significant association between parity of women and uptake of recommended ANC services [X^2 (3, N = 649) = 2.238, p = 0.525]. The percent receiving recommended services ranged from a low of 19.2 (grand multiparous women) to a high of 27.4 in the primiparous women. These percentages are not adjusted for the effects of other variables, (see table 8).

Table 8

Cross Tabulations and Chi-square Results for ANC visits by parity

			Not recommended visits	Recommended visits	Total	χ^2	*df*	*p*
Parity	Primiparous	Count	106(72.6%)	40(27.4%)	146	2.238[a]	3	.525
	Multiparous	Count	220(76.7%)	67(23.3%)	287			
	Grand multiparous	Count	80(80.8%)	19(19.2%)	99			
	Great grand multiparous	Count	89(76.1%)	28(23.9%)	117			
Total		Count	495(76.3%)	154(23.7%)	649			

Tables 2 to 8 show individual covariates compared to the antenatal visits outcome variable. A chi square test was performed to assess the statistical significance in the association between the independent and dependent variables without accounting for confounders. A significant association was between geographic regions of residence and uptake of recommended ANC services [$\chi^2 = 8.684$, $p = 0.034$] (table 2) and education level and uptake of recommended ANC services [$\chi^2 = 20.562$, $p = 0.001$](table 5). There was no significant association between age [$\chi^2 = 4.907$, $p = 0.297$], marital status of women and uptake of recommended ANC services [$\chi^2 = 9.467$, $p = 0.050$] mode of delivery [χ^2 (2, $N = 649$) = 1.253, $p = 0.535$], institution of birth [$\chi^2 = 9.467$, $p = 0.050$] and parity [$\chi^2 = 2.238$, $p = 0.525$].

A multiple logistic regression analysis was performed using all the women ($N = 649$) to determine the predictive relationship between antenatal visits, age of women, geographical variations, marital status, education status of women, parity of women and

mode of delivery as shown in table 9. A test of the full model against a constant only model was statistically significant, indicating that the predictors as a set reliably distinguished between acceptors and decliners of the offer (χ^2= 104.992, p < .000 with *df* = 22). This indicates the model is a good model fit and that the set of independent variables is related to the dependent variable. Nagelkerke's R 2 of .224 indicated a strong relationship between prediction and grouping. Prediction success overall was 80.4% (96.6% for non-recommended visits and 28.6% for recommended visits).

The Hosmer and Lemeshow's goodness-of-fit test statistic tests is used to explain the hypothesis that the observed data are significantly different from the predicted values from the model and the data required is a non-significant value for this test. In this case (χ^2 (8) = 11.516, p = .174) and it is non-significant. The Wald criterion demonstrated that only geographic regions (Wald = 10.519, p 0.015), marital status (Wald = 49.873, p 0.000) and education level (Wald = 21.364, p 0.001) made a significant contribution to prediction (recommended antenatal visits). In three regions Southern, Northern and Eastern women had significantly lower odds of attending the recommended antenatal services compared to Western region (OR =.517, p = 0.019; OR =.497, p = 0.021; OR = 0.014, p = 0.041 respectively). The adjusted odds were significantly lower for women with certificate level education as compared to women with a degree OR= 0.332, p = 0.001. The odds of married women attending the recommended antenatal services was 7.3 times more than that of the single women (OR 7.397). The significance values of the Wald statistics for each predictor indicate that age (Wald = 7.306, p 0.121) mode of delivery (Wald = 0.611, p 0.732), parity (Wald = 5.167, p 0.160), and institution of birth

(Wald 5.197, *p* 0.160) did not make a significant contribution to prediction (recommended antenatal visits).

Table 9

Multiple Logistic Regression Analysis Showing Odds Ratios (ORs), 95% CIs and p for Recommended ANC visits for All Independent Variables

							95% C.I.for EXP(B)	
		B	S.E.	Wald	*df*	Sig.	Exp(B)	Lower	Upper
Step 1[a]	Geographical region								
	Southern	-.660	.280	5.538	1	.019	.517	.298	.896
	Eastern	-.818	.333	6.042	1	.014	.441	.230	.847
	Northern	-.698	.279	6.287	1	.012	.497	.288	.859
	Western			10.519	3	.015	1.0		
	Age category								
	14-18 years	-.198	.276	.516	1	.473	.820	.478	1.408
	19-24 years	-.236	.358	.435	1	.509	.790	.391	1.593
	25-30 years	.617	.505	1.495	1	.221	1.853	.689	4.981
	31-35 years	2.042	1.100	3.450	1	.063	7.709	.893	66.521
	36>			7.306	4	.121	1.0		
	Marital Status								
	Married	2.001	.283	49.873	1	.000	7.397	4.245	12.890
	Parity								
	Primiparous	.207	.422	.240	1	.624	1.230	.538	2.814
	Multiparous	-.274	.345	.629	1	.428	.760	.386	1.496
	Grand multiparous	-.548	.377	2.105	1	.147	.578	.276	1.212
	Great grand multiparous			5.167	3	.160	1.0		
	Institution of birth								
	Other facility	-1.095	.564	3.772	1	.052	.335	.111	1.010
	CHC	.131	.673	.038	1	.846	1.140	.305	4.263
	Community	-.730	.551	1.753	1	.185	.482	.164	1.420
	Govt.Hospital	-.223	.483	.213	1	.644	.800	.311	2.061
	Private			9.432	4	.051	1.0		
	Mode of delivery								
	Not delivered	-.117	.256	.210	1	.647	.890	.539	1.468
	CS	-.204	.284	.516	1	.472	.815	.467	1.423
	Vaginal delivery			.611	2	.737	1.0		
	Education level								
	No formal education	.159	.295	.290	1	.590	1.172	.658	2.087
	Primary	.728	.560	1.692	1	.193	2.072	.691	6.209
	Secondary	-.136	.470	.084	1	.772	.873	.348	2.191
	Certificate	-1.103	.322	11.727	1	.001	.332	.177	.624
	Diploma	-.559	.301	3.464	1	.063	.572	.317	1.030
	Degree			21.364	5	.001	1.0		
	Constant	-1.290	.648	3.966	1	.046	.275		

a. Variable(s) entered on step 1: Geographical region, Age category, Marital Status, Parity, Institution of birth, Mode of delivery, Education level.

Summary

This study was based on one research question and it`s corresponding six hypotheses. The research question was "To what extent, if any, are ANC visits by Sierra Leone women related to the district of residence, age, marital status, parity, the institution of birth, mode of delivery, and education among maternal death cases?" Based on the above results, the first null hypothesis, that "the use of ANC among pregnant women in Sierra Leone is related to the district of residence after controlling for age, marital status, parity, the institution of birth, mode of delivery and education among maternal death cases," was rejected. The alternative hypothesis was found to be true. i.e. there was a statistically significant difference in the odds of women from some regions as compared to other regions after adjusting for the covariates.

The second null hypothesis, that "the ANC visits are not related to mother's age after controlling for the district of residence, marital status, parity, the institution of birth, mode of delivery, and education among maternal death cases," was accepted. The alternative hypothesis was found to be false. i.e. there was no statistically significant difference in the odds of women`s age and uptake of recommended ANC services after adjusting for the covariates.

The third null hypothesis, that "the use of ANC among pregnant women in Sierra Leone is related to marital status after controlling for the district of residence, age, marital status, parity, the institution of birth, mode of delivery and education among maternal death cases," was rejected. The alternative hypothesis was found to be true. i.e. there was a statistically significant difference in the odds of women`s marital status and uptake of

recommended ANC services after adjusting for the covariates. Unmarried women had significantly lower odds of taking up the recommended ANC visits than the married women (OR 7.397). Also, significantly associated with uptake of recommended ANC visits was education level of women (OR=.517).

Chapter 5 discusses interpretation of the research finding from the analysis and limitations of this study. The studies social change implications and recommendations for further studies will also be addressed.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

This research design that I used was a cross-sectional approach and included a secondary dataset, from the integrated disease surveillance response report (IDSR) of Sierra Leone, West Africa. A maternal death surveillance and review data for 2016 was used. A total of 706 maternal deaths for 2016 (MOHS, 2017). A total of 649 maternal deaths were used for the study after the review and verification of maternal death line listing forms. Personal identifiers were removed, and data transcription into an Excel spreadsheet and later into SPSS was done. The study was based on the ABM of health care use, with an aim of understanding variations in ANC use in the country, geographic setting, age, marital status, parity, the institution of delivery, mode of delivery, and education status. Age and marital status were included as covariates, because each factor has been independently shown to play a role on a mother`s decision to seek ANC services.

Upon completion of data collection and cleaning the analysis were carried out, which included descriptive statistics for each variable, bivariate analysis, and multiple logistic regression focusing on the dependent variable (ANC visits). The results presented allowed for confirmation or rejection of the research questions and hypotheses. An association was found for women from some regions as compared to other regions, and marital status of women after adjusting for the covariates. Education level of women was also significant in the ANC visits made by the women. Other covariates were not statistically significant for this study.

Interpretation of Findings

The aim of the study was to identify whether an association existed between geographical locations, the age of women, marital status, parity, and institution of birth on ANC services in Sierra Leone. The WHO (2017) has recommended that women have up four to eight ANC visits per pregnancy. The numbers of antenatal visits were recorded at the time of investigation of the maternal deaths. The research question stated that there is no difference of ANC visits by Sierra Leone women in relation to the district of residence, age, marital status, parity, the institution of birth, mode of delivery, and education among maternal death cases.

The first null hypotheses stated that there is no difference between the use of ANC among pregnant women in Sierra Leone is related to the district of residence after controlling for age, marital status, parity, the institution of birth, mode of delivery and education among maternal death cases. The second null hypotheses stated that there is no difference between the use of ANC visits are not related to mother's age after controlling for the district of residence, marital status, parity, the institution of birth, mode of delivery, and education among maternal death cases. The third null hypotheses stated that there is no difference between the use of ANC among pregnant women in Sierra Leone is related to the marital status after controlling for the district of residence, age, marital status, parity, the institution of birth, mode of delivery and education among maternal death cases. The covariates for each hypothesis were included in the final logistic regression models and compared to the ANC visits outcome variable. They included age, geographical regions, marital status, mode of delivery, institution of birth, education level

and parity. A significant association was found for geographic regions of residence, marital status of women and education level. There was no statistical significance in the association between age, mode of delivery, institution of birth, and parity.

The results have shown that there are marked disparities in terms of use of ANC services in different geographical settings, marital status of women, and education status of the women. The results indicate that rural women are women that had died were less likely to receive ANC services unlike women from the capital city. The rural population was more disadvantaged in accessing an ANC which would suggest long waiting time, lack of staff, poor lack of knowledge or money may be the possible inhibiting factor in receiving adequate ANC services. It should also be noted that the western area has the largest concentration of health workers in the already limited human resource for health thus staff from rural areas end up overworked (Wurie, Samai & Witter, 2016). Urban population on the other hand is mostly affected public and private health care allocation and inequitable distribution of social amenities that contribute to maternal well-being making it difficult for low income women to access the services (Tawiah, 2011). The aftermath of EVD outbreak that had brought the health sector to a standstill would have contributed to poor ANC use in the rural areas as the communities still lacked faith in the health system. These are evidenced from related findings which argue that health service interruption was recorded in the three West African countries that were most affected by the outbreak (Bolin Ribacke et al., 2017). The poor ANC use is not determined by only health workers but also other social issues. This is because 42% of health the workforce in Sierra Leone is currently employed in Western Area with the other 58% being shared

by the other regions (MOHS, 2016). Despite Western area having a higher ANC use of poor management of staff in urban areas coupled with reports of poor delegation, favoritism and a lack of autonomy for staff could also have contributed to poor ANC services in the western area (Witter, 2016 and Wurie et al., 2016).

The women's marital status and their education level ware found to be a contributing factor to ANC use. Single women were more likely to not adhere to recommended ANC visits unlike their married counterparts. Perhaps this could be attributed to lack of spousal support, weak financial status or unwanted pregnancies. Other studies carried out in Africa supported the conclusion that single women were at a higher risk of poor use of ANC services (Rurangirwa, et al., 2017 and Gitonga, 2017). In my study lesser use of ANC services was seen as levels of education increased among women. The same trend was also seen in the frequency tables were women with a degree and diploma had the highest mortality. This finding is contrary to other studies that indicate that women with higher education use ANC services more than the less educated (Onasoga et al., 2012; Mugo et al., 2015; Tawiah, 2011 and Gitonga, 2017).

The use of the ABM to assess the ANC use in Sierra Leone provides insight in the need to improve ANC use in the country. Ultimately the county should focus in improving quality of ANC services so as to help reduce maternal mortality. That notwithstanding, more needs to be done regarding improvement of the quality of services and fair distribution of health services. To achieve this, the government has to focus on issues like removing social cultural barriers, reducing poverty; improving women literacy and improving of transport fairly distributed Health (Witter, Wurie, and Samai, 2015).

Limitations of the Study

Misclassification of maternal deaths was a major limitation of the study. The Internal Classification of Diseases, Tenth Revision (ICD-10) classifies maternal death as any death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes (WHO, 2017). While the definition seems straight forward, its application in practice creates problems when medical certification of the cause of death is unavailable or of inadequate quality, or when deaths occur at home (University of Queensland, 2010; Merdad et al., 2013). Another limitation was inability to capture some of the deaths that qualified to be maternal deaths especially for illegal abortions out, as not all information would be disclosed. Incomplete data and missing variables from the data and poor participation of community members during the maternal death investigations resulted to omission of some of the cases from the study thus reducing the sample size. Another limitation was that since the data was being collected following a death, a woman may have had other factors that contributed to the ANC uptake, but this information was not known by other people. Such information would have helped in assessing the quality of ANC given to the women. While the ANC card is supposed to record the services rendered most women are not keen to keep them safely and when they exist the staff do not record all the services given to women during the ANC sessions The inability to control other confounding and modifying factors was a limitation as I had to the available data being a secondary data. Despite these limitations the study results are important as

they have demonstrated variations on antenatal use based on geographical regions, marital status and education level of women.

Recommendations for Further Studies

Further studies will need to be carried out to assess the quality of ANC services given in the country. The need for standardization of services is important to ensure quality of the services rendered. Assessment of quality of services was highlighted as a major issue previously in the demographic health survey where by the proportions of women who took internal parasite drugs varied markedly from one region to another with Southern and Western regions having 80 percent while the Eastern region had 64 percent (Statistics Sierra Leone, & ICF International, 2014). The data from this study used a secondary dataset but to fully get information on ways of improving the quality of ANC, I would recommend the use of a primary data.

Further studies should be included in the covariates to assess the use of ANC to better understand the quality of service given including gender and type of health workers that render ANC services, behavior of health workers, availability of health workers, availability of drugs and equipment's, planned or unplanned pregnancies, confidentiality at the clinic, transport costs, cultural implications to accessing care, time allocated for ANC, income of the women and costs attached to ANC services.

While the study demonstrated geographic variation in ANC uses there need for further studies which target the whole country to assess if the variation is also present in other health services and if it follows the same pattern with the study findings. Studies that have so far been conducted in the country assessing health use in relation to

geographical variations are very limited and they focus only on some districts thus not generalizable to the population of Sierra Leone (Kanu et al., 2014 and Sharkey et al., 2017).

Further study to evaluate the disease surveillance system at that collects the maternal death data is required. The system was rejuvenated in 2015 following the Ebola outbreak as such it is still a young system. Evaluation of the surveillance system performance is necessary to help determine if there are areas that require improvement in regard to the intent is to use the findings to adjust the design, protocol or approach for future surveillance activities (WHO, 2013).

Implications for Social Change

The study findings come at a time when the government is implementing the health sector recovery plan 2015-2020 which highlights maternal health issues as a major concern that require urgent attention. Some of the issues that are being addressed is the standardization of care to help promote equity in service provision. The study helps highlight some issues that the government should focus on so as to improve maternal health. Sierra Leone has one of the highest maternal mortality indicators in the world with 1,360 deaths per 100,000 live births (WHO, 2015). Understanding the drivers of maternal mortality in the country is critical and using antenatal services as a method of interaction and training of women on the danger signs to watch out could help reduce these unnecessary deaths.

According to Shoff et al., (2014) identification of place-specific perspective into ANC research helps to better identify local risks as well as further improve maternal and

infant health. The findings contribute to a positive social change by helping improve ANC services thus reducing inequity in health care access and provision of health services for women, ultimately saving lives of mothers and children of Sierra Leone.

Recommendation for Further Action

ANC being a component of continuum of care is critical in ensuring good health for mother. My recommendations will focus mainly on issues that that been demonstrated by the data in order encourage the government to make use of the data they collect to inform changes in health care delivery.

Despite its importance most of the women in Sierra Leone are not receiving the much needed service especially the women from the Eastern region. Many studies have indicated that rural women are more at risk to not utilizing antenatal services (Statistics Sierra Leone, & ICF International, 2014; Kanu et al., 2014; Mugo et al., 2015 and Sharkey et al., 2017) which is consistent with the findings of this study. As the ministry of health and sanitation implement the reproductive health strategy the there is need to focus on the deterrent factors to ANC use in the rural areas too so as to bridge the inequity as well as enforcing the free health care policy.

The inequity in use of ANC for women with higher education level could be seen as a poor maternal protection policy at the work place where women are not women allowed permission to attend ANC services. The government should review the maternal policy to ensure all working are allowed time off to attend ANC clinic.

The study indicated that some maternal deaths were not investigated despite them being reported on time. This has to do with unavailability of staff, vehicles or fuel at the

district level. Non-investigation leads to laxity of the staff thus reducing the efficiency of the system. The ministry of health and sanitation should support the district health management teams with timely resources to ensure that the gains are not lost. Public private partnership is critical in supporting the district health management teams with resources to supplement the government.

The study revealed that 22.5% of mothers that had lost their lives were girls below eighteen years old with 7% still in their primary or secondary level, demonstrating a high prevalence of teenage pregnancies. The government should pay attention to protection of children. These requires a multispectral approach where by the ministry of health provides adolescent friendly health service, the ministry of education supports family education and ministry of social welfare reinforces policies around child protection and early marriage.

The study revealed serious need for the government to improve the family planning services in the country 15.3 % and 18% for grand multiparous and great grand multiparous women respectively. Despite community deliveries being banned in the country the study showed that about 15% of women had delivered at the community level thus putting them at more risk of death. Revisiting the bylaws to ensure they are reinforced in all communities is critical.

Conclusion

This study aimed to understand how geographical location, the age of women, marital status, parity, mode of delivery, and institution of birth impact on ANC services

use in Sierra Leone. The study used a cross-sectional approach which used a secondary dataset of maternal death for 2016, from the IDSR report of Sierra Leone.

My study indicated a significant disparity in terms of use of ANC services in different geographical settings, marital status of women, and education status of the women. No significant association was demonstrated in regard to ANC use based on women`s parity, mode of delivery, and their choice of institution of birth. These findings were supported by both logistic regression and chi squared with all the covariates for each hypothesis being included in the final logistic regression models.

The findings have suggested a weak implementation of health policies in the country. The government to make use of the data they collect to inform changes in health care delivery for women as well as reduce inequity in maternal health service provision as highlighted by the study in an effort to promote social change. The recommendations highlighted in the study serves as a starting point for the government to help fast track the maternal mortality reduction agenda forward. The finding and limitations found in my study warrant further studies on other covariates to assess ANC use and an evaluation of disease surveillance system should be carried out targeting the whole country for better generalization.

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