2019

# Health System Access to Maternal and Child Health Services in Sierra Leone

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College of Health Sciences

This is to certify that the doctoral study by

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the review committee have been made.

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The Office of the Provost

Walden University
2019

Abstract

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Doctoral Study Submitted in Partial Fulfillment

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## Abstract

The robustness and responsiveness of a country's health system predict access to a range of health services, including maternal and child health (MCH) services. The purpose of this cross-sectional study was to examine the influence of 5 health system characteristics on access to MCH services in Sierra Leone. This study was guided by Bryce, Victora, Boerma, Peters, and Black's framework for evaluating the scaleup to millennium development goals for maternal and child survival. The study was a secondary analysis of the Sierra Leone 2017 Service Availability and Readiness Assessment dataset, which comprised 100% (1, 284) of the country's health facilities. Data analysis included bivariate and multivariate logistic regressions. In the bivariate analysis, all the independent variables showed statistically significant association with access to MCH services and achieved a $p$-value < .001. In the multivariate analysis; however, only 3 predictors explained 38% of the variance ($R^2$ = .380, $F$ (5, 1263) = 154.667, $p$ <.001). The type of health provider significantly predicted access to MCH services (β =.549, $p$ <.001), as did the availability of essential medicines (β= .255, $p$ <.001) and the availability of basic equipment (β= .258, $p$ <.001). According to the study findings, the availability of the right mix of health providers, essential medicines, and basic equipment significantly influenced access to MCH services, regardless of the level and type of health facility. The findings of this study might contribute to positive social change by helping the authorities of the Sierra Leone health sector to identify critical health system considerations for increased access to MCH services and improved maternal and child health outcomes.

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# Dedication

This dissertation is dedicated first to my late parents: Alhaji Fouard Kanu and Madam Aminata Bangura and to my late sister Hafsatu Fouard Kanu (May their Souls Rest in Perfect Peace).

I also dedicate this work to my wife, Mrs. Zainab Kanu; to my children: Alhassan, Alusine, Zainab and Hafsatu; to my niece Fatmata and all my siblings. Your limitless love, spiritual prayers, encouragement, and support made completion of this journey possible.

My life-long mentor, Dr. SAS Kargbo, believed in me and supported me in fulfilling my aspiration of achieving a doctoral degree. I, therefore, also dedicate this thesis with a special feeling of gratitude to Dr. SAS Kargbo and family.

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# Acknowledgments

Foremost, I would like to give thanks to God for all the blessings He has given me and the opportunity to earn such a prestigious degree. I would like to thank my dissertation research committee for their guidance and support throughout this process. My dissertation chair, Dr. Mountasser Kadrie: I feel extremely fortunate to have worked with you and learned from you during my time in developing this dissertation. I am also grateful to my committee member Dr. Kelly Sams for her positive encouragement. I owe thanks to my University Research Reviewer (URR), Dr. Richard Palmer for his insightful feedback; which undoubtedly contributed to the quality of this work.

I am thankful to the leadership of the Ministry of Health & Sanitation (MoHS) for their support in diverse ways. I am particularly grateful to Dr. SAS Kargbo, former Director of the Directorate Policy Planning & Information (DPPI) for his unwavering support, mentorship, and pragmatic optimism, throughout my doctoral studies. Drs Brima Kargbo and Santigie Sesay, were also very supportive in motivating me to pursue my dream for which I want to thank them very much. I appreciate Mr. Edward Foday, the Research & Publication Specialist at DPPI/MoHS. He was incredibly supportive throughout the process of gaining access to the dataset used in this study. Special thanks to Mr Musa Sillah-Kanu, the Senior M&E-NMCP/MoHS for his support too.

I received tremendous support from my family and friends during my studies. Words cannot express my appreciation for my family and siblings for their understanding and unconditional love. I thank you, and I would forever remain appreciative of your support.

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Section 1: Foundation of the Study and Literature Review

## Introduction to the Study

There have been sustained global efforts in the past 2 decades to address maternal and child health issues. These issues are disproportionately impacting low- and middle-income countries (LMIC) in terms of morbidities, mortalities, and economic burden. In 2000, the World Health Organization (WHO, 2011a) issued the Abuja Declaration that galvanized the commitment of 189 nations towards the improvement of social and economic conditions of the poorest countries in the world by 2015. The Abuja Declaration had the potential of positively impacting the lives of vulnerable women and children as they suffer the most from the consequences of social and economic deprivations. The Millennium Development Goals (MDGs) are an elaboration of the Abuja Declaration as they also required wealthy nations to provide resources for improvement, and the poor developing countries themselves to implement and maintain appropriate efforts towards the attainment of the goals. Goals 4 and 5 aimed at reducing child mortality and improving maternal health; and poor maternal and child health outcomes are some of the burdensome issues in poorer nations (WHO, 2011b). The Sustainable Development Goals (SDG) agenda also highlighted the importance of continued efforts towards improving maternal and newborn health. Under the SDG Goal 3, maternal mortality ratio (MMR) of fewer than 70 deaths per 100,000 live births was set, and aiming for all countries to reduce neonatal mortality to 12 per 1,000 live births by 2030 (United Nations[UN], 2016).

A significant improvement in maternal and child survival was observed since the adoption of the MDGs. The MDG 2015 report showed a worldwide drop by 45% of MMR between 1990 and 2013, from 380 maternal deaths per 100,000 live births to 210 (UN, 2015). A decline of 49% of MMR was observed in sub-Saharan Africa (UN, 2015). Despite the progress, hundreds of deaths of women due to pregnancy and childbirth-related complications are estimated to occur every day, with most of these deaths disproportionately occurring in sub-Saharan Africa. Of the estimated 289,000 global maternal deaths that were reported in 2013, 86% of them occurred in sub-Saharan Africa and Southern Asia (WHO, 2014a; UN, 2015).

The UN (2015) MDG report also showed a decline in child mortality rates, dropping from 90 to 43 deaths per 1,000 live births between 1990 and 2015. A significant decline was reported in sub-Saharan Africa; a drop from 179 deaths per 1,000 live births in 1990 to 86 in 2015 (UN, 2015). The MDG 2015 report, however, noted that, not only does sub-Saharan Africa carry about half of the burden of the world's under-5 deaths (an estimated 3 million in 2015), but it is also the region where both the number of live births and under-5 populations are expected to rise substantially over the next decades (UN, 2015). Under-5 deaths will increase unless progress in reducing the under-5 mortality rate is enough to outpace population growth. Sierra Leone, one of the poorest countries in sub-Saharan Africa, has one of the highest maternal and child mortality rates in the world, currently reported at 1,165/100,000 and 156/1,000, respectively (Demographic Health Survey [DHS], 2013). As reported by WHO (2014), over a lifetime, there is an approximately 5% chance of a Sierra Leonean woman dying from childbirth and

pregnancy-related causes. The country poor maternal and child health outcomes can be attributed to many factors, including poverty and civil unrest. The country had a 10-year civil war between 1991 and 2002, and this caused damages to health infrastructure (MoHS, 2015). By the end of the war in 2002, only 16% of previous health facilities were operational, and most of them are within the capital city (Bertone, Samai, Edem-Hotah, & Witter, 2014). Postwar reconstruction saw the rehabilitation and establishment of new health facilities coupled with health sector governance strengthening. In line with the global efforts to reduce the mortality rates of the vulnerable women and children through the MDG, the government of Sierra Leone introduced the Free Health Care Initiative (FHCI) in 2010. The initiative exempted pregnant women, lactating mothers, and under-5 children from paying for both preventive and curative services in all public health facilities (Bolkan, Bash-Taqi, Samai, Gerdin, & von Schreeb, 2014; Donnelly, 2011; Government of Sierra Leone [GoSL], ) 2013). The introduction of the FHCI was seen as a catalyst for the start of the large-scale rebuilding of the healthcare system. There were a significant donor and multilateral support to strengthen the health system through health infrastructural expansion, improvement in drugs and medical supplies, and health worker capacity building. An evaluation report on the impact of the FHCI showed a significant uptake of both preventive and curative maternal and child health services between the period 2010 and 2015 (Witter, Brikci, Harris, Williams, Keen, Mujica, Jones, et al., 2018).

Before the 2014 Ebola viral disease (EVD) outbreak in Sierra Leone, the health sector had made significant progress in some MDG indicators related to health. The

country had seen improvement in health coverage, including (a) an increase from 7% to 16% in modern contraception; (b) skilled birth attendance improving from 42% to 62%; (c) insecticide-treated bednets increase from 26% to 49%; and (d) malaria treatment jumped from 6% to 77%; diarrhoea management improving from 68% to 88%, and basic immunization increasing from 54% to 78% (DHS, 2013; Sierra Leone Ministry of Health & Sanitation [MoHS], 2015). The relative gains of the FHCI scheme on maternal and child health were reversed by the Ebola epidemic and ultimately made it impossible to achieve any of the health-related MDGs (Ribacke, van Duinen, Nordenstedt, Hoijer, Molnes, Froseth, et al., 2016). Like in postwar health sector reconstruction, the post EVD also witnessed an investment to strengthen the health system. This was as a result of the evidence of weak health sector governance and infrastructure that was blamed for the rapid spread of the epidemic (Ribacke et al., 2016; Elston, Moosa, Moses, Walker, Dotta, Waldman, & Wright, 2015). Scholars have indicated that individual and household characteristics such as poverty, illiteracy, religion, and cultural factors account for the poor maternal and child health outcomes (Stekelenburg, Kyanamina, Mukelabai, Wolffers, & van Roosmalen, 2004; Tlebere, Jackson, Loveday, Matizirofa, Mbombo, Dohert, Wigton, et al., 2007). Although both preventable maternal and child mortalities are linked to the availability of resources at health facilities (Thaddeus & Maine, 1994), the relationship has not been quantifiably examined in Sierra Leone. There is limited local knowledge on the extent to which the health system influences access to maternal and child healthcare (MCH); particularly following the post-Ebola health sector

investment. This study provided empirical evidence on the health system influence on access to essential MCH services in Sierra Leone.

The study findings will contribute to efforts towards increasing access to quality MCH services in Sierra Leone The evidence generated from this study provides insight into the role of the respective health system pillars on increasing access to healthcare and guiding health system investment. This is critical in maximizing gains from the shrinking support towards public health programs. The evidence can help policy makers and other stakeholders in the design of relevant, timely, and evidence-informed policies and programs to improve both the access and quality provision of essential MCH services in Sierra Leone. The social change implication for this study is a strong and responsive health system that will lead to a reduction in maternal and child mortality rates in Sierra Leone.

In this section, I present the problem statement and purpose of the study. The nature of the study, research questions, and hypotheses are included alongside the theoretical framework. Also presented in this section is an overview of recent literature related to the scope of the study including a review of the theories that formed the basis of this study and the methodological approaches explored in previous related studies. An explanation of what is known and controversial about the variables of interest in this study, and what remains to be studied, are also presented. Finally, assumptions, scope, delimitations, limitations, and significance of the study are highlighted.

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## Problem Statement

The global attention on the high rates of morbidities and mortalities in vulnerable women and children, especially in LMICs, has led to sustained efforts towards the reduction of maternal and child mortalities across the world. The Abuja Declaration and the MDGs have contributed to the decline of maternal and child deaths (Hardee, Gay, & Blanc, 2012; WHO, 2014b; UN, 2015). Although sub-Saharan countries also witnessed a drop on these mortalities, the region continues to record the highest MMR in the world. In their systematic analysis on the global trends in maternal mortality between 1990 and 2015, Alkema, Chou, Hogan, Zhang, Moller, Gemmill, Fat, et al. (2016) reported a relative decline from 385 deaths per 100,000 live births in 1990 to 216 in 2015. There was a regional disparity on the global trend on MMR with 12 deaths per 100,000 live births for the high-income region and 546 for sub-Saharan Africa (Alkema et al., 2016). A decline was also recorded for global child mortality rates in the same period, from 1.7 million in 1990 to 1 million in 2016 (Alkema et al., 2016). Low- and middle-income countries have, however, been disproportionately affected, with 98% of the death of children aged 5-14 years taking place in these countries in 2016 (Masquelier, Hug, Sharrow, You, Hogan, Hill, Liu, et al., 2018). Sierra Leone has one of the highest maternal and under-5 mortality rates at 1,165/100,000 and 156/1,000, respectively (DHS, 2013).

The health sectors in countries in sub-Saharan Africa are faced with many challenges, including a disrupted and fragmented health system (Colvin, Konopka,

Chalker, Jones, Albertini, Amzel, & Fogg, 2014). As described by Thomson, Amoroso, Atwood, Bonds, Rwabukwisi, Drobac, et al. (2018), the health systems of these countries are characterized by poor infrastructure, limited human resources, and weak stewardship. The capacity of the health system to respond timely and adequately to the health needs of the people is critical to averting deaths, especially in vulnerable populations such as pregnant women and children. The health system requires equipped and accessible health facilities, as well as the right mix of competent health professionals to be able to provide life-saving interventions for both children and women during pregnancy, labor, and postnatal periods. According to Friberg, Kinney, Lawn, Kerber, Odubanjo, Bergh, et al. (2010), four million lives could be saved annually if existing interventions for improved maternal, newborn, and child survival along the continuum of care reached 90% of families. A notable priority intervention globally recognized as cost-effective for the reduction of maternal and neonatal mortality rates is the emergency obstetric and newborn care (EmONC). Sierra Leone has been implementing the EmONC initiative since 2011 to enhance access to quality MCH services across the nation. To date, though, the availability and accessibility of EmONC services across all facilities in Sierra Leone is still poor (GoSL, 2015).

The lack of functional and EmONC-compliant facilities is not unconnected with the strength of the health system. The WHO (2000) defined health system as "all the activities whose primary purpose is to promote, restore or maintain health" (p.5). There are six building blocks of a health system, and they are leadership and governance, healthcare financing, health workforce, medical product and technologies, health

information system, and service delivery (WHO, 2015a). Each of the building blocks can predict access to components of quality health service delivery. The lack of compliant EmONC facilities in the country reflects a range of critical implementation challenges. For example, human resources for health, one of the health system pillars, are a crucial component in delivering high quality, affordable, and accessible health care services in every country. The ability for a country to meet its health goals depends on the knowledge, skills, motivation, and deployment of the people responsible for organizing and delivering health care services (Chen, Evans, Anand, Boufford, Brown, Chowdhury, Cueto, et al., 2004). Sierra Leone faces a shortage of health workers. The WHO (2014) has determined a critical threshold of 23 doctors, nurses, and midwives per 10,000 populations for the health workforce to be able to provide the minimal levels of basic skilled care for pregnant women and children. According to WHO (2014), countries that fall below this threshold will struggle to provide the skilled services required to improve the status of maternal and child health and are likely to suffer higher levels of maternal and child mortality. As of 2010, Sierra Leone had only two skilled providers per 10,000 population (WHO, 2014a), and the country ranked fourth from the bottom of a list of 49 priority low-and-middle-income countries for health worker-to-population ratios (Chen et al., 2004). The staff shortage in the health sector was further decimated by the 2014 EVD outbreak, with an estimated 257 health workers dying from the epidemic (MOHS, 2017).

There exist healthcare solutions to prevent or manage maternal complications. Preventing maternal deaths requires access to antenatal care during pregnancy, skilled care assistance during childbirth, and care and support in the postnatal period. The timely

management and treatment of complications by a skilled birth attendant can save the lives of both the mother and the baby (WHO, 2015b). A successful delivery, in addition to skilled birth attendance, requires life-saving drugs. Specific essential interventions and medicines are needed to improve maternal health and prevent deadly complications and these include oxytocin, misoprostol, and magnesium sulfate (WHO, 2013; Briggs, Embrey, Maliqi, Hedman, & Requejo, 2018). Poor and vulnerable women in Africa, including Sierra Leone, still lack adequate access to essential health medicines (Hill, 2012; Spector, Reisman, Lipsitz, Desai, & Gawande, 2013), and this poses threats to the survival of women during childbirth. Stock-outs (Briggs et al., 2018) and low availability (Sado & Sufa, 2016) of essential medicines for the treatment of childhood illnesses have also been reported in sub-Saharan countries, and these have the potential of claiming the lives of children from preventable and treatable illnesses.

Various health facility levels exist for the provision of care. For primary health care (PHC), the services are often provided in health centers and clinics; while secondary and tertiary health care services are provided in hospitals. The network of health facilities that deliver essential healthcare, including MCH services, has been reported to influence both access and quality health services. Kruk, Leslie, Verguet, Mbaruku, Adanu, and Langer (2016) examined the quality of basic maternal care in health facilities in five African countries and found that the quality of care in primary care facilities was poorer than at secondary facilities. The ownership (private versus public) of the health facilities has also been reported to influence service access and quality. Shayo, Senkoro, Momburi, Olsen, Byskov, Makundi, Kamuzora et al. (2015) examined Tanzanian access and use of

quality, equity, and trust and revealed that respondents who visited public health facilities reported medicine shortages more than those who visited private health facilities. Deribew, Biadgilign, Berhanu, Defar, Deribe, Tekle, and Dejene (2018) assessed the capacity of the health facilities in Ethiopia for comprehensive HIV/AIDS care and revealed that public hospitals have a better capacity score (77.1%) than health centers (45.9%) and private health facilities (24.8%). The health system plays a role in access to healthcare. There is, however, limited empirical evidence on the extent to which health system can predict access to MCH services. In this study, therefore, I sought to discern the influence of health system characteristics on access to MCH services in Sierra Leone. The study can provide insight into the roles of the respective health system characteristics on MCH service delivery in the country. The evidence generated by the study may guide the development of appropriate policies and strategies to improve access and quality of MCH services, thereby contributing to a reduction in maternal and child morbidities and mortalities in Sierra Leone.

## Purpose of the Study

A quantitative secondary data analysis was used to answer the research questions. The use of this approach is based on the positivist philosophical assumption that examining the relationship between and among variables is central to answering questions and hypotheses through experiments and surveys, using statistical analysis (Creswell, 2013). The research questions in this study required quantitative analysis for examining the associations between health system factors and access to MCH services.

I conducted a secondary analysis of archived data from the MoHS. The data comprised of health facilities that were surveyed in the 2017 service availability and readiness assessment (SARA). I examined the nature of the association between health system characteristics (the independent variables) and access to MCH services (the dependent or outcome variable). The health system characteristics (the independent variables) may relatively influence access to MCH services. In this study, five health system characteristics were investigated : (a) type of health provider, (b) level of the health facility, (c) availability of essential medicines, (d) availability of basic equipment, and (e) type of health facility (i.e., private vs. public). The outcome variable was the access to essential MCH services (which referred to the availability and accessibility of selected services including antenatal care, skilled birth attendance, postnatal care, immunization, nutrition, malaria, and HIV treatment among others).

## Research Questions and Hypotheses

RQ1: Can access to MCH services be predicted based on the type of health provider?

$H_0$1: Access to MCH services cannot be predicted based on the type of health provider?

$H_1$1**:** Access to MCH services can be predicted based on the type of health provider.

RQ2: Can access to MCH services be predicted based on the level of the health facility?

$H_0$2**:** Access to MCH services cannot be predicted based on the level of the health facility.

$H_1$2**:** Access to MCH services can be predicted based on the level of the health facility.

RQ3: Can access to MCH services be predicted based on the availability of essential medicines?

$H_0$3**:** Access to MCH services cannot be predicted based on the availability of essential medicines.

$H_1$3**:** Access to MCH services can be predicted based on the availability of essential medicines.

RQ4: Can access to MCH services be predicted based on the availability of basic equipment?

$H_0$4**:** Access to MCH services cannot be predicted based on the availability of basic equipment.

$H_1$4**:** Access to MCH services can be predicted based on the availability of basic equipment.

RQ5: Can access to MCH services be predicted based on the type (private vs. public) of health facility?

$H_0$5: Access to MCH services cannot be predicted based on the type of health facility.

$H_1$5: Access to MCH services can be predicted based on the type of health facility.

## Theoretical Foundations of Study

### Choice of Theory

The purpose of this study was to understand the extent to which health system characteristics influence access to essential MCH services in Sierra Leone. The study was guided by a conceptual framework that was adapted from Bryce, Victora, Boerma, Peters, and Black's (2011) framework for evaluating the scale-up to MDGs for maternal and child survival. Bryce et al.'s framework is based on the assumption that an essential prerequisite to scaling-up MCH services is a responsive health system. The framework is built on the WHO and International Health Partnership (IHP) to develop country monitoring and evaluation platforms for national health strategies (Bryce et al., 2011; Victora, Black, Boerma, & Bryce, 2011).

The effective delivery of MCH services depends on a well-coordinated and responsive health system. This involves having the right inputs that are channeled through the appropriate processes to enhance the attainment of desired outputs and outcomes that improve access to quality MCH services. The adapted framework of this study outlines the pathways through which inputs (health policies and program strategies) are implemented through processes (health system strengthening initiatives) to achieve intermediate outputs (decisions to seek care, ability to reach care, readiness to provide care) and outcomes (safe delivery service coverage and quality) that contribute to reductions in maternal and child mortalities.

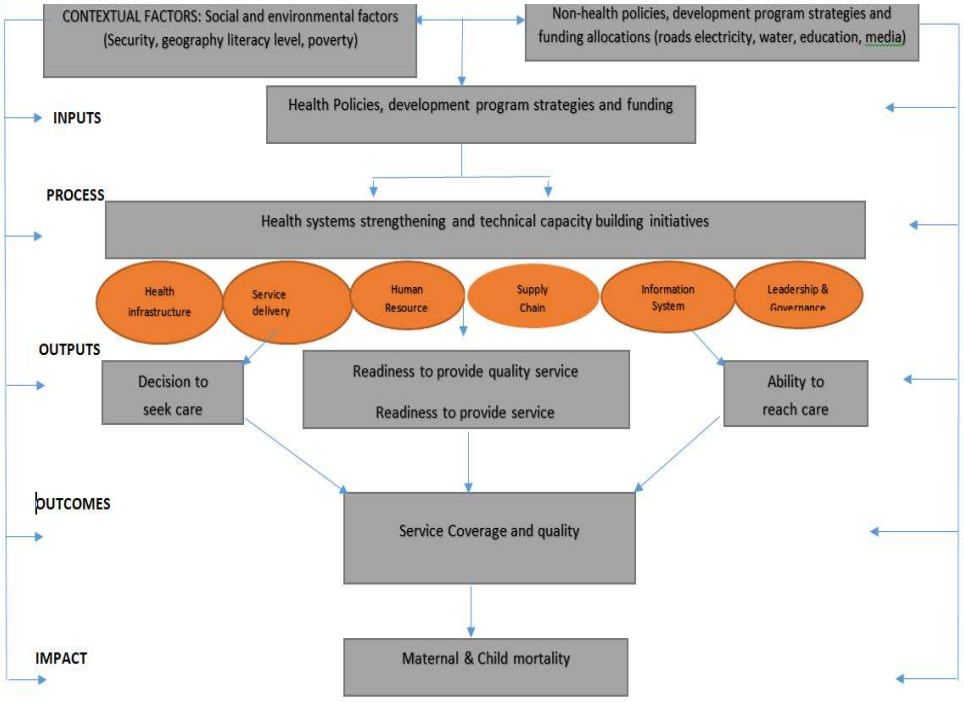
**The Rationale for the Choice of Framework**

The extent to which mothers and children can benefit from an MCH program is dependent on supply-side (service providers) and demand-side (service-users) factors. Increasing the coverage of essential MCH services, therefore, requires addressing both supply-side and demand-side barriers to health care provision. As asserted by De Brouwere, Richard, and Witter (2010), the supply side factors that determine service availability is dependent on the extent to which stakeholders of MCH programs implement the available policies and plans. On the demand-side, key barriers include geographical and physical barriers to accessing healthcare (De Brouwere et al., 2010). This is further complicated by the individual, household, and community levels and sociocultural factors (Adu, Tenkorang, Banchani, Allison, & Mulay, 2018; Jat, Ng, & Sebastian, 2011). All of these are determinants to service uptake as they influence where, when, and how women seek obstetric care. The chosen framework is a simplified model for illustrating the pathways from health policy and strategy formation to the population. The choice of this framework was considered rational as it aims at deconstructing the challenges from a supply-side perspective as well as illustrating the contribution of the health system blocks in increasing access and enhancing MCH services that leads to a reduction of maternal and child mortalities.

**Logical Connections**

Considering the interplay of the individual, contextual/sociocultural, and health system factors, an adapted framework from the Bryan et al. (2011) model was used in my study to understand the influence of the health system characteristics on access to MCH

services. Figure 1 depicts the connections of contextual factors and health system strengthening to reduce maternal and child mortalities.




. *Figure 1*. Conceptual framework for strengthening health systems to reduce maternal & child mortality.

At each level beyond the inputs, the model borrows elements from other health system strengthening initiatives and health service delivery frameworks (Gabrysch & Campbell, 2009; Thaddeus & Maine, 1994). This is done to illustrate the links between health system characteristics and maternal health outcomes and to also capture the influence of contextual factors at all levels of health service design and implementation. At the process level of the framework, the content includes the WHO (2007) six building blocks that are considered as desirable attributes of a well-functioning health system. Some efforts to improve service coverage can only focus on selected elements of the

system. However, the combination of different components and the dynamic interactions between them may influence the availability, accessibility, and use of services.

At the next level, the framework borrowed from the conceptual models published by Thaddeus and Maine (1994) and by Gabrysch and Campbell (2009) illustrate the outputs-decision to seek care, ability to reach care, and facility readiness to provide quality services. Thaddeus and Maine (1994) conceptualized the barriers to accessing healthcare services by women in labor as a series of three delays: the first delay is deciding to seek care, the other delay has to do with reaching the health facility, and the third delay is receiving the appropriate services at the health facility. Gabrysch and Campbell (2009) described four categories of determinants of intrapartum care use as a preventative measure in normal, uncomplicated deliveries: (a) sociocultural factors, (b) perceived benefit/need of skilled attendance, (c) economic accessibility, and (d) physical accessibility. In the adapted framework for this study, the determinants on the accessibility, availability, and the use of safe delivery services are represented as the influence of contextual factors on the output level of the model. These outputs are the results of inputs and processes that are equally influenced by a variety of contextual factors.

At the outcomes level, the illustration represents the result of the interactions between the demand-side, supply-side and contextual factors at each level of the model (i.e., from policy formulation to service availability, accessibility, and care-seeking).

Last, a combination of contextual factors and service quality and coverage is needed to impact maternal mortality. The impact level in the framework is presented to

highlight the overarching goal of scaling up safe delivery services and child health interventions to reduce maternal and child mortalities in Sierra Leone. The framework is a simplified model for illustrating pathways from health policy and strategy formation to population health. It provides an opportunity in understanding how health system strengthening initiatives can result in improved maternal and child health, as well as in identifying the conditions that facilitate or hinder the reach of essential MCH services to the vulnerable women and children who need them (Bryce et al., 2011).

## Nature of Study

This was a quantitative, secondary data analysis using cross-sectional survey data to understand the relative influence of the health system characteristics on access to MCH services. The use of a quantitative approach is considered appropriate for situations where systematic, standardized comparisons are needed (Bowling, 2002). The use of statistical methods in the quantitative analysis means that the analysis is often considered reliable as well as generalizable due to larger sample sizes as opposed to a qualitative approach (Bowling, 2002; Creswell, 2008).

The main function of the health system is to ensure access to quality health services (Adam & de Savigny, 2012; Sherr, Requejo, & Basinga, 2013). Different components form service access, and these include service availability (physical presence or reach of the facility), affordability (service user's ability to pay for service), and acceptability (inherent to sociocultural dimension to agree in using the service). In addition to services, access is also the dimension of the quality of services. Service readiness, which refers to the capacity of the health facilities to deliver essential services

offered, and service availability are both considered as prerequisites to service quality (WHO, 2013a). These two dimensions do not, however, guarantee the delivery of quality services. A joint WHO/USAID-developed SARA methodology is being used by countries to generate essential information on the status of the health system regarding service accessibility and the readiness of health facilities to deliver an adequate level of health services to the general population (WHO, 2013b). The SARA health facility survey collects data from a range of health system dimensions, such as health staff, drugs, and medical supplies; equipment; and basic amenities such as electricity and water supplies. In this study, secondary data analysis was conducted using the 2017 SARA for Sierra Leone to highlight any significant difference in the availability of quality MCH services across the different levels of healthcare facilities. I used the 2017 SARA dataset because it is the first SARA that has been conducted immediately after the EVD outbreak, which was accompanied by an investment in strengthening the health sector. Additionally, the 2017 SARA was a census of all public and private health facilities in the country, as compared to previous assessments that were limited only to sampled facilities. Taking into account the relative investment in strengthening the health system following the outbreak, I highlighted the current status of health facilities concerning the provision of quality MCH services across the country.

The independent variables included five health system characteristics: (a) type of health provider, (b) level of the health facility, (c) availability of essential medicines, (d) availability of basic equipment, and (e) type of health facility (i.e., private vs. public). The dependent variable was access to essential MCH services (such as antenatal care,

skilled birth attendance, postnatal care, and childhood preventive and curative services). In the analysis of the secondary data, SPSS version 25 was used. Bivariate and multivariate logistic regression analyses were performed to assess whether the health system attributes (independent variables) can predict access to MCH services (dependent variable). Table 1 shows the WHO health system blocks and the measures that are examined in the current study.

Table 1

*Health System Determinants on Access to MCH Services*

| **WHO health system blocks** | **Measures** |
|---|---|
| Health facility and infrastructure | • Level and type of health facility |
| Human Resource for Health | • Type of MCH provider |
| Service Delivery | • Types of MCH services offered or available at the health facility |
| Drugs and medical supplies | • Availability of essential medicines<br>• Availability of basic equipment for MCH service delivery |

## Literature Search Strategy

### Search Strategy

The execution of the literature review for this study was conducted using varied electronic databases through the Walden University Library. Among the databases were

MEDLINE, PubMed, PROQUEST, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Cochrane Database of Systematic Reviews, Thoreau, and relevant academic texts (including e-books). Other databases, including websites of UN agencies (such as WHO, UNICEF, UNFPA) and Google Scholar, were also explored to retrieve relevant information. The unpublished work of the Sierra Leone MoHS and its development partners also form part of the materials explored to inform the literature review.

To explore the topics of interest for this study, various search terms were used. Keywords that stand alone or in combination were used including *healthcare access, maternal health, newborn and child health, maternal morbidity, child morbidity, antenatal care, health systems, health systems strengthening, healthcare access, maternal mortality, infant and child mortality, emergency obstetrics and newborn care, child health services,* and *maternal health services.*

## Scope of Literature Review

The review of the literature for this study includes the following: (a) peer-reviewed studies encompassing systematic reviews and meta-analysis, (b) studies on the association between the respective health system dimensions and MCH services use, (c) studies published between 2008 and 2018, (d) studies published in English, and (e) studies published in all regions of the world.

## Literature Related to Key Variables and Concepts

**Global Trends on Maternal and Child Mortalities.** In their systematic analysis on the global trends in maternal mortality between 1990 and 2015, Alkema et al. (2016)

reported a relative decline from 385 deaths per 100,000 live births in 1990 to 216 in 2015. There was a regional disparity on the global trend on MMR with 12 deaths per 100,000 live births for the high-income region and 546 for sub-Saharan Africa (Alkema et al., 2016). A decrease in mortality among children has also been observed during the same period. Masquelier et al. (2018) reported a decrease in the death of children younger than 5 years by more than half from 1990 to 2016. According to Masquelier et al., the probability of a child dying between the ages of 5 years and 15 years was 7.5 deaths per 1000 in 2016. Masquelier et al. also reported a decrease from 1.7 million in 1990 to 1 million in 2016 in the number of deaths among children aged 5-14 years. As in global MMR, regional differences were also reported in global child mortality. LMIC accounted for only 21% of the global population of children aged 5-14 years, but they are disproportionately affected (Masquelier et al., 2018). In 2016, 98% of all deaths of children 5-14 years occurred in these countries, and seven countries alone are reported to account for more than half of the total number of deaths in children (Masquelier et al., 2018).

**Health System and Access to Healthcare.**

A description of the health system, as conceptualized in the literature, is presented in this section. This includes highlighting health system goals and functions. An increase in the number of studies related to health system was observed since the year 2000. Scholars have, however, failed to cover all components of the systems, particularly for LMICs.

***The concept of the health system.***

Two different terms are embedded in a health system, with each having its meaning. Health, on the one hand, is defined as a state of complete physical, mental, and social well-being; and not merely the absence of disease or infirmity (WHO, 2007). The system, on the other hand, is a set of interconnected parts that function as one entity. According to Atun and Menabde (2008), these parts could be individuals, items, and organizations that must operate together to be effective. Several studies on health system have been conducted, but their focus, according to Smith and Hanson (2012), has largely been on healthcare, including preventive, curative, and promotive care. Other aspects, such as social structures and policy that form part of the definition of the health system, are given little attention. With regards to the scope and components of the health system, the literature lacks consensus in these areas. Different health system definition and approaches are being supported and advocated by different organizations (Smith & Hanson, 2012). Smith and Hanson noted that the various definitions of health system mostly include direct and indirect activities related to health, while some limit health system to include only health service providers and organizations that provide or deliver personal medical services. The World Bank (2007) definition for health system refers to health financing, public-private partnerships development, macroeconomic factors, and public sector reforms. The WHO (2007) considered the health system as an entity that includes all organization, people, and actions whose primary intent is to promote, restore, or maintain health. The activities of the health system range from direct service provision through clinics and hospitals to community-level prevention strategies and health

education (WHO, 2000). Kruk and Freedman (2008) considered this definition as narrow because it is limited to activities that are under the partial or full control of the government. Worldwide, the main funders and health services providers are the governments, especially in LMIC. Nonhealth specific activities (which also belong to the other systems and society) are not included in the WHO definition. Some of these activities may indirectly contribute to the health of the population and the broader system function. For instance, activities such as increasing the enrolment of girls in schools and the improvement of road networks have a positive contribution to the health of vulnerable women and children. These activities are outside the remit of the health system but can affect population health if they are absent in terms of limiting healthcare access potentials. Smith and Hanson (2012) suggested that a health system should broaden its scope to ensure that all the factors that have the potential to impact (directly or indirectly) the health of the population should be considered in both definition and practice.

Adopting the wider definition of health system makes it challenging to quantify its performance. The data on the health system is related to the more narrowly defined healthcare system. The focus has been on curative, preventive, promotive, and palliative intervention targeting individuals and communities. Health system research has mostly focused on the aspects related to the narrower definition of the health system. Health system is defined as the combined functioning of public health and personal healthcare services that are under the direct control of identifiable agents, especially the ministries of health (Nolte & Mckee, 2012).

To ensure stakeholders have a shared understanding of what the health system is and the actionable points for strengthening the health system, the WHO (2007) developed a framework comprised of six building blocks of a health system: (a) health service coverage; (b) human resources for health; (c) health information systems; (d) medical products, vaccines, and technology; (e) health financing; and (f) leadership and governance. These building blocks are expected to support a "health system that can prevent, treat and manage illness, and preserve mental and physical well-being for all individuals equitably and efficiently, within a specified geographic area" (WHO, 2007, p. 1).

Increasing attention on the concept of the health system has been observed since the year 2000. As stated by Kruk and Freedman (2008), one of the notable reasons applies to the horizontal approach in managing community and population health. This followed after a long period of using the vertical approach that includes donor thematic health investment and small-scale, community-based projects. The vertical approach focuses on solving a specific or few health problems through the application of a measure. This approach deals with selected priority interventions as seen in Global Fund-supported projects for Malaria, Tuberculosis (TB), and HIV control programs. The vertical approach has been criticized as unsustainable, and it is considered to be more suitable for dealing with health emergencies or crises in a localized community (Sherr et al., 2013). Broader health system strengthening and primary health care, according to Sachs (2012), are now seen as core to achieving universal health coverage (UHC) and critical to meeting the new health-related UN Sustainable Development Goals (SDGs).

***Health systems goals and functions***.

A functioning health system aims at attaining three intrinsic intended outcomes or goals. As outlined by Kruk, Freeman, Anglin, and Waldman (2010), one of the goals of the health system is to ensure that the population attains better and equitable health through equitable service delivery and fair financing arrangement. Another goal is responsiveness. This refers to the ability of the system to respond to people's expectation related to their health needs and to be treated in a dignified manner by the health providers. A responsive health system will contribute to the use of health services, as patients with poor experiences from the system will be hesitant to use the services. The satisfaction of service-users is a reflection of the level of responsiveness of a health system. Service affordability has been cited as a potential barrier to healthcare access. The third intrinsic goal has to do with the promotion of financial fairness and protection of the population against the costs of ill-health. Individual healthcare needs are unpredictable, and the system should ensure the cost of regaining health should not be catastrophically high as this will limit access to the needed services. This can be through effective mechanisms for risk-sharing and provision of financial protection.

In addition to the intrinsic goals of the health system, the WHO (2000) discussed other instrumental or intermediate goals. Among these instrumental goals include the health system being accessible, affordable, equitable, and sustainable (WHO, 2000). Where there are challenges in measuring the intrinsic goals, the instrumental goals can be quantified as a proxy for the main goals. The attainment of these goals will optimize the health of the population through fairness on the financing arrangements as well as on the

responsiveness of the health system. Where health system includes accessible services, there is a higher likelihood for the use of the services to ameliorate the sufferings of those who need those services at a particular point in time. The adequate measurement on the attainment of the three intrinsic goals of the health system would reflect on the cumulative impact of healthcare access as well as on the other instrumental goals (Kruk & Freedman, 2008; Murray & Frenk, 2000; WHO, 2000).

***Health system characteristics***.

A health system that functions effectively addresses all the requirements of the six components or building blocks as proposed by WHO (2007). According to WHO's Alliance for Health Policy and Systems Research [AHPSR] (2004), the four vital functions of the health system are: (a) *Stewardship*- government oversight inclusive of defining the vision and direction of health policy, exerting influence through regulation, and collecting and using key data; (b) *resource generation*- encompassing critical inputs such as human resources, physical capital, and drugs and medical supplies; (c) *service provision*- including formal and informal, public and private, and includes management of service delivery; and (d) *financing*- including the volume and sources of financial resources available for the health system, including mechanisms for pooling resources and transferring them to service providers.

Each of the four vital functions of the health system has its contributions to the functionality of the wider system to provide proper health service delivery. According to WHO (2007), a proper health service delivery refers to the delivery of effective, safe, and quality personal and nonpersonal health intervention to individuals and communities that

need the services at any time and anywhere with maximum efficiency. A well-performing workforce is one that is responsive, fair, and efficient in achieving the best population health outcomes possible, given available resources and circumstances. This involves having sufficient staff and a skill mix of the health workforce that is equitably distributed, responsive, competent, and productive (WHO, 2007). The function of good health financing is to ensure that adequate funding is available for the running of the system, which can protect the population from financial catastrophe or improvement due to costs for their healthcare needs. The financial capacity of the system provides incentives that are critical for the efficiency of both service providers and users. A good stewardship function requires strategic policy frameworks that guide effective oversight, coalition building, regulation, and accountability (WHO, 2007). Further, a well-functioning health information system is needed for a good stewardship function of a health system. This involves having reliable and timely information on population health determinants and health status as well as health system performance (WHO, 2007).

***Management of health system***.

Although the government is responsible for all four of the main functions of a health system (stewardship, resource generation, service provision, and financing), there are other essential actors. The main actors in a health system include (a) the government as steward, financing body, health service provider, and for health promotion; (b) non-governmental organization ( NGO ) sector as health service provider and/or health promotion; (c) traditional health care providers (e.g., traditional healers, traditional birth

attendants); (d) private sector; and (e) patients/clients and the community at large (WHO, 2011b).

A national health system has management functions related to (a) individual care management, (b) health unit management, and (c) health system management (Alliance for Health Policy and Systems Research [AHPSR], 2004; WHO, 2011b). Collectively, a national health system oversees the four main functions of stewardship, resource generation, financing, and service provision, which includes and necessitates long-term planning and day-to-day management (WHO, 2011b).

**Dimensions of Access to Healthcare**

One of the fundamental determinants of health is health services. Access to health services may determine the survival of an individual, for example, during labor for both the mother and infant. It is through health services that health professionals provide preventive, curative, and promotive services for improved population health outcomes. The subject of access to healthcare has been studied in the past 2 to 3 decades, as evidenced in the existing body of literature on the subject. Healthcare access is a complex concept, and various frameworks that attempted to delineate dimensions of access to healthcare have been reported (Jacobs, Ir, Bigdeli, Annear, & Van Damme, 2012; Levesque, Harris, & Russell 2013; Obrist, Iteba, Lengeler, Makemba, Mshana, Nathan, Alba et al. 2007).

Consequently, the concept of healthcare access is yet to have a universally accepted definition. Many authors use the terms access and use interchangeably. The two terms are conceptually different. One definition of access is the timely use of service

according to need (Peters et al. 2008). This definition describes the use. Thiede (2005) asserted that access should be seen as a precondition to health service use. In this context, use should, therefore, not be used as a proxy for access. Many factors often determine healthcare use even though services are technically available (Obrist et al., 2007; Parkhurst et al., 2005). Thiede (2005) posited that the best definition of access is not the potential to use, but rather the freedom to use. Thiede stressed on the need to ensure the health system must be not only medically secure but also culturally secure. Access to maternal and obstetric care, for example, should incorporate women's cultural expectation on maternal health services in addition to measures to promote quality medical care.

Some of the definitions of access to healthcare provide a summary of a set of more specific areas of fit between service-users and the healthcare system. My review of the literature was guided by Peters et al. (2008) framework of access to healthcare services, as illustrated in figure 2, and focusing specifically on low- and middle-income countries. Peter et al. framework presented four components/dimensions of access: *geographical accessibility* (the relationship between location of the service-user and the location of health services); *financial accessibility* (the relationship between the user's willingness and ability to pay for the cost of services); *availability* (the relationship between the type and quality of care needed by users, and the type of quality of care that is available); and *acceptability* (the relationship between the user's preferences and expectations about health services and the characteristics of health services provided).

Quality is placed at the center of all dimensions of access. These four dimensions are further discussed below to highlight their relationships to access to MCH services.

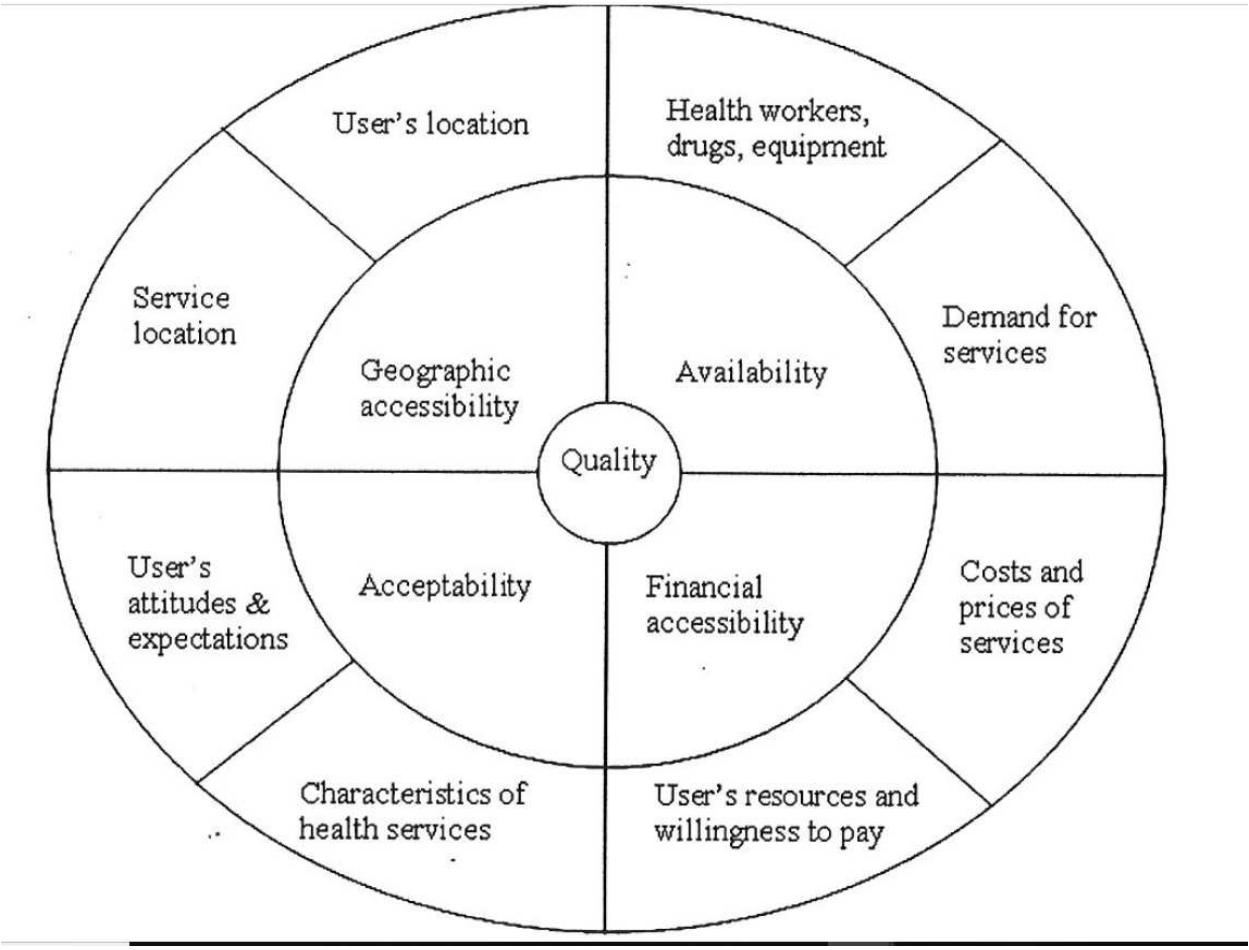



*Figure 2: Areas with potential barriers to accessing health services (Source: Peters et al., 2008)*

***Geographic accessibility.***

The geographic dimension of access means that health facilities geographical location are close enough for service-users to reach; and that the users have suitable means (such as access to transportation and road-worthy routes of sufficient quality) to reach the health facilities that are further away. Geographic accessibility to healthcare

facilities represents a fundamental barrier to the uptake of MCH services, giving rise to hidden spatial pockets of localized inequalities. Studies have consistently found an inverse relationship between the distance to healthcare facilities and the use of health services. A study by Ruktanonchai, Ruktanonchai, Nove, Lopes, Pezzulo, Bosco, et al. (2016) examined the utilization of maternal and newborn (MNH) healthcare as an emergent property of accessibility in five East African countries to sub-national inequalities. The authors considered several MNH outcomes in the context of geographic accessibility to map the likelihood of receiving care before, and after delivery. They utilized a geo-referenced dataset of nearly10,000 health facilities to generate information, including relevant maps that reflect the probability of a woman obtaining critical maternal and newborn care in the study counties of Burundi, Kenya, Rwanda, Tanzania, and Uganda. The authors calculated a geographic inaccessibility score to the nearest health facility at 300 x 300m using a dataset of 9,314 facilities from the five countries. They utilized hierarchical mixed-effects logistic regression from DHS data to examine the odds of (a) skilled birth attendance, (b) receiving 4+ antenatal care visits at the time of delivery, and (c) receiving a postnatal health check-up within 48 hours of delivery. Their findings revealed that, across all outcomes, increasing geographic inaccessibility scores were associated with the strongest effects in lowering the odds of obtaining care observed across outcomes. Specifically, for each increase in the inaccessibility score to the nearest health facility, the odds of having skilled birth attendance at delivery was reduced by over 75% (0.24; *CI*: 0.19 - 0.3), while the odds of receiving antenatal care decreased by nearly 25% (0.74; *CI*: 0.61- 0.89) and 40% for obtaining postnatal care

(0.58; *CI*: 0.45 - 0.75). The results from their study suggest that decreasing accessibility to the nearest health facility significantly deterred utilization of all maternal health care services. Similar findings have been reported in related studies in low- and middle-income countries, showing a strong influence of geographic accessibility on the use of facilities (Gabrysch, Cousens, Cox & Campbell, 2011; Lohela, Campbell, & Gabrysch, 2012; Malqvist, Sohel, Do, Eriksson, & Persson, 2010).

A significant barrier to healthcare use is the traveling time - which is often used as a measure of access to healthcare services in a health facility (Masters, Burstein, Amofah, Abaogye, Kumar, & Hanlon, 2013; Robin, Nesbitt, Lohela, Soremekun, Vesel, Manu, Okyere et al., 2016). In their study to evaluate the influence of distance and quality of care on the place of delivery in the Brong Ahato region in Ghana, Robin et al. (2016) found that distance is an important obstacle to facility delivery in the region. According to their findings, the probability of facility delivery ranged from 68% among women living 1 km from their closest facility to 22% among those living 25km away. Similar findings were reported by Kyei, Campbell, and Gabrysch (2012) study that examined the influence of distance and level of service provision at facilities on ANC use and quality of ANC received in rural Zambia. Kyei, Campbell, and Gabrysch study revealed a strong influence of both distance to facility, and level of the provision at the closest facility on the quality of ANC received. The authors further reported that, for each 10 km increase in distance, the odds of women receiving good quality ANC decreased by a quarter, while each increase in the level of provision category of the closest facility was associated with a 54% increase in the odds of receiving good quality ANC. The findings of Kyei,

Campbell, and Gabrysch study were similar to that of Keya, Rob, Rahman, Bajracharya, and Bellows (2014) on the distance, transportation cost, and mode of transportation in the utilization of facility-based maternity services in rural Bangladesh. The study of Kyei, Campbell, and Gabrysch (2012) did not, however, find any effect of distance on the timing of ANC or number of visits. Also, a better level of the provision at the closest facility was not associated with either earlier ANC attendance or higher number of visits. It can be deduced from these findings that, women residing at further distances either do not decide to seek care or are unable to identify and access a facility. This poses serious threats to the lives of both the mother and baby in obstetric emergencies. There is a need thus to ensure efforts are made to improve not only maternal health services but also their accessibility.

Studies have also shown that pregnant women if given a choice to select their preferred maternity health facility, would prefer those that are closer to their homes or place of work. Pilkington, Blondel, Drewniak, and Zeitlin (2012) conducted a study on how pregnant women's choices interact with the distance they must travel to give birth and the supply of maternity services. Pilkington et al. attempted to establish how proximity is valued by the population when the choice is not constrained. It was revealed that the majority of the women chose their maternity unit based on proximity (Pilkington et al., 2012) .

Poor geographic accessibility has also been reported to pose harm to the health of pregnant women. In their study to assess the harm of travel burden for pregnant women during prenatal care; and after controlling for age, race/ethnicity, marital status,

education, household income, weight status, and physical activity, Shi et al. (2017) found that, traveling more than 50 miles is associated with increased odds for having high blood pressure during pregnancy (*OR* = 2.867, 95% *CI* = 1.079,7.613), as compared with a travel distance shorter than 5 miles.

Geographic accessibility is a problem for every healthcare need. In their systematic review on the barriers to surgical care in low- and middle-income countries, Grimes, Bowman, Dodgion, and Lavy (2011) found geographic accessibility as one of the key barriers to accessing surgical services due to distance, poor roads, and lack of suitable transport.

***Financial accessibility***

The dimension of financial accessibility refers to the formal, informal, and indirect costs of services, and these costs do not exceed service-users' ability and willingness to pay. Financial access dimension is now considered one of the most important determinants of access to healthcare. Both direct (cost of treatment and informal payments) and indirect costs deter the poor from seeking treatment (Dalaba, Akweongo, Savadogo, Saronga, Williams, Sauerborn, et al., 2013). The indirect costs to healthcare access include the opportunity cost of time of both the service-user and the relative(s) that accompany him/her, costs of transportation, and expenses on food and lodging (Peters et al., 2008). There are economic consequences of the direct and indirect costs for paying health services, and these include catastrophic spending (spending high proportions of household finances) or distress financing (borrowing money or selling

assets); and both of which can push people into deeper poverty and longer-term debts (Peters et al., 2008; Quintussi, de Poel, Panda, & Rutten, 2015).

The ability of individuals and families to access healthcare services is contingent upon their ability to pay for the costs. Timely access to obstetric emergencies is critical if both the lives of the mother and the newborn should be saved (Khan, & Zaman, 2010). The most significant limitation faced by families in low-income countries is the out-of-pocket (OOP) payment for such services. To examine the magnitude of costs incurred by patients and households, Honda, Randaoharison, and Matsui (2011) conducted a study on the OOP cost for maternity services at a tertiary hospital in Madagascar, focusing on emergency cesarean section (CS) and neonatal care. Data on 103 women and 73 newborns were collected from the study facility within five months. The study identified 12 possible cases where both the mother and the baby required emergency CS and emergency care, respectively, and this placed a double burden on the household. This study reported that OOP cost for CS was catastrophic for poor families, and the treatment for neonatal complications also posed another serious financial burden on these families. While OOP cost for healthcare services creates catastrophic expenditure on individuals and households, one of the serious implications is the nonuse of health services even when they are badly needed. Wilunda, Scanagatta, Putoto, Takahashi, Calia, Abebe, et al. (2017) conducted a qualitative study in south-Sudan to elicit the barriers to utilization of ANC services. Their findings identified a myriad of factors that prevent women from utilizing ANC services, and prominent among them were the women's inability to meet the demand for payment for healthcare services. Similarly, findings of a systematic

review of the literature conducted by Geleto, Chohenta, Musa and Loxton (2018) on the barriers to access and utilization of emergency obstetric care at health facilities also noted the cost of services as a key obstacle. In a bid to increase access to healthcare, especially for emergency obstetric and neonatal care, financial risk protection mechanisms should be leveraged upon.

### *Availability*

The availability dimension of healthcare access refers to services relevant to the population being present and available when needed. In this case, the necessary resources, including drugs and consumables; equipment; and adequately trained staff; are all present to meet the health needs of the population. Availability is another critical dimension that can affect service uptake. When there is a lack of service availability, or when there is a perceived lack of availability by the service-users, the ultimate result is reduced use of services. It often does not matter how close a health facility is to the patients or even when services are offered free, the availability of those services is constrained if, for example, the facility is closed due to staff shortage, or the inability of the facility to provide services due to lack of essential supplies and equipment. The perception of the service-users is also a significant component for consideration in the availability dimension of access to health services. Lack of confidence in the health system as a result of perceptions of poor quality often leads to patients choosing not to seek care. Numerous studies have been conducted to examine the link between the quality of care and the utilization of health services. There is a greater likelihood that health facilities would not be used if they lack appropriate supplies, including drugs and

equipment, and also if they are not adequately staffed. For instance, it was found that individuals would choose to travel further distances for healthcare if the services are perceived to be of an acceptable standard (Adogu, Egenti, Ubajaka, Onwasigwe, & Nnebue , 2014; Kahabuka, Kvale, Moland, & Hinderaker, 2011). In Kahabuka et al. (2011) study to investigate the choices of mothers for child health care in rural Tanzania, it was found that, irrespective of the additional time, money, and another related cost on their choice, mothers or caregivers frequently bypass locally available services for those perceived as providing quality and friendlier health services. Studies have cited poor staff attitude and discriminatory conduct to patients as a determinant that influences the reasons for using or not using local health services (Adogu et al., 2014, Strasser, Kam, & Regalado, 2016). Insensitivities to the local customs and culture also have a role in the use of available services; and as reported in the study of Kahabuka et al. (2011), this can result in delay in seeking healthcare services by the local population; causing an under-utilization of the available services with dire consequences in the vulnerable women and children.

### *Acceptability*

Acceptability, as one of the dimensions of healthcare access, is also important. The perceptions, attitudes, and expectations of the service-users can determine the degree of acceptability of services provided. Acceptability, according to Dillip, Alba, Mshana, Hetzel, Lengeler, et al. (2012), is a neglected and poorly conceptualized dimension of access to healthcare. They interpreted access as a concept representing the degree of fit between the clients and the system. Based on this understanding and drawing from the

earlier works of Penchansky and Thomas (1981), Dillip et al. consider "acceptability" as the relationship of clients' attitudes about personal and practice characteristics of providers to the actual attributes of existing providers, as well as to provider attitudes and acceptable personal characteristics of clients. In this regard, the acceptability dimension of access to healthcare is dependent on either the supply- and demand-sides characteristics.

Studies have been conducted to examine how the dimension of 'acceptability' affects healthcare service delivery. Most of the studies established an association between acceptability and several attributes of the individuals, including demographic, social, and economic status. Age has been reported to be associated with high acceptability of health services. In their study, Bucyibaruta, Eyles, Harris, Kabera, Oboirien, and Ngyende (2018) reported that, for antiretroviral therapy (ART) for HIV treatment, higher odds were detected for patients aged above 40 years for maternal health service acceptability than those aged 40 years and younger in the unadjusted regression model. The findings of a systematic review by Mugglin, Estill, Wandeler, Bender, Egger, Gsponer et al. (2012) reported similar results, where older age category was associated with high acceptance of starting ART in sub-Saharan Africa. Schatz and Knight (2018) however, cautioned that patients with age above 50 years might only present to ART services referral when they are symptomatic, or when a partner is diagnosed with HIV. Higher odds of maternal health acceptability have also been reported for those aged 21 years and above when compared to mothers aged 20 years and younger (Bucyibaruta et al., 2018). In their systematic review of the determinants of adolescent health during pregnancy in sub-

Saharan Africa, Yakubu and Salisu (2018), identify non friendly adolescent reproductive services as negative health-service related determinants. As reported by Hodgkinson, Beers, Southammakosane, and Lewin (2014), low levels of acceptability for maternal health services among adolescent mother relates to higher levels of healthcare provider stigma expressed towards younger women for unwanted pregnancies; and compounded by unfriendly services for this age group overall (Yakubu & Salisu, 2018). Fatti, Shaikh, Eley, Jackson, and Grimwood (2014) study among adolescent and young pregnant women found that, compared to adult mothers, adolescent mothers were found to be more likely to present to the health facility for the first time during labor, without attendance to ANC. Their study also revealed a reduced rate of antenatal ART uptake; indicating that, the population of young mothers have poor uptake for maternal health services.

The acceptability of health services is influenced by gender. Bucyibaruta et al. (2018) study found that the acceptability of ART was higher among men than in women. The systematic review findings of Magnus, Herwehe, Murtaza-Rossini, et al. (2013) however contrast the results of Bucyibaruta et al. (2018). According to Magnus et al. (2013), male patients in sub-Saharan Africa were less satisfied with ART services. They are also found to be less likely to be retained in care than their women counterparts. Gender was also associated with acceptability for tuberculosis (TB) drugs. Chimbindi, Bärnighausen, and Newell (2014) study in South-Africa found that male patients, when compared to female patients, had lower odds for TB community acceptability.

Another dimension that has shown to have a considerable influence on patients' acceptability of healthcare provider is the socioeconomic status (SES). Bucyibaruta et al.

(2018) reported higher odds for ART provider among individuals from middle SES than those from lower SES from whom health care access means proportionately higher costs. Mugglin et al. (2012) meta-analysis on HIV diagnosis and initiation of ART in sub-Saharan Africa reported that patients with lower SES were less likely to start ART and had a higher loss to ART program. In examining the inequities in maternal health care, Wabiri, Chersich, Shisana, Blaauw, Rees, and Dwane (2016) noted that mothers from a middle SES had higher odds for maternal health provider acceptability than their counterparts from low SES.

**Determinants of Access to MCH Services**

There are numerous interacting factors recognized as key determinants to the utilization of MCH services. It ranges from social, economic, and health system factors. These factors operate at various levels and can influence health-seeking behaviors of women and for their children. An insight into factors that influence the utilization of MCH services is important for multiple reasons. Firstly, it provides an understanding of patterns of use of available services for these populations. Further, it can predict patient satisfaction as well as outcomes of care. Inherently, therefore, such understanding will inform the development of policies and interventions that promote a satisfactory utilization rate of MCH services.

The literature has a plethora of studies that have demonstrated a significant relationship between several socioeconomic factors and the use of MCH services. This section describes the role of individual and health system characteristics that can influence the utilization of MCH services in low- and middle-income countries (LMIC).

***Individual characteristics***

The sociodemographic characteristics of individuals have been widely recognized as playing an essential role in the use of health services. Maternal education has been consistently cited as one of the most significant predictors in the utilization of MCH services (Berhane, Yiman, Jibat, & Zewdu, 2018; Emina, Chirwa, & Kandala, 2014; Weitzman, 2017). There is a higher likelihood that better-educated mothers are more health literate (i.e., the ability to be more aware of health problem, having more knowledge on navigating the health system as well as correctly adhering to prescription, treatments and preventive health information) than poorly or non-educated mothers. As a proxy for higher socioeconomic status, mother's education provides her the opportunity to seek healthcare whenever she perceives it as necessary. Minh, Giang, Hoat, Chung, Huong, Phuong, and Valentine (2016) analyzed selected social determinants of health and their relationships with maternal health service coverage and child mortality in Vietnam. Minh et al. used a cross-sectional design with data from the 2011 Vietnam Multiple Indicator Cluster; with a study sample of 11,663 women aged 15-49 years. The findings of Minh et al. study highlighted the role of education on access to maternal health services. The authors reported that, incomplete education was a significant factor associated with lower access to skilled birth attendants (*OR*-0.28, 95% *CI*: 0.14-0.55; *OR*-0.19, 95% *CI*: 0.05-0.80) and a higher risk of having had a child death in the previous two years (*OR*-1.71, 95% *CI*: 1.28-2.30; *OR*-1.59, 95% *CI*: 1.20-2.10). The educational

status of both the woman and her husband or partner has been reported to consistently exhibit a positive relationship with the uptake of ANC and skilled delivery (Adjiwanoua, Bougmab, & LeGrandc, 2018; Spangler & Bloom 2010).

The mother's education has been found as a significant determinant of access to child health services (Weitzman, 2017). Studies by Alam, van Ginneken, and Timaeus (2009) on the determinants of perceived morbidity and use of child services among children in rural Bangladesh and that of Makuta and Du Toit (2016) on factors influencing the utilization of MCH services in Malawi also cited the mother's education as one of the important determinants of child health access to health services. Haider, Qureshi, and Khan (2017) study in Bangladesh highlighted that improvement of women's education and social and economic status in general, in combination with more availability of high-quality primary health care would lead to better health care of children. Grépin and Bharadway (2015) study in Zimbabwe found that increased education leads to delayed age at marriage, sexual debut, and first birth; and that increased education leads to better economic opportunities for women. Grépin and Bharadwaj findings highlighted the benefit for maternal education as they stated that, children born to mothers that have benefited from education were about 21% less likely to die than children born to mothers without education. Another study conducted by Balogun, Abiola, Yusuf, Al-Shenqiti, Balogun, and Tetty (2017) in Nigeria examined whether maternal literacy can influence complete immunization coverage in children. The results of the study indicated a prevalence ratio of 1.44 (95% *CI*: 1.16-1.77) of complete immunization in children whose mothers were educated versus those whose

mothers were not educated. It is clear from these findings that complete immunization completeness was higher for children born to educated mothers. A key reason for this is partly because maternal education leads to the acquisition of literacy skills and health-seeking behavior, which then improves immunization uptake for their children.

The age of the mother and the number of times she has given birth have been found in several studies as playing a significant role in health service utilization, especially for antenatal care and facility-based deliveries. As reported by several Scholars, the age of the mother serves as a proxy for accumulated knowledge of health services (Aggarwal, Pandey, & Bhatacharya, 2007; Chakraborty, Islam, Chowdhury, & Bari, 2002; Magadi, Agwanda, & Obare, 2007). In the case of younger women or mothers, on the other hand, they might be more knowledgeable about modern health services and place more value upon modern medicine. The correlations between maternal age at pregnancy and the utilization of skilled birth attendants are inconsistent. While some researchers reported that younger maternal age is positively correlated with facility-based deliveries (Mpembeni, Killewo, Leshabari, Massawe, Jahn, Mushi, & Mwakipa, 2007; van Eijk, Bles, Odhiambo, Ayisi, Blokland, & Rosen, 2006), the study by Yanagisawa, Oum, and Wakai (2006) reported the contrary, that older mothers are more likely to deliver in facilities with skilled birth attendants

The quality of the relationship for a woman also has a role in determining access to health services. Significant others, such as mother-in-law and husband were found to be important in accessing resources, such as support to access ANC services (Mumtaz & Salway 2007). The perceptions of the community in which a woman lives are important

determinants of maternal and child health utilization (Montagu, Yamey, Visconti, Harding, & Yoong, 2011). The findings of a study by Kruk et al. (2010) in Tanzania emphasized the critical role of women's social worlds. Kruk et al. reported that women's location of delivery was influenced by community opinions regarding the quality of the health system. Kowalewski, Jahn, and Kimatta (2000) study in Tanzania also found that the utilization of antenatal care was strongly influenced by community perceptions of the danger signs during pregnancy and labor. The competition between biomedical and community perceptions often leads to a mismatch of risks. This can influence which treatment options to seek; ranging from modern healthcare services to traditional and faith-healing methods.

The literature has also provided consistent evidence that family income, and indirectly husband's occupation or job status were significant factors that enhance greater use of maternal health care (Faiz, Batool, Ejaz, & Rashid, 2016; Fekede & Mariam, 2007; Mumtaz & Salway 2007; Paudel, Nilgar & Bhandankar, 2014; Phiri, Rattanapan,& Mongkolchati,2015; Sein, 2012;). It shows thus that, women whose husband and family are poor are constrained to seek health services promptly, and this threatens the survival of both the mother and child. There is a clear link between maternal mortality and poverty both between and within low-income countries (Bull, Mittelmark, & Kanyeka, 2013; Maraga, Namosha, Gouda, Vallely, Rare, & Phuanukoonnon, 2011). The access challenge to health care for the low-income families is, therefore, both on the demand side (i.e., the high cost of services, lack of knowledge on available services, cultural norms) and the supply side (i.e., lack of access to adequate and well-resourced facilities).

Many studies have also looked at another dimension of access to examine their influence on the utilization of maternal and child health services. Physical accessibility to MCH services, in term of transportation and distance, has been cited as an important variable that is strongly associated with the utilization of these services (Ensor & Cooper, 2004; Ghosh, & Mistri, 2016; Phoya, Mavalankar, Raman & Hussein, 2012). A significant enabling factor for the use of these services is the availability of transportation. The absence of available transportation is considered a serious risk for both the mother and child in the event of obstetric emergencies. The proximity to health services proved to be important, and this is especially for the rural population in developing countries (Ghosh & Mistri, 2016; Ibnouf, van den Borne, & Maarse, 2007). In developing countries where road network in rural areas are poor, the effect of distance on service use becomes stronger, especially when this combines with the lack of transportation (Ghosh & Mistri, 2016; Keya et al., 2014). The transportation challenges in developing countries inherently result in indirect costs of treatment on service-users, with catastrophic health expenditure to the most impoverished families.

Studies have also established that the place of residence and geographic region (especially living in rural areas), time and cost of transportation are associated with the level of utilization of MCH services ( Keya et al., 2014; Tlebere et al. 2007). The consequences are greater to the rural population who are most likely unable to meet the cost of transportation and with lesser choices for healthcare. The implications are dire on the survival of women in obstetric emergencies and their children.

While the presence or availability of health service determines their accessibility, studies have however, proved that the accessibility of health services is something more than the mere existence or availability at any given time. Health services might be physically present but factors such as customs, religion, consumer's perceptions and willingness to seek care, and health system characteristics play a role on whether women could access the services (Maraga et al., 2011; Parkhurst et al., 2005; Sialubanje, Massar, Hamer, & Ruiter, 2014).

Another strong determining factor that has been cited by many researchers in different countries is the cost of treatment (defined as high out-of-pocket household expenditure on health services). These costs include direct payment for services and indirect (such as transportation and opportunity costs). The effects of healthcare cost are reported to be stronger among the poor (Balabanova, Parkhurst, McKee, & McPake, 2006; Dalaba, Akweongo, Aborigo, Williams, Aninanya, Saueborn, & Lokanova, 2015; Montagu et al., 2011). As Simkhada, Teijlingen, Porter, and Simkhada (2008) noted in their systematic review, adequate utilization of maternal and child services in LMIC would hardly be achieved by merely increasing the number of health facilities available to women. The social, political, and economic contexts impacting women must be better understood to design facilities and health systems that enable women to access health services.

Research has consistently provided evidence that access to healthcare is a crucial determinant of health. As for maternal health, access to health for children is critical for their survival and well-being. As reported, access to health has been shown to reduce

child mortality and morbidity (Rutherford, Mulholland, & Hill, 2010). Like some of the barriers highlighted in maternal healthcare access, children also face serious barriers ranging from the sociodemographic characteristics of their parents and families to health system factors. Lungu, Biesma, Chirwa, and Darker (2016) qualitative study to explore health-seeking practices for common childhood illness and perceived barriers to accessing under-5 child health services in urban slums of Lilongwe, Malawi identified various health system barriers affecting health-seeking for child health. Among these barriers include stockouts of medicines and supplies, long waiting times, late facility opening times, negative attitude of health workers, the suboptimal examination of the sick child, long distance to health facilities, and cost of healthcare.

***Health system factors***

The decision to access MCH services does not only rely on the individual and household characteristics of women but also on health system factors that inherently have to deal with affordability, perceptions of quality among other related factors. Studies have examined the respective components of the health system about maternal health-seeking behaviors (Parkhurst et al. 2005). Some of these studies have emphasized on the significant impact of availability, affordability, and the aspect of quality in women's health behavior as well as the relationship between the patients and service-providers and maternal health outcomes (Matsuoka, Aiga, Rasmey, Rathavy, & Okitsu, 2010; Lungu, Biesma, Chirwa, & Darker, 2016; Wild, Lesley, Paul, & Nelson, 2015).

There is a lack of consensus in the literature about the exact meaning of the health system, its focus, and components. Further, while most studies examined women's socio-

economic and cultural factors in assessing maternal health services, only a few studies have considered how the broader health system also influence health care access by women. Examples of these studies include that of Nnorom (2017) investigation of health system predictors to maternal health medicines in LMIC. Another study by Ngongo (2016) examined health system influence on the utilization of ANC compliance among rural Congolese women. Bucagu, Kagubare, Basinga, Ngabo, Timmons, and Lee (2012) evaluated the impact of health system strengthening on coverage of maternal health services in Rwanda.

Using demographic and health survey data for 165,774 women in 31 LMIC, Kruk and Prescott (2012) measured the contribution of national factors, particularly health system characteristics, to the individual likelihood of professionally attended delivery for women. Kruk and Prescott's findings indicated that a range of national-level factors were important determinants of the likelihood of safe delivery for women in those countries. Higher odds of professionally attended delivery were found among women in wealthier countries; whereas greater wealth inequality within countries was associated with lower odds of attended delivery. The findings also noted the importance of health system structural factors. For example, for every 10% increase in healthcare workers per 1000, the odds of a woman having a safe delivery increased by 8%. This finding corroborates with Anand and Barnghausen (2004) ecological studies that found positive associations between country wealth, health resources, and the overall proportion of skilled birth attendance.

In their work to examine the extent to which strategic interventions to improve health system capacity may translate into greater service coverage, decreased attrition, and improved patient-level outcomes, Price, Chi, Phiri, Ayles, Chintu, Chilengi, et al., (2018) analyzed data from two studies conducted in rural and Zambia's semi-urban Lusaka Province in 2014 and 2015. Health system capacity, the primary exposure, was measured with a validated balanced scorecard approach, while the outcome, community-level maternal antiretroviral drug use at 12 months postpartum was measured via self-report in a large cohort study evaluating PMTCT program impact. Price et al. used linear regression to analyze the associations between health system capacity and the study outcome. The findings of this study noted positive trends between several domains and overall facility capacity scores. Patient satisfaction most strongly predicted maternal antiretroviral use at 12 months after delivery. The association between health system capacity and maternal antiretroviral drug use was stronger in peri-urban compared to rural facilities. In a related study on antiretroviral therapy (ART), Colvin et al. (2014) cited health system factors that led to low prioritization of maternal ART and patients' persistent dropout. Service delivery barriers included poor communication and coordination among health system actors, poor clinical practices, and gaps in provider training. These findings demonstrated the need for an improved understanding of the facility- and participant-level factors that truly affect health services generally and health outcomes to promote targeted investment in health system strengthening towards these priorities.

Health system characteristics also impact access to child health services. In their study, Fernandes, Wagenaar, Anselm, Pfeiffer, Gloyd, and Sherr (2014) examined subnational trends in child mortality and their relation to key variables related to health-system strength between 2000 and 2010, in Mozambique. They used demographic and health survey (2003 and 2011) and multiple indicator cluster survey (2008) data to examine health system factors associated with changes in child mortality. Fernandes et al.'s findings indicated that health workforce density (adjusted rate ratio 0·94, 95% *CI* 0·90 - 0·98) and maternal and child health nurse density (0·96,0·92 - 0·99) were both associated with reduced under-5 mortality rate, as were institutional birth coverage (0·94,0·90 - 0·98) and government financing per head (0·80, 0·65 - 0·98). Higher population per health facility was associated with an increased under-5 mortality rate (1·14, 1·02 - 1·28). The neonatal mortality rate was most strongly associated with institutional birth attendance, maternal and child nurse density, and overall health workforce density. The infant mortality rate was most strongly associated with institutional birth attendance and population per health facility. These results show that improvements in the health workforce, institutional birth coverage, and government health financing have an impact on child survival.

A health system strengthening intervention designed to improve child survival was implemented in peri-urban Mali. The intervention focused on removing access barriers through community health worker (CHW) active case finding, the removal of user fees for the poor, strengthened clinical infrastructure, a rapid referral network to link community members to the health system, and a package of prevention services

addressing conditions of poverty. In assessing the impact of the health system strengthening interventions, Johnson, Thompson, Atwood, Alley, Beckerman, Kone, et al., (2013) conducted four household surveys using a cluster-based, population-weighted sampling methodology with baseline at 12, 24, and 36 months. They considered the following outcomes: the percentage of children initiating an effective antimalarial within 24 hours of symptom onset; the percentage of children reported to be febrile within the previous two weeks; and the under-5 child mortality rate. According to Johnson et al.'s findings, there was a statistically significant difference in under-5 mortality between the 2008 and 2011 surveys. In 2011, the hazard of under-5 mortality in the intervention area was one-tenth that of baseline (PR 0.10, $p < 0.0001$). After three years of the intervention, the prevalence of febrile illness among children under-5 was significantly lower, from 38.2% at baseline to 23.3% in 2011 (PR = 0.61, $p = 0.0009$). The percentage of children starting an effective antimalarial within 24 hours of symptom onset was nearly twice that reported at baseline (PR = 1.89, $p = 0.0195$). These findings showed that community-based health system strengthening may facilitate early access to prevention and care and may provide a means for improving child survival.

A related study in South African hospitals also demonstrated short-term and sustained effects of health system strengthening interventions on improving mortality trends for severe pediatric malnutrition (Muzigaba, Kigozi, & Puoane, 2017). Muzigaba, Kigozi, and Puoane (2017) examined the effects of a health system strengthening intervention to improve mortality trends for pediatrics severe malnutrition in rural South African hospitals. It was reported that, the intervention was associated with a statistically

significant decrease of up to 0.4% in monthly total severe acute malnutrition (SAM) case fatality rate (CFR), a non-statistically significant reduction of up to 0.09% in monthly SAM CFR within 24 hours of admission and a non-statistically significant decrease of up to 0.11% in monthly SAM CFR among HIV-positive cases. The reduction in mortality trends for both outcomes was only slightly reversed upon the discontinuation of the intervention. While the health strengthening interventions improved child survival, it is, however, not sustainable as the reverse was noted following the discontinuation of the interventions. This is often the case of much donor-driven health system strengthening initiatives in LMIC where the governments are sometimes incapable of continuing to support projects when funding ceases.

Overall, almost all of the studies that examined the relationship between the health system and access to health services focused mainly on either the mother or the child alone. Further, most of these studies considered only one or two of the health system characteristics and their influence on maternal and child health services. Consequently, the current study examined health system factors (i.e., health facility level; the type of health facility; type of MCH provider; availability of essential drugs; and availability of basic equipment) on their relative influence on the access to not only maternal health services but also child health services.

**Studies Related to Key Constructs and Methods**

Access to quality healthcare includes several dimensions and notably availability, affordability, and acceptability. However, the provision of quality services also depends on service readiness. The World Health Organization defined ‘readiness’ as achieving

and maintaining a state of preparedness in the facility to provide comprehensive quality care to patients; indicated by the availability of trained staff, infrastructure, guidelines, essential drugs, medical commodities and diagnostic capacity (WHO, 2013a). Service readiness alone cannot guarantee the actual delivery of quality services but is being considered as one of the indispensable aspects for the provision of comprehensive quality healthcare (WHO, 2013a). The fragmentation of approaches in assessing service availability and readiness, according to WHO (2013a), is leading to various information gaps.

To address the information gap, the WHO and its global partners developed a standard tool referred to as the service availability and readiness assessment (SARA). The tool allows the capturing of facility readiness comprehensively and therefore, fills the critical information gaps in evaluating health system strengthening programs (WHO, 2013b). The SARA is intended to be a rapid assessment of the availability and readiness of health facilities to provide quality health services. This assessment involves the collection of data from a range of health system components, including human resources, basic equipment, health supplies, and infrastructure, among other parameters. SARA survey is part of the strong country monitoring systems of facilities and readiness to deliver services, and track how health system responds to increased inputs and improved outputs and impact on the health system (Andriantsimietry, Rakotomanga, Rakotovao, Ramiandrson, Razakariasy, Favero, Gomez, et al., 2016).

SARA is today one of the most widely employed, standardized health facility assessment tools that generate nationally representative data on health service delivery

and quality in LMICs (Sheffel, Karp & Creanga, 2018). Studies aim at examining health system functionality, and its responsiveness to the health needs of especially mothers and children have employed SARA methodology and its data. For example, Aftab, Hassan, Bari, Hossain, Hasan, Azad et al. (2017) conducted a pilot cross-sectional study to assess health facilities using SARA tool in Tangail, Bangladesh to inform plans for scaling-up the assessment across all health facilities in the country. The report of their study after segregating general service readiness into five domains revealed the following readiness scores: basic amenities (53.06%), basic equipment (83.33%), standard precautions for infection prevention (55.56%), and basic equipment (58.93%) for included health facilities. Similarly, specific service readiness includes family planning (48.15%), child immunization (67.71%), preventive and curative care (71.43%), and basic surgery (93.33%). Aftab et al.'s study revealed the strength and weakness of health facilities in providing maternal and child health services. As part of measures to inform the design of effective interventions to reduce maternal, newborn and child mortality and morbidity in Madagascar, Andriantsimietry et al., 2016 conducted an assessment on 52 public health facilities, ranging from university hospitals (CHU), referral district and regional hospitals (CHD/ CHRR) to basic health centers (CSB) using the SARA tool. The findings of the assessment were: for basic emergency obstetric and newborn care (BEmONC) readiness, on average, CHU had nine (71.8%), CHD/CHRR had eight and CSB had six out of the thirteen tracer items. Regarding the availability of the eleven tracer items for comprehensive CEmONC services, on average a CHU had nine ( 80.0%), a CHRR had eight (71.1%), and a CHD that is the only type of hospitals in the rural area had three

tracer items (30.0%). Tracer item availability results are low, indicating the need to strengthen supplies at basic health centers to improve the quality of maternal, newborn and child health services in Madagascar; and ultimately to reduce mortalities of these vulnerable population.

Kanyangarara, Chou, Creanga, and Walker (2018) conducted a study that aimed at giving insight into obstetric availability, readiness, and coverage in LMIC was conducted in 17 countries. Kanyangarara et al. linked facility data from SARA, with corresponding household survey data obtained from the demographic health survey (DHS) and multiple indicator cluster surveys (MICS). A total of 111,500 health facilities were surveyed across 17 low-income and middle-income countries. The study results revealed median percentages of 19% and 10% of facilities offering emergency obstetric care and "ready to provide obstetric services" respectively. A considerable rural-urban difference was noted in the analysis with 19% and 29% in the availability of facilities offering emergency obstetric care and 'ready to provide obstetric services' respectively. The low levels of availability, readiness, and coverage reported in LMIC countries may have resulted in substantial missed opportunities of these countries' health systems.

The SARA methodology has also been used to examine the provision and state of readiness of health facilities in the delivery of child health interventions. A study in Bangladesh assessed the general service and child immunization-specific health facility readiness. Shawon, Adhikary, Ali, Shamsuzzaman, Ahmed, Alam, Shackelford et al. (2018) randomly selected a total of 123 health facilities from different levels of service, including both public and private health facilities from two administrative divisions of

Rajshahi and Sylhet. The results were as follows: the general service readiness index for pharmacies, community clinics, primary care facilities, and higher care facilities were 40.6%, 60.5%, 59.8%, and 69.5%, respectively in Rajshahi division; and 44.3%, 57.8%, 57.5%, and 73.4%, respectively in Sylhet division. Facilities at all levels had the highest scores for basic equipment (ranged between 51.7% and 93.7%) and the lowest scores for diagnostic capacity (ranged between 0.0% and 53.7%). A lack of readiness in various aspects was clear from the findings of this study, and most notably is the health facilities diagnostic capacity. As a standard and widely used tool to monitor the status of health facilities, concerns have been raised on the comprehensiveness of the tools to generate information for newborn care. For instance, in their review of health facility assessment tools' ability to capture service readiness for inpatient care for small and sick newborns, Moxon, Guenther, Gabrysch, Laryea, Ram, Niermeyer et al., (2018) identified several measurement omissions that are needed to capture information on key intervention areas and follow-up services, as well as specialized staff and service infrastructure. Much input is needed for the SARA tool to ensure readiness to provide inpatient care for small and sick newborns.

The use of the SARA methodology tool to assess health facility preparedness to provide care has not only limited to maternal and child health care. The tool has recently also been used to assess the readiness status and the availability of services for non-communicable (NCD) diseases. Getachew, Bekele, Amenu, Defar, Teklie, Taye, et al. (2017) used the SARA tool to evaluate the availability and readiness of health facilities for NCD in Ethiopia. They assessed a total of 547 public and private facilities comprising

of hospitals, health centers, and clinics across 11 regions within Ethiopia. The results of the evaluation were as follows: the availability of diagnosis and management of diabetes, cardiovascular disease, chronic respiratory disease, and cervical cancer were 22 %, 41 %, 45 %, and 2 %, respectively. The cervical cancer diagnosis was the least available; only 2 in 10 facilities offered this diagnosis service. Among all health facilities providing services for NCDs, the availability of trained staff for diabetes, cardiovascular disease, chronic respiratory disease, and cervical cancer prevention and control were 10 %, 7 %, 8 %, and 61 % respectively. Among health facilities that were offering diabetes diagnosis and management services, none of them had all thirteen services. On average, 53 % of facilities had seven of the thirteen items. Among the facilities that provided cardiovascular disease services, only 1 % of them had all twelve items. On average, 41 % of these facilities had six of the twelve items. From health facilities that were providing diagnosis and management of cervical cancer, only five out of ten health facilities had all four items. On average, 72 % of facilities had two out of the four items. Rural and urban differences were noted in the overall levels of NCD diagnosis in health facilities. For example, for diabetes diagnosis and management, the variation between urban and rural health facilities was 34 % and 5 % respectively.

In a related study to assess the level of preparedness of lower-level health facilities in Tanzania for the outpatient management of hypertension, Bintabara and Mpondo (2018) used the SARA tool to survey 725 health facilities, 73 % of whom are located in rural settings. Bintabara and Mpondo findings indicated that only 28 % of the assessed facilities were considered prepared for the outpatient primary care of

hypertension. About 9% and 42% of the assessed facilities reported to have at least one trained staff and guidelines for hypertension, respectively. In the multivariate analysis, private facilities [*AOR* = 2.7, 95% *CI*; 1.2-6.1], urban location [*AOR* = 2.2, 95% *CI*; 1.2-4.2], health centers [*AOR* = 5.2, 95% *CI*; 3.1-8.7] were significantly associated with preparedness for the outpatient primary care of hypertension.

Biswa et al., (2018) assessment on the readiness of health facilities for diabetes and cardiovascular services in Bangladesh reported that 58% and 24.1% of the facilities had diagnosis and treatment services for diabetes and CVD, respectively. Shortage of trained staff (18.8% and 14.7%) and lack of adequate medicine supply (23.5% and 43.9%) were identified to be factors responsible for inadequate services for diabetes and CVD. The results of all these studies show a sub-optimal service availability and readiness of the health facilities to provide NCD-related health services.

**Review and Synthesis of Studies Related to Key Independent and Dependent Variables**

Much of the research on the utilization of maternal and child health services focus on individual predisposing and enabling factors. As emphasized in many studies, the decisions of women and mothers of children accessing healthcare are also dependent on community and national contexts (Minh et al., 2016). There is also an interplay between systemic factors and individuals' choices. Global efforts have been directed to LMICs through varied health system strengthening initiatives to reduce the high rates of morbidities and mortalities, especially among the vulnerable women and children. In this section, the review focuses on examining the extent to which the independent variables,

i.e., health system characteristics (skilled birth attendants; health infrastructure; and medical commodities: equipment and essential medicines) contribute to the access of maternal and child health services (dependent variable) in low-and-middle-income countries.

***Availability and access to health providers including skilled birth attendants.***

One of the critical components of a functioning health system is the human resources for health; as maintaining and improving population health requires the right mix of health providers. It has been reported that the lack of health providers and inequity in their distribution, especially physicians are potential barriers to accessing healthcare (Lassi, Musavi, Maliqi, Mansoor, de Francisco, Toure, & Bhutta, 2016; Rosenblatt, Andrilla, Curtin, & Hart, 2006). Shortages of healthcare providers are strongly associated with the poorer health status of communities (Kohrs & Mainous, 1995); as such shortages often lead to a reduction or lack of health services capacity with dire consequences on patient safety (Goodman, Fisher, Stukel, et al., 1997; O'neill, 2003).

The presence of certain critical resources, including health professionals, can prevent most of the maternal deaths, stillbirths, and neonatal deaths (Lassi et al., 2016). It has been widely reported that, access to skilled birth attendant (SBA) and to EmONC, in the case of obstetrics and neonatal complications, are effective interventions towards the reduction of the number of global maternal and newborn deaths (Lawn et al., 2011; Oestergaard, Inoue, Yoshida, Mahanani, Gore, Cousens et al., 2011; Scott & Ronsmans, 2009; WHO, 2010). The World Health Organization defined SBA as an accredited health professional such as a midwife, doctor or nurse who has been educated and trained to

proficiency in the skills needed to manage normal (uncomplicated) pregnancies, childbirth and the immediate postnatal period, and in identification, management and referral of complications in women and newborns (WHO, 2004b). Adegoke, Utz, Msuya, and van den Broek (2012) emphasized the importance of SBA but also pointed on the need for an enabling environment to conduct save deliveries and newborn care when they stated that, skilled birth attendants working together within an enabling environment constitute skilled birth attendance. Studies have shown a strong correlation between an increased proportion of births attended by SBA and a reduced maternal mortality ratio (Adegoke & van den Broek, 2009; Campbell et al., 2005; Doctor, Nkhana-Salim, & Abdulsalam-Anibilowo, 2018). More recently in LMIC, a correlation between an increase in the number of births attended by an SBA and a reduction in MMR has been noted (Campbell et al., 2005; Li, Luo, Deng, Jacoby, & de Klerk, 2007). The strategy of having all births to be managed by SBA is premised on the suggestion that, the availability of skilled services at birth has the potential of managing maternal complications and may be readily referred to specialist for further attention (Atuoye, Dixon, Rishworth, et al., 2015; Campbell & Graham, 2006; Crowe, Utley, Costello, & Page, 2012; Graham, Bell, & Bullough, 2001), thereby leading to a reduction by 27%, 18%, and 50% of stillbirths, neonatal deaths and maternal deaths respectively (Pattinson, Kerber, Buchmann, Friberg, Belizan, Lansky et al., 2011).

Despite the recognition of the importance of SBA in the reduction of maternal and neonatal deaths, LMICs are still struggling to have the required and sufficient professionals that should serve as SBAs. In their study to map the cadres of health

providers considered as SBAs in sub-Saharan Africa, Adegole et al. (2012) reported that, cadres not considered SBA performed deliveries and provided EmONC functions. This underscores the human resource for health shortages in this region; with dire consequences on the survival of women and children. The shortage of health workers including SBA was considered as one of the significant constraints for the inability of many countries, especially among LMICs, to attain the three health-related MDG targets (Chen et al., 2004; Cometto & Witter, 2013; Haines & Cassels, 2004; Travis, Bennett, Haines, Pang, Bhutta, Hyder, Pielemeier et al., 2004). In addition to the shortages, there is also an uneven distribution of the health workforce (Speybroeck, Ebener, Sousa, Paraje, Evans, & Prasad, 2006). The African region has the highest burden of diseases but only has access to 1% of the world's health professionals (WHO, 2006). Asia, despite having half of the world's population has access to only 30% of the world's health workforce (WHO, 2006) whereas America which has 10% of the global burden of disease has approximately 40% of the global health professionals (WHO, 2006). The uneven distribution of health professionals also occurs within each country with a lower number of professionals in the rural compared to urban areas (Efendi, 2012; Zurn, Dal Poz, Stilwell, & Adams, 2004). The mal-distribution of health professionals is compounded by the difficulties of recruiting and retaining staff in many LMICs. These countries are grappling with challenges such inadequate number of medical and nursing schools, poor staff remunerations, poor working conditions, lack of professional development, low morale and motivation among others (Lehmann, Dieleman, & Martineau, 2008). These challenges are undermining LMICs' ability to attract and retain

health professionals; with many moving to wealthier countries (Kirigia, Gbary, Mathuri, Nyoni, & Seddoh, 2006; Lassey,Lassey & Boamah, 2013).

The shortages and mal-distribution of health professionals mean some births will occur in the absence of SBAs. According to Doctor et al. (2018), at least half of all births in LMICs are not managed by SBAs. Several factors, other than the shortages of health professionals, have been cited to be responsible for the nonSBA managed deliveries in LMIC (Gabrysch & Campbell, 2009). These include sociocultural factors, lack of understanding of the importance of skilled birth attendance at birth, financial hardship, and physical challenges in accessing health facilities (Gabrysch & Campbell, 2009). Studies have also found factors such as urban and rural residence and wealth disparities to separately influence the utilization of maternal health services including SBA (Atuoye et al., 2015; Kawakatsu et al., 2014; WHO, 2015c). These factors can directly or indirectly affect decision-making to seek care and the ability to access health services.

In their study to explore the determinants of utilization of ANC visits and delivery by an SBA in Ethiopia, Wulinda et al. (2015) found that, attendance of at least 4 ANC visits was positively associated with wealth status, knowledge on the recommended number of ANC visits and attitude towards maternal health care. Skilled birth attendance at delivery was found to be positively associated with urban residence, wealth, and perceived good quality of maternal health services. The findings of Wulinda et al. further demonstrated the need for continuous effort in raising awareness on the importance of ANC and SBA as well as improving the quality of care. This can result in increase

delivery by SBA, reduce inequities and prevent the death of a mother and the baby from birth complications.

In a study to examine the impact of residential wealth index on the utilization of SBA in Nigeria and Malawi, Atuoye, Amoya, Kuuire, et al., (2017) analyzed 6 DHS datasets in both countries. The authors reported that residential wealth index was a significant predictor of utilization of skilled delivery services. Another study by Shimamoto and Gipson (2015) examined women's empowerment and its influence on SBA use in Senegal and Tanzania. Shimamoto and Gipson analyzed multiple dimensions of empowerment from the 2010 DHS, conducted a multivariate regression analysis to examine the association between these empowerment dimensions and SBA use. Shimamoto and Gipson's study found that women's status and empowerment were positively related to SBA use. Wealth and residence, among other socio-demographic characteristics, were also found to have similar effects in both countries.

Women's education as a form of empowerment has also been found to be an important predictor of SBA use. Fagbamigbe, Hurricane-Ike, Yusuf and Idemudia (2017) study in Nigeria found that educated women used SBAs more than uneducated women (92.4% vs. 13.1%), and their odds ratio of using SBA were three times that of uneducated women (*OR*=3.09, 95 *CI*=2.17- 4.38). Fagbamigbe et al. also found that women involved in decision-making regarding their use of health facility were 12% more likely to use SBA than others who do not. The findings of all these studies illuminated the importance of reducing poverty gaps between and within countries and women's empowerment for improved maternal and child health outcomes. Improvements in both the human resource

for health and quality of health services are required to be made by LMICs to optimize the utilization of MCH services including SBA; which resultantly will reduce preventable childbirth-related complications and deaths.

***Availability and access to medical commodities.***

Another critical component for effective health service delivery is the availability of essential medical commodities (i.e., medicines, medical consumables, and equipment). These commodities, according to WHO (2004), are required for maintaining population health. Studies have demonstrated an association between shortages of medical commodities and quality of care (Donabedian, 1988; Donabedian, 2005). The absence of sufficient medical commodities such as medicine and equipment will hamper the provision of services, undermine the quality of care, and resultantly leads to low levels of patients' satisfaction and preventable deaths (Macha, Harris, Garshong, Ataguba, Akazili, Kuwawenruwa et al., 2012; Mkoka, Goicolea, Kiwara, Mwangu, & Hurtig, 2014; Penfold, Shamba, Hanson, Jaribu, Manzi, Marchant, Tanner et al., 2013). When drugs are in short supplies, patients and families often would have to procure medicines outside the health facilities and often at a higher cost. The shortages of medicines, among other medical commodities in public health facilities, have been cited as responsible for a large share of the out-of-pocket payments (OOP) faced by households in LMICs (Cameron, Ewen, Ross-Degnan, Ball, & Laing, 2009; WHO, 2004a). This poses a serious threat to healthcare accessibility and affordability by the majority poor. Health systems of LMIC have the difficult challenge of ensuring the availability of essential medical commodities (Borghi & Binyaruka, 2017), especially for children (Sado & Sufu, 2016). The United

Nations Commission on Life Saving Commodities estimates suggested that, across LMICs, just a third to half of the children received basic drugs to treat some of the commonest childhood illnesses such as diarrhea and pneumonia. Similarly, only a third of women received appropriate management for major causes of maternal deaths such as eclampsia and postpartum hemorrhage (Pronyk, Nemser, Maliqi, Spingstubb, Sera, Karimov, Katwan, et al., 2016). The United Nations (2012) note that, the persistent gaps in the availability of and access to life-saving commodities have been identified as major obstacles to achieving universal basic health care for pregnant women and children.

Access to essential medicines (EM), as noted earlier, is one of the biggest challenges of LMICs' health systems. More than half of the population of these countries lack access to EM (Elamin, Izham, Ibrahim, Abd, & Yousif, 2010). It has been reported that access to EM is influenced by many interlinked factors and among them include the availability of medicines in health facilities, availability of sustainable financing and reliable health systems, rational selection and use of medicines, and affordable prices (Hinsch, Kaddar, & Schmitt , 2014; Zaidi, Bigdeli, Aleem, & Rashidian, 2013). Finding the recommended dosage for children in the healthcare facilities is also another factor that is limiting access of EM to the sick children (Anson, Ramay, & Esparza, 2012; Jiang, Yang, Yan, Liu, & Zhao, 2013). Sado and Sufa (2016) conducted a study in the Western part of Ethiopia to assess the availability, prices, and affordability of EM for children to determine their accessibility for children. Sado and Sufa found an average availability of 43% and 42.8% of public and private sectors, respectively. Sado and Sufa stated that medicines were unaffordable both at public and private health facilities for the treatment

of common conditions within the study area. The low availability and high prices of EM, as concluded by the Sado and Safu hampers the accessibility of these commodities to the vulnerable children. In contrast to the findings of Sado and Safu (2016) where public health facilities were found to having greater availability of EM, a study by Balasubramaniam, Beneragama, and Ranganathan (2011) in Sri Lanka however, found a greater availability of EM in private hospital at 80% compared to public hospitals at 52%. This has implications for children from poor households who cannot afford the high costs of services in private hospitals.

Among the factors that will influence health-facility delivery is the perception of quality by service-users and their families. There is a high preference for facility-based childbirth when there is an appropriate quality of care, with the necessary medical facilities (Abdullah, Choo, Hesse, Abantanga, Sory, Osen, Ng, et al., 2011; Sakeah, McCloskey, Bernstein, Yeboah-Antwi, Mills, & Doctor; 2014). It is therefore mandatory that facilities have available and accessible emergency obstetric services such as parental oxytocics, antibiotics, and anticonvulsants, assisted deliveries, manual extraction of the placenta and so on, to guarantee the continuum of quality maternal healthcare (Bossyns, Abache, Abdoulaye, Miye, Depoorter, & van Lerberghe, 2006; Paxton, Maine, Freedman, Fry, & Lobis, 2005). In LMIC, the availability of these medical commodities for quality maternal health care remains a challenge.

Tran and Bero (2015) found a variation among countries on the availability of essential maternal medicines. As noted in Tran and Bero findings, there is high availability of oxytocin in six out of the seven countries studied compared to ergometrine.

Ergometrine was found to be available in a higher percentage in health facilities in the Philippines and the Solomon Islands than oxytocin. In the same study, it was found that less than 60% of health facilities have MgSO4 available; with only 18% of facilities in Laos had MgSO4. A similar review conducted by Smith, Currie, Cannon, Armbruster, & Perri (2014) found that 34 out of 37 of the countries assessed also reported regular availability of oxytocin in the national medical stores. This availability also reflected in the health facilities with 89% and 76% of countries reported regular availability of oxytocin and MgSO4 respectively. The high availability of oxytocin and MgSO4 in health facilities is not the same as misoprostol; as only 27% of the countries studied reported regular availability in health facilities. Amidst the concerns for the availability of these medicines is also their affordability. In Smith et al. (2014) study, 70% (26 of 37) of the countries reported that oxytocin was offered for free at public health facilities to the clients. This is not the case in nine other countries where respondents stated that oxytocin is not offered freely even though the national policy stated otherwise. Both the issues of availability and affordability of these life-saving commodities have serious implications for the survival of women during childbirth.

Several researchers have examined factors that undermine the provision of maternal health services, and almost all of these studies have cited the inadequate supplies of EM and equipment. Sumankuuro, Crockett, and Wang (2018) conducted a qualitative study of health workers and community members in Ghana to explore the perceived barriers to maternal and newborn health services. Their findings show significant barriers affecting the quality and appropriateness of maternal and newborn

health services. Among the notable obstacles are inadequate medical equipment and essential medicines; and infrastructural challenges. Similar findings were observed in a related study by Mugo, Dibley, Damundu, and Alam (2018) in Sudan where the lack of essential medicine, supplies, and equipment contributed to the inadequate quality of ANC services.

***Influence of health Infrastructure on service delivery.***

While it is evident that health personnel and medical commodities such as drugs and equipment play a critical role in the provision of healthcare services, the role of the healthcare infrastructure is equally important to ensure services are of an excellent standard. In the context of the health care system and reference to health care facilities, facility infrastructure is defined as the total of all physical, technical and organizational components or assets that are prerequisites for the delivery of health care services (Scholz, Ngoli, & Flessa, 2015). Infrastructure is, therefore, a major component of the structural quality of the health care system. Both the functionality and quality of the 'infrastructure' component of health care system determine the accessibility, availability, quality, and acceptability of health services as well as the working condition of facility staff (Choo, Perry, Hesse, Abantanga, Sory, Osen, et al., 2010; Fotso & Mukiira, 2012; Urassa, Carlstedt, Nystrom, Massawe, & Lindmark, 2002). Even though the relevance of health facility infrastructure on quality service provision is well acknowledged, there is, however, limited literature on the subject (Scholz et al., 2015). In this section, the literature on health facility infrastructure is reviewed to highlight the extent to which the component can facilitate or hinder MCH services.

There is wide agreement in the literature that the health systems in LMIC face governance challenges in delivering health services, and this affects mostly the vulnerable population of women and children. One of the common issues has to do with the quality of health infrastructure; as both the facilities and utilities to support primary healthcare service delivery are of poor quality (WHO, 2006). The poor status of health infrastructure has been cited by a good number of studies as a barrier to the utilization of MCH services. One of the main reasons reported in a study in Cambodia for the nonuse of maternal health services was the lack of ward space to allow women to rest after delivery (Matsuokaa et al., 2010). Hsia, Mbembati, Macfarlane, and Kruk, (2012) also reported that the poor status of buildings, the unreliable supply of utilities such as water and electricity could undermine the delivery of quality maternal and child health services. Reliable basic infrastructure, particularly electricity and water, are critical enabling factors in improving the health system and consequently, contribute to the attainment of the SDGs. As found out by a study to determine the effect of a rural electrification project that provides 24-hour electricity on health facilities and MCH services in Gujarat, India, Chen, Chindarkar, and Xiao (2016) reported that the reliable electricity significantly improved the operational capacity of health facilities. This was facilitated by the increasing availability and functionality of a wide range of essential devices and equipment. It was further noted that the utilization of MCH services was significantly increased (Chen, Chindarkar, & Xiao, 2016).

Despite the available evidence on the positive contributions of both electricity and water and sanitation facilities to quality healthcare delivery, LMICs face challenges in

providing these utilities. Odagiri, Azhar, Cronin, Gressando, Hidayat, Utamin et al. (2018) assessment on water and sanitation facilities in Indonesia reported that one-quarter of primary health care did not have access to a combination of basic water and sanitation services; with significant regional variation (10.6%-59.8%). Also noted was that 72% of three important locations within the health facilities, i.e., consultation room, immunization, and the delivery room lacked hand washing facilities. A related study by Omuta (2016) examined the physical amenities (including the sources of electricity and water) in primary health care centers in Delta state, Nigeria. Varying degrees of infrastructural deficiencies were observed: 34.22% of the health facilities had no access to safe water, and over half (51.33%) were not connected to the national grid. A study by Nguyen, Wilson, and McDonald (2017) explored the perspective of maternal health workers on how infrastructure impacts the provision of maternity services in rural Vietnam. Their findings revealed a deficit of facility buildings and inadequacy of clean water supply as issues undermining quality MCH services delivery.

Healthcare delivery is carried out at different levels of the healthcare system, and this includes primary, secondary, and tertiary health care facilities. The delivery of healthcare services involves the first-contact, continuous, comprehensive, and coordinated care provided to individuals irrespective of age, gender, or disease (Starfield, 1994). The first point of contact for sick individuals is usually the primary care through clinics and health centers. Scholars have demonstrated that effective primary care is associated with improved access to health services, reduced hospitalizations in secondary or tertiary healthcare facilities (Hung, Rane, Tsai & Shi, 2012; Starfield, Shi & Macinko,

2005). Service-users hold different perceptions of the quality of care provided in health centers (primary care) and hospitals (secondary and tertiary care). Most people in China are reported to hold the perception that the quality of care in a hospital setting is superior to the care provided in health centers; hence, there is more use of hospitals for primary healthcare needs than health centers (Hu et al., 2016). Recent findings of a study to compare the quality of care provided at different care settings by Hu et al. (2016) in Guangdong Province, China contrast those perceptions. According to Hu et al., the community health center was associated with higher scores in quality of care than secondary and tertiary hospitals. Further, they found that patients visiting community health centers were more likely to report satisfactory experiences compared to those from secondary and tertiary hospitals. Similar findings were reported by different comparative studies among primary care users in the US healthcare settings; and health centers were found to achieve a higher quality of care (Forrest &Whelan, 2000; Shi, Lebrun, Hung, Zhu, & Tsai, 2012). However, the analysis conducted by Kruk et al. (2016) on the quality of basic maternal care in health facilities in Kenya, Namibia, Rwanda, Tanzania, and Uganda reported different results. Kruk et al. found that the quality of care in primary care facilities was substantially poorer than at secondary facilities.

Healthcare system comprises of both public and non-public (private and faith-based) health facilities. The use of these institutions by individuals is influenced by many factors, including sociodemographic, social structures, educational level, economic status, and health system factors (Shaikh & Hatcher, 2004; Stevenson, Cox, Britten, & Dundar, 2004). There is also a perception, as reported by Giusti, Criel, and Bethune

(1997) that public health facilities are seen as the preserve for the poor, while private health facilities are perceived to serve more affluent people. This perception may not be unconnected with the cost of care at private facilities as it is often more expensive than the public health facilities. Some studies have been conducted to compare the utilization of public and private health facilities. Shayo et al. (2015) conducted a study in Tanzania to compare the access and utilization of quality, equity, and trust in the Mbarali district. The findings of Shayo et al.'s study revealed that respondents who visited public health facilities reported medicine shortages more than those who visited nonpublic health facilities. They also reported that respondents who visited public facilities were 4.9 times less likely than those who visited non-public facilities to emphasize the influence of cost in accessing and utilizing health care (*OR*=4.9, *CI*:3.9-6.1). A significant difference was found in the provider-client relationship with a satisfaction level of 89.1% and 74.7% in private and public facilities, respectively (*OR*=2.8, *CI*: 1.5-5.0). This shows that the level of client trust is lower in public health facilities than in private health facilities.

A Colombian survey conducted by Perez, Dennis, Rondo, Metcalfe, and Rown (2016) to compare intensive care mortality ratios between private and public hospitals also reported a better standard of care and facilities in private hospitals than public hospitals. According to Perez et al., the mortality ratio ranged from 0.59 to 2.36; and the four intensive care units with the lowest mortality ratio belonged to private institutions; while four of five institutions with the highest mortality ratio belonged to the public sector. Also, intensive care in private institutions has lower median length of stay, and

higher education training for specialists and nurses. The substantial differences between private and public intensive care units may be associated with patient outcome.

Another study to assess the capacity of the health facilities for comprehensive HIV/AIDS care was conducted by Deribew et al. (2018) in Ethiopia. Deribew et al. assessed the structural, process, and overall capacity of the health system based on the Donabedian quality of care model. The authors used multiple linear regressions to assess the association of the location and type of health facilities with the overall capacity score. Deribew et al. findings revealed that public hospitals have a better capacity score (77.1%) than health centers (45.9%) and private health facilities (24.8%). A higher overall capacity score for urban (45.9%) health facilities than rural (38.2%) health facilities (β = 15.4, 95% *CI*: 11.7, 19.2) was also observed. Health centers (β = - 21.4, 95% *CI*: -25.4, -17.4) and private health facilities (β = -50.9, 95% *CI*: -54.8, - 47.1) had lower overall capacity score than hospitals. There is a clear demonstration from the findings of Deribew et al. study that the capacity of health facilities for HIV/AIDS care and treatment is poor in the private facilities and health facilities compared to hospitals.

***Availability and Access to EmONC Services***

Consistent evidence has cited hemorrhage, hypertensive disorders, and sepsis as responsible for more than half of the maternal deaths globally (Say, Chou, Gemmill, Tuncalp, Moller, Daniels, Gulmezoglu, et al., 2014). These causes can be prevented by medical interventions that are termed as ‘signal functions’ for EmONC (Paxton et al., 2005; UN, 2009). EmONC is subdivided into basic emergency obstetric and newborn care (BEmONC) and comprehensive emergency obstetric and newborn care (CEmONC).

According to the UN (2009), a designated BEmONC facility should have seven specific signal functions: (i) administering parenteral antibiotics, (ii) administering uterogenic drugs for active management of the third stage of labor and prevention of postpartum hemorrhage, (iii) use of parenteral anticonvulsants for the management of pre-eclampsia/eclampsia, (iv) manual removal of placenta, (v) removal of retained products (e.g. manual vacuum extraction, dilatation, and curettage), (vi) performing assisted vaginal delivery (AVD), i.e. vacuum extraction or forceps delivery, (vii) performing basic neonatal resuscitation). A designated CEmONC facility should have a total of nine signal functions including the seven as in BEmONC and including caesarian section (CS) delivery and blood transfusion services to be available 24 hours a day, seven days a week (UN,1997; 2009). The United Nations recommend that, for every 500,000 population, there should be at least five EmONC facilities (UN, 1997; 2009). However, ensuring the availability of services does not only have to do with an adequate number of facilities. The functionality of the signal functions is also very important, and the population coverage of the signal functions for EmONC is an important indicator for preventing maternal and perinatal deaths (Roy, Biswas & Chowdhury, 2017).

The health system components described in previous sections namely, the human resources for health (skilled birth attendants), medical commodities (essential drugs and equipment), and health infrastructure have a significant influence on the functionality of the signal functions in EmONC facilities. Meeting the requirements of all the signal functions for effective EmONC operations is still a challenge in many LMICs. Researchers that have conducted studies in countries in Africa on health facilities

EmONC compliance have reported that the proportion of facility-based deliveries and the met need for EmONC were low (Admasu, Haile-Mariam, & Bailey, 2011; Girma, Yaya, Gebrehanna, Berhane, & Lindtjorn, 2013). This is linked to the poor staffing of the facilities, with staff lacking the required competencies. Also, drugs, equipment, and other supplies are lacked in the facilities which undermined the capacity of the facilities to perform the signal functions. A study was conducted in Burundi and Uganda by Chi, Bulage, Urdal, and Sundby (2015a) to explore the barriers to the effective delivery of EmONC services. Participants were health providers and staff of NGOs in maternal health. Chi et al. reported challenges on the availability, quality, and distribution of EmONC services. The common barriers reported in the two countries included a shortage of qualified staff, lack of essential medicines and equipment; and the weak governance of the health facilities.

Ntambue, Malonga, Cowgill, Dramaix-Wilmet, and Donnen (2017) conducted a study to assess the availability, use, and quality of EmONC according to the WHO standards in 53 of the 180 health facilities that provide maternity care in Lubumbashi, Democratic Republic of Congo. The findings revealed that the availability of EmONC falls short of the WHO standards. There was no facility, except one tertiary hospital, that provides all the EmONC signal functions. However, all had carried out at least one of the nine signal functions during the three months preceding our survey. It was also revealed that the population coverage for EmONC was very low. There was only one comprehensive EmONC facility providing services to a catchment area of 918,819 inhabitants; this is far below the WHO recommended five EmONC facilities for every

500,000 population. Girma et al., (2013) study in the Gamo Gofa Zone of south-west Ethiopia also found low EmONC coverage for the population. According to Girma et al., only a total of five BEmONC and CEmONC compliant facilities was serving a population of 1.7 million. This is below the UN's minimum recommendation; where a total of 14 BEmONC and CEmONC facilities are required to serve the 1.7 million population.

Strengthening health facilities to provide EmONC functions has been the focus of many health systems in LMIC, and evidence has demonstrated the impact of the initiative on MCH service provision and outcomes. Mirkuzie, Sisay, Reta, and Bedane (2014) conducted a cross-sectional study to examine the changes in maternal and neonatal outcomes between 2008 and 2013 in Addis Ababa, Ethiopia. Mirkuzie et al. found that all the health centers (BEmONC) had a continuous water supply. Access to a 24-hour ambulance service is about average; with 50% access in 2013 as compared to 34% in 2008. There were consistent improvements in the availability of uterotonic drugs, with 85% in 2008 and 100% in 2013. Mirkuzie et al. however found no significant improvements in the knowledge and competencies of providers on post-partum hemorrhage (PPH) management and essential newborn care.

To investigate the changes on the availability, use, and quality of EmONC services in Mozambique, Augusto, Keyes, Madede, Abacassamo, de la Corte, Chilundo and Bailey (2018) conducted secondary data analysis of two nationally representative cross-sectional EmONC (2007 and 2012) assessments to examine the signal functions by type of facility and volume of deliveries. While the findings noted many signs of

improvement within the five years of both assessments, there were, however, some challenges. According to Augusto et al., there was a highly visible expansion on the provision of individual functions among BEmONC health facilities, but the performance at the CEmONC health facilities was found to be less satisfactory. Few hospitals were reported to provide assisted vaginal delivery, obstetric surgery, and blood transfusions. Signs of improvements were noted for other key indicators such as institutional deliveries, including CS delivery. Overall, the availability of facilities providing the full range of signal functions decreased between 2007 and 2012 (Augusto et al., 2018).

In Ethiopia, Tiruneh, Karim, Avan, Zemichael, Wereta, Wickremasinghe, Keweti, et al. (2018) examined the effectiveness of the BEmONC initiative on the rate of facility deliveries and the met need for BEmONC in rural health centers. They collected before and after data from 134 intervention health centers. The authors used a BEmONC implementation strength score, which ranged between zero and ten from seven input and five process indicators. According to Tiruneh et al., there was a statistically significant increase in the implementation strength score from 4.3 at baseline to 6.7 at follow-up ($p <$ .05). A significantly corresponding increase in health center delivery was noticed from 24% to 56% ($p < .05$). The authors also reported that, for every unit increase in BEmONC implementation strength score, there was a corresponding average of 4.5 percentage points (95% *CI*: 2.1- 6.9) increase in facility-based deliveries; while a higher score for BEmONC implementation strength of a health facility at follow-up was associated with a higher met need. The findings of this study demonstrated that EmONC initiative is effective in improving MCH provision and outcomes.

The capacity of health facilities to provide effective EmONC services also varies by facility type (public vs. private). Tembo, Chongwe, Vwalika, and Sitali (2017) surveyed of 35 public and private health facilities in Lusaka district, Zambia to evaluate the availability and usability of signal functions. Tembo et al. reported that of the 35 (25.7% private and 73.5% public) health facilities assessed, only 22 (62.8%) were staffed 24-hours a day, seven days a week and had provided obstetric care three months before the survey. While all the private health facilities were reported to be accessible 24 hours a day, seven days a week; this is not the case for public health facilities that provide antenatal and postnatal care services. Further, private hospitals were better staffed than public hospitals in terms of numbers and specialty as they had all the categories of staff to provide support to EmONC. Comparatively, private hospitals had 66 general practitioners and 25 specialists (obstetricians and gynecologists), while public health facilities had 14 and one, respectively. Similar variance was also observed in the availability of essential supplies, including equipment and ambulances between private and public health facilities assessed. Overall, only 3 (8.6%) and 5 (14.3%) of the 35 health facilities had provided BEmONC and CEmONC services respectively before to the survey.

## Operational Definition of Terms

**Access:** This is defined as the timely use of service according to need (Peters et al. 2008).

**Access to essential MCH services** refers to the availability and accessibility of the following services: antenatal care, skilled birth attendance, postnatal care,

immunization, nutrition, malaria and HIV treatment; and diagnostic facilities (WHO, 2007).

**Health system factors**: The features that characterize a health system by the WHO six building blocks framework. These include human resources for health, essential drugs, and medical technologies; health services (WHO, 2007).

**Health System:** consists of all organizations, people, and actions whose primary interest is to promote, restore, or maintain health (WHO, 2007).

**Maternal health services**: services needed to prevent and treat pregnancy and childbirth-related complication (WHO, 2007).

**Child health services:** refer to the promotion of wellbeing through screening, nutrition, and immunization against diseases of the person younger than five years of age.

**Utilization of health services** refers to the use of available MCH services offered in the health facility as experienced by the mothers who attend the identified health services.

**Service availability:** the presence at all time the essential healthcare services that are provided with the optimum quality at a safe environment within the health facility (WHO, 2013).

**Service readiness:** achieving and maintaining a state of preparedness in the facility to provide comprehensive quality care to patients indicated by the availability of trained staff, infrastructure, guidelines, essential drugs, medical commodities and diagnostic capacity (WHO, 2013).

## Assumptions

The SARA data collection involved both interviews of health facility staff as well as extracting information from health records and observations to verify reported information. The 2017 SARA survey involved 100% of the country's health facilities. There are, however some assumptions:

**Assumption 1**

I assume that the facility staff correctly and comprehensively recorded information on MCH services utilization. It is my assumption also that, the study respondents (i.e., the health providers) were truthful in their answers on the information sought on their health facilities.

**Assumption 2**

I assume that the dataset is representative of all the health facilities in the country.

**Assumption 3**

I assume that the data is complete and accurate and that both the study participants and data collectors provided unbiased data for the respective health facilities. I also assume that there were robust data quality assurance and verification measures that minimized the risk of inaccurate information recording, in particular, duplication, wrong coding, and missing data.

**Assumption 4**

The data on access to services as well as health system components may under-estimate or over-estimate the current situation and may introduce bias in the weighted results.

## Scope and Delimitations

This study sought to understand the relative influence of the health system on access to MCH services. It assessed the relationship between one dependent variable: "access to essential MCH services" (which refers to the availability and accessibility of the following services: antenatal care, skilled birth attendance, postnatal care, immunization, nutrition, malaria and HIV treatment among others) and five independent (health system characteristics) variables: (a) type of health provider, (b) level of health facility (c) availability of essential medicines, (d) availability of basic equipment, and (e) type of health facility (i.e. private vs. public). The study was guided by a conceptual framework that is adapted from Bryce et al., (2011) framework for evaluating the scale-up to MDGs for maternal and child survival. Bryce et al. framework is based on the assumption that an essential pre-requisite to scaling-up MCH services is a responsive health system (Bryce, Victora, Boerma, Peters, & Black, 2011). For this reason, the selection of the independent variables prioritizes health system characteristics.

The choice of the cross-sectional design means that the analysis aimed to establish the associations, not the cause-and-effect relationships or the reasons for these associations. This study was limited to establishing the relationships between the health system characteristics and access to essential MCH services in Sierra Leone. In this study, secondary data analysis was conducted using the 2017 SARA for Sierra Leone to highlight any significant difference in the readiness and availability of quality MCH services across the different levels of healthcare facilities. The use of the 2017 SARA dataset is because it is the first SARA that has been conducted immediately after the

EVD outbreak, which was accompanied by a tremendous investment in strengthening the health sector. The results of this study are generalizable across all health facilities in the country, as they reflect the current status of the health system with regards access to MCH services in Sierra Leone.

## Limitations

The use of secondary data inherently limits my ability to define or manipulate the independent variables and in turn, limit the robustness of the data analysis. Further, some health system components that could also influence access to MCH services such as governance and health financing were not evaluated in this study due to data limitation of the original SARA dataset.

## Summary, Significance, and Conclusions

High maternal and child mortality rates are indicators widely used to determine the health and development status of a nation. The high maternal and child mortality rates are indicators that the health system functionality is fraught with problems; and that broader systemic issues including poverty, for example, exist with a negative impact on population health outcomes. Maternal and child health have, therefore, been the subject of much attention from the policy community, in part due to the lack of progress in reducing maternal and child mortality rates, especially in low-income countries like Sierra Leone (Abegunde, Orobaton, Sadauki, Bassi, Kabo, & Abdulkarim, 2015). The issue of maternal and child health is also a top priority for the government of Sierra Leone. In 2010, the government introduced the free health care initiative for pregnant women, lactating mothers and children below the age of five years in order to increase

access to MCH services and ultimately, to reduce maternal and child mortality in the country. While several initiatives accompanied the free health scheme to improve the quality and utilization of MCH services; the country still recorded one of the highest maternal and child mortality rates in the world at 1,165/100,000 and 156/1000 respectively (DHS, 2013). It has also been reported that, the 2014 Ebola Viral Disease (EVD) had negative implications on the access and utilization of quality MCH services (Ribacke, Saulnier, Eriksson, & von Schreeb, 2016) due to community mistrust of health facilities and health workers perceived as exposure to the Ebola virus (Scott, Crawford-Browne, & Sanders, 2016). While socio-cultural factors have been reported to influence access to MCH services (Chi, Bulage, Urdal, & Sundby, 2015b; Kananura, Kiwanuka, Ekirapa-Kiracho, & Waiswa, 2017; Wulinda, Quaglio, Putoto, et al., 2015; Wilunda, Scanagatta, Putoto, Montalbetti et al., 2017), health system factors can also influence the access to critical components of quality health service delivery. Previous studies have examined the health system predictors on access to maternal health medicines (Nnorom, 2017) and the utilization of maternal health services such as antenatal care compliance (Ngongo, 2016). Most of the studies focused mainly on maternal health and used only one or two of the WHO health system blocks. This study examined more broadly the relative effects of health system blocks (including the health infrastructure, service delivery, human resources, drugs & supplies) on the availability and accessibility of not only maternal health services but also child health services in Sierra Leone. This study provided an opportunity to highlight the influence of post-Ebola health system strengthening initiatives on the provision of quality MCH services in Sierra Leone. It

contributes to positive social change by highlighting the relative influence of health system on access to MCH services. The study findings would inform efforts towards broadening strategies to address neglected or weak health system blocks to optimize access to quality MCH services, which ultimately can contribute towards the reduction of maternal and child mortality rates in Sierra Leone.

Section 2: Research Design and Data Collection

## Introduction

This was a quantitative, secondary data analysis using cross-sectional survey data. The study's main purpose was to investigate the influence of health system factors on access to MCH services. The MoHS SARA data were analyzed to understand the relative influence of health system characteristics on access to MCH services. In this section, I described the research design and rationale, including the study variables, the design's connection to the research questions, and constraints related to the chosen design. It includes the methodology, the study population, sampling technique, procedures, measurement instruments, and data analysis plan. I described the ethical procedures followed, including institutional review board (IRB) approvals, agreements obtained to gain access to the data, and ethical concerns related to data collection and confidentiality.

## Research Design and Rationale

This study was a quantitative, secondary data analysis using cross-sectional survey data to determine the influence of health system characteristics on the access to MCH services. Cross-sectional surveys, as one of the commonly used research designs (Frankfort-Nachmias & Nachmias, 2008), have both advantages and limitations. One of the weaknesses of cross-sectional design is that it restricts the researcher from manipulating the independent variables or sequencing the occurrence of events, making it impossible to compare causal inferences and before-and-after interventions or procedures (Frankfort-Nachmias & Nachmias, 2008). Another reported limitation of a cross-sectional survey by Rossetti (2015) is the likelihood of introducing recall bias because

primary data are collected from information collected in the past. Albeit the limitations, for nonexperimental analysis, the cross-sectional survey is considered most appropriate (Rossetti, 2015). This design provides a snapshot of the situation in the study location and allows the comparison between different or similar geographic locations at a given point in time. According to Rossetti, the cross-sectional survey design is relatively less expensive when compared to other designs such as cohort and experimental studies. The data collection (questionnaire administration) in a cross-sectional design can be conducted relatively easy through telephone interviews, online platforms, and e-mail/mail. Using this design, therefore, saved my time and money, as well as enhanced the privacy of the study participants (see Frankfort-Nachmias & Nachmias, 2008).

**Study Variables**

I examined the nature of the association between health system characteristics (the independent variables) and access to essential MCH services (the dependent variable). As defined by Frankfort-Nachmias and Nachmias (2008), dependent variables are those variables for which researchers work to explain the change, whereas the independent variables are those that explain the change in the dependent variables. The health system characteristics (the independent variables) may relatively influence access to essential MCH services (dependent variable). In this study, the following health system characteristics (independent variables) were investigated: (a) types of health provider, (b) level of health facility, (c) availability of essential medicines, (d) availability of basic equipment, and (e) type of health facility (private vs. public). The dependent variable was access to essential MCH services (which referred to the number of MCH services that can

be offered by the health facility contingent upon the availability of certain tracer items [health provider, essential medicines, and basic equipment]). Table 2 shows a description of the measurements for each of the variables.

Table 2

*Variable Descriptions and Measurements*

| Variable Name | Variable Description | Variable Measurement |
|---|---|---|
| **Dependent Variable** | | |
| Access to MCH services | This refers to the number of procedures and interventions offered by the health facility. It is measured based on the availability and functioning of supportive items categorized into three domains: health provider; essential medicines; and basic equipment. Items that best represent the outcome variable are combined to form a composite dichotomous variable. MCH services availability score for each facility is calculated by adding the proportions. Facilities that scored 50% or more are considered to have good access to MCH services; while those that scored less than 50% are considered to have poor access to MCH services. | Binary categorical |
| **Independent variables** | | |
| Level of facility | This refers to the level of the health facility. Facility level is coded as: 1= MCHP; 2=CHP; 3= CHC; 4= hospital 5= Clinic | Ranked Categorical |
| Type of health facility | This refers to facility ownership. It is coded as 1=public and 0=private | Nominal Dichotomous |

| | | |
|---|---|---|
| Type of health provider | The professional category of the health provider coded as 1= Nurses and midwives; 2=doctors; 3= others (CHO, CHA) | Nominal Categorical |
| Essential Medicines | This refers to the type of essential medicines that are available at the facility. Essential medicines availability score for each facility is calculated by adding the proportions. Facilities that score 50% or more are considered to have good availability of essential medicines; while those that score less than 50% are considered to have poor availability of essential medicines. | Binary categorical |
| Basic Equipment | This refers to the types of basic equipment available at the facility. Basic equipment availability score for each facility is calculated by adding the proportions. Facilities that score 50% or more are considered to have good availability of basic equipment; while those that score less than 50% are considered to have poor availability of basic equipment. | Binary categorical |

**Connections of Research Design to the Questions and Scientific Knowledge**

I investigated the relative influence on health system characteristics on access to MCH services in Sierra Leone. Previous scholars have examined the influence of one or two of the health system characteristics on healthcare access using mostly observational studies. These researchers did not use manipulation and secondary data analysis of cross-sectional surveys. In this study, a quantitative secondary data analysis using cross-sectional survey data was used; cross-sectional design remains one of the most popular

research design in studies of healthcare access (Joshi, Torvaldsen, Hodgson, & Hayen, 2014; Manithip, Sihavong, Edin, Wahlstrom, & Wessel, 2011; Tsegay, Gebrehiwot, Goicolea, Rdin, Lemma, & San Sebastian, 2013). Using the MoHS health management information systems (HMIS) is challenged due to the poor quality of data; as such cross-sectional health facility survey is more useful in the context of Sierra Leone.

This study was a secondary analysis of data from a quantitative health facility survey conducted by the Sierra Leone MoHS in collaboration with the WHO Sierra Leone country office in 2017. The Sierra Leone 2017 SARA was conducted as a census of health facilities, including private health facilities in the country. The default for the inclusion of health facilities in the census was the master facility list (MFL) that comprised of 1,284 health facilities. The WHO SARA questionnaire version 2017 was customized to fit the Sierra Leone context. Field enumerators and supervisors were trained at a 10-day workshop. A total of 21 pairs of enumerators collected the data, with each pair responsible for 56 health facilities during the period of the survey. A data quality review (DQR) and quality of care (QoC) assessments were conducted in a proportionately selected 10% of the health facilities. The assessment involved the collection of data from a range of health system components including human resources, basic equipment, essential medicines, and infrastructure. Data collection was done through facility staff interviews, observations, and facility document reviews. Scholars often use SARA methodology or its data. The study dataset contained the required information for the variables of this study, enabling the answering of the research questions.

I used the archived data of the 2017 SARA survey in Sierra Leone. Secondary data analysis is less expensive when compared with studies that require primary data collection (Frankfort-Nachmias & Nachmias, 2008; Rosetti, 2015). This study contributes towards understanding the relative influence of broader health system characteristics and access to MCH services in Sierra Leone. It provides ground for further studies on the relationship between health system characteristics and access to healthcare.

## Methodology

### Target Populations

The WHO SARA methodology provides a comprehensive approach for monitoring the supply of health services using a standard set of tracer items to determine the extent to which health facilities are prepared or ready for the provision of services. There have been challenges in generating quality and comprehensive information about health infrastructure, workforce, logistics, and medicine, especially among low-income countries. The use of different tools for health data collection by the different countries in these regions further complicates health management information systems. A uniform and complete facility assessment tool (i.e., SARA) was developed by the WHO and has been widely used in LMIC. Sierra Leone has been using the tool to assess health facilities. In this study, the target population was the health facilities that were assessed in the 2017 SARA survey.

### Settings

The WHO supports all WHO member states to conduct SARA surveys annually or as and when a country determines. It is a comprehensive assessment aimed at

measuring tracer indicators for the delivery of quality healthcare services. The 2017 Sierra Leone SARA survey was conducted as a census of all health facilities (both public and private facilities) using the master facility list as the default list for inclusion. The 2017 SARA integrated a DQR and QoC assessment of service delivery at a health facility and was referred to as SARA *Plus* (SARA+).

**Sampling and Sampling Procedures**

Often it is expensive to include every individual or unit in a study. Sampling is, therefore done. According to Frankfort-Nachmias and Nachmias (2008), a sample is a subset of sampling units that share attributes of the target population; and this allows generalization of findings on a sampled population to the target population. In this study, the sampling unit was the health facility as used in the 2017 SARA survey. I used a probability sampling design to draw a representative subset of health facilities that were assessed in the 2017 SARA survey.

G*Power 3.1.9.2 software was used to calculate the sample size for statistical power of .80, alpha error (α) of .05. Statistical power of .80 assumes that an effect was detected in 80% of cases when it is present (Frankfort-Nachmias & Nachmias, 2008). An α of .05 assumes that there was only a 5% probability of erroneously rejecting a true hypothesis (Frankfort-Nachmias & Nachmias, 2008). The effect size reported in the literature ranged from *OR* = 1.57 (95% *CI*: 1.09-2.28) for the type of health facility and ANC availability (Tran, Gottvall, Nguyen, Ascher, & Petzold, 2012) to *OR* = 4.9 (95% *CI*: 3.0-8.1) for the number of ANC interventions provided to pregnant women (Trinh, Dibley, & Byles, 2007). I opted for a conservative effect size of 1.5 and estimated a

sample size of 1,074 health facilities for a two-tailed test using the G*Power 3.1.9.2. The original 2017 SARA dataset had a total of 1,284 health facilities, and I decided to use the whole dataset.

## Procedures for Archival Data

### Access to the Dataset and Permission

The Sierra Leone MoHS has a Research & Publication Unit within the Directorate of Policy Planning & Information (DPPI) that oversees the conduct of local studies, including reviewing ethics requirements and granting permission for the conduct of studies and the publication of results. A request was made to meet with the director DPPI and the Research & Publication Specialist in MoHS. During the meeting, the study procedure, including means of accessing the SARA dataset, was discussed. The requirements as provided by DPPI/MoHS were duly followed, and the data was provided, following the signing of the Data Use Agreement (see appendix A).

## Instrumentation and Operationalization of Constructs

The main source of information for this study was the 2017 SARA dataset available at the Sierra Leone MoHS. The SARA questionnaires comprise of a range of measures on health system characteristics. Information on health system characteristics that were considered in the study encompassed the level of healthcare delivery, type of health facility (private vs. public), type of health provider, availability of essential medicines, and availability of basic equipment. The available and accessible MCH services offered by the health facility should include clinical measurements of weight and blood pressure, laboratory urine and blood tests, HIV counseling and testing, prevention

and treatment of malaria, neonatal tetanus, intestinal worms, deliveries, growth monitoring and promotion (GMP), infant and young child feeding (IYCF), and postnatal care.

## Operationalization of Variables

### Dependent Variable

This is "access to MCH services", and this refers to the number of MCH services offered by the facility. This was measured based on the availability and functioning of supportive items categorized into three domains as follows: MCH service provider, essential medicines, and basic equipment. Items that best represent the outcome variable are combined to form a composite dichotomous variable. MCH services availability score for each facility was calculated by adding the proportions. Facilities that score 50% or more are considered to have good access to MCH services, while those that score less than 50% are considered to have poor access to MCH services. This cut-off point of 50% was also used in previous studies (Bintabara & Mpondo, 2018; Bintabara, Nakamura, & Seino, 2017).

I measured access to MCH services through various interventions and diagnostic procedures. The interventions and procedures that were considered for this variable include weight measurement, blood pressure measurement, blood test, urine test, HIV counseling and testing, iron supplementation, deworming, malaria prevention and treatment, tetanus toxoid, deliveries, postnatal care, childhood immunization, GMP, infant, and IYCF.

**Independent Variables**

The health system characteristics that can influence access to MCH services; this include type of MCH service provider, level of health facility, availability of essential medicines, availability of basic equipment, and type of health facility. I measured these variables as follows: (a) level of health facility: The dataset included information on the facility level: Peripheral health units (MCHP, CHP, CHC), hospital, and clinics; (b) type of health facility: The dataset included information on the facility ownership (public vs. private); and (c) type of health provider: The dataset included information on the professional category of staff at each facility.

**Availability of essential medicines.** The dataset included information on the tracer or essential drugs as in the country's basic package of essential health services (BPEHS). The essential medicines include items for delivery, newborn, and childcare. The following drugs were considered for this variable: injectable antibiotic, injectable uterotonic, injectable magnesium sulfate, injectable diazepam, intravenous fluids, skin disinfectant, antibiotic eye ointment, 4% chlorhexidine, injectable gentamicin, amoxicillin suspension, antimalaria, and analgesics.

**Availability of basic equipment.** The dataset included information on the tracer or equipment as in the country's BPEHS. The following basic equipment was considered for this variable: sterilization equipment, sphygmomanometer, stethoscope, thermometer, child weighing scale, adult weighing scale, height board, MUAC, examination light, delivery pack, suction apparatus, manual vacuum extractor, vacuum aspirator or D&C kit, neonatal bag and mask, and delivery bed.

## Data Analysis Plan

### Statistical Software

To analyze the data for this study, the IBM SPSS Statistics 25 software was used. The software was used to run both the descriptive and inferential analyses.

### Data Cleaning and Screening Procedures

The 2017 SARA dataset received from the Sierra Leone MoHS was in SPSS format. The dataset contained multiple variables. The first step was to ascertain the presence of all the variables for my study. The next step was the production of frequency tables by variable to assess for irregular entries. Through this step, a researcher would be able to check for coding errors, missing data, and outliers (Leech, Barrett, & Morgan, 2008). There were less than 2% of missing values in one of the five independent variables, and these were excluded in the analysis.

## Research Questions and Hypotheses

RQ1: Can access to MCH services be predicted based on the type of health provider?

$H_0$1: Access to MCH services cannot be predicted based on the type of health provider?

$H_1$1**:** Access to MCH services can be predicted based on the type of health provider.

RQ2: Can access to MCH services be predicted based on the level of health facility?

$H_0$2**:** Access to MCH services cannot be predicted based on the level of the health facility.

$H_1$2**:** Access to MCH services can be predicted based on the level of the health facility.

RQ3: Can access to MCH services be predicted based on the availability of essential medicines?

$H_0$3**:** Access to MCH services cannot be predicted based on the availability of essential medicines.

$H_1$3**:** Access to MCH services can be predicted based on the availability of essential medicines.

RQ4: Can access to MCH services be predicted based on the availability of basic equipment?

$H_0$4**:** Access to MCH services cannot be predicted based on the availability of basic equipment.

$H_1$4**:** Access to MCH services can be predicted based on the availability of basic equipment.

RQ5: Can access to MCH services be predicted based on the type (private vs. public) of health facility?

$H_0$5: Access to MCH services cannot be predicted based on the type of health facility.

$H_1$5: Access to MCH services can be predicted based on the type of health facility.

## Statistical Analysis

The statistical analysis of this study was done using SPSS version 25. Before running the full analysis, I conducted a test for multicollinearity as a means to ascertain the independence of independent variables from each other. The proportion of data used for my variables of interest was categorically measured; as such, the presence of outliers was not a concern. These checks were followed by descriptive and inferential analyses.

### Descriptive Statistics

The first step was to compute a total score for all items representing each variable and set the cut-off score for variable categories. Then convert each variable into a dichotomous variable. For example, the availability of tracer items (health facility staffing, essential medicines, and basic equipment) was transformed into "Good Availability" and "Poor Availability." The outcome variable of Access to MCH services was transformed into "Good Access" and "Poor Access."

The second step of the descriptive analysis included a chi-square test to analyze the proportion of health facilities by variable category. To support acceptance or rejection of the null hypotheses, the confidence level, or the *p*-value indicating the presence or absence of significance in the study, had to meet or be less than .05. In a multiple regression analysis, the *p*-value of the overall model indicates whether there is a significant relationship between the predictor and criterion variables. An overall *p*-value > .05 indicates that the relationship between variables is not significant, and an overall *p*-value < .05 indicates that the relationship is significant. A *p*-value < .01 or .001 indicates that the relationship is more significant and highly significant, respectively. The $R^2$ value

indicates the level of criterion variability explained by the best set of predictor variables, or those predictors that produce the best model that fits the data. The value of *R* shows a positive or negative relationship between the criterion and predictor variables. A negative correlation indicates an inverse relationship between variables and a positive correlation points to the same directional relationship between the predictor and criterion variables. These two analyses helped to identify the independent variable categories with good availability of tracer items or good access to MCH services.

**Inferential Analysis**

For the inferential analysis, I applied the logistic regression in two steps to assess the association between health system variables (independent variables) and access to MCH services (dependent variable).

The First step included a bivariate analysis of the association between each of the health system variables and access to MCH services. The results were presented as crude *OR*, 95% *CI*, and *p*-value.

The second step included multivariate analysis of the association between health system variables with $p < .05$ identified during the bivariate analysis and high access to MCH services. Multiple linear regression using the SPSS ENTER method of model building was conducted to evaluate the relative strength of the predictor variables of type of health provider, level of health facility, availability of essential medicines, availability of basic equipment, type of health facility (private vs. public) with criterion variable of access to MCH services. Each of the predictor variables was inputted into the regression simultaneously to test which of the five independent variables that had a statistically

significant predictive relationship with the dependent variable; and a $p$-value < .05 significantly predicted access to MCH services.

## Threats to Validity

### External Validity

Creswell (2013) pointed out that a threat to external validity occurs when the findings of a study are generalized to individuals who do not fit the characteristics of study participants or settings. This occurs when the researcher erroneously draws an incorrect inference from the sample data. In my study, the primary study included all health facilities in the master list of the country. This thus allows the generalization of the findings of my study across the Sierra Leone health facilities; thereby increasing its external validity.

### Internal Validity

Threats to internal validity include factors such as the procedures and treatment used in a study; and this also includes the attributes of the study participants (Creswell, 2013). When such factors affect the researcher's ability to draw meaningful conclusions from a study, threats to internal validity, therefore become eminent and concerning (Creswell, 2013). In this study, the use of secondary cross-sectional survey data and the inclusion of all the health facilities prevent sampling bias; and hence, mitigate threats to internal validity.

### Construct Validity

Threats to construct validity occur when variable definitions and measures are insufficient (Creswell, 2013). To mitigate construct validity threats, this study maintained

the same definitions and measures of variables used in previous studies on access to MCH services such as ANC services utilization (Joshi et al., 2014; Mugo, Dibley, & Agho, 2015; Trinh et al., 2007; Tsegay et al., 2013).

### Statistical Conclusion Validity

Creswell (2013) reported that the threats to statistical conclusion validity occur when the study findings are not accurate because of insufficient statistical power or the violation of key assumptions. In this study, a sufficient sample of 1,284; representing 100% of the surveyed health facilities in the Sierra Leone 2017 SARA were used; so that they achieve a computed power of .80 or more on all independent variables. Furthermore, I ensured that the study met the assumptions required for logistic regression analysis.

## Ethical Procedures

This study was approved by the Walden University institutional review board (IRB) before the data was reviewed to ensure the protection of participants' rights. The SARA data are a government dataset 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 the confidentiality of respondents and their families. A web-based course was offered by the National Institute of Health (NIH) Office of Extramural Research to raise the awareness of researchers working with human subjects. The course provides insight into the obligations of the researchers towards the rights and welfare of human subjects in the conduct of research. I took this course as part of the essential measures in protecting the rights of study participants for my doctoral study.

The IRB approval number for this study is 05-24-19-0664113. The Data Use Agreement between myself and the Sierra Leone MoHS can be found in Appendix A.

### Protection of Participants Rights

The study had no direct interaction with study participants, as secondary data was used. Further, the participants in the SARA dataset are the 'health facilities,' and the data did not include personal identifiers. Also, the study sought the Walden University IRB approval to ensure that it meets the required ethical standards.

### Data Protection

To protect the dataset, it is being stored on a password-protected computer with a back-up hard drive that is also password-protected. The dataset is going to be kept for five years after the end of the study, and it will be destroyed after that; using the appropriate measures.

## Summary

The study was a quantitative secondary data analysis using cross-sectional survey data collected by the Sierra Leone MoHS 2017 SARA survey. The 2017 SARA survey was a census covering all health facilities in the country. The study used 100% of the facilities that were surveyed.

The independent variables are the health system characteristics that may relatively influence access to MCH services. The following health system characteristics were considered in this study: (a) type of health provider, (b) level of health facility, (c) availability of essential medicines, (d) availability of basic equipment, and (e) type of health facility (i.e., private vs. public). The outcome variable is the "access to MCH

services" (which refers to the availability and accessibility of selected services: antenatal care, skilled birth attendance, postnatal care, immunization, nutrition, malaria, and HIV treatment).

Data were analyzed using the IBM SPSS Statistical software version 25. The study analyses included descriptive analysis as well as inferential analysis, conducting bivariate and multivariate logistic regression on the health system\ characteristics that influence access to MCH services in Sierra Leone.

Section 3: Presentation of the Results and Findings

## Introduction

The purpose of this quantitative, cross-sectional survey using secondary data analysis was to investigate the influence of health system attributes on access to MCH services. The study participants were health facilities that were surveyed in the Sierra Leone MoHS 2017 SARA. The IBM SPSS Statistics version 25 software was used to answer the research questions and to test the hypotheses listed below:

RQ1: Can access to MCH services be predicted based on the type of health provider?

$H_0$1: Access to MCH services cannot be predicted based on the type of the health provider?

$H_1$1**:** Access to MCH services can be predicted based on the type of the health provider.

RQ2: Can access to MCH services be predicted based on the level of the health facility?

$H_0$2**:** Access to MCH services cannot be predicted based on the level of the health facility.

$H_1$2**:** Access to MCH services can be predicted based on the level of the health facility.

RQ3: Can access to MCH services be predicted based on the availability of essential medicines?

$H_0$3**:** Access to MCH services cannot be predicted based on the availability of essential medicines.

$H_1$3**:** Access to MCH services can be predicted based on the availability of essential medicines.

RQ4: Can access to MCH services be predicted based on the availability of basic equipment?

$H_0$4**:** Access to MCH services cannot be predicted based on the availability of basic equipment.

$H_1$4**:** Access to MCH services can be predicted based on the availability of basic equipment.

RQ5: Can access to MCH services be predicted based on the type (private vs. public) of health facility?

$H_0$5: Access to MCH services cannot be predicted based on the type of health facility.

$H_1$5: Access to MCH services can be predicted based on the type of health facility.

## Data Collection

The primary SARA data collection was coordinated and supported by the WHO Sierra Leone country office in collaboration with the MoHS. The SARA was conducted as a census of all health facilities in Sierra Leone, and this took place within a period of 30 - 40 days between March and April 2017. The current master facility list (MFL) was used as the default list for inclusion. The WHO's SARA questionnaires, version 2017,

were customized for Sierra Leone during a 3-day workshop. Field enumerators were competitively selected and interviewed by the MOHS. Following a 10-day training workshop for the enumerators, a total of 62 were selected. A total of 21 pairs of enumerators were formed, each with responsibility for an average of 56 facilities to be completed in an average of 39 days. Ten supervisors were trained and assigned responsibility for the supervision of two clusters each, including final responsibility for uploading the census and survey processing system (CSPro) facility data files to the central server. Ten back checkers were selected and trained to conduct quality assurance. The back checker team recollected data from 5% of randomly selected facilities. DQR and QoC assessments were conducted in a sample of 10% of the facilities, proportionately selected to include facilities that offered antenatal care (ANC); delivery and newborn care; and HIV, malaria, and TB care services.

There was no discrepancy between the plan presented in Section 2 and the actual data collection.

**Inclusion and Exclusion Criteria**

The original 2017 SARA dataset included a total of 1,284 health facilities, representing 100% of the Sierra Leone health facilities, including both public and private. The default list for inclusion in the survey was the MFL. Facilities that were not in the MFL were excluded in the survey. For this study, all of the surveyed health facilities were considered, and facilities that were not in the MFL were excluded.

## Review of Statistical Assumptions

The study analysis included bivariate and multivariate logistic regressions on one outcome variable (access to MCH services) and five independent variables (i.e., type of health provider, level of health facility, availability of essential medicines, availability of basic equipment, and type [private vs. public] of health facility). I reviewed the key assumptions of logistic regression analysis, in particular, the presence of multicollinearity, the magnitude of missing data, and the compliance with a minimum of 10 cases per variable category. No outliers were expected in the data because all of the variables were categorically measured.

**Multicollinearity.** This occurs when there are two or more predictors that have a high degree of correlation, which may lead to imprecise results (Leech, Barret, & Morgan, 2008). The absence of multicollinearity means that the independent variables are not too highly correlated with each other (Hair, Anderson, Tatham, & Black, 1995). To evaluate for the presence or absence of multicollinearity among predictors, the variance inflation factor (VIF) and the tolerance statistic can be used. The VIF indicates whether an individual predictor is strongly correlated with any other predictors. A VIF substantially greater than 1 indicates that multicollinearity might be biasing the regression model, and a VIF greater than 10 is indicative of significant concern. Tolerance statistics lower than 0.2 or 0.1 also is a problematic value.

In testing this assumption, the first test was a bivariate correlation analysis of the five independent variables in SPSS using the Pearson correlation coefficient. The results showed no value of the Pearson correlation coefficient equal to or above .80, confirming

that there was no multicollinearity between the variables of interest. All of the correlation coefficients were below .60. The second test was the collinearity diagnostics in linear regression that examined the tolerance rate and VIF. In the present regression analyses, the VIF and the tolerance statistic indicated that no multicollinearity among the predictors was present (see Table 3).

Table 3

*Collinearity and Tolerance*

| Model | Collinearity Statistics | |
|---|---|---|
| | Tolerance | VIF |
| Health facility staffing | .732 | 1.367 |
| Level of health facility | .698 | 1.432 |
| Availability of essential medicines | .977 | 1.024 |
| Availability of basic equipment | .987 | 1.013 |
| Type of health facility | .907 | 1.013 |

**Missing data.** High rates of missing data can introduce biases and compromise the validity of the study findings. In this study, all variables were screened for missing data by reviewing frequency tables for each variable. The missing data analysis showed that only one of the five independent variables had some missing data. The variable was the availability of essential medicines with 14 counts missing (1.1%). With a sample size of 1,284 participants, the proportion of missing data will not statistically affect the validity of the results; hence, they were excluded in the final analysis.

**Sample size and minimum number of cases in each variable category.** Logistic regression requires larger samples than linear regression. Each category of the independent variables included in logistic regression analysis must have a minimum of 10 cases (Vittinghoff & McCulloch, 2007). The total sample of 1,280 was large enough to achieve sufficient statistical power. Some categories of the independent variables were combined to satisfy the rule of 10. The lowest cell count was 18 cases. All the other

categories had more than 20 cases.

## Variable Categorization and Coding

The analysis included one outcome variable and five independent variables. Responses to numeric and string question items that best represented these variables were combined to form composite dichotomous variables for the regression analysis. The outcome variable (i.e., access to MCH services) had two categories: poor access to MCH services (code: 0) and good access to MCH services (coded: 1) as a composite score of three variables: health provider (staffing), essential medicines, and basic equipment. Health facilities of less than 50% of the combined scores were assumed to have poor access to MCH services (coded: 0) while those with and above 50% of the combined score were assumed to have good access to MCH services (coded: 1).

Similar procedures were used to organize the five independent variables, and they included two or more categories. Type of health provider (staffing) comprised of two categories: poor staffing (coded: 0) and good staffing (coded: 1). Level of health facility had two categories: secondary health facilities or hospitals (Coded: 0) and primary health facilities or PHUs (coded: 1). The availability of essential medicines had two categories: health facilities with less than 50% of essential drugs were assumed to have poor availability (coded: 0) and those with and above 50% had good availability (coded: 1). The availability of basic equipment had two categories: health facilities with less than 50% of basic items were assumed to have poor availability (coded: 0), and those with and above 50% had good availability (coded: 1). The type of health facility included two categories: public health facility (coded: 0) and private health facility (coded: 1).

## Descriptive Analysis

The distribution of the 1,284 health facilities by the level of health care delivery indicated that 1,174 (91%) were PHUs, and 54 (4.2%) and 56 (4.4%) were hospitals and clinics respectively. The 1,174 PHUs were comprised of 625 (53%) maternal and child health posts (MCHP), 325 (28%) were community health posts (CHP), and 224 (19%) were community health centers (CHCs). The distribution of the type of health facilities (public vs. private) showed that 1,037 (81%) and 247 (19%) were public and private, respectively. Comparisons across both the level and type (private vs. public) of health facilities showed a significant difference in accessing MCH services (see Table 4).

Table 4

*Background Characteristics of the Health Facilities*

| Characteristics | <50%(Poor Access<br>*n* (%) | ≥50% (Good Access)<br>*n* (%) | Chi-Square | *df* | *p*-value |
|---|---|---|---|---|---|
| **Level of health facility** | | | | | |
| Hospitals | 0 (0) | 54 (100) | | | |
| Community health centers | 10 (4.5) | 214 (95.5) | 160.696 | 4 | <.001 |
| Community health posts | 84 (25.8) | 241 (74.2) | | | |
| Maternal & child health posts | 281 (45.0) | 344 (55.0) | | | |
| Clinic | 17 (30.4) | 39 (69.6) | | | |
| **Type of health facility** | | | | | |
| Public | 348 (33.6) | 689 (66.4) | 23.145 | 1 | <.001 |
| Private | 44 (17.8) | 203 (82.2) | | | |

The availability of the tracer items for MCH service delivery (i.e., type of health provider, staffing, essential medicines, and basic equipment) varied across health facilities (see Table 5). The type of health facility (private vs. public) and the level of health facility had a statistically significant association with access to MCH service provider ($p < .001$). Regarding the availability of essential medicines, the type of health facility (private vs. public) had a statistically significant association with essential medicines ($p < .001$). However, the level of health facility showed no association with

essential medicines ($p > .05$). With regards the availability of basic equipment, the level of health facility showed a statistically significant association with basic equipment ($p < .001$). The type of health facility (private vs. public) however, had no statistically significant association with basic equipment ($p > .05$).

Table 5

*Characteristics of Health Facilities and the Availability of MCH Tracer Items*

| Characteristics | Tracer Indicators | <50% (Poor Availability) | ≥50% (Good Availability) | Chi-Square | df | *P*-value |
|---|---|---|---|---|---|---|
| | | *n* (%) | *n* (%) | | | |
| **Level of health facility** | ***Availability of staffing*** | | | | | |
| | Hospitals | 1 (1.9) | 53 (98.1) | | | |
| | Community Health Centers | 16 (7.1) | 208 (92.9) | 436.181 | 4 | <.001 |
| | Community Health Posts | 164 (50.4) | 161 (49.6) | | | |
| | Maternal & Child Health Posts | 502 (80.3) | 123 (19.7) | | | |
| | Clinic | 25 (44.6) | 31 (55.4) | | | |
| | ***Availability of Essential Medicines*** | | | | | |
| | Hospitals | 2(3.8) | 51(96.2) | | | |
| | Community Health Centers | 15(6.7) | 209(93.3) | | | |
| | Community Health Posts | 31(9.6) | 293(90.4) | 3.734 | 4 | >.05 |
| | Maternal & Child Health Posts | 57(9.2) | 562(90.8) | | | |
| | Clinic | 3(6.0) | 47(94.0) | | | |
| | ***Availability of Basic Equipment*** | | | | | |
| | Hospitals | 0(0.0) | 54(100.0) | | | |
| | Community Health Centers | 0(0.0) | 224(100.0) | | | |
| | Community Health Posts | 8(2.5) | 317 (97.5) | 21.173 | 4 | <.001 |
| | Maternal & Child Health Posts | 11(1.8) | 614(98.2) | | | |
| | Clinic | 5(8.9) | 51(91.1) | | | |
| **Type of Health Facility** | ***Availability of staffing*** | | | | | |
| | Public facilities | 619 (59.7) | 418(40.3) | 45.142 | 1 | <.001 |
| | Private facilities | 89(36.0) | 158(64.0) | | | |
| | ***Availability of Essential Medicines*** | | | | | |
| | Public facilities | 103(10.1) | 921(89.9) | 16.422 | 1 | <.001 |
| | Private facilities | 5(2.0) | 241(98.0) | | | |
| | ***Availability of Basic Equipment*** | | | | | |
| | Public facilities | 22(2.1) | 1015(97.9) | 1.871 | 1 | >.05 |
| | Private facilities | 2 (0.8) | 245(99.2) | | | |

**Statistical Analysis Findings by Research Questions and Hypotheses**

The analysis report below includes the outcomes of bivariate and multivariate logistics regression analyses based on a sample of 1,284 health facilities included in my study. The first step was bivariate logistic regression analysis of the predictive relationship between five independent variables (i.e., type of health provider, level of health facility, availability of essential medicines, availability of basic equipment, and type of health facility) and access to MCH services. I found that all the independent variables had a statistically significant association with access to MCH services and achieved a $p$-value < .001.

The second step included a multivariate logistic regression. Multiple linear regression using the SPSS ENTER method of model building was conducted to evaluate the relative strength of the relationship between the predictor variables (type of health provider, level of health facility, availability of essential medicines, availability of basic equipment, type of health facility) and the criterion variable (access to MCH services). Each of the predictor variables was inputted into the regression simultaneously to test which of the five independent variables that had a statistically significant predictive relationship with the dependent variable; and a $p$-value < .05 significantly predicted access to MCH services. The results of the regression (see tables 6 and 7) indicated that three predictors explained 38% of the variance ($R^2$ = .380, $F$ (5, 1263) = 154.667, $p$<.001). It was found that the type of health provider significantly predicted access to MCH services (β= .549, $p$<.001). The availability of both essential medicines (β= .255,

$p<.001$) and basic equipment (β= .258, $p<.001$) also significantly predicted access to MCH services (see table 8).

Table 6

*Model Summary*

| **Model** | *R* | *R Square* | Adjusted R Square | S.E Estimates |
|---|---|---|---|---|
| 1 | .616(a) | 0.38 | 0.377 | 0.362 |

(a) Predictors: (Constant), type of health provider, level of health facility, availability of essential medicines, availability of basic equipment, type of health facility

(b) Dependent Variable: Access to MCH Services

Table 7

*ANOVA Results for the Regression Model for Access to MCH Services*

| **Model** | Sum of Squares | df | Mean Square | *F* | Sig |
|---|---|---|---|---|---|
| Regression | 101.552 | 5 | 20.31 | 154.667 | .000(b) |
| Residual | 165.854 | 1263 | 0.131 | | |
| Total | 267.506 | 1268 | | | |

Table 8

*Multiple Regression Results for Individual Predictor Variables*

| Model | | β | t | Sig | 95 *CI* of β | |
|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound |
| 1 | Constant | -.032 | -.302 | 0.763 | -.24 | .176 |
| | Type of Health Provider | .545 | 22.806 | 0.000 | .498 | .592 |
| | Level of Health Facility | -.002 | -.118 | 0.906 | -.027 | .024 |
| | Essential Medicines | .255 | 6.903 | 0.000 | .182 | .327 |
| | Equipment | .258 | 3.217 | 0.001 | .101 | .416 |
| | Type of Health Facility | .003 | .102 | 0.919 | -.050 | .056 |

**Research Question 1**: Can access to MCH services be predicted based on the type of health provider?

$H_0$1: Access to MCH services cannot be predicted based on the type of health provider?

$H_1$1**:** Access to MCH services can be predicted based on the type of health provider.

A bivariate logistic regression was performed to examine the predictive relationship between the type of health provider and access to MCH services. The result showed a statistically significant association between the type of provider and access to MCH services $\chi^2$ (1) = 42.736, *OR* = 707.413, *CI* [98.924, 5058.746], $p < .001$. This finding may suggest that health facilities with the right mix of health providers can provide better access to MCH services. The multivariate logistic regression that followed also retained the statistically significant association between the type of health provider and access to MCH services (β= .549, t = 22.806, *CI* [.498, .592], $p < .001$). Therefore, I reject the null

hypothesis and conclude that access to MCH services can be predicted based on the type of health provider.

**Research Question 2**: Can access to MCH services be predicted based on the level of the health facility?

$H_0$2**:** Access to MCH services cannot be predicted based on the level of the health facility

$H_1$2**:** Access to MCH services can be predicted based on the level of the health facility

A bivariate logistic regression was performed to examine the predictive relationship between the level of health facility and access to MCH services. The result showed a statistically significant association between the level of health facility and access to MCH services $\chi^2$ (1) = 117.235, *OR* = .394, *CI* [.333, .466], $p < .001$. However, the multivariate logistic regression that followed did not retain the statistically significant association between the level of health facility and access to MCH services (β= -.002, t = -.118, CI [- .027, .024], $p > .05$). Therefore, I accept the null hypothesis and conclude that access to MCH services cannot be predicted based on the level of a health facility.

**Research Question 3:** Can access to MCH services be predicted based on the availability of essential medicines?

$H_0$3**:** Access to MCH services cannot be predicted based on the availability of essential medicines

$H_1$3**:** Access to MCH services can be predicted based on the availability of essential medicines

A bivariate logistic regression was performed to examine the predictive relationship between the availability of essential medicines and access to MCH services. The result showed a statistically significant association between the availability of essential medicines and access to MCH services $\chi^2$ (1) = 26.709, *OR* = 2.863, *CI* [1.921, 4.266], $p < .001$. This finding may suggest that health facilities that are strongly stocked with essential medicines can provide better access to MCH services. The multivariate logistic regression that followed also retained the statistically significant association between the availability of essential medicines and access to MCH services (β= .255, t = 6.903, *CI* [.182, .327], $p < .001$). Therefore, I reject the null hypothesis and conclude that access to MCH services can be predicted based on the availability of essential medicines.

**Research Question 4:** Can access to MCH services be predicted based on the availability of basic equipment?

$H_0$4**:** Access to MCH services cannot be predicted based on the availability of basic equipment

$H_1$4**:** Access to MCH services can be predicted based on the availability of basic equipment

A bivariate logistic regression was performed to examine the predictive relationship between the availability of basic equipment and access to MCH services. The result showed a statistically significant association between the availability of basic equipment and access to MCH services $\chi^2$ (1) = 12.570, *OR* = 4.715, *CI* [2.001, 11.111], $p < .001$. This finding may suggest that health facilities that have basic equipment can provide better access to MCH services. The multivariate logistic regression that followed also

retained the statistically significant association between the availability of basic equipment and access to MCH services (β= .258, t = 3.217, *CI* [.101, .416], $p < .001$). Therefore, I reject the null hypothesis and conclude that access to MCH services can be predicted based on the availability of basic equipment.

**Research Question 5**. Can access to MCH services be predicted based on the type of the health facility (private vs. public)?

$H_0$5: Access to MCH services cannot be predicted based on the type of the health facility.

$H_1$5: Access to MCH services can be predicted based on the type of the health facility.

A bivariate logistic regression was performed to examine the predictive relationship between the type of health facility (private vs. public) and access to MCH services. The result showed a statistically significant association between the type of health facility and access to MCH services $\chi^2$ (1) = 22.222, *OR* = 2.324, *CI* [1.637, 3.299], $p < .001$. However, the multivariate logistic regression that followed did not retain the statistically significant association between the type of health facility and access to MCH services (β= .003, t = .102, *CI* [-.050, .056], $p > .05$). Therefore, I accept the null hypothesis and conclude that access to MCH services cannot be predicted based on the type of health facility.

## Summary

This study included five research questions and ten hypotheses investigating the association between health system characteristics and access to MCH services in Sierra Leone. The analysis involved bivariate and multivariate analyses. The results of the bivariate analysis indicated that, all of the health system characteristics examined (type of health provider; level of health facility; availability of essential medicines; availability of basic equipment; and type (private vs. public) of health facility had a statistically significant association with access to MCH services with a $p$-value < .001. The multivariate analysis included a multiple logistic regression analysis of the five independent variables above, which had a $p$-value < .05 to test if the independent variables significantly predicted access to MCH services. The results of the regression indicated that three predictors explained 38% of the variance ($R^2$ = .380, $F$ (5, 1263) = 154.667, $p$ <.001). It was found that the type of health provider significantly predicted access to MCH services (β =.549, $p$ <.001); as did the availability of essential medicines (β= .255, $p$ <.001), and the availability of basic equipment (β= .258, $p$ <.001). Both the level (hospitals and PHUs) and type (private vs. public) of health facilities did not significantly predict access to MCH services ($p$ > .05).

I conclude that the type of health provider, availability of essential medicines, and basic equipment are good predictors of access to MCH services in Sierra Leone.

Section 4 includes a discussion of health system characteristics that have shown a statistically significant association with access to MCH services in Sierra Leone and a comparison of these findings with previous studies. It presents the study limitations, its

implications for positive social change, and recommendations for research, policy, and practice.

Section 4: Application to Professional Practice and Implications for Social Change

## Introduction

This study was a quantitative, cross-sectional survey using secondary data from the Sierra Leone MoHS 2017 SARA survey. I examined the influence of health system attributes on access to MCH services. Maternal and child health issues remain one of the biggest challenges in the world despite sustained global efforts to address the issues (WHO, 2011a). LMICs have been disproportionately impacted by these issues in terms of morbidities, mortalities, and economic burden (UN, 2016; WHO, 2011a). Sierra Leone, one of the poorest countries in sub-Saharan Africa, has one of the highest maternal and child mortality rates in the world, currently reported at 1,165/100,000 and 156/1,000, respectively (DHS, 2013). The country's poor maternal and child health outcomes can be attributed to many factors, including poverty. The strength of the country's health system described as weak has been attributed to the rapid spread of the 2014 EVD outbreak (Ribacke et al., 2016; Elston et al., 2015), and this could also be a factor that influences maternal and child health outcomes. Although both preventable maternal and child mortalities are linked to the availability of resources at health facilities (Thaddeus & Maine, 1994), the relationship has not been quantifiably examined in Sierra Leone. There is limited local knowledge on the extent to which the health system influences access to MCH services. This study was conducted to provide insight into the relative influence of health system characteristics on accessing MCH services in Sierra Leone.

The data analysis involved bivariate and multivariate analyses. The results showed that, the type of health provider significantly predicted access to MCH services

(β= .549, $t$ = 22.806, *CI* [.498, .592], $p < .001$), as did the availability of essential medicines (β= .255, $t$ = 6.903, *CI* [.182, .327], $p < .001$), and the availability of basic equipment (β= .258, $t$ = 3.217, *CI* [.101, .416], $p < .001$). Both the level (hospitals and PHUs) and type (private vs. public) of health facilities did not significantly predict access to MCH services ($p > .05$).

## Interpretation of Findings

### Study Findings and Past Research

**Type of health provider and access to MCH services.** I examined the association between the available types of health provider and access to MCH services. The results from bivariate and multivariate analyses showed a predictive relationship between the range of health providers (skilled birth attendants) and access to MCH services. Health facilities with the right mix of health providers have greater access to MCH services.

This study supported the findings of numerous studies including Lawn et al. (2011), Oestergaard et al. (2011), Scott and Ronsmans (2009), and Lassi et al. (2016) that the presence of certain critical resources including health professionals is a necessary ingredient in predicting access to MCH services. This can prevent most of the maternal deaths, stillbirths, and neonatal deaths.

The findings from this study also supported evidence from related studies by Lawn, Tinker, Mujanja, and Cousens (2006), Ronsmans and Graham (2006), and Kinney, Kerber, Black, Cohen, Nkrumah, Coovadia, Nampala, and Lawn (2010) that demonstrated positive associations between access to facility-based services from skilled

birth attendants during pregnancy, delivery and post delivery, and improved maternal health outcomes.

A critical component of a functioning health system is the human resources for health. They are required in maintaining and improving population health; as such, no study was found to disagree with the evidence as demonstrated in this study.

**Health infrastructure and access to MCH services.** I examined the association between both the level (PHUs vs. hospitals) and type (public vs. private) of health facility and access to MCH services. I found in the bivariate logistic regression analysis that access to MCH services varied by the level of care. The higher the level of care, the better the access to MCH services. Similarly, the results in the bivariate logistic regression analysis indicated a significant difference in access to MCH services by facility type (private vs. public). The private health facilities had better access to MCH services than public facilities. However, the association for both the level and type of health facility disappeared in the multivariate analysis, indicating that neither the level of health facility nor the type of health facility had a predictive relationship with access to MCH services. The descriptive analysis showed that both the levels and types of health facilities had greater than 50% of good access to MCH services.

The findings of this present study differed from Gebrehiwot, Sebastian, Edin, and Goicolea (2014)'s study on the health providers' perceptions of facilitators and barriers to the use of institutional delivery in Tigray, Ethiopia. Gebrehiwot et al. indicated that hospitals with specialized staff were a significant facilitator of facility-based delivery.

Kruk et al. (2016) revealed that the quality of care in primary care facilities was substantially poorer than at secondary facilities.

The results of this study also did not align with Memirie, Verguet, Norheim, Levin, and Johansson's (2016) study on the role of primary health care (PHC) on the inequalities in the use of maternal and child health services in Ethiopia. Memirie et al. reported that the role of PHC facilities as points of delivery of MCH services is relatively low as compared to public hospitals and private facilities. Memirie et al. noted however that, there is low use of hospitals and private facilities by poor and rural residents due to high out-of-pocket spending.

Matsuoka et al.'s (2010) study on the perceived barriers to the use of maternal health services in rural Cambodia had dissimilar findings to this study. Matsuoka et al. reported that the lack of ward space in lower level health facilities to allow women to rest after delivery affects facility-based delivery. Matsuoka et al. furthered that, the absence of skilled birth attendants in public health facilities was a barrier to using the facilities.

Shayo et al. (2015) compared the access and use of quality, equity, and trust in the Mbarali district and revealed contrary findings to this study. Shayo et al. reported that respondents who visited public health facilities reported medicine shortages more than those who visited nonpublic health facilities. Shayo et al. also reported that respondents who visited public facilities were 4.9 times less likely than those who visited nonpublic facilities to emphasize the influence of cost in accessing and using health care. Shayo et al. also reported a lower level of client trust in public health facilities than in private health facilities.

**Availability of essential medical commodities and access to MCH services.** I examined the association between the availability of essential medical commodities (i.e., essential medicines and basic equipment) and access to MCH services. The results from bivariate and multivariate analyses showed a predictive relationship between the availability of both essential medicines and basic equipment; and access to MCH services. Health facilities with better supplies of essential medicines had greater access to MCH services. Similarly, health facilities with better supplies and functioning equipment had greater access to MCH services.

The findings of my study were in concurrence with studies that demonstrated an association between medical commodities and access to quality maternal health care. The absence of sufficient medical commodities, such as medicine and equipment, will hamper the provision of services, undermine the quality of care, and lead to low levels of patients' satisfaction and preventable deaths (Macha et al., 2012; Mkoka et al., 2014; Penfold et al., 2013; Quick, Boohene, Rankin, & Mbwasi, 2005; Uzochukwu, Onwujekwe, & Akpala, 2002). Sumankuuro, Crockett, and Wang (2018) showed significant barriers affecting the quality and appropriateness of maternal and newborn health services. Among the notable obstacles were inadequate medical equipment and essential medicines.

The findings of the current study aligned with a study by Mugo et al. (2018) in Sudan, where the lack of essential medicine supplies and equipment contributed to the inadequate quality of ANC services. Mugo et al. also linked the lack of essential medicine to individual mothers' dissatisfaction with the services received, and this

affected their continuation of seeking care from the health facilities. Similarly, Sado and Sufa (2016) also reported that the low availability of essential medicines affects child health care needs.

**Study Findings and Bryce et al. Conceptual Framework**

This study used an adapted Bryce et al. (2011) framework for evaluating the scale-up to MDGs for maternal and child survival as its conceptual framework. The framework posited that the effective delivery of MCH services depends on a well-coordinated and responsive health system. This involves having the right inputs that are channeled through the appropriate processes to enhance the attainment of desired outputs and outcomes that improve access to quality MCH services. Increasing the coverage of essential MCH services requires addressing both supply-side and demand-side barriers to health care provision. The supply-side factors inherently have to do with the health system characteristics such as health infrastructure, health staff, essential medical commodities, and service delivery. The current study examined health system characteristics as an intervention to increase access to MCH services, and ultimately to improve MCH outcomes. The findings of the current study support Bryce et al. (2011) framework for evaluating the scale-up to MDGs for maternal and child survival. The findings of this study showed that the availability of the right mix of health provider is a significant predictor for accessing quality MCH services. Further, the availability of essential medical commodities such as essential medicines and basic equipment are critical components of the health system that improve access to MCH services and the health outcomes of mothers and children. In this regard, Bryce et al. (2011) framework

for evaluating the scale-up to MDGs for maternal and child survival was a useful conceptual framework that guided the identification of the study variables, design of study questions and hypotheses, data analysis, and interpretation of findings.

## Limitations of the Study

The study used a cross-sectional quantitative design with institutional-level data collected at one point in time (Sedgwick, 2014). The following are considered as limitations to the study: firstly, the cross-sectional nature of the study did not allow any sequencing of events between predictor variables and the criterion nor any trend analysis on the outcome of the study. Secondly, the study did not collect household data to understand other barriers to accessing MCH services. At the household level, a range of different measures of equity (e.g. geographical location of health facility; traveling time to health facility; direct and indirect cost of services) and socioeconomic status (e.g. education, age, employment staus) have been considered as significant predictors to healthcare access (Dalaba et al., 2013; Ghosh & Mistri, 2016; Ruktanochai et al., 2016; Weitzman, 2017 ). The demand-side factors of accessing MCH services are, therefore missed out in this study. Another limitation is that the observational nature of the study did not allow any cause-and-effect analysis in the absence of variable manipulation. Lastly, the cross-sectional nature of this study did not allow any causal inferences or explanatory dimensions to observations.

## Recommendations for Further Research

This study was the first cross-sectional study to examine the influence of health system on access to MCH services in Sierra Leone. It has provided insight on the important role of staffing, essential medicines, and basic equipment on accessing MCH services. Also, the study has highlighted some knowledge gap and areas for further research. In Sierra Leone, the ANC attendance rates by pregnant women as well as the uptake of childhood immunization, for example, are impressively high. The current study has however revealed that there is a significant difference in the availability of MCH tracer indicators of staffing, essential medicines, and basic equipment in all health facilities regardless of the level of care and type of facilities (private vs. public). Accessing MCH services is not sufficient to assure quality. Therefore, further qualitative and quantitative research on the quality of MCH services provided in health facilities is needed. These studies should investigate barriers to quality MCH services provision and maternal, and child health outcomes to guide the design of public health interventions aim at improving the quality as well as increasing access to MCH services. The study also showed that both the level of care and the type of health facilities do not influence access to MCH services. Little is known in Sierra Leone on the extent to which the numerous health facilities in the country drive demand for MCH services. Therefore, further research could help understand the drivers of MCH utilization. In particular, qualitative studies will be helpful to provide an in-depth understanding of the intricate dynamics of access to MCH services.

The cross-sectional nature of this study did not allow any causal inferences or explanatory dimensions to observations. A prospective study of access to MCH services would be helpful to understand the sequencing of events and establish cause-and-effect relationships among independent variables. Furthermore, future studies should include other health system characteristics (independent variables) not measured in this study; and this may include health provider attitudes; privacy and confidentiality at service delivery point; waiting time; duration of maternal and child consultations; and both direct and indirect costs of accessing MCH services.

The attainment of better access to MCH services in Sierra Leone is contingent upon the effectiveness and level of implementation of innovative and life-saving interventions and strategies specific to the context and realities of the country. Therefore, further studies are needed to identify the most effective strategies for not only access but also for the quality of MCH services. This resultantly will contribute towards the reduction of the high maternal and child mortality rates in Sierra Leone

## Implications

### Implications for Positive Social Change

The limited access to MCH services has been attributed to the high rates of morbidity and mortality among the vulnerable women and children, especially in low- and middle-income countries like Sierra Leone. This study has examined this very important health issue that burdens mostly poor countries which are characterized by the weak health system, coupled with disparities and social injustices as evident through the disproportionate burden of high maternal and child deaths (WHO, 2011b; UN, 2014).

Despite the concerted global effort to increase access to MCH services, sub-Saharan countries like Sierra Leone still face limited access to such services. The poor access to MCH services may have contributed and will be contributing to the premature deaths of both children and women during childbirth.

This study contributes to positive social change by highlighting the relative influence of health system attributes on access to MCH services. Knowledge on the health system predictors of access to MCH services would help the stakeholders in health, including health system managers and providers as well as funding agencies on critical areas for strengthening and investment for increased and improved access to quality MCH services. The study findings, if used appropriately would inform efforts towards broadening strategies to address neglected or weak health system components to optimize access to quality MCH services, which ultimately will contribute towards the reduction of maternal and child mortality rates in Sierra Leone.

For the highlighted reasons above, the Sierra Leone Ministry of Health & Sanitation (MOHS) and its partners notably the UN agencies, development partners and health-related agencies will be targeted for the dissemination of the findings of this study. Also, to be part of the dissemination agenda of the findings of this study are local and international civil society organizations (CSOs) through program, policy, and strategic meetings and conferences. Furthermore, the study will be published in peer-reviewed journals to share its findings with the international community.

**Implications for Practice**

This study may play an important role in designing effective interventions for improving the accessibility of quality MCH services. Its findings have highlighted three important areas of consideration for a functioning health system: health provider, essential medicines, and basic equipment as critical tracer items for the delivery of MCH services. Sierra Leone, like many other countries in sub-Saharan Africa, faces serious challenges on the needed human resources for a responsive health system (Lehmann, Dieleman, & Martineau, 2008) due to the chronic shortage of staff and coupled with mal-distribution with urban/rural disparity. This inherently undermines the quality of service delivery. The MoHS should, therefore, put in place a human resource policy that encourages the training and equitable distribution of staff, especially skilled birth attendants across the country. The collective efforts of both MoHS and its development partners should also be directed towards providing incentives (housing, remote allowances, professional development among others) to enhance staff retention, especially for those in hard-to-reach communities to reduce the inequities in the access to MCH services.

Frequent stock-outs of essential medicines in health facilities have the propensity of driving MCH service-users away from the health facilities to private health providers, for example. As a result of high costs of treatment in private health facilities, the implications for users would include delay in seeking care and sub-optimal treatment for conditions; leading to further complications and sometimes death. The availability of essential medicines as well as basic equipment must, therefore, be prioritized by

ministries of health to maximize the impact of the health system on population health outcomes. Often, governments find it difficult to manage the procurement and distributions of medical commodities, which leads to the delay in replenishing stock. Private-public-partnership (PPP) could be an effective approach in overcoming such challenges with resultant improvement on access to MCH services. With global concerns over the shrinking support for public health programs, donor-dependent health systems like the one in Sierra Leone can use the findings of this study to prioritize health sector investment and galvanizing relevant individuals and agencies in the private sector for robust mobilization and effective and efficient management of health sector resources.

## Conclusions

Sierra Leone, like many other low-income countries, faces chronic challenges on the issue of maternal and child health. The persisting high maternal and child mortalities in these countries testify the prevailing social injustice in the access to quality MCH services for disadvantaged populations. This study is the first to examine the predictive relationship between health system characteristics and access to MCH services in Sierra Leone. The findings of this study support the hypotheses that health system characteristics, in particular staffing, essential medicines, and basic equipment can predict access to MCH services. The new knowledge generated by this study is useful to guide the local health authorities as well as international partners in designing high impact and life-saving interventions, and for the improvement and enhancement of quality of access to MCH services. The successful implementation of these interventions could contribute significantly in closing the inequity gap in access to MCH services, and

resultantly improve maternal and child health outcomes in Sierra Leone. Notwithstanding, further research is needed to generate insight into the demand-side perspectives on the relative influence of the health system on access to MCH services in Sierra Leone.

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