University of the Western Cape

Inequalities in the use of maternal and reproductive health services in Sierra Leone

Mluleki Tsawe

Student Number: 2861022

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Supervisor: Prof. A. Sathiya Susuman

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KEYWORDS

Antenatal care

Concentration index

Concentration curve

Contraceptive use

Delivery care

Dissimilarity index

Human Opportunity Index (HOI)

Shapley decomposition

Socioeconomic inequalities

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ABSTRACT

This thesis extends the literature on the trends and magnitude of health inequalities in the area of maternal and reproductive health services in Sierra Leone, and particular across sub-Saharan Africa. It attempted to provide a good understanding of, not only the determinants of maternal and reproductive healthcare use, but also factors that enable health inequalities to exist in Sierra Leone. This is an appropriate topic in population health studies as it aims to address important questions on the research agenda in the context of sub-Saharan Africa, particularly in a country with poor health outcomes such as Sierra Leone. A proper understanding of not only the coverage rates of population health outcomes but also the extent of health inequalities as well as the factors that contribute to these inequalities is crucial for any government. The thesis applied various techniques in the analysis of DHS data (from 2008 and 2013 rounds) in an attempt to answer the research questions.
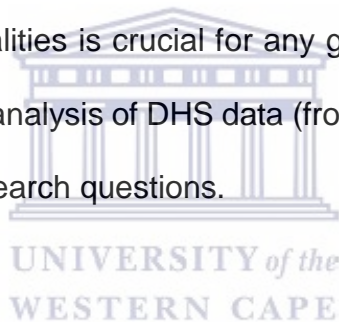
Owing to the nature of the dependent variables selected for this thesis, the binary logistic regression was chosen as the appropriate method of analysis in order to find the determinants of maternal and reproductive health services. Moreover, the concentration index was used to measure inequalities in the use of maternal and reproductive health services. The concentration index is a widely used analysis technique in the analysis of health inequalities in the fields of population, public, and economic health. We also adopted the Human Opportunity Index (HOI) technique, which takes into consideration the correlates of inequalities, the life circumstances of individuals as well as their efforts in examining and explaining

health inequalities. The concentration index was further decomposed to find factors which explain inequalities in the use of healthcare services.

The results showed that there was a general increase in the use of maternal and reproductive health services between 2008 and 2013, while the use of delivery care services as well as contraception remained low. Moreover, maternal age, marital status, socioeconomic status (maternal education and household wealth), number of living children, decision-making power, media exposure, skilled antenatal care, and geographic location (place of residence and region) were important determinants of the use of maternal and reproductive health services in the country. Inequalities in maternal and reproductive health services declined over time. Although inequalities declined over time, inequalities were largest by household wealth index, and a bit smaller by maternal education. There were high inequalities in the use of skilled birth attendants and facility-based deliveries. Furthermore, maternal education was found to be the most noticeable factor that explains inequalities in the use of maternal and reproductive health services.
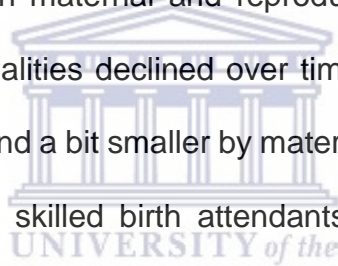
DECLARATION

I declare that *inequalities in the use of maternal and reproductive health services in Sierra Leone* is my own work, that it has not been submitted before for any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged as complete reference.

UNIVERSITY *of the*
WESTERN CAPE

Mluleki Tsawe   November 2018

Signed: ....

ACKNOWLEDGEMENTS

I thank my supervisor, Professor Appunni Sathiya Susuman for the guidance and encouragement from the inception of this work. This work would not be possible without the financial support afforded to me by the National Research Foundation, under the scarce skills doctoral scholarship[1]. I am also grateful to the DHS Program, Statistics Sierra Leone, and other stakeholders involved for providing the datasets used in this thesis. To my friends and family – thank you for all the support.

DEDICATION

Dedicated to Rose, Lakhiwe, Veronica, Thamsanqa, Vusumzi, and Kelly.

To God be the glory.

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ACRONYMS & ABBREVIATIONS

aOR   -   Adjusted Odds Ratios

CI   -   Confidence Interval or Concentration Index

DHS   -   Demographic and Health Survey

DI   -   Disparity Index

D-index   -   Dissimilarity index

FHCI   -   Free Health Care Initiative

GLM   -   Generalized Linear Models

HOI   -   Human Opportunity Index

MCH   -   Maternal and Child Health

MDGs   -   Millennium Development Goals

OOP   -   Out-Of-Pocket

PCA   -   Principal Components Analysis

RNCH   -   Reproductive, New-born and Child Health

SBA   -   Skilled Birth Attendant

SDGs   -   Sustainable Development Goals

SLDHS   -   Sierra Leone Demographic and Health Survey

Stata   -   Statistics and Data (syllabic abbreviation)

WHO   -   World Health Organization

CHAPTER 1: BACKGROUND

1.1   Introduction

Sierra Leone is among countries with the highest MMR in the world (WHO, 2014). The high MMR does not come as a surprise since this country has been marred by prolonged political conflicts. These conflicts have worsened the socioeconomic and demographic outlook of all citizens in the country. It is well-known that poor countries (as well as countries with a tense political climate) tend to have negative health outcomes, where the majority of the population cannot access lifesaving health services (Barat et al., 2004; Peters et al., 2008). Over the last few decades, many researchers have delved into research aimed at unearthing factors that determine health inequalities in many societies. Health inequality is a common phrase used to label disparities in health among populations (Kawachi et al., 2002). Evidence-based research into many aspects of health inequalities has provided policy-makers and other relevant stakeholders with means of understanding and putting measures in place to reduce such inequalities. With this background in mind, this thesis seeks to examine inequalities in maternal and reproductive health use in the country.

The government of Sierra Leone launched some policies to address issues pertaining to population and health. According to Statistics Sierra Leone and ICF International, the Government of Sierra Leone launched a revision of the National Population Policy in 2009. This revised policy was aimed to address several of the critical issues of "population, health and sexual and reproductive rights, education, gender equality, equity and empowerment of women, the special needs of persons

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in especially difficult circumstances such as amputees, war widows, street children and other physically challenged persons and their interrelated development challenges" (Statistics Sierra Leone and ICF International, 2014: 3).

Furthermore, in 2011, the Ministry of Health and Sanitation launched a policy aimed at reducing inequalities in Reproductive, New-born and Child Health (RNCH) and improving the uptake of Reproductive, New-born and Child Health outcomes (Ministry of Health and Sanitation, 2011). The country has struggled to increase the uptake of lifesaving maternal and reproductive health outcomes. This is evident in the low uptake of contraceptive services and high home births. Complete use of maternal and reproductive health services has a significant impact in lowering the MMR of any country. Therefore, if inequalities exist and hamper the use of these services, the prospects of reducing maternal mortality will become minimal. The latest Demographic and Health Survey shows that the use of antenatal services in Sierra Leone is high (97.1% of antenatal services are provided by a skilled provider, and 76% of women had at least four antenatal visits for their recent live birth), while there is low uptake of facility deliveries as well as births delivered by skilled birth attendants (Statistics Sierra Leone and ICF International, 2014). This is a paradox as it would be expected that if antenatal use is high, then facility-based deliveries as well as use of skilled birth attendants should also be high.

As far as the literature review is concerned, no previous studies relating to inequalities in maternal and reproductive health services were done in Sierra Leone, even though this country is among countries with the highest MMR (over

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1000 deaths per 100 000 live births in 2013)[2] in the world. Besides the highest MMR, the country also had a history of many conflicts over the years which resulted in eradicating equality among individuals. Therefore, these inequalities might be related to those of social and health related aspects of the community. As a poor country, socioeconomic inequalities are expected, but there is no empirical evidence to show the extent of these inequalities in the use of maternal and reproductive health services in Sierra Leone. As means of filling gaps in research in the country, this thesis has an academic grounding to provide insights for understanding maternal and reproductive health care use, and to explore the inequalities which may be prevalent in minimising maternal and reproductive health care use in Sierra Leone. This thesis therefore, mainly tries to find out if there are inequalities in maternal and reproductive health care use in the country. Therefore, the purpose of this thesis is to unpack inequalities in maternal and reproductive health services in Sierra Leone.
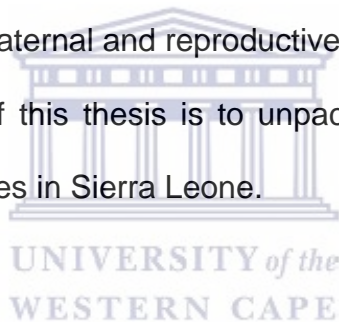
1.2   Selection criteria of study country: Sierra Leone

For purposes of this study, eighteen *West African* countries were considered. A number of selection criteria were carefully put forth in order to meet the objectives and main purpose of the study. One of the reasons for selecting West African countries is due to the fact that most of the countries in this region have endured a long history of political conflicts and civil wars.[3] A West African country was

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[2] See: https://www.dhsprogram.com/pubs/pdf/FR297/FR297.pdf

[3] The researcher believes that these *in-country* conflicts may have in one way or another contributed to maternal and reproductive health inequalities in some if not all the countries where conflicts were once prevalent

considered if[4]: (a) it had the latest standard DHS data as of 1st July 2015; (b) it had at least two DHS data points[5]; (c) it had a prevalence of skilled birth assistants at below 60%[6]; (d) it had a prevalence of four or more antenatal visits at below 80%; (e) it had a contraceptive prevalence among married women at below 20%; (f) it had civil war or major conflicts which spanned the 1990s and the 2000s; (g) its latest DHS full report is written in English[7]; and (h) if its Maternal Mortality Ratio was 700 deaths per 100 000 live births or more. Please note that countries without the latest or any DHS data, and those with non-English-written DHS reports were excluded. Therefore, Sierra Leone was chosen because it met all the selection criteria.

1.3   Overview of maternal and reproductive health services in Sierra Leone

Maternal and reproductive health relate to women's health (and subsequently that of the newborn) during pregnancy as well when the child has been born. The World Health Organization, and other agencies, has developed various maternal and reproductive health indicators to measure development (mainly for monitoring and evaluation as well as policy implementation) in relation to women and child health in developing countries. The major source of information relating to maternal and reproductive health in Sierra Leone is the reports produced from the Demographic and Health Surveys conducted in the country in 2008 and 2013. This section profiles the trends in maternal and reproductive health use according to the Sierra

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[4] See Appendix Table A1.1

[5] For trend / comparison purposes

[6] All maternal and reproductive health indicator prevalence rates according to the *latest* published DHS full report as of 1 July 2015

[7] The author chose countries which had English-written DHS reports for convenience and to avoid language barriers as he has no understanding of other languages used in DHS reports (*i.e.* French, etc.)

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Leone Demographic and Health Surveys and other relevant sources. What follows is a brief overview of the situation with regard to antenatal care, delivery care, and contraceptive use in Sierra Leone.

1.3.1 Antenatal care

Antenatal care is an important health outcome that is essential in preventing many health problems during a woman's pregnancy. Many authors have argued that complete antenatal check-ups, and sue of skilled antenatal care providers is essential in promoting improved maternal and child health outcomes and in decreasing the risk of maternal mortality among pregnant women (Regassa, 2011; Susuman, 2012; Pell et al., 2013). The World Health Organization (WHO) recommends that women have at least four antenatal visits during the first trimester (Garrido, 2009). It is, therefore, essential that pregnant women seek antenatal care as early as possible and continue with antenatal care through to child-birth (Statistics Sierra Leone and ICF International, 2009). Late initiation of antenatal care often results in complications that could have been prevented if antenatal care was initiated at earlier stages of pregnancy.

Attendance of the WHO recommended antenatal visits grew by an average annual growth rate of 20.4%[8] per annum between 2008 and 2013, from 51.6% to 76.0% (Statistics Sierra Leone and ICF International, 2009; Statistics Sierra Leone and ICF International, 2014). Use of skilled antenatal care providers remains high in

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[8] See appendix Table A1.3. The World Health Organization recommends four or more antenatal visits during a woman's pregnancy

the country, it increased from 86.9% in 2008 to 97.1% in 2013 (Statistics Sierra Leone and ICF International, 2009; Statistics Sierra Leone and ICF International, 2014). Women who reported that they had no antenatal visits during pregnancy showed a decline from about 7% in 2008 to about 2% in 2013, with an average annual growth rate of -10% per annum. Chapter four will provide a clearer profile of the use and determinants of antenatal care in the country.

1.3.2 Delivery care

Delivery care pertains to the type of place of delivery (i.e. where the woman gives birth) as well as the type of assistance received during delivery. This thesis focuses on the type of assistance received during delivery (*the use of skilled birth attendants*) as well as the type of facilities women choose to give birth in; as this is an important component of maternal health which can significantly lower the chances of maternal and infant mortality, depending on where the women gives birth and who assists her. Sierra Leone has a high percentage of women who still give birth at home, without the assistance of skilled birth attendants, and this could come as an explanation to the country's high maternal mortality ratio.

The SLDHS shows that the percentage of women who reported that they had been assisted by a skilled provider during birth increased from about 42% in 2008 to about 60% in 2013, thus showing an increase of about 17% between the two periods (Statistics Sierra Leone and ICF International, 2009; Statistics Sierra Leone and ICF International, 2014). Use of facility-based deliveries remains low in the country. Women who gave birth in a health facility increased from 24.6% in

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2008 to 54.4% in 2013. It is a norm for women in developing countries to give birth at home, and often without the assistance of skilled birth attendants, and this often reflects negatively on the fight for the reduction of maternal mortality (Joseph et al., 2002; Peltzer, 2005; Tann et al., 2007).

1.3.3 Contraceptive use

Contraception is an essential component of family planning. It gives women the power to decide how the space their births. High uptake of contraception has a potential to reduce high fertility in high fertility countries. For purposes of this study, contraceptive use refers to the use of methods which aim to avoid or delay pregnancy among women of reproductive ages. Sierra Leone has a very low uptake of contraception, where the percentage of women who use contraception has remained less than 20% over time. The uptake of modern contraceptives increased from about 7% in 2008 to about 16% in 2013 (Statistics Sierra Leone and ICF International, 2009; Statistics Sierra Leone and ICF International, 2014). Chapter four will shed light into the trends and determinants of contraceptive use in Sierra Leone – and will tentatively provide reasons for the low contraceptive uptake.

1.4   Objectives of the study

The main objective of this study is to assess demographic and socioeconomic inequalities in maternal and reproductive health services.

The study also aims to:

- Analyse and understand the patterns and trends in the use of maternal and reproductive health services in Sierra Leone

- Examine the determinants of maternal and reproductive health use in Sierra Leone

1.5 Research questions

The study mainly seeks to answer the following questions:

i. What are the determinants of maternal and reproductive health use in Sierra Leone?

ii. To what extent is there an existence of inequalities in the use of maternal and reproductive health services in Sierra Leone?

iii. Which demographic and socioeconomic factors explain inequalities in the use of maternal and reproductive health services in Sierra Leone?
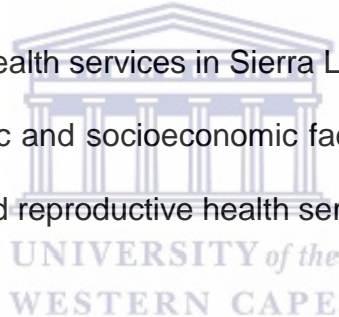
1.6 Significance of the study

Sierra Leone seems to be deserted when it comes to population-related and demographic studies. Little is known of the health inequalities that may be prevalent in the country. This study aims to provide insights into the use of maternal and reproductive health services as well as demographic and socioeconomic inequalities thereof. Moreover, through scientific research, this study aims to contribute useful and evidence-based information that may aid reproductive and maternal related policy formations in Sierra Leone. It is also fitting to indirectly monitor and evaluate whether the Ministry of Health and Sanitation

(through the Reproductive, New-born and Child Health policy) has made some strides in improving the uptake of maternal and reproductive health services in the country.

1.7   Scope of the study

The study used two existing datasets namely: the 2008 Sierra Leone Demographic and Health Survey, as well as the 2013 Sierra Leone Demographic and Health Survey. The 2013 Sierra Leone Demographic and Health Survey is the latest source of data on maternal and reproductive health in the country in terms of the standard Demographic and Health Surveys[9]. Both datasets are nationally representative and allow conclusions to be made for the entire country. These datasets will be used to provide insights into inequality in maternal and reproductive health services in Sierra Leone. Furthermore, the study focuses on three broad dimensions of maternal and reproductive health services, namely: antenatal care (i.e. use of four or more antenatal visits, as well as use of skilled antenatal services), delivery care (i.e. facility-based deliveries, as well as use of skilled birth attendants), and contraceptive use. Maternal and reproductive health services are not limited to these three broad dimensions, but these dimensions were chosen based on available literature on similar studies.

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[9] The standard DHS Surveys have large sample sizes and are usually conducted about every 5 years, to allow comparisons over time. Other surveys are more specialised [e.g. Malaria Indicator Survey (MIS) and may not always include indicators related to maternal and reproductive health services]

1.8   Andersen's behavioural model of health care utilization

Andersen's behavioural model of health care utilization is used in this study (chapter four) to explain the determinants of maternal and reproductive health services in Sierra Leone. Use of health care services is an individual experience; as such, it is at the individual level that one makes the decision to make use of maternal and general health care services (Addai, 2000). This model suggests that the utilization of health care services is based on a set of distinct factors; namely: external environment, predisposing factors, enabling factors, and need factors. It is, therefore, fitting to explain the determinants of maternal and reproductive health by means of this model. Chakraborty *et al.,* (2003) states that predisposing and enabling factors may not be adequate to promote health care use, which then makes the need factors central to health care use. According to this model, health care services are used because one sees the need to use these; which, in turn, drives individuals to use these services (Chakraborty *et al.,* 2003). Because predisposing factors are demographic in nature, they cannot be changed by social circumstances (Young *et al.,* 2006). Enabling factors promote healthcare use; unlike predisposing factors, the enabling factors have the possibility of being changeable (Young *et al.,* 2006). The health behaviour model is universal in that it includes individual factors, community factors and the health system in trying to understand the determinants of health care use (Young *et al.,* 2006). Predisposing, enabling factors, and need factors are further expounded as follows (Chakraborty *et al.,* 2003; Adamu, 2011):

- **Predisposing factors:** these are demographic factors such as age, education, number of living children, etc.

- **Enabling factors:** these are income, health care and facility accessibility, availability of health care services and facilities, etc.

- **Need factors:** these include the perceived morbidity, health status, etc.

- **External environment**: these include community level factors, such as place of residence, region, etc.

Figure 1.1 shows Andersen's behavioural model of health care utilization. Predisposing and need factors are individual characteristics which proximately determine the utilization of maternal and reproductive health care services. As illustrated by the dotted line, there is a link between the predisposing and need factors. Enabling factors are community-based factors which have an influence on maternal and reproductive health care utilization. All these factors (predisposing, enabling and need) have an influence on maternal and reproductive health care utilization.

Figure 1.1: Andersen's Behavioural Model of Health Care Utilization (depiction)

External environment

- Place of residence
- Region
- Media saturation

Predisposing factors

- Maternal age
- Marital status
- Maternal education
- Number of living children
- Women's decision-making
- Number of HH members

Enabling factors

- Wealth index
- Media saturation

Need factors

- Antenatal care

Use of maternal and reproductive health services
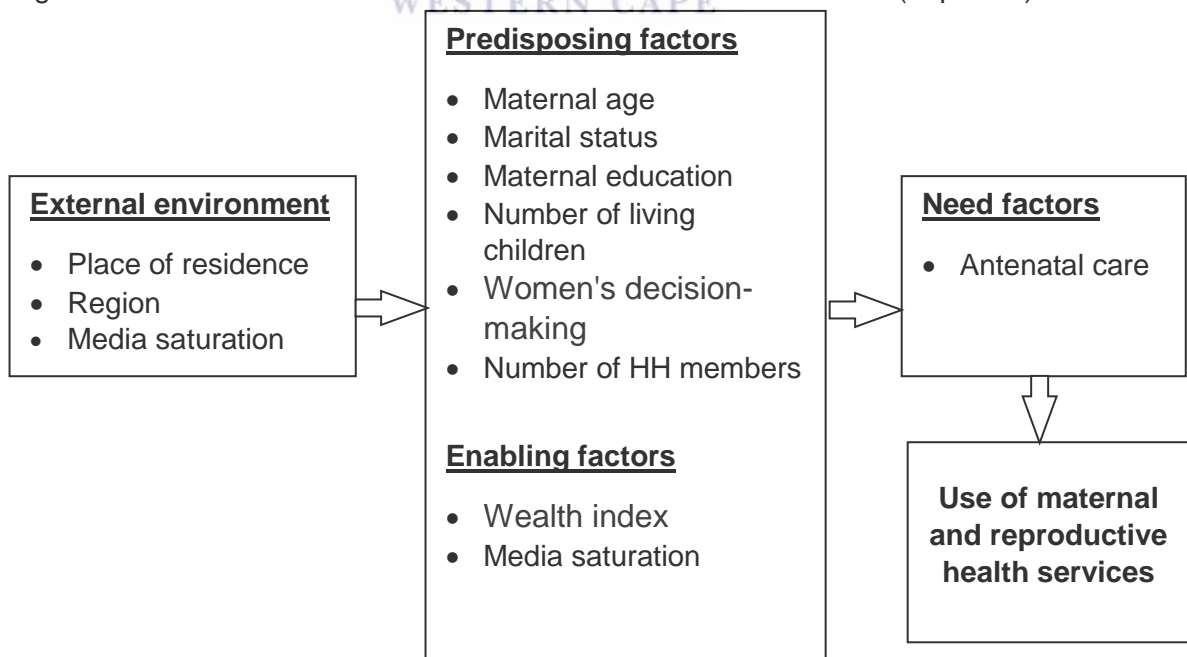
[Modified from Anderson and Newman (1973); Young et al., 2006; Adamu, 2011; Karkee et al., 2014]

1.9   Thesis structure

This thesis has been organized into eight chapters. Chapter one provides the background to the study. Chapter two provides the literature review in relation to the objectives of the study, indicating the views of different authors who have attempted to address the issues pertaining to inequality in health (more specifically, maternal and reproductive health). Chapter three concentrates on the sources of data and methods used in the thesis. The analysis chapters (chapter four to chapter seven) are written in academic research paper style. While some chapters have been submitted for publication (and are under review), some are yet to be submitted. Each chapter is written as a standalone chapter, although the same data is used in the different analyses in these chapters. The reason for this style of writing is that it makes it easier to send the papers for publication (which is something I plan to do). Chapter four presents analysis of the prevalence and determinants of maternal and reproductive health. Chapter five presents an assessment of inequalities in maternal and reproductive health utilization. Chapter six presents an examination of inequality of opportunity in the use of maternal and reproductive health. Chapter seven presents the decomposition analysis of the concentration index (used in chapter five) in order to put into context the factors that contribute to inequalities in the use of maternal and reproductive health services. chapter eight, summarises the findings of this study and provides overall conclusions.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Literature has shown that the use of healthcare services is unequal among societies and population groups; and that there many factors which explain these unequal health care distribution and use. With regards to maternal and reproductive health services use, inequalities are multifaceted and exist among many societies, especially those within developing countries. This chapter, therefore, presents a brief background into the context in which health inequalities often come about, a brief background of the relationship between socio-political conflict and health care, as well as some selected determinants of maternal and reproductive health service use. Moreover, the chapter also presents the conceptual framework that is selected for this study.

2.2 Health care systems

Sierra Leone forms part of West African countries; these countries have been confronted with various historical challenges of the economic and political nature, which have, over the years, led to extreme underdevelopment (Bhattacharyya, 2007). Like most countries within the African region, historical injustices have led most West African countries to lack in basic and necessary health infrastructure, especially in rural areas (Quinn, 2016). It is no surprise that Sierra Leone has, over the years, had an adverse health situation. Sierra Leone has been ranked among the countries with the most inefficient health care systems in the world (WHO, 2000). Inefficient health care systems provides a basis for health inequalities to exist; as these inequalities are often more noticeable in the unequal health

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conditions of different groups within society, as well as in the unequal access to the resources provided by the health system (Barreto, 2017).

2.3   Conflict and health care

As mentioned, Sierra Leone has experienced prolonged civil wars and related socio-political conflict which has adversely affected the health systems in the country. The civil war which took place over a ten-year period caused major problems in the country, more so for rural areas, where the little health care facilities that existed got destroyed (Quinn, 2016). There is an interrelationship between socio-political conflict, access to health care, and health inequalities. Countries which have had prolonged socio-political conflict tend to have poor health outcomes as well as poor health infrastructure (Martineau et al., 2017). Socio-political conflict has the propensity to negatively affect health care access and provision, as well as health care infrastructure, due to destruction of health infrastructure during such conflict (Ghobaraha et al., 2004; Martineau et al., 2017).

2.4   Theoretical explanation of health inequality

There are various theories which have been used to explain health inequalities among populations. Most of these theories are beyond the scope of this study. This subsection briefly highlights some theories of health inequalities which have been put forth overtimes. Therefore, this is mainly a brief explanation of the notions that are upheld within each of the selected theories.

2.4.1 Artefact theory

The artefact theory argues against the *real* presence of health inequalities, and considers health inequalities to be a result of errors in the way social class data is collected and the way in which health inequality measurements (or definitions) have changed over time (West, 1998; Bambra, 2011; McCartney et al., 2013). This theory does not explicitly state that health inequalities do not exist; in fact, it recognises that class inequalities do exist among populations (West, 1998; Bambra, 2011). Various authors who have found health inequalities to exist in society and thus have rejected this theory, mainly on its premise that inequalities are not real (West, 1998; McCartney et al., 2013).

2.4.2 Social selection theory

The social selection theory argues that differentials in social class in health occur when healthy people move up the socioeconomic ladder and unhealthy people move down (West, 1998). In essence, this theory argues that health is a determinant of social position (Bambra, 2011). Of course, this is not always the case in the real world. For instance, there may be a person with disabilities in a family, and his disability may not change his socioeconomic class and that of his family. Literature shows that, over the years, various researchers have delved into this theory and have unequivocally rejected it as a theory that explains health inequalities – i.e. there's no found *causal* relationship between health and social selection (Bambra, 2011; McCartney et al., 2013).

2.4.3 Cultural and behavioural theory

The cultural-behavioural theory is based on the premise that health behaviours vary between socioeconomic classes, and as such, destructive health behaviours tend to be associated with persons with lower socioeconomic statuses (Bambra, 2011). West (1998) has strongly argued against assuming that culture and behaviour are one-and-the-same. Nonetheless, this theory is also based on the premise that certain health behaviours and differences between social groups have a causal effect with regard to health inequalities – and certain authors have argued against this premise (McCartney et al., 2013). Furthermore, if one was to remove the socioeconomic conditions of persons, then this theory would remain weak in explaining health inequalities (McCartney et al., 2013).

2.4.4 Structural theory

This theory posits that a person's socioeconomic position (i.e. material conditions) determines their health status. As such, differentials between persons have direct, and differentiated, influences on their health outcomes (McCartney et al., 2013). Structural theorists tend to put less importance on the other theories, explained above, whilst enforcing the importance of this theory (McCartney et al., 2013). Moreover, structural theorists also believe that differential health risks across geographical locations and socioeconomic classes tends to contribute to health inequalities (Arcaya et al., 2015).

2.5   Selected determinants of maternal and reproductive health

This subsection presents a few determinants of maternal and reproductive health services. These determinants have been seen to contribute to broader health inequalities in various ways. It is also know that the use of maternal and reproductive health services is context-based, in that it varies across and within cultures, communities and individuals (Babalola, 2014a). Moreover, studies have noted that there are various factors which determine the use of maternal and reproductive health services, such as socioeconomic status, maternal age, as well as other determinants which are not discussed in this section. These factors have the potential of contributing to inequalities in maternal and reproductive health services.

Maternal age

Age is among the important predictors of maternal and reproductive health care use. Various studies have shown that when it comes to delivery care, women in the *older* reproductive ages tend to use facility deliveries less than those at *younger* reproductive ages (Thind et al., 2008; Desta et al., 2017; Shahabuddin et al., 2017). Various authors suggest that older women who have given birth have a habit of believing that they have more experience when it comes to pregnancies and that they can handle pregnancy-related complications and, as such, do not need to comply with the recommended maternal health services (Birmeta et al., 2013). A study by Thind et al., (2008) found that women at older reproductive ages (i.e. 30 years and older) significantly use less public and private health facilities for delivery. Unlike institutional delivery, use of antenatal care tends to increase with

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age. Studies have found that older women (i.e. aged 30 years and older) are significantly more likely to use antenatal services compared to younger women, *usually in their teens or early twenties* (Babalola, 2014b; Dahiru & Oche, 2015).

Most African countries have high fertility rates and very low levels of contraceptive use. Moreover, studies have shown that the use of contraception generally increases with reproductive age, whereby women at older reproductive ages tend to use contraceptive health services more than younger women (Khan et al., 2012; Nyarko, 2015). This could be explained by the fact that older women may use more contraceptive services as means of limiting (or stopping) childbearing compared to their younger counterparts, who may be unaware of the various contraceptive options available to them. However, a study looking into the determinants of marital contraception in Bangladesh found that, as much as the use of contraceptive services increases with maternal age, it tends to drop for women in their forties (Haq et al., 2017).

Maternal education & literacy

Extensive research has been conducted on the determinants of maternal and reproductive health services, particularly with regards to maternal education. In fact, several authors have posited that maternal education and literacy are among the biggest determinants of maternal health care and reproductive health care use (Tann et al., 2007; Ahmed et al., 2010; Regassa, 2011; Arthur, 2012; Ergano et al., 2012; Dahiru & Oche, 2015). Maternal education has been found to be associated with health-care-seeking behaviours related to maternal and

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reproductive health services (Ahmed et al., 2010). Several studies have found a positive relationship between maternal education and the use of maternal and reproductive health services (Babalola and Fatusi, 2009; Ahmed et al., 2010; Dagne, 2010; Karlsen et al., 2011; Ergano et al., 2012). Women with higher literacy and education levels tend to use maternal and reproductive health services more than women with lower levels of education (Khan et al., 2012; Saxena et al., 2013). Moreover, women with lower levels of education tend to have low literacy levels and do not use the essential maternal and reproductive health services that are required of them (Koblinsky et al., 2008).

Household wealth

Women's socioeconomic status has a positive influence on the use of maternal and reproductive health services. Studies show that women from a higher socioeconomic standing tend to use more maternal and reproductive health services than women from a lower socioeconomic standing (Babalola, 2014b; Karkee et al., 2014; Dahiru & Oche, 2015). A study among women in Ghana found that women from the richest households were significantly more likely to use contraceptive services compared to women from poor households (Nonvignon & Novignon, 2014). This is more evident in most African countries, especially those without proper health care systems. Women from poor households struggle to use essential life-saving maternal and reproductive health services due to various factors such as, not having enough money to pay for services (especially in countries where user-fees are not yet abolished) and also not having enough

money to pay for transportation – this is particularly evident for women in rural areas.

Geographic location

Another important determinant of maternal and reproductive health care use is geographical location. Studies have found that women from rural areas are less likely to use maternal and reproductive health services as compared to those living in urban areas (Dagne, 2010; Nonvignon & Novignon, 2014; Dahiru & Oche, 2015) – this is often due to accessibility and affordability constraints which are more prevalent in rural areas. It is also said that in rural areas, women have to travel long distances to get to health care facilities and this becomes a barrier to accessing maternal and reproductive services (Harris et al., 2011; Silal et al., 2012). Moreover, there seems to be variation in maternal and reproductive health care use among regional/provincial locations within the countries. The regions and provinces that are more urban tend to have more women who use maternal and reproductive health services that the more rural regions.

2.6   Conceptual framework for health inequalities

The conceptual framework adopted for this study is based on the framework developed by the Commission on Social Determinants of Health (CSDH)[10]. Solar and Irwin (2010) argue that a good social determinants of health framework should determine the social determinants of health as well as the related inequalities in

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[10] See: Figure 2.1

health. The framework looks at different elements of inequality such as socioeconomic status, education, race or ethnicity, as well as geographical location among other elements, and posits that the social determinants of health are the inherent conditions in which people are born, live, as well as the systems put in place to deal with health, or ill-health (Solar & Irwin, 2010; Zere et al., 2011). In essence, the CSDH looks into establishing the underlying explanations to health disparities and inequities, and in doing so, the CSDH framework does not only look at demographic elements but also looks into other wider structures which include economic policies, social norms, as well as social policies among others (Chapman, 2010; Solar & Irwin, 2010). Therefore, both the demographic, and socio-political elements of inequality determine power (and socioeconomic) inequalities which have the chance of negatively (or positively) influencing health through exposure to *intermediary determinants* (Solar & Irwin, 2010).
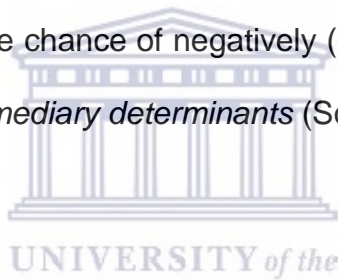
Structural determinants: social determinants of health inequalities

According to the CSDH, the structural determinants form part of the social and economic context in which individuals find themselves, and these *structural determinants* are the social determinants of health inequities (Solar & Irwin, 2010). The structural determinants include the socio-political context as well as the socioeconomic position. The socioeconomic position includes socio-demographic factors such as, sex, ethnicity, education, occupation, and income, which can be used as equity stratifiers to explain inequalities among populations. Solar and Irwin, (2010), state that 'structural determinants cause social stratification in society and explain the socioeconomic position of individuals'. Therefore, the

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unequal distribution of the above-mentioned (as well as other) *structural determinants* in societies tends to lead to inequalities in health outcomes.

Intermediary determinants: social determinants of health

The intermediary determinants work hand-in-hand with the structural determinants to profile health outcomes (Solar & Irwin, 2010). The intermediary determinants include material circumstances, psychosocial factors, behaviours and biological factors. These intermediary determinants have the potential to either improve or limit an individual's life and health outcomes (Solar & Irwin, 2010). Material circumstances relate to material objects such as housing; psychosocial circumstances relate to the individual's social living circumstances and relationships; and behavioural and biological factors can relate to *risky* health behaviours (tobacco and alcohol consumption), which often have a different distribution among individuals (Solar & Irwin, 2010). These factors form regulate the differences which are often found in individual's exposure to ill-health (Solar & Irwin, 2010). Therefore, it can be said that the individual's socio-political context has a direct effect on intermediary determinants (Solar & Irwin, 2010).

Figure 2.1: A conceptual framework for action on the social determinants of health
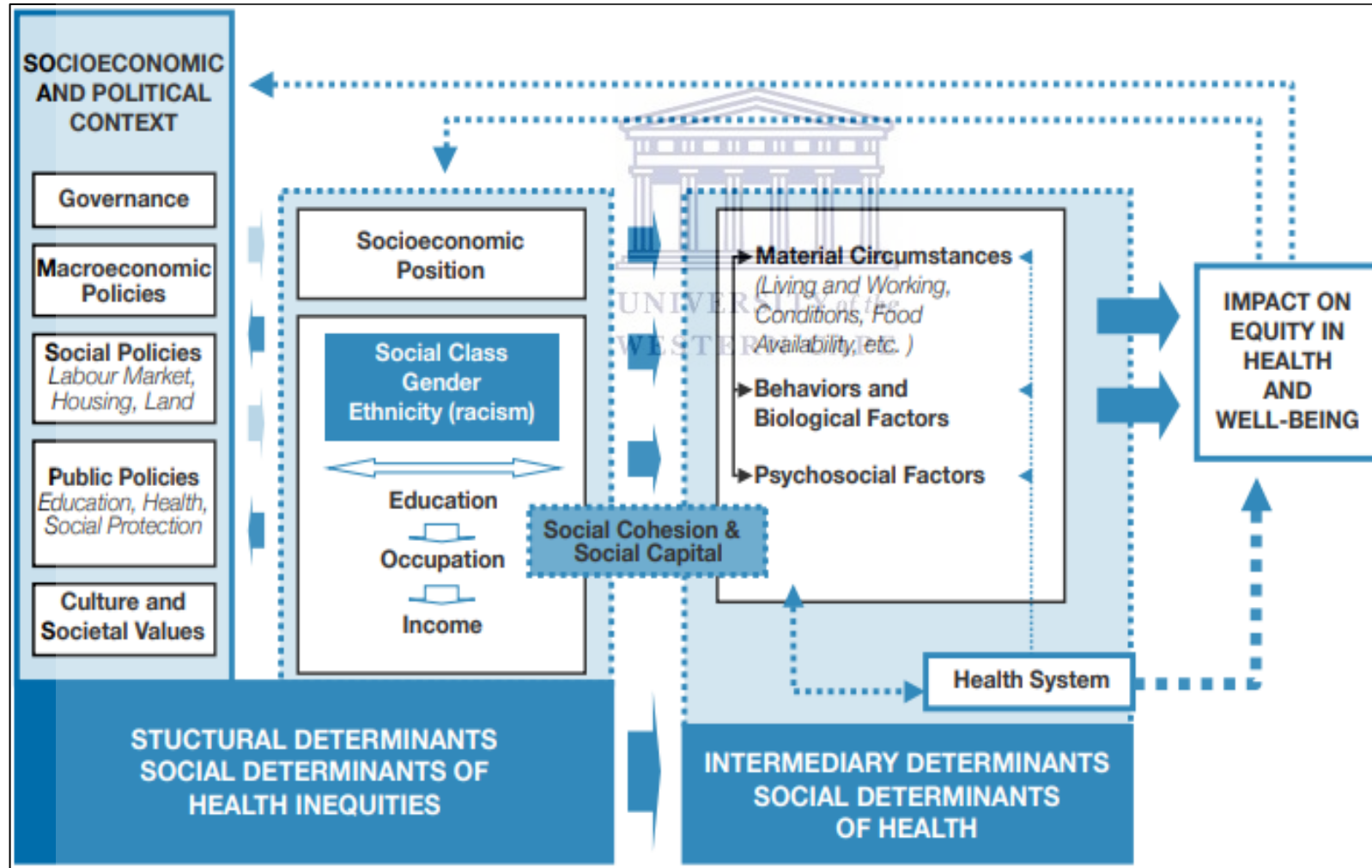
Source: Solar & Irwin, 2010 – (Commission on the Social Determinants of Health, 2010)

CHAPTER 3: DATA SOURCES & METHODS

3.1   Introduction

This chapter provides details on the study setting, data sources and analytical methods that have been deployed. The chapter also provides details on the sample sizes selected for each of the outcome variables used in the study, and discusses the different types of inequality measures that will be used in the study.

3.2   Sierra Leone in context

According to Statistics Sierra Leone (2009 and 2014), Sierra Leone is a country positioned on the west coast of Africa and covers an area of about 72 000 square kilometres. The 2004 Population and Housing Census estimated that the country has about five million people. Its neighbouring countries include the Republic of Guinea and the Republic of Liberia. The official language is English, and the country as a whole has about fifteen ethnic groups. There are four major tribes in the country and these are: the Mende, Temne, Limba, and Creole; with Christianity and Islam being the main religions.

Sierra Leone is mainly dependent on agricultural produce, and the economy is thus largely agricultural. The agricultural sector accounts for about fifty per cent of the real gross domestic product (GDP). However, the share of the GDP attributed to the agricultural sector has been gradually declining over time with a sharper drop from forty-seven percent in 2012 to forty-one percent in 2013, largely owing to the mining activities in the country which were prevalent during this period. The

performance of the Sierra Leonean economy has been deteriorating since the advent of independence, with its greatest decline during the ten-year civil conflict.

Map 3.1: Map of Sierra Leone depicting the regions and main towns
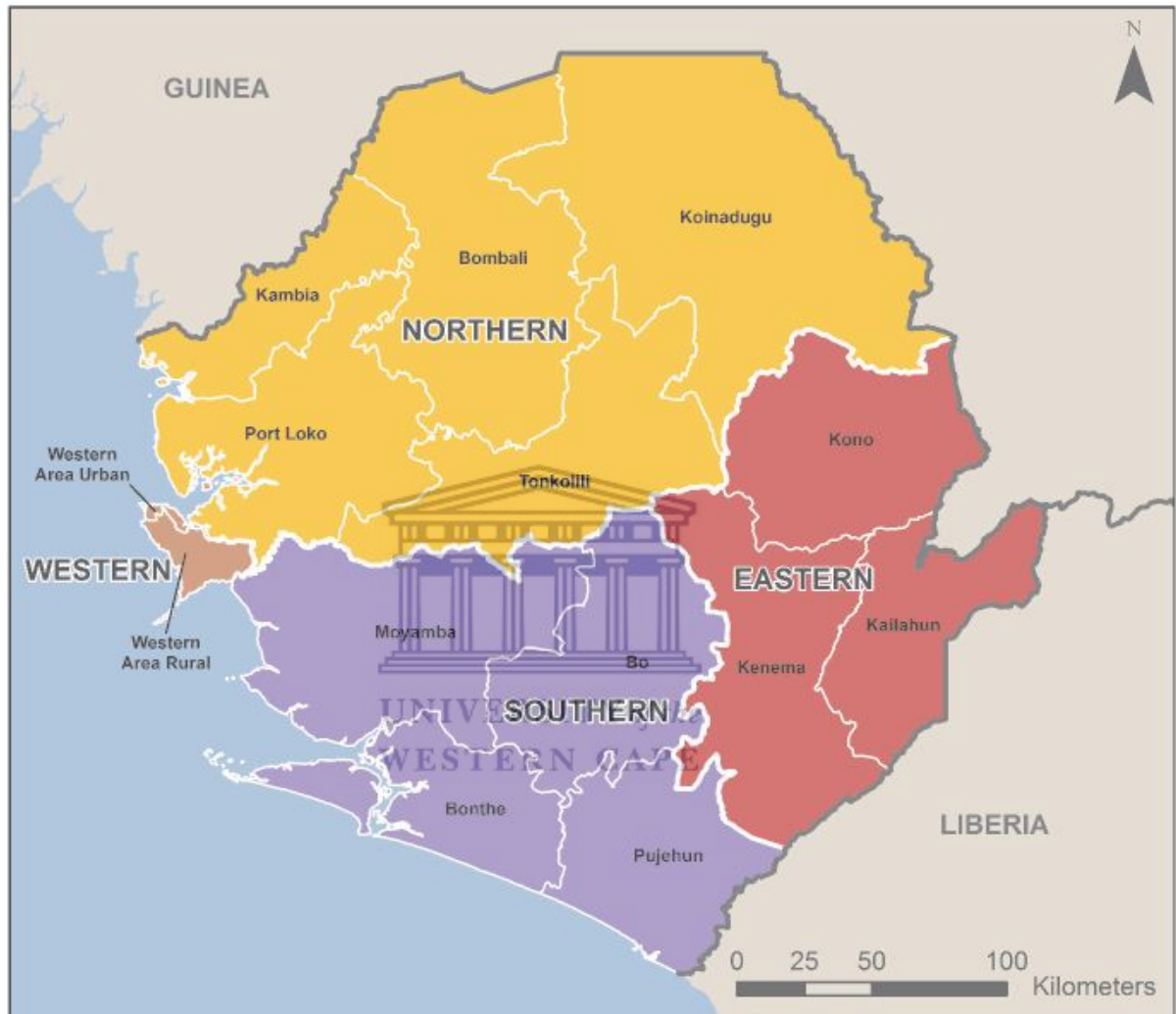
Source: Statistics Sierra Leone and ICF International, 2014

3.2.1 Regions of Sierra Leone

The country is administratively managed and divided into four regions. Each region is further subdivided into districts, and each district is divided into chiefdoms. Overall, the country has fourteen districts and one hundred and forty-nine chiefdoms. This section provides a brief description of the regions of the country.

3.2.1.1　　　Eastern region

The Eastern region is one of the four regions of Sierra Leone. This region is made up of an area of about 15 553 km² and has a population of about 1 641 012 (2015 census, provisional results). The sex ratio for this district was estimated at 97.9, indicating there were more females than males (2015 census, provisional results). This region is made up of three districts, whereby Kenema district is the capital and administrative district.

3.2.1.2　　　Northern region

The Northern region is made up of five districts and covers an area of about 35 936 km² and has a population of about 2 502 805 (2015 census, provisional results). This region also has more females than males, with a sex ratio of 95.1 males per 100 females (2015 census, provisional results). The administrative and economic town (Makeni) is located within Bombali. The region is largely made up of the Muslim religion and the Temne people make up the majority of the population.

3.2.1.3　　　Southern region

The Southern region covers an area of about 19 694 km² and has an estimated population of 1 438 572 (2015 census, provisional results). The region has more females than males, with a sex ratio of 95 males per 100 females (2015 census, provisional results). It is made up of four districts (Bo, Bonthe, Moyamba, and Pujehun). The capital and administrative city is Bo, which is also among the most populated cities in Sierra Leone.

3.2.1.4   Western region

The Western area is one of the four main regions of Sierra Leone. This region is made up of two districts and covers an area of about 557 km² and has a population of about 1 493 252 (2015 census, provisional results). This region also has more females than males, with a sex ratio of about 98 males per 100 females (2015 census, provisional results). The Western urban area (district) is the most populous district (1 050 301 people) according to the 2015 census provisional results.

3.3   Data sources

As explained in chapter one, two datasets were used in this study, namely: the 2008 Sierra Leone Demographic and Health Survey, as well as the 2013 Sierra Leone Demographic and Health Survey. These datasets are nationally representative samples, which permits one to make conclusions about the entire country based on the results obtained from such data. From these datasets a subset was selected for the purpose of this study (this will be explained further in section 3.4 of this chapter).

3.3.1   Characteristics of Sierra Leone DHS 2008

The Sierra Leone DHS of 2008 was the first Demographic and Health Survey to be conducted in the country. The survey used a nationally representative sampling technique to sample 7 758 households. Out of the occupied households, 7 284 households were successfully interviewed, which showed a 98% household

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response rate. According to Statistics Sierra Leone (2009), sampling was done in two stages. The first stage involved the selection of 353 sample points which were selected from a list of enumeration areas in the master sample frame that was designed for the 2004 Sierra Leone Population and Housing Census. The second stage involved a complete listing of households which was carried out in each selected cluster. This resulted in the systematic selection of twenty-two households per cluster for participation in the survey.

Women of reproductive age (15-49 years) who were either permanent residents of the households or visitors present in the household on the night before the survey were eligible to be interviewed. Moreover, all men aged 15-59 years in half of the households selected for the survey were eligible to be interviewed if they were either permanent residents or visitors present in the household on the night before the survey. Furthermore, the 2008 SLDHS administered three types of questionnaires (Household Questionnaire, the Women's Questionnaire, and the Men's Questionnaire). These questionnaires followed the model questionnaires developed by the MEASURE DHS programme to gain information on the characteristics of households and persons in the country. Fieldwork for the 2008 SLDHS began in the end of April and took over two months to complete.

3.3.2 Characteristics of Sierra Leone DHS 2013

The Sierra Leone DHS of 2013 was the second Demographic and Health Survey to be conducted in the country. The survey used a nationally representative

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sampling technique[11] to sample 13 006 households. The computed response rate for households was 99.3%[12]. Out of 12 629 interviewed households, 16 658 women were interviewed. Women of reproductive age (15-49 years) who were either usual household members or women present in the household on the night before the survey were eligible to be interviewed.

Furthermore, the 2013 SLDHS also administered three types of questionnaires (Household Questionnaire, the Women's Questionnaire, and the Men's Questionnaire). As with all DHS questionnaires, these questionnaires followed the model questionnaires developed by the MEASURE DHS programme to gain information on the characteristics of households and persons in the country. Fieldwork for the 2013 SLDHS began in June 2013 and was completed in October of the same year. After fieldwork was completed, all questionnaires were sent to the offices of Statistics Sierra Leone for reviewing and editing.
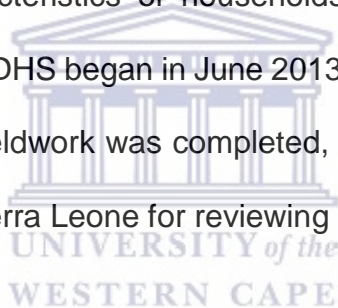
3.3.3 Comparability of DHS data

Demographic and Health Survey data are collected in a similar manner across countries, with slight differences from country to country[13]. Therefore, DHS data are comparable due to the methods that ICF International (together with a variety of statistical agencies) adopts. These methods ensure that certain key variables are kept across surveys with little deviation across time. This, in turn, ensures that

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[11] Probability proportional to their size, with a selection of 435 clusters (277 rural and 158 urban)
[12] The denominator being only occupied households (12 724 occupied households)
[13] Or survey to survey

trends in certain phenomenon can be observed and studied across time and between countries.

3.4   Study sample

Sampling is a technique that involves selecting a small number of people (who are usually considered to be representative of the entire population) for a particular study (Burns & Grove, 2005). This study considered women of reproductive age (15-49 years) from the two SLDHS. Appendix Table A1.2 depicts the selected samples for the study according to the outcome variables. For the five outcome variables, *do not know* and missing cases[14] were removed from the analysis. The author believes that *do not know* and *missing* cases do not offer any meaningful results and may distort the study findings and conclusions.

3.5   Data management, methods and analysis techniques

The analysis for the study was carried out using Stata version 14 (StataCorp LP, Texas, USA) and Microsoft Excel 2013. Complex survey sampling was accounted for by using the *svyset* command in Stata version 14. All analyses were weighted in order to provide results which were generalizable to the entire population. The type of analysis used in each analysis chapter is further explained in that particular chapter.

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[14] The author removed *do not know* and missing cases from the analysis purely out of preference

3.5.1 Analysing prevalence and trends in maternal and reproductive health service use

To analyse the prevalence and trends in maternal and reproductive health service use, descriptive univariate and bivariate analyses were employed. The aim of the univariate analyses was to describe the characteristics of women per each sample, based on the outcome variable concerned. Therefore, this analysis was concerned with introducing the reader to each of the selected subsamples and variables. In order to measure differentials in maternal and reproductive health use, a bivariate descriptive analysis was employed. At this stage of the analysis, the independent variables were cross-tabulated with each of the five outcome variables to tentatively[15] examine whether a relationship existed between the covariates and the outcome variables. The bivariate analysis was also meant to examine whether the trends of maternal and reproductive health use had changed or remained the same between 2008 and 2013.
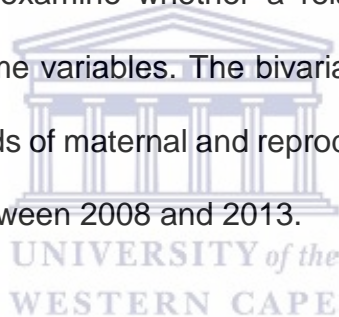
3.5.2 Analysing determinants of maternal and reproductive health use

The determinants of maternal and reproductive health use were analysed using logistic regression analysis. Logistic regression is among the widely used estimation models in public health and health related research. This regression technique is most suitable for use when the dependent variable(s) is dichotomous, as in the case of this study. Therefore, for the purpose of this study, logistic regression modelling was deemed suitable to measure relationships between the

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[15] *Tentatively* because the chi-square test does provide a test for some relationship between two cross-tabulated variables, but it fails to give a clear direction of such a relationship, hence this is then provided by a regression analysis.

outcome variables and the covariates. The logistic regression equation adapted for the study is presented below:

$$\ln\left(\frac{p}{1-p}\right) = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \ldots + \beta_i x_i$$

The equation above refers to a regression model which is represented by more than one independent variable that is either dichotomous, ordinal, nominal, continuous, etc. the study has five outcome variables showed in Appendix Table A1.2. These outcome variables are represented by (p/1-p) in the equation above. The purpose of regression coefficient (β_i) is that it increases natural logarithm (log-odds) for a one unit increase in predictor variable (x_i) when all other x_is are constant. It measures association between x_i and natural logarithm (log-odds) adjusted for all other x_is.
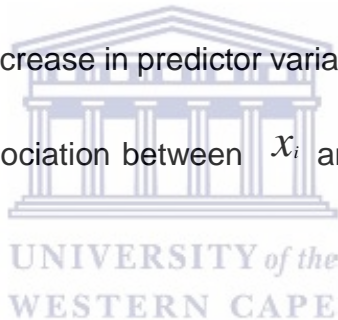
3.5.3 Quantitative measures of inequality

The study is based on quantitative analysis of secondary data and focuses on quantitative measures of health inequalities. It is argued that inequality is a multifaceted concept that requires measurement through a variety of quantitative techniques (WHO, 2013). There are two main groups of health inequality measures, and these include the simple and complex measures of health inequality; where simple measures of health inequality make basic (*pairwise*) comparisons between population subdivisions, and complex measures take all

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population subdivisions into consideration when measuring health inequality (WHO, 2013). The two most used complex measures of health inequality include: (a) the slope index of inequality, (b) the concentration index (WHO, 2013). Although both of these measures are considered to be 'complex measured' of health inequality, researchers often choose to use both or one in their research – and it seems that the choice of the preferred index is a matter of preference.

In this study, the concentration index is used to explain health inequalities in maternal and reproductive health services. Besides selecting this index due to preference, the index was also selected based on the fact that it has an advantage over the slope index of inequality; the concentration index makes it possible to make socioeconomic inequality-related comparisons in the use of health services over time (trends) and can afford comparisons among different places. Moreover, the concentration index has an ability to show the magnitude to which a health outcome is concentrated among the poor (*low socioeconomic status*) or rich (*high socioeconomic status*) individuals and/or households, where the index value becomes *negative* when the health outcome is concentrated among the poor and *positive* when it is concentrated among the rich (WHO, 2013). Moreover, the concentration curve is often used to visualise the concentration index, where the equity stratifier (i.e. education, wealth, etc.) is ranked across the *x*-axis and the cumulated fraction of the health outcome is plotted on the *y*-axis, and a diagonal line represents the line of equality (WHO, 2013). In instances where the health outcome lies below the equity line, then it can be said that there are pro-rich inequalities in that society, but if it lies above the equity line, then there are pro-poor inequalities.

CHAPTER 4: PREVALENCE AND DETERMINANTS OF MATERNAL AND REPRODUCTIVE HEALTH SERVICES IN SIERRA LEONE

4.1   Abstract

Background: Poor maternal and reproductive health outcomes remain a major challenge for most African countries. Low-income countries account for most maternal and child deaths. Although there are many benefits resulting from the use of maternal and reproductive health services, women in developing countries, such as Sierra Leone, still fail to increase the use of these life-saving services.

Methods: The study used two rounds (2008 and 2013) of the Sierra Leone Demographic and Health Survey datasets. Bivariate and multivariate analyses were used to study the prevalence and determinants of maternal and reproductive health services in Sierra Leone.

Results: The findings show a general increase in the use of maternal and reproductive health services between 2008 and 2013, although the use of delivery care services and contraception remained quite low. The multivariate analysis shows that maternal age, marital status, socioeconomic status, number of living children, decision-making power, media exposure, skilled antenatal care, and geographic location are crucial factors in the use of maternal and reproductive health services even though these findings are not consistent for both data points in this study.

Conclusion: There has been great improvement in the use of maternal and reproductive health services. There is a possibility that the FHCI played an important role in increasing the use of these services. However, the use of delivery care services and contraception remains very low. Further policy debates aimed

at boosting the use of certain maternal and reproductive health services are needed to ensure universal coverage.

Keywords: Prevalence, Determinants, Antenatal care, Delivery care, Contraceptive use

4.2   Background

Poor maternal and reproductive health outcomes remain a major challenge for most African countries. The literature shows that low-income countries account for most maternal and child deaths, which is due, in part, to low or non-use of maternal and reproductive health services (WHO, 2015a). Use of maternal and reproductive health services is crucial for better maternal and child health outcomes (Birmeta et al., 2013; Dahiru & Oche, 2015; Abekah-Nkrumah & Abor, 2016). Women often receive life-saving information related to their health and that of their children when attending maternal health services. Sierra Leone is among the countries with very high maternal mortality ratios in the world (Statistics Sierra Leone and ICF International, 2014). Even though there are many benefits resulting from the use of maternal and reproductive health services, women in developing countries, such as Sierra Leone, still fail to increase the use of these life-saving services (Dahiru & Oche, 2015). For instance, the percentage of home births is high in Sierra Leone, at 44.4%, which results in facility-based births being low at just over fifty per cent (Statistics Sierra Leone and ICF International, 2014).

Furthermore, the use of family planning (contraceptives) is crucial when it comes to women's sexual and reproductive health (Nonvignon and Novignon, 2014). Contraceptive use in Sierra Leone remains low, even though there has been a

slight increase over time (Statistics Sierra Leone and ICF International, 2014). Over the years, international organisations have been working with various countries, especially low-income countries to improve sexual and reproductive health outcomes in these countries. The World Health Organization (WHO) framed the Mother Baby Package as means of improving maternal and child health. This package is based on four pillars, which include: family planning, antenatal care, delivery care, and obstetric care (WHO, 1998; Abekah-Nkrumah & Abor, 2016). Moreover, the Sustainable Development Goals (SDGs) build on the Millennium Development Goals (MDGs) to further the prospects of sustainable development around the world. SDG targets three and five speak to universal access to sexual and reproductive healthcare services, which includes family planning (WHO, 2015b; Haq et al., 2017).

Many factors have been found to affect the use of maternal and reproductive health services. Accessibility of sexual and reproductive health is one of the biggest challenges in poor countries. Studies have found that women in non-urban areas, with low socioeconomic status, struggle to use maternal and reproductive health services (Nonvignon and Novignon, 2014; Karkee et al., 2014). Several studies have been conducted in developing countries top examine the determinants of various maternal and reproductive health service use. The majority of these studies often reveal similar results, although each country has its own specific context with regard to the determinants of maternal and reproductive health service use. A few studies have been conducted in relation to maternal and reproductive health in Sierra Leone (Assaf and Winter, 2015; Sharkey et al., 2017). These studies mostly provide descriptive results (mainly the prevalence of

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maternal and reproductive healthcare use) and do not go further into examining the factors that determine maternal and reproductive health service use. This study, therefore, attempts to fill the gaps in understanding factors that determine the use of maternal and reproductive health services in Sierra Leone. The study has two main objectives, namely: (i) to examine prevalence of maternal and reproductive healthcare services in Sierra Leone, and (ii) to identify socio-demographic factors associated with the use of the abovementioned health services.

4.3   Data and methods

4.3.1 Data sources

The study uses two rounds (2008 and 2013) of the Sierra Leone Demographic and Health Survey (SLDHS) datasets. Statistics Sierra Leone in collaboration with the Ministry of Health and Sanitation of Sierra Leone, with support from various international agencies (i.e. ICF Macro/International, WHO, etc.), collected the SLDHS data. The SLDHS is nationally representative and based on a two-stage probability sampling strategy. The data had a response rate of 98% in 2008 and 99% in 2013 (Statistics Sierra Leone and ICF Macro, 2009; Statistics Sierra Leone and ICF International, 2014). For both data collection points, women of reproductive age (15-49 years) who were either usual household members or women present in the household on the night before the survey were eligible for interviews. The SLDHS datasets are publicly available upon request through Measure DHS website (https://dhsprogram.com/).

4.3.2 Dependent variables

Five dependent variables were use in this study. The outcome variables are grouped into three: antenatal care, delivery care, and any method of contraception. These variables form part of the main pillars of the Mother Baby Package and are essential for safe motherhood. The analysis excludes *don't know* and *missing* cases for all the dependent variables because these cases distort the results and one cannot make meaningful conclusions from don't know and missing cases. We applied Andersen's behavioural model in this chapter (see chapter 1).

4.3.2.1   Antenatal care

Antenatal care is made up of two dichotomous variables, namely: (i) four or more antenatal care visits, and (ii) skilled antenatal care provider. Four or more antenatal visits refers the percentage (or number) of women with four or more antenatal care visits for their most recent pregnancy. In this case, we considered the recommended antenatal visits (which is four or more antenatal visits). Having four or more antenatal visits allows for enough time to discover pregnancy-related complications. Four or more antenatal visits is coded as: 1 if a woman had 4+ visits, or else 0. Skilled antenatal care provider refers to the percentage of women whose antenatal visits (for the most recent birth) were attended by a skilled provider (i.e., doctor, nurse/midwife, etc.). Skilled antenatal care provider is coded as: 1 if a woman was attended by a skilled antenatal care provider, or else 0.

4.3.2.2   Delivery care

Two dichotomous variables are used to study delivery care. These variables are: (i) births delivered in a facility, and (ii) births assisted by a skilled birth attendant (SBA). Births delivered in a facility refers the percentage of births that were delivered in a facility. Births delivered in a facility is thus coded as: 1 if a woman gave birth in a healthcare facility, or else 0. Another variables used here is births assisted by a skilled birth attendant which refers to the percentage of births that were assisted by a skilled birth attendant [doctor/nurse/midwife, Maternal and Child Health (MCH) Aide]. Skilled birth attendant is coded as: 1 if a woman was assisted by a skilled birth attendant during birth, or else 0.

4.3.2.3   Any method of contraception

Any method of contraception is the percentage of women, in union (married or cohabiting) using any method of contraception. In the survey, women were asked about the various methods of contraception they were currently using, and various options were available to pick from (i.e. not using, pill, injections, withdrawal, etc.). Any method of contraception is coded as: 1 if a woman reported use of any method of contraception, or else 0. Please note the analysis is limited to only women in union.

4.3.3   Independent variables

Nine independent variables were selected for the study, based on the review of literature in developing countries. These variables include: (i) maternal age, (ii) marital status, (iii) maternal education, (iv) household wealth, (v) number of living

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children, (vi) media exposure (access radio, television, and newspaper at least once a week), (vii) Decision-making power, (viii) place of residence, and (ix) region. These variables serve as explanatory variables in the analysis of the prevalence and determinants of maternal and reproductive health use in Sierra Leone. Use of skilled antenatal care was added as another independent variable in the analysis of delivery care. The independent variables are further defined in the appendices, Table A4.1.

4.3.4 Statistical analyses

This paper investigated the determinants of selected maternal and reproductive health services in Sierra Leone. Univariate (descriptive) and bivariate analyses were adopted to study the characteristics of the sample as well as the prevalence of maternal and reproductive health service use. The association between the use of maternal and reproductive health services and independent variables was examined using multivariate logistic regression. All analyses were carried out using Stata and Microsoft Excel. The *svyset* command was used to account for clustering, sample weight and stratification. This procedure uses sample weights to adjust the estimates for the effects of oversampling and under-sampling in smaller enumeration areas. Therefore, we used the svy prefix command for all analyses in this study. We considered an alpha (α) level of 0.05 as statistically significant.
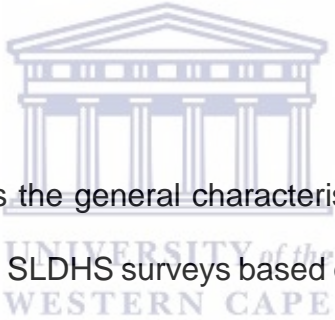
4.3.5 Ethical considerations

All analyses were conducted using publicly available data from the Sierra Leone Demographic and Health Surveys. The Institutional Review Board of Macro International, Inc. reviewed and approved the collection of data for both periods of the Sierra Leone Demographic and Health Surveys. The authors submitted a request for the use of this data to the DHS Program and permission was granted to download and use the data as per the request.

4.4   Results

4.4.1   Antenatal care

Sample characteristics

Tables A4.2-A4.3 presents the general characteristics of women of reproductive age who participated in the SLDHS surveys based on antenatal care services. The sample characteristics are grouped according to Andersen's behavioural model (see chapter one). With regard to the predisposing factors, the majority of women in the sample were aged 20-29 years, with an average age of around 28.8. Moreover, most women reported that they were in union, had no education, had two-to-three living children, and were mostly not involved in decision-making on various household needs. Furthermore, with regard to the enabling factors, most women in the sample were from poor households and had no media exposure. The external environment factors showed that the majority of women were from the Northern region and resided in rural areas of residence.

Prevalence of antenatal care

Table 4.1 presents the prevalence of antenatal care services by background characteristics. The results also show the chi-square (χ^2) test; the χ^2 test shows that some of the selected background characteristics are statistically associated with the use of antenatal care services, with fluctuations over time. Generally, the use of antenatal care increased over time. The use of four or more antenatal increased from 68.1% in 2008 to 87.3% in 2013; and the use of skilled antenatal care providers increased from 86.9% in 2008 to 97.1% in 2013. At first, the findings related to the prevalence of four or more antenatal visits is presented, and later the prevalence of skilled antenatal care is presented. The results related to the use of skilled antenatal care providers provide some differences when compared to those related to the use of four or more antenatal visits. Please note that, in the context of this chapter, antenatal care refers to the use of antenatal visits as well as the use of skilled antenatal care providers. Women aged 30-39 years (in 2008) and those aged 20-29 years (in 2013) reported a higher prevalence of four or more antenatal visits. Skilled antenatal care use decreased with maternal age, whereby older women reported a lower prevalence of skilled antenatal care.

Differentials, over time, were observed in relation to marital status. In 2008, there was a higher prevalence of four or more antenatal care among never married women, while the prevalence was higher for formerly married women in 2013. The results also showed that the use of four or more antenatal visits was more prevalent among women with higher socioeconomic status. The use of antenatal care increased with maternal education and household wealth. This meant that

women with higher levels of education and those from wealthier households used antenatal care services considerably more than women with lower levels of education and those from poorer households. For instance, over eighty percent of women with higher levels of education reported that they used antenatal services, and over three quarters of women from rich households reported that they used antenatal services.

Women's decision-making power is an important policy indicator, which is crucial in measuring women empowerment. The results show that women who reported that they solely made all three decisions[16] had a higher prevalence of antenatal care. Media exposure is another important indicator, especially in developing countries where populations rely mostly on media platforms, such as radios, for crucial maternal and reproductive health information. The results showed that women who reported that they had access to the media, and those in urban areas of residence had a higher prevalence of antenatal care. Differentials were also observed with regard to the region and the use of four or more antenatal visits. Women from the Western region (in 2008) and Southern region (in 2013) had a higher prevalence of four or more antenatal visits. With regard to the use of skilled antenatal care providers, women from the Western region (in 2008) and from the Eastern as well as the Southern region (in 2013) had a higher prevalence of skilled antenatal care providers.

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[16] Decisions on: (i) their own health care, (ii) making large household purchases, and (iii) visits to family or relatives.

Table 4.1: Prevalence of antenatal care by background characteristics

| Characteristics | Antenatal visits | | | | Skilled antenatal care | | | |
| | 2008 | | 2013 | | 2008 | | 2013 | |
	%	χ^2	%	χ^2	%	χ^2	%	χ^2
Predisposing factors								
Maternal age		8.3***		21.0*		3.6		43.4*
<20	65.9		85.6		89.0		98.6	
20-29	68.4		89.1		87.9		97.9	
30-39	70.3		86.2		86.0		96.2	
40-49	60.7		84.4		83.6		94.9	
Marital status		10.6**		1.4		8.8**		7.9***
Never married	77.3		87.6		93.4		97.5	
In union	67.6		87.2		86.4		97.0	
Formerly married	63.9		88.2		86.1		98.4	
Maternal education		75.6*		29.6*		54.4*		52.7*
No education	64.2		85.9		84.5		96.3	
Primary	75.2		86.8		92.7		98.0	
Secondary+	84.5		92.0		95.0		99.2	
Number of living children		5.3		10.3***		5.9		23.4*
None	69.6		86.6		86.0		95.8	
One child	69.4		88.7		88.4		98.5	
Two-to-three children	68.5		87.5		86.3		97.0	
Four or more children	66.8		86.0		86.7		96.3	
Decision-making power		3.8		13.5*		9.0**		6.7***
All three decisions	70.5		89.2		89.7		97.5	
Some joint-decisions	66.1		86.6		85.4		95.9	
None	67.2		85.9		85.4		97.2	
Enabling factors								
Household wealth		98.0*		27.0*		73.8*		26.9*
Poor	60.8		85.0		82.7		96.3	
Average	66.1		87.2		85.9		96.7	
Rich	78.4		89.9		92.5		98.2	
Media exposure		12.1*		1.0		2.8		0.4
No	67.7		87.2		86.8		97.1	
Yes	94.5		90.6		95.1		97.6	
External environment								
Place of residence		103.3*		28.4*		74.7*		28.2*
Urban	81.6		91.0		93.9		98.2	
Rural	62.8		85.8		84.1		96.7	
Region		140.6*		80.5*		86.9*		62.4*
Eastern	73.3		89.7		89.6		98.3	
Northern	58.0		83.3		81.9		95.5	
Southern	74.6		91.0		90.3		98.2	
Western	84.8		88.8		94.1		97.7	
Total	**68.1**		**87.3**		**86.9**		**97.1**	

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013
Note: ***= P<0.05; ** = P<0.01; * = P<0.001

Determinants of antenatal care

Table 4.2a-4.2b shows the binary logistic regression results on the determinants of the use of antenatal care. Multivariate analysis was ran to identify factors most strongly associated with the use of antenatal care services over time. The results show variation in the patterns of four or more antenatal visits use over time. In 2013, women aged 20-29 years [aOR 1.4, 95% CI: 1.0-1.9] were significantly more likely to use four or more antenatal visits compared to those who were aged 40-49 years. Moreover, the results revealed that the use of four or more antenatal visits was significantly associated with socioeconomic factors (*maternal education* and *household wealth*). Women from a higher socioeconomic position [secondary+ education, aOR 1.7, 95% CI: 1.1-2.4 in 2008 and aOR 1.9, 95% CI: 1.4-2.6 in 2013; rich households, aOR 1.4, 95% CI: 1.0-1.9 in 2008 and aOR 1.4, 95% CI: 1.0-1.9 in 2013] were significantly more likely to use four or more antenatal visits than those from a lower socioeconomic position. Moreover, in 2013, women with an average socioeconomic status [aOR 1.3, 95% CI: 1.0-1.7] were also significantly more likely to use four or more antenatal visits than those from a lower socioeconomic position.

The multivariate results also showed that decision-making power is an important determinant of four or more antenatal visits use. Women who reported that they singularly made all three decisions [aOR 1.3, 95% CI: 1.0-1.7 in 2008 and aOR 1.6, 95% CI: 1.3-2.1 in 2013] were significantly more likely to use four or more antenatal visits than those who reported that they have no decision-making power. As mentioned earlier, all three decisions refers to a combination of the following:

(i) final say on own health care, (ii) final say on making large household purchases, and (iii) final say on visits to family or relatives. Here, all three decisions refer to a woman who makes these decisions alone, without partner/husband. Furthermore, the results showed that geospatial location (region and place of residence) were important determinants of four or more antenatal visits use. In 2008, urban residents [aOR 1.5, 95% CI: 1.0-1.7] were significantly more likely to use four or more antenatal visits than women from rural places of residence. Moreover, women from certain regions [Eastern, aOR 2.0, 95% CI: 1.1-2.1; Southern, aOR 2.2, 95% CI: 1.6-3.1; and Western, aOR 2.1, 95% CI: 1.4-3.0 in 2008; Eastern, aOR 1.9, 95% CI: 1.4-2.6; and Southern, aOR 2.1, 95% CI: 1.5-2.9 in 2013] were significantly more likely to use four or more antenatal visits than women from the Northern region.

Table 4.2a: Binary logistic regression on the determinants of the use of four or more antenatal visits

Characteristics	2008			2013		
	Odds ratio (aOR)	95% CI		Odds ratio (aOR)	95% CI	
		Lower	Upper		Lower	Upper
Predisposing factors						
Maternal age						
<20	1.0	0.6	1.7	1.0	0.7	1.6
20-29	1.2	0.8	1.7	1.4***	1.0	1.9
30-39	1.3	1.0	1.9	1.2	0.9	1.5
40-49®	1			1		
Marital status						
Never married	0.9	0.6	1.4	0.8	0.6	1.1
In union®	1			1		
Formerly married	0.9	0.6	1.4	1.3	0.8	2.1
Maternal education						
No education®	1			1		
Primary	1.3	1.0	1.8	1.0	0.8	1.3
Secondary+	1.7**	1.1	2.4	1.9*	1.4	2.6
Number of living children						
None	1.0	0.5	1.9	1.0	0.6	1.7
One child	1.0	0.7	1.4	1.1	0.8	1.4
Two-to-three children	1.0	0.8	1.3	1.0	0.8	1.2

Characteristics	2008			2013		
	Odds ratio (aOR)	95% CI		Odds ratio (aOR)	95% CI	
		Lower	Upper		Lower	Upper
Four or more children®	1			1		
Decision-making power						
All three decisions	1.3***	1.0	1.7	1.6*	1.3	2.1
Some joint-decisions	1.1	0.9	1.4	1.2	0.9	1.5
None®	1			1		
Enabling factors						
Household wealth						
Poor®	1			1		
Average	1.2	1.0	1.6	1.3***	1.0	1.7
Rich	1.4***	1.0	1.9	1.4***	1.0	1.9
Media exposure						
No	0.3	0.1	1.0	1.3	0.6	2.7
Yes®	1			1		
External environment						
Place of residence						
Urban	1.5**	1.1	2.1	1.4	1.0	2.1
Rural®	1			1		
Region						
Eastern	2.0*	1.5	2.6	1.9*	1.4	2.6
Northern®	1			1		
Southern	2.2*	1.6	3.1	2.1*	1.5	2.9
Western	2.1*	1.4	3.0	0.9	0.6	1.5

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013
Note: ***= P<0.05; ** = P<0.01; * = P<0.001; ® = reference category

Table 4.2b showed that, in 2013, younger women (aged less than 20 years) [aOR 3.9, 95% CI: 1.8-8.1] were significantly more likely to use skilled antenatal care compared to those who were aged 40-49 years. In the same year, never married women [aOR 0.4, 95% CI: 0.2-0.8] were significantly less likely to use skilled antenatal care compared to women who reported that they were in union. Moreover, the results revealed that the use of skilled antenatal care increased with socioeconomic status. Women from a higher socioeconomic position [primary education, aOR 1.8, 95% CI: 1.1-2.7; secondary+ education, aOR 2.0, 95% CI: 1.2-3.3 in 2008 and aOR 1.5, 95% CI: 0.9-2.6 for primary education; aOR 5.3, 95% CI: 2.1-13.5 in 2013; rich households, aOR 1.5, 95% CI: 1.0-2.3 in 2008 and aOR 2.0, 95% CI: 1.0-3.8 in 2013] were significantly more likely to use skilled antenatal care than those from a lower socioeconomic position.

The results showed that decision-making power is an important determinant of skilled antenatal care. Women who reported that they singularly made all three decisions [aOR 1.8, 95% CI: 1.3-2.6 in 2008 and aOR 1.4, 95% CI: 1.0-2.1 in 2013] were significantly more likely to use skilled antenatal care than those who reported that they have no decision-making power. Furthermore, in 2008, urban residents [aOR 1.7, 95% CI: 1.1-2.8] were significantly more likely to use skilled antenatal care than women from rural places of residence. Moreover, women from certain regions [Eastern: aOR 2.0, 95% CI: 1.3-2.9; and Southern: aOR 2.2, 95% CI: 1.6-3.6 in 2008; Eastern: aOR 3.1, 95% CI: 1.8-5.3; and Southern: aOR 2.5, 95% CI: 1.6-4.0 in 2013] were significantly more likely to use skilled antenatal care than women from the Northern region.

Table 4.2b: Binary logistic regression on the determinants of the use of skilled antenatal care provider

Characteristics	2008			2013		
	Odds ratio (aOR)	95% CI		Odds ratio (aOR)	95% CI	
		Lower	Upper		Lower	Upper
Predisposing factors						
Maternal age						
<20	1.5	0.9	2.7	3.9*	1.8	8.1
20-29	1.4	0.9	2.3	2.4	1.5	4.0
30-39	1.1	0.7	1.8	1.4	0.9	2.0
40-49®	1			1		
Marital status						
Never married	1.3	0.8	2.2	0.4**	0.2	0.8
In union®	1			1		
Formerly married	1.2	0.7	2.1	2.0	0.9	4.8
Maternal education						
No education®	1			1		
Primary	1.8**	1.1	2.7	1.5	0.9	2.6
Secondary+	2.0**	1.2	3.3	5.3*	2.1	13.5
Number of living children						
None	0.6	0.3	1.4	0.4	0.2	1.1
One child	0.8	0.5	1.2	1.1	0.7	1.9
Two-to-three children	0.8	0.6	1.1	0.8	0.6	1.2
Four or more children®	1			1		
Decision-making power						
All three decisions	1.8*	1.3	2.6	1.4***	1.0	2.1
Some joint-decisions	1.3	0.9	1.9	0.8	0.5	1.2

Characteristics	2008			2013		
	Odds ratio (aOR)	95% CI		Odds ratio (aOR)	95% CI	
		Lower	Upper		Lower	Upper
None®	1			1		
Enabling factors						
Household wealth						
Poor®	1			1		
Average	1.2	0.9	1.7	1.3	0.9	1.9
Rich	1.5***	1.0	2.3	2.0***	1.0	3.8
Media exposure						
No	1.1	0.3	4.2	3.7	0.7	18.7
Yes®	1			1		
External environment						
Place of residence						
Urban	1.7***	1.1	2.8	1.1	0.6	2.1
Rural®	1			1		
Region						
Eastern	2.0*	1.3	2.9	3.1*	1.8	5.3
Northern®	1			1		
Southern	2.2*	1.3	3.6	2.5*	1.6	4.0
Western	1.5	0.9	2.3	1.0	0.4	2.6

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013
Note: ***= P<0.05; ** = P<0.01; * = P<0.001; ® = reference category

4.4.2 Delivery care

Sample characteristics

Tables A4.4-A4.5 presents the general characteristics of women of reproductive age who participated in the SLDHS surveys based on delivery care services. The results show that, with regard to the predisposing factors, the majority of women in the sample were aged 20-29 years, with an average age of around 29 years. Most women reported that they were in union, had no education, had two-to-three living children, and were not involved in decision-making. Moreover, with regard to the enabling factors, most women in the sample were from poor households and had no media exposure. Based on the need factors, the majority of women reported that they used unskilled antenatal care providers when they were recently pregnant. The external environment factors showed that the majority of women were from the Northern region and resided in rural areas of residence.

Prevalence of delivery care

Table 4.3 presents the prevalence of delivery care services by background characteristics. Here, delivery care refers to births delivered in a facility as well as births assisted by a skilled birth attendant (SBA) such as a doctor/nurse/midwife, etc. Generally, the use of delivery care increased over time. Despite this increase, the use of delivery services has remained quite low. The use of facility based deliveries increased from 25.3% in 2008 to 54.9% in 2013. Moreover, the use of skilled birth attendants increased from 42.4% in 2008 to 59.7% in 2013. The χ^2 test shows that some of the selected background characteristics (i.e. marital status, maternal education, household wealth, etc.) are statistically associated with the use of delivery care services, with fluctuations over time. The results show that the use of facility-based deliveries decreased with maternal age, while there were age fluctuations with regard to the use of skilled birth attendants. Generally, older women reported a lower prevalence of delivery care compared to younger women. With regard to marital status, there was a higher prevalence of delivery care among never married women over time.

Moreover, the results showed that the use of delivery care increase with socioeconomic status. For instance, the percentage of births delivered in a health facilities and those delivered by skilled birth attendants was higher among women with secondary or more education as well as those from rich households. There was also a high prevalence of delivery care among women with few or no children. Interestingly, the results also showed that women who have no decision-making power had a high prevalence of delivery care. The results showed that women

who reported that they had access to the media, and those in urban areas of residence had a higher prevalence of delivery care. Differentials were observed with regard to the region and the use of delivery care services. Generally, women from the Western region and Eastern regions had a higher prevalence of delivery care.

Table 4.3: Prevalence of delivery care by background characteristics

Characteristics	Facility-based deliveries				Skilled birth attendants			
	2008		2013		2008		2013	
	%	χ^2	%	χ^2	%	χ^2	%	χ^2
Predisposing factors								
Maternal age		6.5		74.7*		18.2*		108.7*
<20	26.4		59.5		40.9		65.1	
20-29	26.0		57.7		44.2		63.5	
30-39	25.3		51.3		42.1		55.3	
40-49	20.5		50.1		35.2		52.5	
Marital status		24.6*		86.2*		60.7*		121.7*
Never married	37.8		67.3		63.0		74.3	
In union	24.1		53.6		40.8		58.1	
Formerly married	30.4		54.7		47.4		61.6	
Maternal education		244.5*		361.5*		383.3*		481.4*
No education	20.5		49.9		35.7		54.2	
Primary	34.5		58.2		55.9		63.0	
Secondary+	47.4		72.2		73.1		79.3	
Number of living children		43.1*		117.8*		48.8*		165.8*
None	39.6		60.1		55.2		66.5	
One child	30.4		63.2		46.8		69.5	
Two-to-three children	26.6		56.0		44.5		61.0	
Four or more children	20.7		49.4		37.4		53.2	
Decision-making power		21.6*		63.7*		19.0*		82.3*
All three decisions	22.5		51.6		39.3		56.1	
Some joint-decisions	22.3		51.3		39.9		56.0	
None	29.7		59.7		46.8		64.8	
Enabling factors								
Household wealth		146.7*		356.4*		417.7*		666.4*
Poor	19.5		49.5		31.6		51.4	
Average	23.9		49.7		38.6		53.2	
Rich	33.8		65.2		58.9		74.7	
Media exposure		87.0*		63.2*		56.9*		78.0*
No	24.8		54.5		41.9		59.2	
Yes	67.4		85.3		85.7		95.2	
Need factors								
Skilled antenatal care		66.5*		127.6*		178.3*		203.3*
Unskilled	19.2		47.6		32.2		50.7	
Skilled	28.9		58.1		48.9		63.8	
External environment								
Place of residence		296.5*		461.8*		591.7*		741.3*

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Characteristics	Facility-based deliveries				Skilled birth attendants			
	2008		2013		2008		2013	
	%	χ^2	%	χ^2	%	χ^2	%	χ^2
Urban	40.6		69.0		66.9		78.9	
Rural	19.6		50.1		33.2		53.2	
Region		212.1*		948.9*		442.1*		1000.0*
Eastern	29.2		73.1		50.1		77.0	
Northern	16.0		37.4		27.4		41.5	
Southern	34.2		61.2		53.2		64.0	
Western	36.2		61.9		63.7		74.2	
Total	**25.3**		**54.9**		**42.4**		**59.7**	

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013
Note: ***= P<0.05; ** = P<0.01; * = P<0.001

Determinants of delivery care

Table 4.4a-4.4b shows the binary logistic regression results on the determinants of the use of delivery care. Similar to the results related to the use of antenatal care, the results show variation in the patterns of facility-based delivery use over time. In 2008, never married women [aOR 0.7, 95% CI: 0.5-1.0] were significantly less likely to use facility-based deliveries compared to those who were in union. Moreover, the results revealed that the use of facility-based deliveries was significantly associated with socioeconomic factors. Women from a higher socioeconomic position [secondary+ education, aOR 2.2, 95% CI: 1.6-3.0 in 2008 and aOR 1.9, 95% CI: 1.6-2.3 in 2013; rich households, aOR 1.6, 95% CI: 1.3-2.2 in 2013] were significantly more likely to use facility-based deliveries than those from a lower socioeconomic position. Moreover, in 2008, women with an average socioeconomic status [aOR 1.3, 95% CI: 1.0-1.7] were significantly more likely to use facility-based deliveries than those from a lower socioeconomic position.

In 2008, use of facility deliveries decreased with the number of living children. The results show that women with none or fewer living children [no living children, aOR

2.1, 95% CI: 1.1-4.2; and one living child, aOR 1.4, 95% CI: 1.1-1.9] were significantly more likely to use facility-based deliveries than those with four or more living children. The multivariate results also showed that, in 2013, women who jointly made decisions with their partner/husband [aOR 0.7, 95% CI: 0.6-0.9] were significantly less likely to use facility-based deliveries than those who reported that they have no decision-making power. Moreover, women who reported that they had no media exposure [aOR 0.4, 95% CI: 0.2-0.9 in 2008; and aOR 0.5, 95% CI: 0.2-0.9 in 2013] were significantly less likely to use facility-based deliveries than those with media exposure. Use of skilled antenatal care also determines the use facility-based deliveries. Women who reported that they used skilled antenatal care [aOR 1.5, 95% CI: 1.3-1.7 in 2008; and aOR 1.4, 95% CI: 1.3-1.6 in 2013] were significantly more likely to use facility-based deliveries than those who used unskilled antenatal care.

Furthermore, urban residents [aOR 2.3, 95% CI: 1.7-3.3 in 2008; and aOR 1.5, 95% CI: 1.1-2.0 in 2013] were significantly more likely to use facility-based deliveries than women from rural places of residence. Moreover, women from the Eastern and Southern regions [Eastern, aOR 2.0, 95% CI: 1.4-2.8; and Southern, aOR 2.7, 95% CI: 1.8-4.3 in 2008; Eastern, aOR 4.8, 95% CI: 3.4-7.0; and Southern, aOR 2.8, 95% CI: 2.1-3.8 in 2013] were significantly more likely to use facility-based deliveries than women from the Northern region.

Table 4.4a: Binary logistic regression on the determinants of the use of facility-based deliveries

Characteristics	2008			2013		
	Odds ratio (aOR)	95% CI		Odds ratio (aOR)	95% CI	
		Lower	Upper		Lower	Upper
Predisposing factors						
Maternal age						
<20	0.7	0.4	1.1	0.9	0.7	1.3
20-29	0.9	0.6	1.2	1.1	0.8	1.3
30-39	1.0	0.7	1.4	1.0	0.8	1.2
40-49[®]	1			1		
Marital status						
Never married	0.7***	0.5	1.0	0.9	0.7	1.1
In union[®]	1			1		
Formerly married	1.2	0.8	1.8	0.8	0.6	1.1
Maternal education						
No education[®]	1			1		
Primary	1.6*	1.2	2.1	1.3**	1.1	1.5
Secondary+	2.2*	1.6	3.0	1.9*	1.6	2.3
Number of living children						
None	2.1***	1.1	4.2	1.1	0.7	1.7
One child	1.4***	1.1	1.9	1.2	1.0	1.5
Two-to-three children	1.3**	1.1	1.7	1.1	1.0	1.3
Four or more children[®]	1			1		
Decision-making power						
All three decisions	0.8	0.6	1.0	0.9	0.7	1.1
Some joint-decisions	0.8	0.6	1.1	0.7*	0.6	0.9
None[®]	1			1		
Enabling factors						
Household wealth						
Poor[®]	1			1		
Average	1.3***	1.0	1.7	1.2	1.0	1.4
Rich	1.1	0.8	1.6	1.6*	1.3	2.2
Media exposure						
No	0.4***	0.2	0.9	0.5***	0.2	0.9
Yes[®]	1			1		
Need factors						
Skilled antenatal care						
Unskilled[®]	1			1		
Skilled	1.5*	1.3	1.7	1.4*	1.3	1.6
External environment						
Place of residence						
Urban	2.3*	1.7	3.3	1.5***	1.1	2.0
Rural[®]	1			1		
Region						
Eastern	2.0*	1.4	2.8	4.8*	3.4	7.0
Northern[®]	1			1		
Southern	2.7*	1.8	4.3	2.8*	2.1	3.8
Western	1.1	0.8	1.5	1.2	0.8	1.8

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013
Note: ***= P<0.05; ** = P<0.01; * = P<0.001; ® = reference category

Table 4.4b shows that the use of skilled birth attendants was significantly associated with socioeconomic factors. In fact, the use of skilled birth attendants increased with socioeconomic status. Women from a higher socioeconomic position [secondary+ education, aOR 2.4, 95% CI: 1.8-3.1 in 2008; and aOR 2.0, 95% CI: 1.6-2.5 in 2013; rich households, aOR 1.7, 95% CI: 1.3-2.3 in 2008; and aOR 2.2, 95% CI: 1.6-2.9 in 2013] were significantly more likely to use skilled birth attendants than those from a lower socioeconomic position. In 2013, women who reported that they engaged in joint decision-making with their partner/husband [aOR 0.7, 95% CI: 0.6-0.9] were significantly less likely to use skilled birth attendants than those who reported that they have no decision-making power. Moreover, in 2013, women who reported that they had no media exposure [aOR 0.2, 95% CI: 0.1-0.5] were significantly less likely to use skilled birth attendants than those with media exposure.
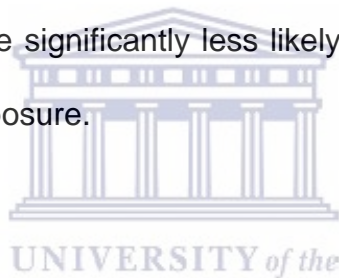
Furthermore, the multivariate analysis results showed that use of skilled antenatal care determines the use skilled birth attendants. Women who reported that they used skilled antenatal care [aOR 1.8, 95% CI: 1.6-2.1 in 2008; and aOR 1.6, 95% CI: 1.4-1.7 in 2013] were significantly more likely to use skilled birth attendants than those who used unskilled antenatal care. Moreover, urban residents [aOR 2.7, 95% CI: 1.9-3.7 in 2008; and aOR 1.8, 95% CI: 1.2-2.6 in 2013] were significantly more likely to use skilled birth attendants than women from rural places of residence. With regard to the regions, women from the Eastern and Southern regions [Eastern, aOR 2.6, 95% CI: 1.9-3.7; and Southern, aOR 3.3, 95% CI: 2.3-4.8 in 2008; Eastern, aOR 5.2, 95% CI: 3.7-7.4; and Southern, aOR

2.8, 95% CI: 2.0-3.8 in 2013] were significantly more likely to use skilled birth attendants than women from the Northern region.

Table 4.4b: Binary logistic regression on the determinants of the use of skilled birth attendants

Characteristics	2008			2013		
	Odds ratio (aOR)	95% CI		Odds ratio (aOR)	95% CI	
		Lower	Upper		Lower	Upper
Predisposing factors						
Maternal age						
<20	0.7	0.5	1.2	1.1	0.8	1.5
20-29	1.0	0.7	1.4	1.2	1.0	1.6
30-39	1.1	0.8	1.4	1.1	0.9	1.3
40-49®	1			1		
Marital status						
Never married	0.9	0.6	1.3	0.8	0.7	1.1
In union®	1			1		
Formerly married	1.2	0.8	1.8	0.8	0.6	1.2
Maternal education						
No education®	1			1		
Primary	1.6*	1.3	2.1	1.2***	1.0	1.5
Secondary+	2.4*	1.8	3.1	2.0*	1.6	2.5
Number of living children						
None	1.5	0.8	2.8	1.1	0.7	1.7
One child	1.0	0.8	1.4	1.2	1.0	1.5
Two-to-three children	1.2	0.9	1.5	1.1	1.0	1.3
Four or more children®	1			1		
Decision-making power						
All three decisions	0.8	0.7	1.1	0.9	0.7	1.2
Some joint-decisions	1.0	0.8	1.2	0.7*	0.6	0.9
None®	1			1		
Enabling factors						
Household wealth						
Poor®	1			1		
Average	1.4**	1.1	1.8	1.3***	1.0	1.5
Rich	1.7*	1.3	2.3	2.2*	1.6	2.9
Media exposure						
No	0.5	0.2	1.2	0.2*	0.1	0.5
Yes®	1			1		
Need factors						
Skilled antenatal care						
Unskilled®	1			1		
Skilled	1.8*	1.6	2.1	1.6*	1.4	1.7
External environment						
Place of residence						
Urban	2.7*	1.9	3.7	1.8*	1.2	2.6
Rural®	1			1		
Region						
Eastern	2.6*	1.9	3.7	5.2*	3.7	7.4
Northern®	1			1		
Southern	3.3*	2.3	4.8	2.8*	2.0	3.8

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Characteristics	2008			2013		
	Odds ratio (aOR)	95% CI		Odds ratio (aOR)	95% CI	
		Lower	Upper		Lower	Upper
Western	1.3	0.8	1.9	1.3	0.8	2.1

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

Note: ***= P<0.05; ** = P<0.01; * = P<0.001; ® = reference category

4.4.3 Contraceptive use

Sample characteristics

Tables A4.6 presents the general characteristics of women of reproductive age who participated in the SLDHS surveys based on contraceptive services. The results show that, with regard to the predisposing factors, the majority of women in the sample were aged 30-39 years, with an average age of around 31 years; and most women reported that they were married, had no education, had at least two living children, and were involved in decision-making. Moreover, with regard to the enabling factors, most women in the sample were from poor households and had media exposure. The external environment factors showed that the majority of women were from the Northern region and resided in rural areas of residence.

Contraceptive prevalence rate

Table 4.5 presents results pertaining to the contraceptive prevalence rate by background characteristics. Here, contraceptive prevalence refers to the percentage of women, in union (*married* or *cohabiting*) who reported that they were using any method of contraception. Although very low, the contraceptive prevalence rate increased over time from 8.2% in 2008 to 16.6% in 2013. A χ^2 test was ran and showed that for both periods (2008 and 2013) age, maternal

education, number of living children, decision-making power, household wealth, media exposure, place of residence and region were significantly associated with contraceptive use. Use of any method of contraception is higher among women aged 30-39 years old. Moreover, there was also a higher contraceptive prevalence rate reported among cohabiting women.

Furthermore, the results showed that the contraceptive prevalence rate increase with socioeconomic status, whereby women with secondary or more education as well as those from rich households had a higher contraceptive prevalence rate compared to their counterparts. The contraceptive prevalence rate also increased with the number of living children, whereby women with four or more living children reported a higher contraceptive prevalence rate compared to women with fewer or no living children. Moreover, women who have decision-making power reported a higher contraceptive prevalence rate than their counterparts. The results also showed that women who reported that they had access to the media, those in urban areas of residence and those from the Western region reported a higher contraceptive prevalence rate.

Table 4.5: Contraceptive prevalence rate by background characteristics

Characteristics	Contraceptive prevalence rate			
	2008		2013	
	%	χ^2	%	χ^2
Predisposing factors				
Age		45.6*		90.7*
<20	1.2		7.8	
20-29	6.9		15.2	
30-39	10.4		20.3	
40-49	9.5		15.6	
Marital status		0.4		15.4*
Married	8.2		16.3	
Cohabiting	8.3		24.7	
Maternal education		207.4*		168.7*
No education	5.7		14.3	
Primary	10.8		19.3	
Secondary+	22.3		26.0	
Number of living children		65.8*		134.4*
None	1.8		5.0	
One child	5.3		14.0	
Two-to-three children	8.4		16.5	
Four or more children	11.2		20.2	
Decision-making power		30.1*		39.7*
All three decisions	10.0		18.4	
Some joint-decisions	8.7		17.4	
None	5.6		13.4	
Enabling factors				
Household wealth		189.5*		233.5*
Poor	4.0		12.3	
Average	4.6		12.8	
Rich	15.2		24.0	
Media exposure		32.3*		26.4*
No	8.0		16.4	
Yes	23.4		29.4	
External environment				
Place of residence		148.3*		268.5*
Urban	16.2		26.6	
Rural	5.0		13.0	
Region		166.3*		177.9*
Eastern	6.2		17.3	
Northern	4.4		12.3	
Southern	8.4		17.2	
Western	21.2		27.1	
Total	**8.2**		**16.6**	

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

Note: ***= P<0.05; ** = P<0.01; * = P<0.001

Determinants of contraceptive use

Table 4.6 shows the binary logistic regression results on the determinants of contraceptive use. In 2013, the multivariate analysis results showed that contraceptive use was higher for women in their 20s and 30s. Women aged 30-39 years [aOR 1.6, 95% CI: 1.3-1.8 in 2013] were significantly more likely to use any method of contraception compared to women aged 40-49 years. In 2013, married women [aOR 0.7, 95% CI: 0.5-0.9] were significantly less likely to use any method of contraception compared to those who were cohabiting. The use of any method of contraception was significantly associated with socioeconomic factors. Women from a higher socioeconomic position [secondary+ education, aOR 2.4, 95% CI: 1.8-3.2 in 2008 and aOR 1.9, 95% CI: 1.5-2.4 in 2013; rich households, aOR 2.4, 95% CI: 1.7-3.5 in 2008 and aOR 1.5, 95% CI: 1.2-1.9 in 2013] were significantly more likely to use any method of contraception than those from a lower socioeconomic position.
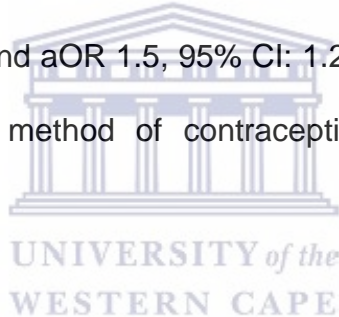
Moreover, the results further suggest that the larger the number of living children, the more likely women are going to use contraception. Women with fewer living children were less likely to use contraception compared to women with a larger number of living children. For instance, women with one living child [aOR 0.3, 95% CI: 0.2-0.5 in 2008; and aOR 0.5, 95% CI: 0.4-0.6 in 2013] were significantly less likely to use any method of contraception than those with four or more living children. With regard to decision-making, women who made important decisions alone [aOR 1.5, 95% CI: 1.2-1.9 in 2008; and aOR 1.4, 95% CI: 1.2-1.7 in 2013] were significantly more likely to use any method of contraception than those who

had no decision-making power. Moreover, women who jointly made most of their decisions with their partner/husband [aOR 1.5, 95% CI: 1.1-2.0 in 2008; and aOR 1.2, 95% CI: 1.0-1.5 in 2013] were significantly more likely to use any method of contraception than those who had no decision-making power. Furthermore, in 2013, urban residents [aOR 1.5, 95% CI: 1.2-1.9] were significantly more likely to use any method of contraception than women from rural places of residence. Moreover, women from some regions [Eastern, aOR 1.4, 95% CI: 1.0-2.1; Southern, aOR 2.3, 95% CI: 1.6-3.4; and Western, aOR 2.7, 95% CI: 1.8-3.9 in 2008; Eastern, aOR 1.4, 95% CI: 1.1-1.8; and Southern, aOR 1.4, 95% CI: 1.1-1.8 in 2013] were significantly more likely to use any method of contraception than women from the Northern region.
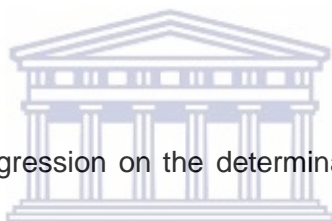
Table 4.6: Binary logistic regression on the determinants of the use of any method of contraception

Characteristics	2008			2013		
	Odds ratio (aOR)	95% CI		Odds ratio (aOR)	95% CI	
		Lower	Upper		Lower	Upper
Predisposing factors						
Age						
<20	0.5	0.1	1.8	1.0	0.7	1.5
20-29	1.2	0.8	1.7	1.4*	1.1	1.7
30-39	1.2	0.9	1.7	1.6*	1.3	1.8
40-49®	1			1		
Marital status						
Married	1.0	0.7	1.4	0.7**	0.5	0.9
Cohabiting®	1			1		
Maternal education						
No education®	1			1		
Primary	1.5**	1.1	2.1	1.4*	1.2	1.7
Secondary+	2.4*	1.8	3.2	1.9*	1.5	2.4
Number of living children						
None	0.1*	0.1	0.2	0.2*	0.1	0.2
One child	0.3*	0.2	0.5	0.5*	0.4	0.6
Two-to-three children	0.6*	0.4	0.8	0.6*	0.5	0.7
Four or more children®	1			1		
Decision-making power						
All three decisions	1.5*	1.2	1.9	1.4*	1.2	1.7
Some joint-decisions	1.5**	1.1	2.0	1.2***	1.0	1.5
None®	1			1		

Characteristics	2008			2013		
	Odds ratio (aOR)	95% CI		Odds ratio (aOR)	95% CI	
		Lower	Upper		Lower	Upper
Enabling factors						
Household wealth						
Poor®	1			1		
Average	1.2	0.8	1.8	1.0	0.8	1.3
Rich	2.4*	1.7	3.5	1.5*	1.2	1.9
Media exposure						
No	0.9	0.5	1.9	1.0	0.7	1.6
Yes®	1			1		
External environment						
Place of residence						
Urban	1.2	0.9	1.6	1.5*	1.2	1.9
Rural®	1			1		
Region						
Eastern	1.4***	1.0	2.1	1.4*	1.1	1.8
Northern®	1			1		
Southern	2.3*	1.6	3.4	1.4*	1.1	1.8
Western	2.7*	1.8	3.9	1.4	1.0	1.8

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013
Note: ***= P<0.05; ** = P<0.01; * = P<0.001; ® = reference category

4.5   Discussion

Key findings

Prevalence of maternal and reproductive health services

One of the main aims of this chapter was to examine the prevalence of maternal and reproductive health services using SLDHS data from 2008 and 2013. The findings show that there has been a general increase in the uptake of maternal and reproductive health services between 2008 and 2013, even though the use of delivery care services and contraception remained quite low. Fluctuating age differentials across the five maternal and reproductive health services were also observed. For instance, the findings of the study showed that while the use of skilled antenatal decreased with maternal age, the use of four or more antenatal visits fluctuated across the age categories. Older women used less delivery care services than younger women, while the use of contraception was higher among

older women. The findings also showed fluctuations in the prevalence of maternal and reproductive health in relation to marital status.

Furthermore, socioeconomic status proved to be another important factor in relation to the use of maternal and reproductive health services. In general, the use of maternal and reproductive health services increased with socioeconomic status. The number of living children a women has ever had proved to be important for delivery care and contraception. While women with few or no children reported a higher prevalence of delivery care use, the contraceptive prevalence rate was higher among women with four or more living children. As stated earlier, women's autonomy in decision-making is an important policy indicator. The findings showed that women who reported to have absolute decision-making autonomy had a higher prevalence of antenatal care as well as contraceptive use. Moreover, women who had access to the media had a high prevalence of maternal and reproductive health use. Geographic differentials observed with regard to the prevalence of maternal and reproductive health use.

Determinants of maternal and reproductive health services

Besides profiling the prevalence of maternal and reproductive health service use, the examination of background took a step further in showing how selected background factors are significantly associated with the use of maternal and reproductive health services. Another aim of this study was to identify socio-demographic factors associated with the use of the maternal and reproductive health services. The advantage of regression-based analysis is that it allows one

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to speak to the direction of the relationship between the dependent and independent variables – which is something not shown through the χ^2 test. The findings of this study showed that younger women significantly used more maternal health services was than older women; moreover, women in their 20s and 30s used more contraception compared to older women. The findings further showed that never married women significantly used more maternal health services was than women in union. With regard to the use of contraception, married women used more contraception compared to those who were cohabiting.

Socioeconomic status was proven to be a significant factor that determines the use of maternal and reproductive health services. The findings showed that women with higher levels of education and those from rich households significantly used more maternal and reproductive health services. The number of living children a woman has had proved to be another significant factor in the use of maternal and reproductive health services, although there were fluctuations in relation to the maternal and reproductive health indicator involved. For instance, women none or with fewer living children were more likely to use facility-based deliveries, while women with fewer living children were less likely to use contraception. Interestingly, women's autonomy as a determinant of maternal and reproductive health service use also fluctuated with the type of service involved. While women's full autonomy in decision-making was a significant determinant of antenatal care and contraceptive use, jointly making some decisions with a partner/husband was a significant determinant of delivery care use.

As mentioned earlier media exposure is important in ensuring that women have access to lifesaving media announcements that may be related to maternal and reproductive health services. The study findings suggest media exposure significantly determines the use of maternal health services. As a need factor for the use of delivery care, the use of skilled antenatal care proved to be an important determinant of delivery care use – whereby women who used skilled antenatal care services significantly used more delivery care services. Moreover, geographic location was another important determinant of maternal and reproductive health services. An urban place of residence as well as residence in some regions (mainly the Eastern, Southern and Western regions) significantly determined the use maternal and reproductive health services.

Study findings in relation to other studies

As mentioned earlier, analysis of the prevalence of maternal and reproductive healthcare use is not new in Sierra Leone. A previous study found similar results to those of this study – whereby there was an increase in the use of maternal and reproductive healthcare services over time (Assaf and Winter, 2015). Previous studies have shown that use of maternal and reproductive health services is influenced by various factors. In this study it was found that maternal age, marital status, socioeconomic status, number of living children, decision-making power, media exposure, skilled antenatal care, and geographic location are crucial factors in the use of maternal and reproductive health services. Moreover, similarly to our study, other studies in developing countries have found that younger women generally used more maternal health services than older women (Desta et al.,

2017; Shahabuddin et al., 2017). Older women often believe that they are more experienced in dealing with complications that may be present during pregnancy and do not need to attend these services, whereas younger women often fear the complications related to child birth and tend not to use home births as much as older women do (Ochako et al., 2011; Birmeta et al., 2013).

Maternal education and household wealth have a positive influence on women's health as they impact people's living conditions and, thus, their health. Studies often show that socioeconomic status is an important factor in the use of maternal and reproductive health services (Babalola, 2014; Karkee et al., 2014; Nonvignon & Novignon, 2014). For policy and gender equality, women's autonomy in decision-making is an important factor which has proved to be an important determinant of maternal and reproductive health use. In a patriarchal society such as Sierra Leone, and many other African countries, women's autonomy is crucial in ensuring that women are able to make important life-saving decisions about their health. Comparable to this study, other studies have also shown that women's autonomy determines the use of maternal and reproductive health services (Fawole & Adeoye, 2015). Access to information (media exposure) is also important in boosting government efforts to increase the use of maternal and reproductive health services. Studies show that media exposure determines the use of maternal and reproductive health services (Tsawe et al., 2015; Ajaero et al., 2016).

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As mentioned, skilled antenatal care is an important determinant of delivery care use. If women attend antenatal services, they may be more aware of complications which may be present in their pregnancy and, as such, may require specialised care when giving birth. Therefore, there is an important link between the use of antenatal services and the use of delivery care services. Other studies have also found results similar to this study, which show that women who use antenatal care services tend to use more facility-based and skilled delivery care services (Islam et al., 2014; Alemayehu & Mekonnen, 2015). Geographically, urban places of residence are often more developed than rural areas, more so in Africa. Moreover, rural areas (and rural regions) often have barriers (i.e. accessibility, high transport costs, etc.) which make it difficult for easy accessibility of health healthcare services. Studies have shown that the use of maternal and reproductive health services is higher in urban areas compared to rural areas (Nonvignon & Novignon, 2014; Dahiru & Oche, 2015).
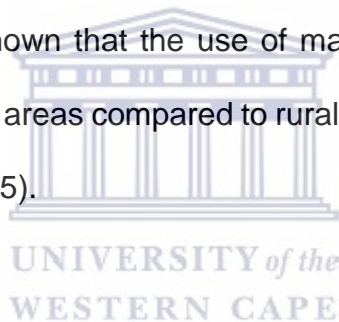
Explanation of study findings

The strength of this study lies in the fact that nationally representative datasets were used. Moreover, to the best of my knowledge, this is the first study in the country that goes beyond providing descriptive statistics and attempts to find factors that determine the use of maternal and reproductive health services. The findings contained in this study are not necessarily different from those conducted in other countries but rather provide a context in which the Sierra Leone government can better understand the specific maternal and reproductive health situation in the country. The study findings suggest that, there has not only been

increases in the use of healthcare services, but there has also been improvements in the healthcare system. Most African countries have a history of poor healthcare systems, which have improved for some countries. In such cases, sound health policies are often required to improve the healthcare system; the government of Sierra Leone initiated the Free Health Care Initiative (FHCI) as means of improving the prospects of maternal and child healthcare (Bertone et al., 2014; Edoka et al., 2017). This initiative was initiated to remove out-of-pocket (OOP) payments, especially with regard to maternal and child health services. There is evidence that the FHCI policy has improved maternal and child health (Sharkey et al., 2017).

Limitations of this study

The findings of this should be interpreted while noting some limitations of the study. SLDHS data are cross-sectional in nature; this limits the drawing of causal inferences with proper reasoning and logic that can authenticate the findings. Moreover, due to the longer recall time, there may be recall bias whereby respondents have to report on past occurrences in relation to their use of maternal and reproductive health services. Some of the independent variables have outliers and, thus, present a major problem for the logistic regression analysis. Due to the large outliers on some of the categories of the independent variables, the odds ratios present with wide confidence intervals. However, the study has some strengths; one of the strengths of this study is that it uses nationally representative data, conducted with assistance from ICF and uses consistent methodology – which makes it easier to analyse the data over different time points.

4.6   Conclusion

Sierra Leone has made considerable progress in improving the use of maternal and reproductive health services. It is possible that the FHCI played an important role in increasing the use of these services. However, the use of delivery care services and contraception remains very low. This is a cause for concern as these are very important services that every woman should be able to use and have easy access to. This study suggests that maternal age, marital status, socioeconomic status, number of living children, decision-making power, media exposure, skilled antenatal care, and geographic location are significant factors that determine the use of maternal and reproductive health services. Further policy debates are needed to boost the use of certain maternal and reproductive health services (i.e. delivery care and contraceptive use). Policies must be geared towards identifying barriers and develop approaches that can assist women in rural areas, and other areas, to realise the benefits of FHCI policy and related health programmes.

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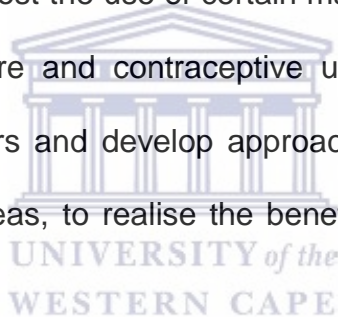
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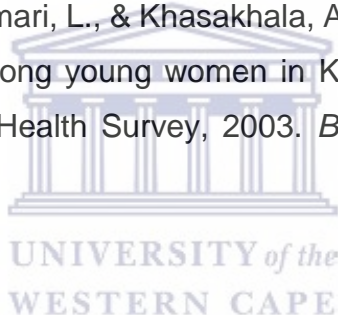
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CHAPTER 5: ASSESSING INEQUALITIES IN MATERNAL AND REPRODUCTIVE HEALTH UTILIZATION IN SIERRA LEONE, 2008 & 2013

5.1   Abstract

Background: Sierra Leone has made some progresses in the uptake of maternal and reproductive health services. Despite improvements in the national coverage rates, there is no evidence pertaining to how equal these improvements have been, especially between the disadvantaged and non-disadvantaged populations in the country.

Methods: Using data from two nationally representative household surveys conducted in 2008 and 2013, we study inequalities in maternal and reproductive health interventions by computing rate ratios, disparity indices and concentration indices (as well as concentration curves) by selected inequality stratifiers such as: household wealth index, maternal education, and urban/rural place of residence.

Results: We found that considerable progress has been made in increasing the uptake of maternal and reproductive health services as well as reducing inequalities over time. In general, we found that inequalities in these health interventions favour women from wealthy households, educated women, as well as women from urban areas. Although inequalities declined over time, the use of delivery services highly unequal. However, out of the selected health interventions, the use of four or more antenatal visits was almost at perfect equality in 2013.

Conclusions: Sierra Leone has made considerable improvements in the uptake of maternal and reproductive health services, as well as in the reduction of inequalities in the use of these services. For some health interventions, inequalities still persist. Therefore, policy initiatives need to prioritise the most

unequal maternal and reproductive health services, such as the use of skilled birth attendants and facility-based deliveries, as well as increase the use of these services among poor women and those from rural areas.

Keywords: Inequality, prevalence, maternal and reproductive health, disparity index, concentration index

5.2   Background

The advancement of women's maternal and reproductive health rights remains crucial in the fight against high child mortality and Maternal Mortality Ratios (MMR), especially in developing countries. In most developing countries there is still a high burden of maternal and child deaths due to childbirth and related complications, partially due to the slow progress in the reduction of maternal and child mortality (Zere et al., 2012; Obiyan and Kumar, 2015; Goli et al., 2017; De La Torre et al., 2018). Looking back at the Millennium Development Goals (MDGs), many countries have made considerable strides towards meeting their MDG targets, more so in relation to maternal and reproductive health services. However, the strides made at national level tend to hide gaps and inequalities that exist at lower levels of geography. The level of maternal and reproductive uptake varies significantly between different socioeconomic groups and geographic locations within a single country and between countries. It remains to be seen if the Sustainable Development Goals (SDGs) will build on the MDGs and significantly increase the uptake of maternal and reproductive health services, while also reducing inequalities between socioeconomic groups.

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Sierra Leone has made some improvements in the uptake of maternal and reproductive health services, but despite improvements in the national averages, there is no evidence of how equal these improvements have been for the disadvantaged and non-disadvantaged populations in the country. Studying health inequalities is certainly not a new phenomenon, especially for the developing world. Inequalities in healthcare, especially in developing countries have drawn more attention since the late nineteenth century (Regidor, 2004). Addressing the health needs of people in lower socioeconomic positions is crucial in improving the overall health of the population as well as reducing inequalities in the use of health services. Research shows that socioeconomic inequalities in the use of healthcare services are still persistent in most developing countries (Axelson et al., 2012).

A study in Ethiopia (using Demographic and Health Survey data from 2014) found that there were certainly inequalities in the use of maternal and reproductive health services, more especially with regard to women in the more affluent regions and urban areas, as well as among women with higher socioeconomic status (Bobo et al., 2017). As much as developing countries often exhibit similar characteristics when it comes to inequalities in healthcare use, each country has its own unique contextual factors that exacerbate such inequalities. When it comes to studying maternal and reproductive health inequalities, Sierra Leone presents an interesting backdrop as it has come from a prolonged past of socio-political wars which have disadvantaged many populations within the country. Various studies have tried to assess the link between past wars and the related effects on healthcare. Studies found that socio-political conflict has a negative effect on various aspects of healthcare, such as access and provision (Ghobaraha et al.,

2004; Martineau et al., 2017). Studying the effects of socio-political wars and related uprisings is not the objective of this study. Furthermore, we are not aware of any other studies which have attempted to assess the extent of inequalities in the use of maternal and reproductive health services in Sierra Leone.

This study has two objectives: (i) to explore whether or not inequalities in the use of maternal and reproductive health interventions (as well as coverage) changed between 2008 and 2013 in Sierra Leone, and (ii) to analyse if there are differentials in inequalities based on the type of chosen inequality stratifier.

5.3   Data and methods

5.3.1 Data sources

We used publicly available data cross-sectional data collected at two points (2008 and 2013) from the Sierra Leone Demographic and Health Surveys (DHS). The Demographic and Health Surveys collect comparable and nationally representative data on various health and demographic related interventions. There is vast literature related to studies that have used secondary data from various Demographic and Health Surveys to analyse trends, determinants, and inequalities in maternal, child, and reproductive health interventions as well as service coverage (Boutayeb and Helmert, 2011). The Sierra Leone various Demographic and Health Surveys used nationally representative sampling techniques to sample 7 758 households in 2008 and 13 006 households in 2013, with a response rate of 98% and 99% respectively (Statistics Sierra Leone and

ICF Macro, 2009; Statistics Sierra Leone and ICF International, 2014). For both data collection points, women of reproductive age (15-49 years) who were either usual household members or women present in the household on the night before the survey were eligible to be interviewed.

5.3.2 Maternal and reproductive health indicators

Table 5.1 presents maternal and reproductive health indicators used in the study. In order to assess inequalities in maternal and reproductive health services, we used these selected health interventions (Table 5.1). Antenatal care refers to the healthcare given to a woman during pregnancy. Antenatal care involves checks for medical conditions that require attention throughout the pregnancy. This study focuses on four-or-more antenatal visits, as recommended by the World Health Organization (WHO) as well as the use of skilled antenatal care providers. Births assisted by a skilled birth attendant (SBA) refer to deliveries assisted by medical professionals, which include doctors, nurses/midwives/MCH Aides, and any other health professionals. Birth delivered in a facility refers to births delivered in healthcare institutions/facilities such as hospitals, clinics, and other available health facilities. Family planning refers to the use of contraceptive services by women who are in union (*married* or *cohabiting*).

Table 5.1: Indicators included in the study

Indicator	Definition
Four or more antenatal care visits (ANC)	% of women with four or more antenatal care visits for their most recent pregnancy
Skilled antenatal care provider	% of women whose antenatal visits (for the most recent birth) were attended by a skilled provider
Births delivered in a facility	% of births that were delivered in a facility
Births assisted by a skilled birth attendant (SBA)	% of births that were assisted by a skilled birth attendant (doctor/nurse/midwife, MCH Aide)
Any method of contraception (CPr)	% of women (in union) using any method of contraception

Note: For all variables included in the study, we excluded 'missing' and/or 'do not know' cases. All the above indicator variables are binary.

5.3.3 Inequality stratifiers and measures

We used several inequality stratifiers/dimensions to measure inequality. These include maternal education, household wealth index, and place of residence. The DHS program does not ask questions on income, expenditure and consumption, and other monetary indicators that are often used to measure inequality. However, the DHS collects data on living conditions and ownership of household assets, which are used to compute a proxy measure for living standards, termed the wealth index (Rutstein and Johnson, 2004). This index is computed for each household [using Principal Components Analysis (PCA) method] in order to disaggregate the sample into equal-sized quintiles (i.e. poorest to richest). We used this household wealth index as one of the inequality stratifiers in the study. We also estimated inequalities using the following inequality stratifiers: maternal education, place of residence, and region. We measured the prevalence of four maternal and reproductive health indicators (four or more antenatal care visits, skilled antenatal care provider, birth delivered in a facility, and births assisted by a skilled birth attendant) for each of the two data points. We also measure the

contraceptive prevalence rate for the two data points. Moreover, we used rate ratios to measure absolute and relative differences using the selected inequality stratifiers.

These measures of inequality provide a general description of the extent of inequalities in maternal and reproductive health interventions. For household wealth, we used the rate ratios for the highest vs. lowest household wealth quintile (RRhhwi = Rhighest quintile ÷ Rlowest quintile) to calculate socioeconomic inequalities in maternal and reproductive health care. For maternal education inequalities in maternal and reproductive healthcare use, we used rate ratios (RReduc = Rhigher ÷ Rnone). With regard to inequalities in maternal and reproductive healthcare use between urban and rural areas, we used rate ratios (RRur = Rurban ÷ Rrural). We further use another descriptive measure of inequality, the disparity index, originally proposed by Sopher in 1974. Kundu and Rao later modified this index in (1986). Similar to the measures highlighted above, this index measures inequality between two groups according to their possession of a certain indicator (i.e. antenatal care use). The analysis is in terms of a logarithm between the two measured groups (i.e. urban vs. rural area of residence). For instance, if p represents the proportion of urban women using antenatal services, and q represents the proportion of rural women using antenatal services, then the modified disparity index (DI) is defined as follows:

$$DI_{mod.} = \log\left[\frac{p*(200-q)}{q*(200-p)}\right]$$

In an ideal situation, the index will be equal to zero when no disparity exists ($p = q$). When the index has a higher value, then degree of disparity is higher; when it shows a low value, then the degree of disparity is lower. A positive index value means that the situation favours individuals in (p) level, and a negative index value means that the situation favours (q) level. For purposes of this study, we interpret the disparity index as follows: *low* if the index value is less than 0.100, *moderate* if the index value is between 0.100 and less than 0.200, and *high* if the index value is more than or equal to 0.200.

One of the major limitations of the measures above is that they provide a basic picture of inequalities and ignore the differentials that exist between all the categories of the inequality stratifier. For instance, when computing the rate ratios for the household wealth index, we only consider two extremes (richest quintile to poorest quintile) and do not consider the rest of the quintiles. To counter this, we used the concentration index. The concentration index has an ability to show the magnitude to which a health intervention is concentrated among the poor (low socioeconomic status) or rich (high socioeconomic status) individuals or households, where the index value becomes negative when the health intervention is concentrated among the poor and positive when it is concentrated among the rich (WHO, 2013). A negative concentration index shows that the use of the health indicator is concentrated among individuals with a low socioeconomic status, while a positive concentration index shows that the use of the health indicator is concentrated among individuals with a high socioeconomic status (Makate and Makate, 2017). Therefore, in order to further quantify inequalities in the selected

indicators, we employed the concentration index. Specifically, we employed the Erreygers corrected concentration index.

$$E(h) = 4 \frac{\mu}{(b_h - a_h)} * C(h)$$

where b_h and a_h are the maximum and minimum bounds of the binary health indicator (i.e. antenatal services), μ is the mean of the health indicator, and $C(h)$ is the concentration index (Purohit, 2017). The Erreygers corrected concentration index is recommended when the variable is binary (Erreygers, 2009). We also used the concentration curve to visualise the concentration index. The concentration curve is often used to visualise the concentration index, where the inequality stratifier (i.e. education, wealth, etc.) is ranked across the x-axis and the cumulated fraction of the health intervention is plotted on the y-axis, and a diagonal line represents the line of equality (WHO, 2013). In instances where the health intervention lies below the equity line, then it can be said that there are pro-rich inequalities in that society, but if it lies above the equity line, then there are pro-poor inequalities. We estimated the corrected concentration index using the *conindex* command of Stata (O'Donnell et al., 2016).

5.3.4 Complex samples procedure

For both data points, the Sierra Leone DHS used a two-stage cluster sampling to select respondents for the surveys. Therefore, to adjust for data representation in our analysis, we used the *svyset* command in Stata in order to account for clustering, sample weight and stratification. This procedure also uses sample

weights to adjust the estimates for the effects of oversampling and undersampling in smaller enumeration areas. Therefore, we used the *svy* prefix command for all analyses in this study. We considered an alpha (α) level of 0.05 as statistically significant. We used Stata version 14.2 and Microsoft Excel for all analyses of this study.

5.3.5 Ethical considerations

We conducted all analyses using publicly available data from the Sierra Leone Demographic and Health Surveys. The Institutional Review Board of Macro International, Inc. reviewed and approved the collection of data for both periods of the Sierra Leone Demographic and Health Surveys. The authors submitted a request for the use of this data to the DHS Program and permission was granted to download and use the data.
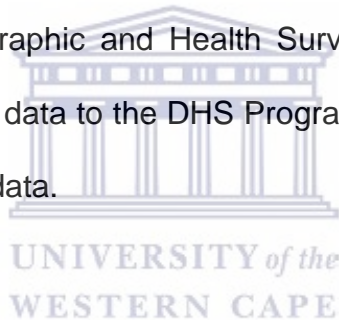
5.4   Results

Prevalence and rate ratios

Table 5.2 shows the selected health indicators by maternal education, using the Sierra Leone DHS data of 2008 and 2013. Overall, there has been an increase in the uptake of maternal and reproductive health interventions. Moreover, the use of maternal and reproductive health services was high among women with higher levels of education. Use of skilled birth attendance and contraception more than doubled between 2008 and 2013. Table 5.2 also shows the ratios of women between those with no education and those with higher levels of education. The

ratios for the selected maternal and reproductive health indicators are greater than one, which indicates an existence of inequalities that favour women with higher levels of education. Moreover, the ratios decreased between 2008 and 2013, which implies the decrease of inequalities between the women with no education and those with higher levels of education. The largest ratio was found among women using any method of contraception in 2008, where the contraceptive prevalence rate for women with higher education was four times more than that of women with no education.

Table 5.2: Maternal and reproductive health indicators by maternal education in 2008 and 2013

| Health indicator | Year of survey | Maternal education | | | | Total | Ratio |
		None	Primary	Secondary	Higher		
Four or more antenatal care visits	2008	64.2	75.2	83.2	97.2	68.1	1.5
	2013	85.9	86.8	91.6	97.2	87.3	1.1
Skilled antenatal care provider	2008	84.5	92.7	94.6	98.5	86.9	1.2
	2013	96.3	98.0	99.3	98.7	97.1	1.0
Births delivered in a facility	2008	20.5	34.5	44.9	70.7	25.3	3.4
	2013	49.9	58.2	71.1	87.6	54.9	1.8
Births assisted by a skilled birth attendant	2008	35.7	55.9	70.9	94.4	42.4	2.6
	2013	54.2	63.0	78.4	90.8	59.7	1.7
Any method of contraception	2008	5.7	10.8	21.8	25.5	8.2	4.5
	2013	14.3	19.3	24.3	39.0	16.6	2.7

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

Figure 5.1 compares the changes the use of maternal and reproductive health use among women with no education and women with higher levels of education between 2008 and 2013. Besides the use of contraception, the absolute increases were greater among the women with no education than those with higher levels of education, for the other indicators. There was a decrease in births assisted by a

skilled birth attendant among women with higher levels of education. The greatest increase among women with no education was found for women who gave birth in a health facility.

Figure 5.1: Absolute percentage point changes in use of maternal and reproductive health services between 2008 and 2013, maternal education
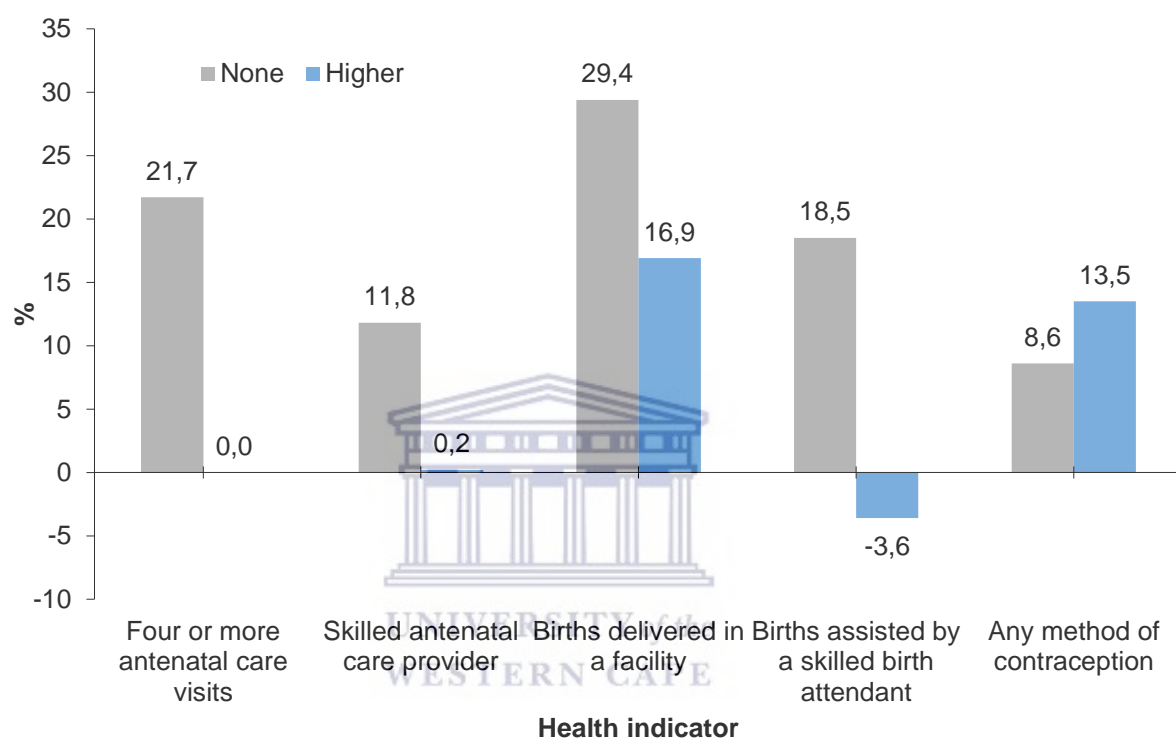
Table 5.3 provides information on the prevalence, wealth-based levels, and ratios of the richest to the poorest households for selected maternal and reproductive health indicators. As with maternal education, the use of maternal and reproductive health services increases with socioeconomic status, where there is higher use of these services among women from the richest households. The ratios for the selected maternal and reproductive health indicators, with regard to household wealth, are greater than one, which indicates an existence of

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inequalities that favour women from the richest households. The ratios showed a decline between 2008 and 2013, suggesting a decrease in pro-rich maternal and reproductive health inequalities. The largest ratio was found among women using any method of contraception in 2008, where the contraceptive prevalence rate for women in the richest households was over four times that of women in the poorest households. Furthermore, Figure 5.2 shows that the absolute increases were greater among women from the poorest households compared to those from the richest households. We found the greatest absolute increase in the prevalence of healthcare use among women whose births were assisted by a skilled birth attendant.

Table 5.3: Maternal and reproductive health indicators by household wealth quintile in 2008 and 2013

| Health indicator | Year of survey | Household wealth | | | | | Total | Ratio |
		Poorest	2nd	Middle	4th	Richest		
Four or more antenatal care visits	2008	59.1	62.5	66.1	70.8	87.2	68.1	1.5
	2013	83.9	86.3	87.2	87.8	92.5	87.3	1.1
Skilled antenatal care provider	2008	82.1	83.2	85.9	89.4	96.1	86.9	1.2
	2013	96.0	96.7	96.7	98.1	98.3	97.1	1.0
Births delivered in a facility	2008	17.4	21.8	23.9	28.4	40.5	25.3	2.3
	2013	48.9	50.3	49.7	60.6	71.0	54.9	1.5
Births assisted by a skilled birth attendant	2008	28.1	35.4	38.6	49.0	71.4	42.4	2.5
	2013	50.9	52.0	53.2	67.4	83.7	59.7	1.6
Any method of contraception	2008	4.4	3.5	4.6	10.6	20.2	8.2	4.6
	2013	12.5	12.1	12.8	20.4	28.1	16.6	2.2

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

Figure 5.2: Absolute percentage point changes in use of maternal and reproductive health services between 2008 and 2013, household wealth
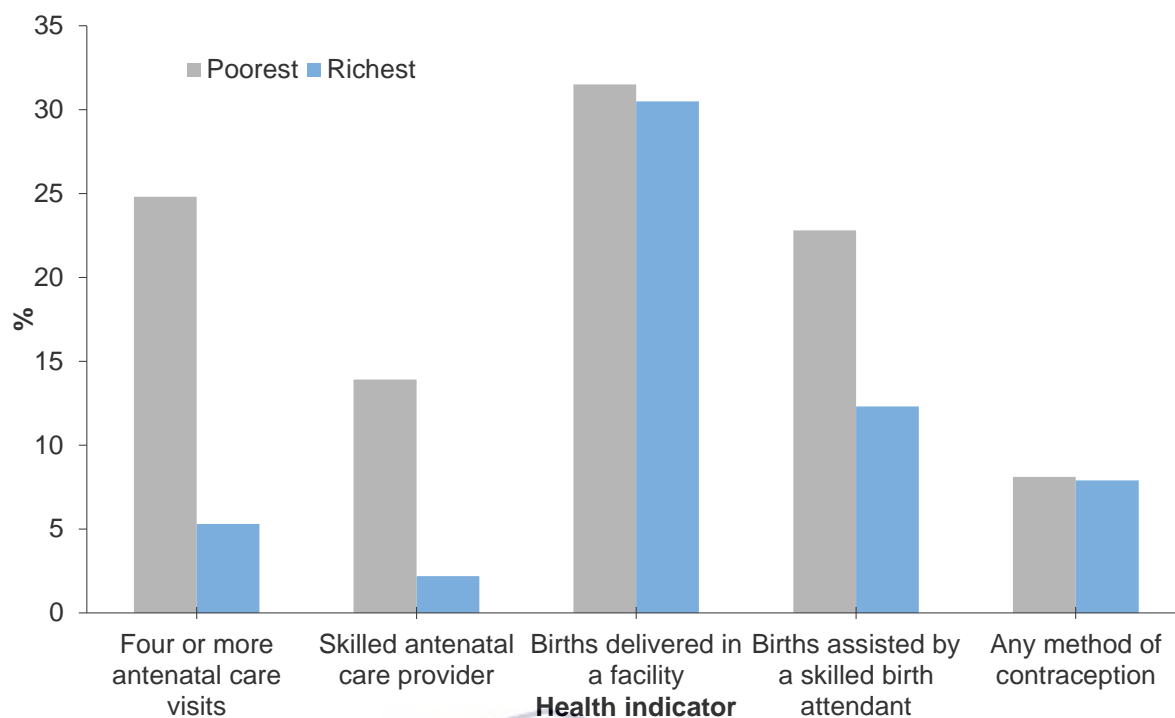
Table 5.4 shows the prevalence, geographical levels, and ratios of the urban to the rural areas of residence for selected maternal and reproductive health indicators. The use of maternal and reproductive health interventions was higher among women from the urban areas than rural areas. Moreover, the ratios are greater than one, which indicates an existence of inequalities that favour women from urban areas. The ratios showed a decline over time, which suggests that there was a decrease in pro-urban maternal and reproductive health inequalities. Furthermore, Figure 5.3 shows that, besides the use of any method of contraception, the absolute increases were greater among women from rural areas compared to those from urban areas.

Table 5.4: Maternal and reproductive health indicators by place of residence in 2008 and 2013

| Health indicator | Year of survey | Place of residence | | Total | Ratio |
		Urban	Rural		
Four or more antenatal care visits	2008	81.6	62.8	68.1	1.3
	2013	91.0	85.8	87.3	1.1
Skilled antenatal care provider	2008	93.9	84.1	86.9	1.1
	2013	98.2	96.7	97.1	1.0
Births delivered in a facility	2008	40.6	19.6	25.3	2.1
	2013	69.0	50.1	54.9	1.4
Births assisted by a skilled birth attendant	2008	66.9	33.2	42.4	2.0
	2013	78.9	53.2	59.7	1.5
Any method of contraception	2008	16.2	5.0	8.2	3.2
	2013	26.6	13.0	16.6	2.0

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

Figure 5.3: Absolute percentage point changes in use of maternal and reproductive health services between 2008 and 2013, place of residence
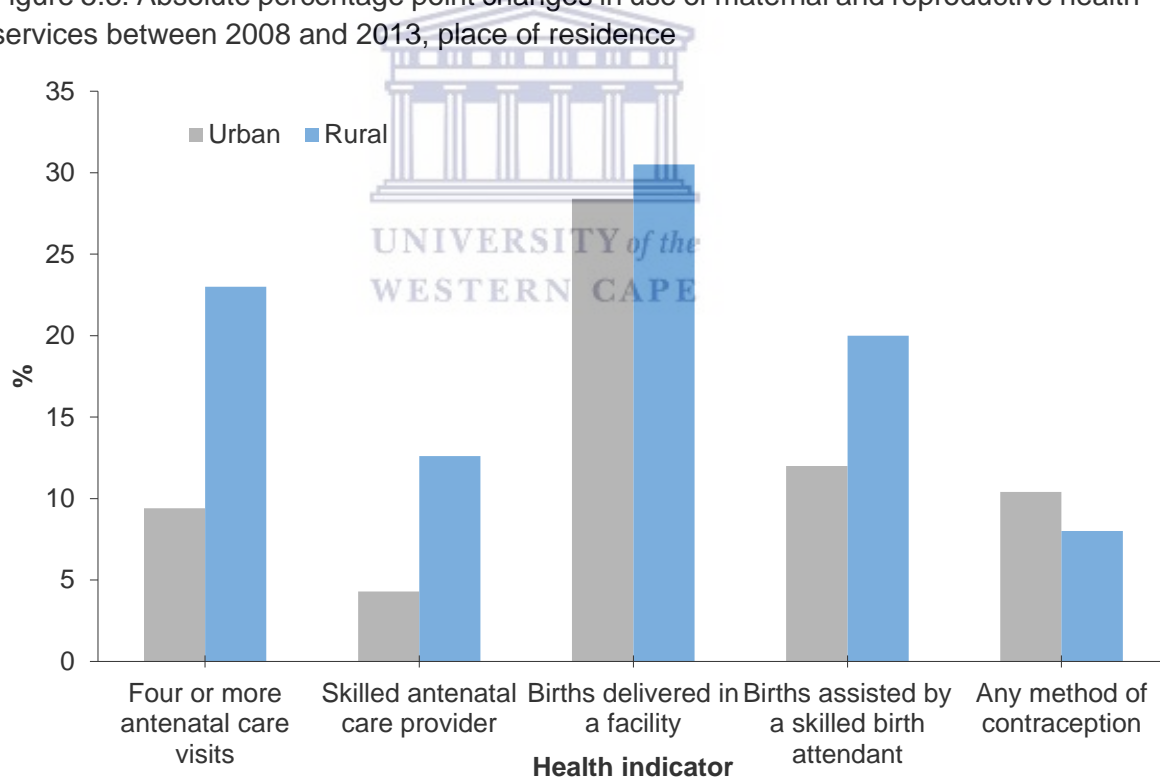
Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

Disparities in maternal and reproductive health use

Disparities in four or more antenatal visits

Figure 5.4 shows wealth-based disparities in the use of four or more antenatal visits by region. As mentioned earlier, the disparity index provides direct comparisons of health between two subgroups, for instance the richest and poorest household, and in this way, it is similar to the analysis of the rate ratio or rate difference. The results show a general decrease in pro-rich disparities over time, between 2008 and 2013. The disparity index was moderate-and-low in all regions in 2013. However, there were variations in disparities across regions in 2008. The Northern and Western regions had a high disparity index, favouring the richest households, in 2008.

Figure 5.4: Index of wealth-based disparities in the use of four or more antenatal care visits by region, Sierra Leone DHS 2008 & 2013
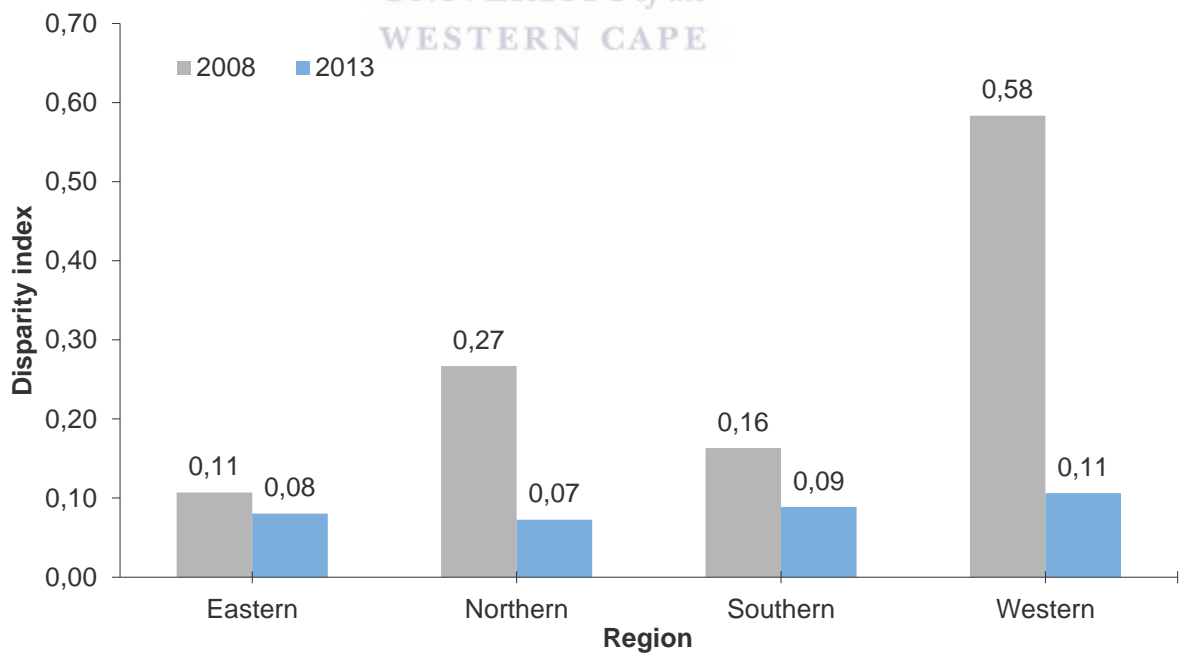
Figure 5.5 shows education-based disparities in the use of four or more antenatal visits by region. The disparities generally favour women with higher levels of education across most of the regions, except for the Eastern region in 2013. In 2008, the Eastern, Northern, and Southern regions had high disparities in the use of four or more antenatal services. In 2013, the disparities remained moderate and low with regard to the use of four or more antenatal visits.

Figure 5.5: Index of education-based disparities in the use of four or more antenatal care visits by region, Sierra Leone DHS 2008 & 2013
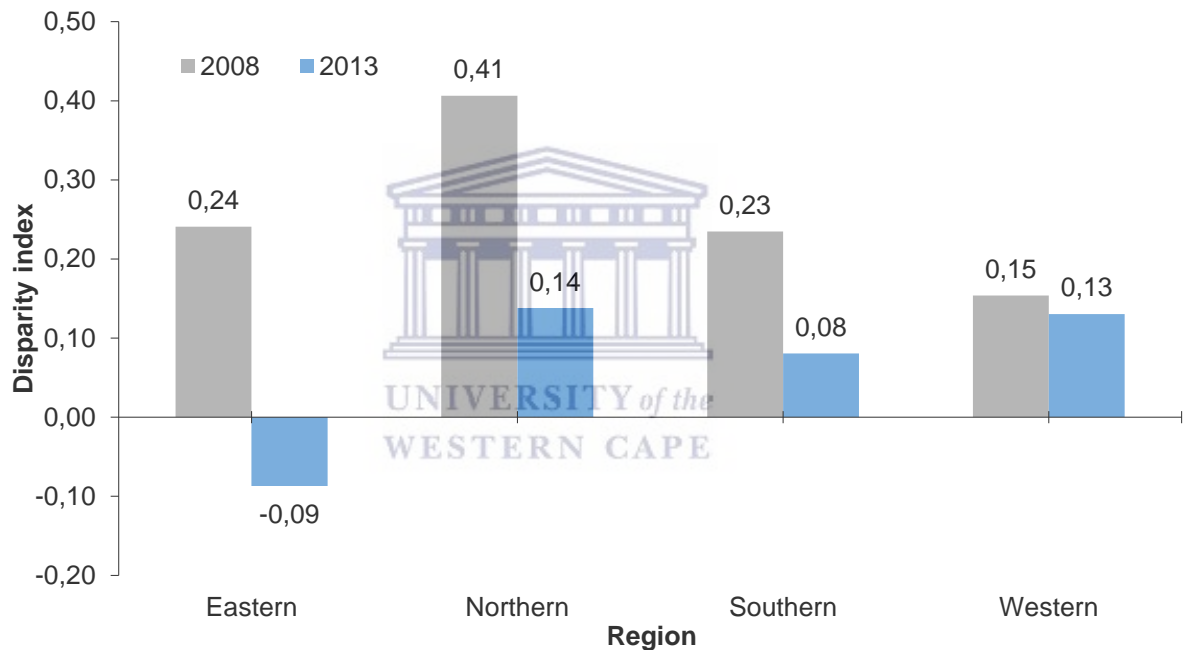
Figure 5.6 shows residence-based disparities in the use of four or more antenatal visits by region. The disparities generally favour women from urban areas across all regions. Even though there was a decline in disparities between 2008 and 2013, the disparities in the use of four or more antenatal visits remained low in both periods across most of the regions, except for the Northern and Western regions.

In 2008, the Northern and Western region had moderate disparities in the use of four or more antenatal visits.

Figure 5.6: Index of residence-based disparities in the use of four or more antenatal care visits by region, Sierra Leone DHS 2008 & 2013
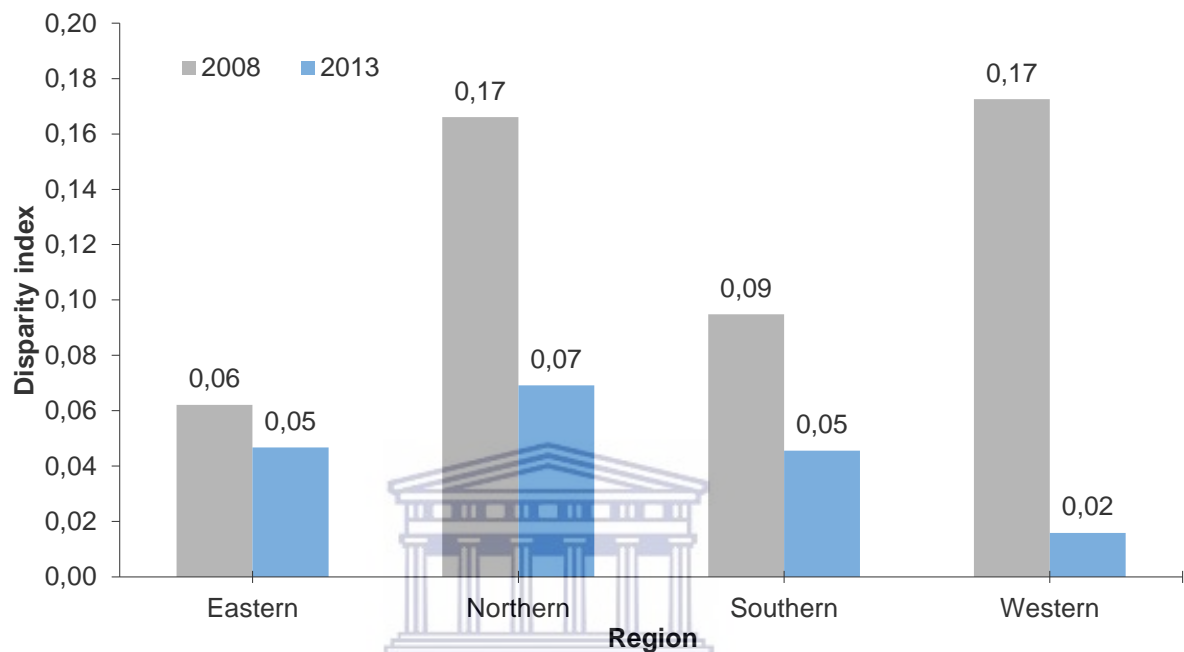
Disparities in skilled antenatal care provider

Figure 5.7 shows wealth-based disparities in the use of skilled antenatal care provider by region. The disparities generally favour women from the richest households across all regions, except for the Western region in 2008. Wealth-based disparities in skilled antenatal care use increased between 2008 and 2013 for the Southern and Western regions. In 2013, the wealth-based disparities in the use of skilled antenatal services remained low, whereas there were substantial variations in 2008. The Northern region had high wealth-based disparities in the use of skilled antenatal services in 2008.

Figure 5.7: Index of wealth-based disparities in the use of skilled antenatal care providers by region, Sierra Leone DHS 2008 & 2013
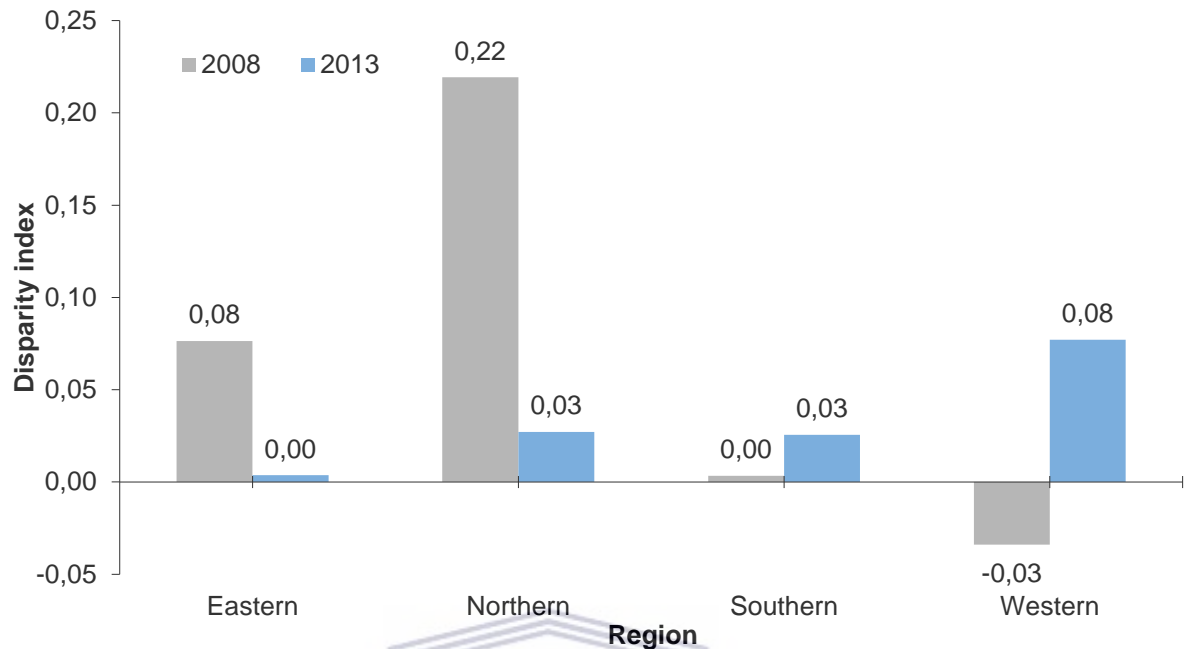
Figure 5.8 shows education-based disparities in the use of skilled antenatal care provider by region. The disparities generally favour women with higher levels of education across most of the regions, except for the Eastern region in 2013. The Eastern region had education-based inequalities that favoured women with no education in 2013. Moreover, in 2013, the education-based disparities in the use of skilled antenatal services remained low, whereas there were substantial variations in 2008. The Northern and Southern regions had moderate education-based disparities in the use of skilled antenatal services in 2008.

Figure 5.8: Index of education-based disparities in the use of skilled antenatal care providers by region, Sierra Leone DHS 2008 & 2013
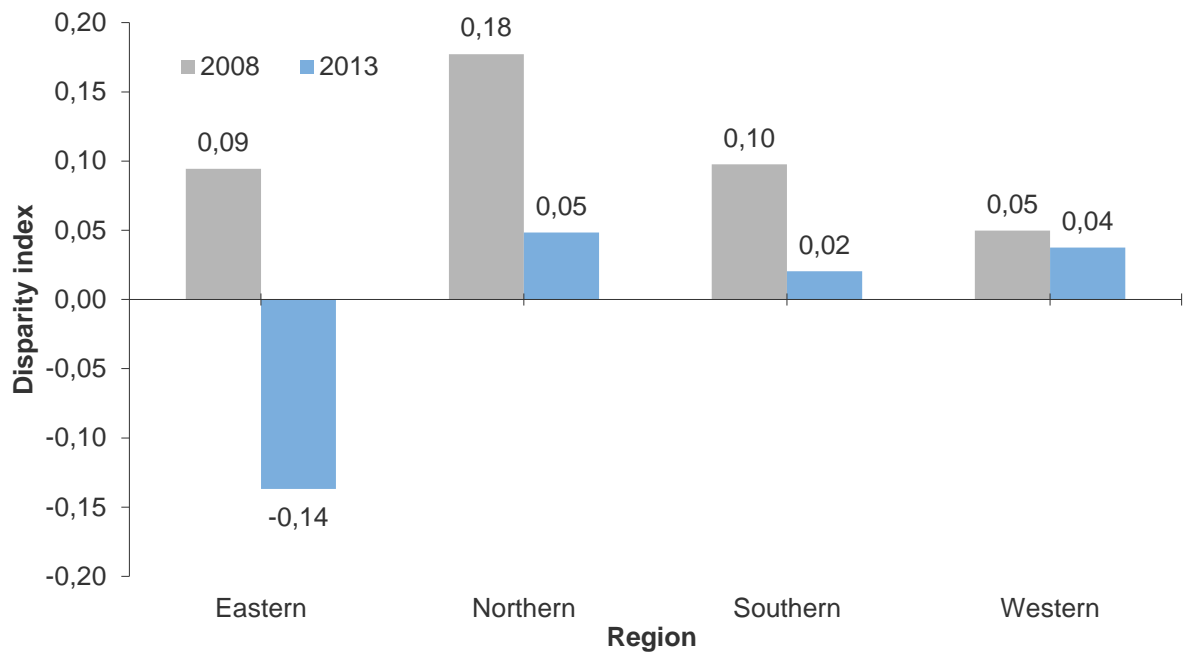
Figure 5.9 shows residence-based disparities in the use of skilled antenatal care provider by region. The disparities favour women from urban areas across all of the regions. The disparities in the use of skilled antenatal services remained low across most of the regions for both periods, except for the Northern region in 2008. The Northern region had moderate residence-based disparities in the use of skilled antenatal services in 2008.

Figure 5.9: Index of residence-based disparities in the use of skilled antenatal care providers by region, Sierra Leone DHS 2008 & 2013
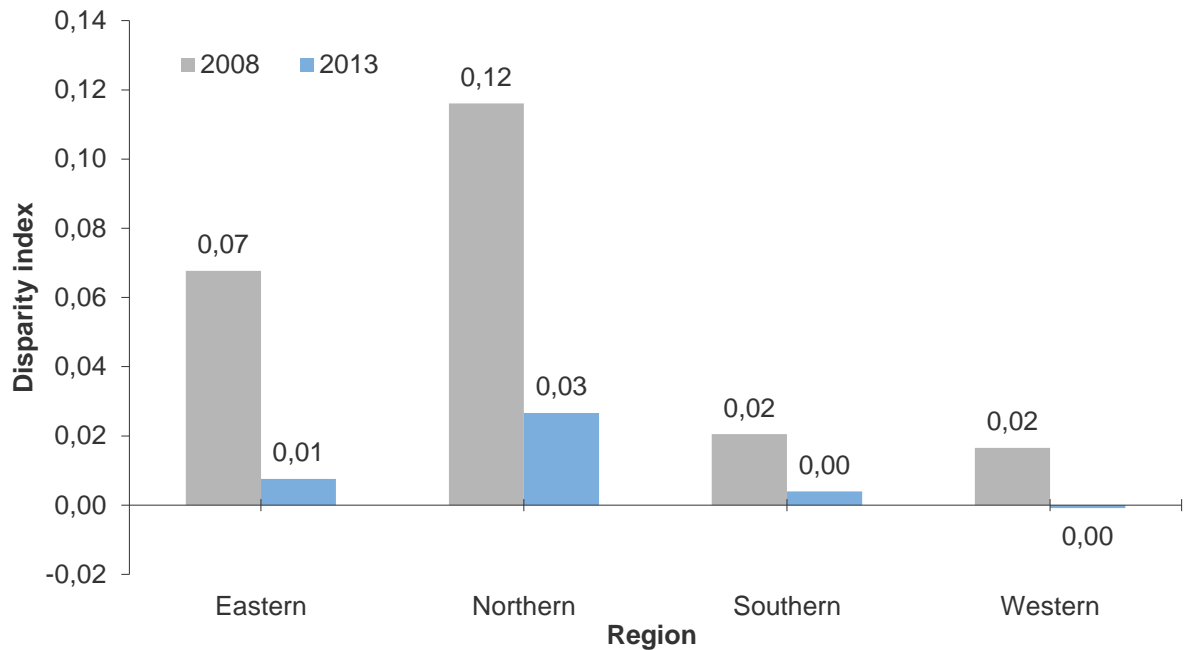
Disparities in births delivered in a facility

Figure 5.10 shows wealth-based disparities in the use of facility deliveries by region. The results show that the disparities in the use of facility-based deliveries favoured the richest households. The Northern and Southern region had high pro-rich disparities in the use of facility-based deliveries. However, the Eastern and Western region had low disparities in facility-based deliveries, in 2013 and 2008 respectively.

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Figure 5.10: Index of wealth-based disparities in the use of healthcare facilities for birth by region, Sierra Leone DHS 2008 & 2013
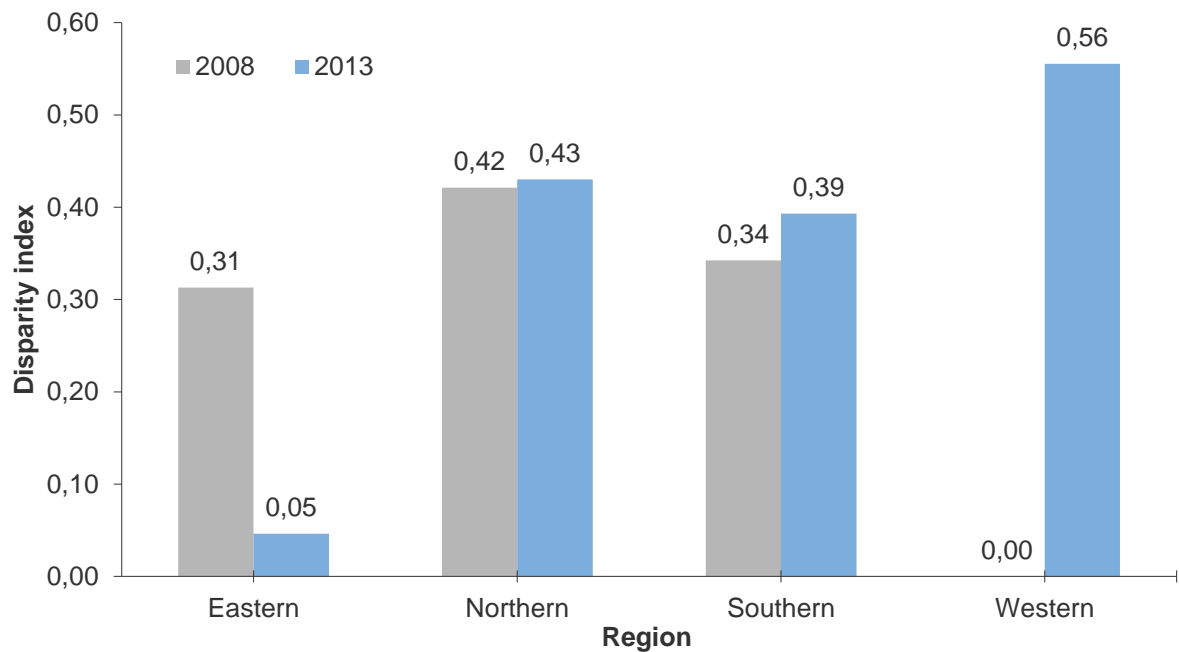
Figure 5.11 shows education-based disparities in the use of facility deliveries by region. Across all regions the disparities in the use of facility-based deliveries favoured women with the highest level of education. In 2008, there were high education-based disparities in the use of facility deliveries across all regions. However, the Eastern region had low disparities in the use of facility deliveries in 2013.

Figure 5.11: Index of education-based disparities in the use of healthcare facilities for birth by region, Sierra Leone DHS 2008 & 2013
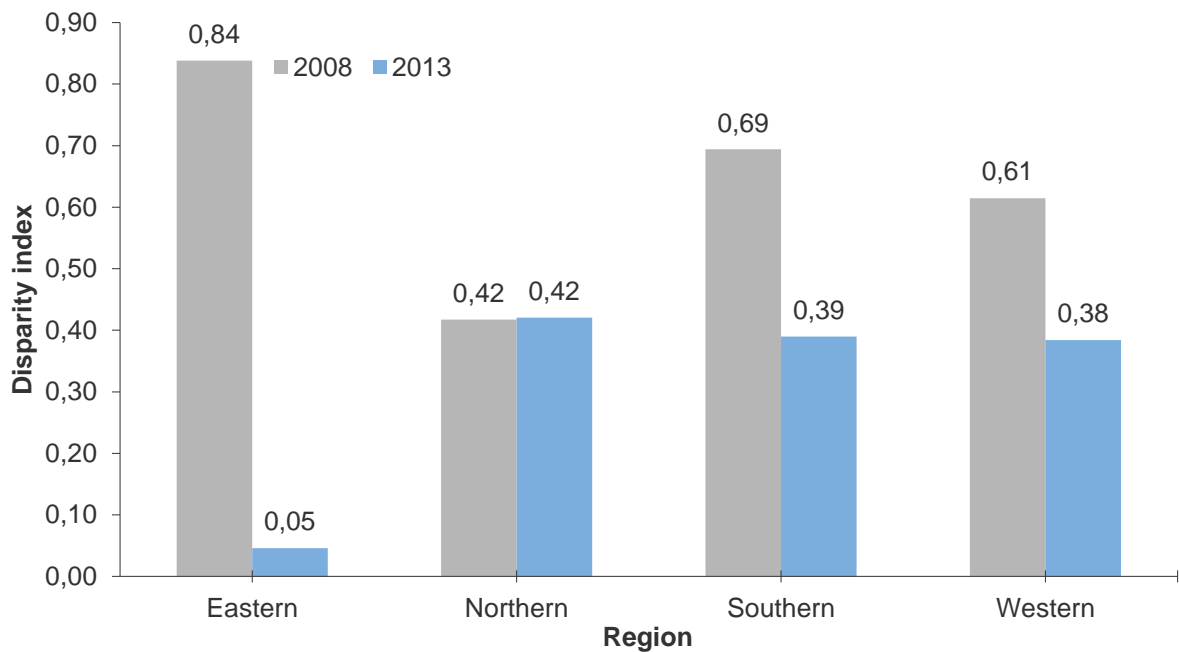
Figure 5.12 shows residence-based disparities in the use of facility deliveries by region. Across all regions the disparities in the use of facility-based deliveries favoured women from urban areas. In 2008, there were high residence-based disparities in the use of facility deliveries across all regions. However, there were variations in disparities with regard to the use of facility deliveries in 2013; where the Eastern region had low pro-urban disparities, the Western region had moderate disparities, and the Northern and Southern regions had high disparities in facility deliveries.

Figure 5.12: Index of residence-based disparities in the use of healthcare facilities for birth by region, Sierra Leone DHS 2008 & 2013
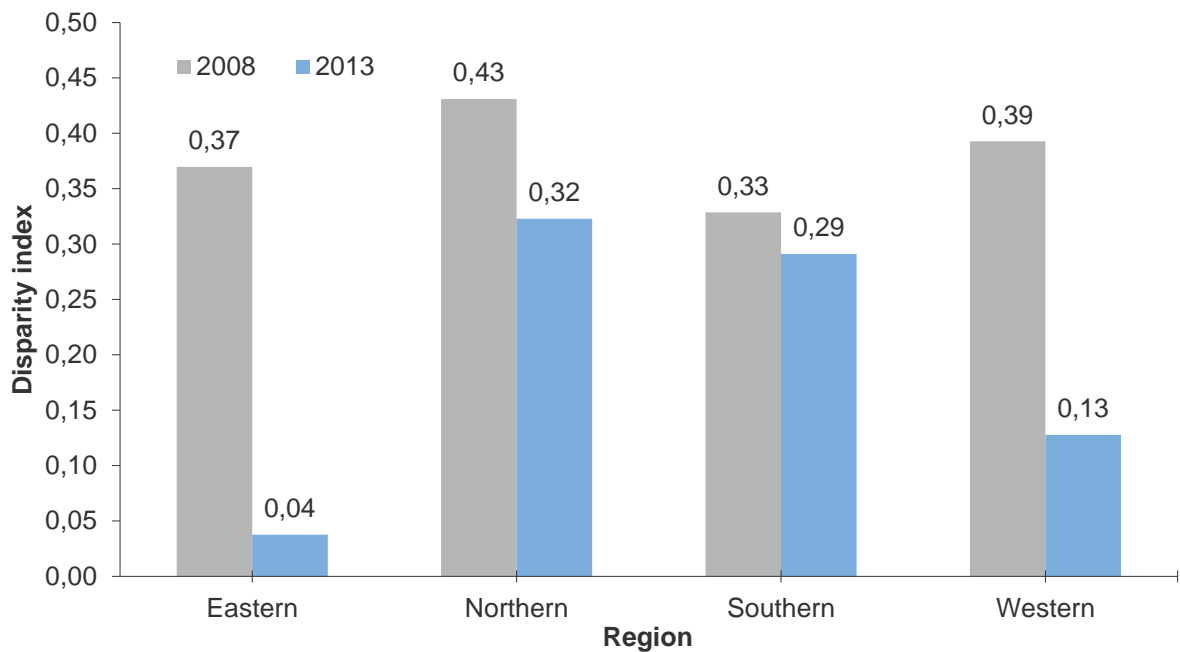
Disparities in births assisted by a skilled birth attendant

Figure 5.13 shows wealth-based disparities in the use of skilled birth attendants by region. The disparities in the use of skilled birth attendants favoured women from the richest households. The Eastern, Northern, and Southern regions had high disparities in the use of skilled birth attendants in 2008; likewise, in 2013, the Northern, Southern, and Western regions had high disparities in the use of skilled birth attendants. The Eastern region had moderate disparities in the use of skilled birth attendants in 2013.

Figure 5.13: Index of wealth-based disparities in the births assisted by a skilled birth attendant by region, Sierra Leone DHS 2008 & 2013
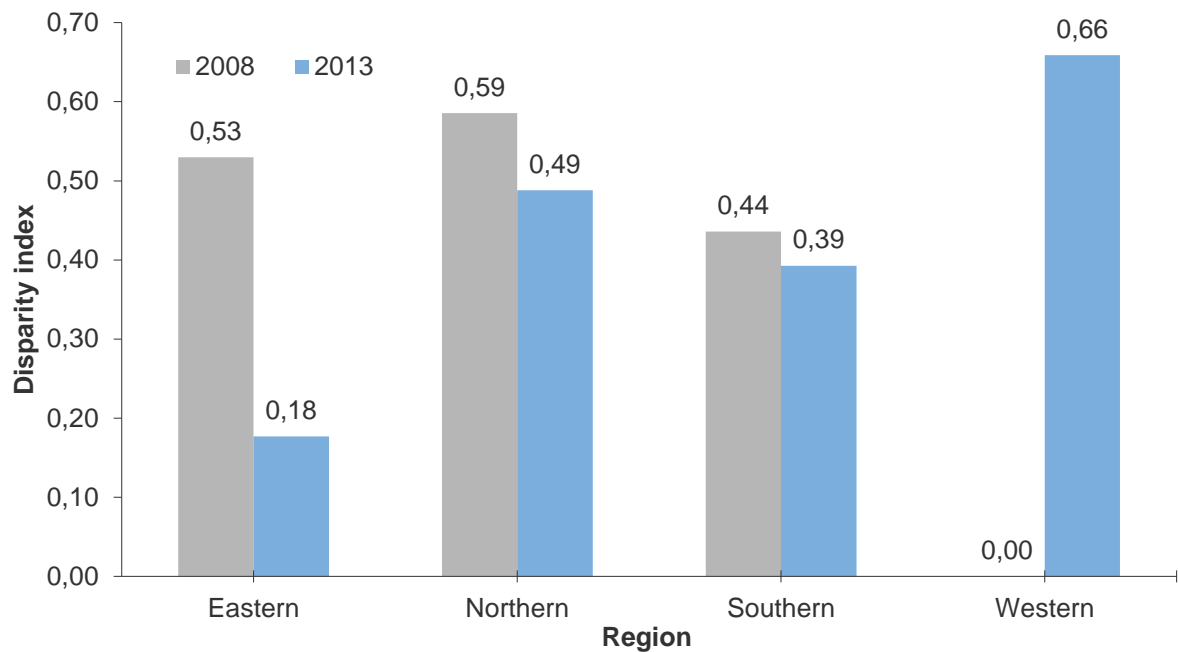
Figure 5.14 shows education-based disparities in the use of skilled birth attendants by region. The disparities in the use of skilled birth attendants favoured women with higher levels of education. Disparities in the use of skilled birth attendants remained high across all regions in 2008. Likewise, the Northern, Southern, and Western region had high disparities in the use of skilled birth attendants in 2013. However, the Eastern region had moderate disparities in the use of skilled birth attendants. The Northern region had high disparities in the use of skilled birth attendants for both periods.

Figure 5.14: Index of education-based disparities in the births assisted by a skilled birth attendant by region, Sierra Leone DHS 2008 & 2013
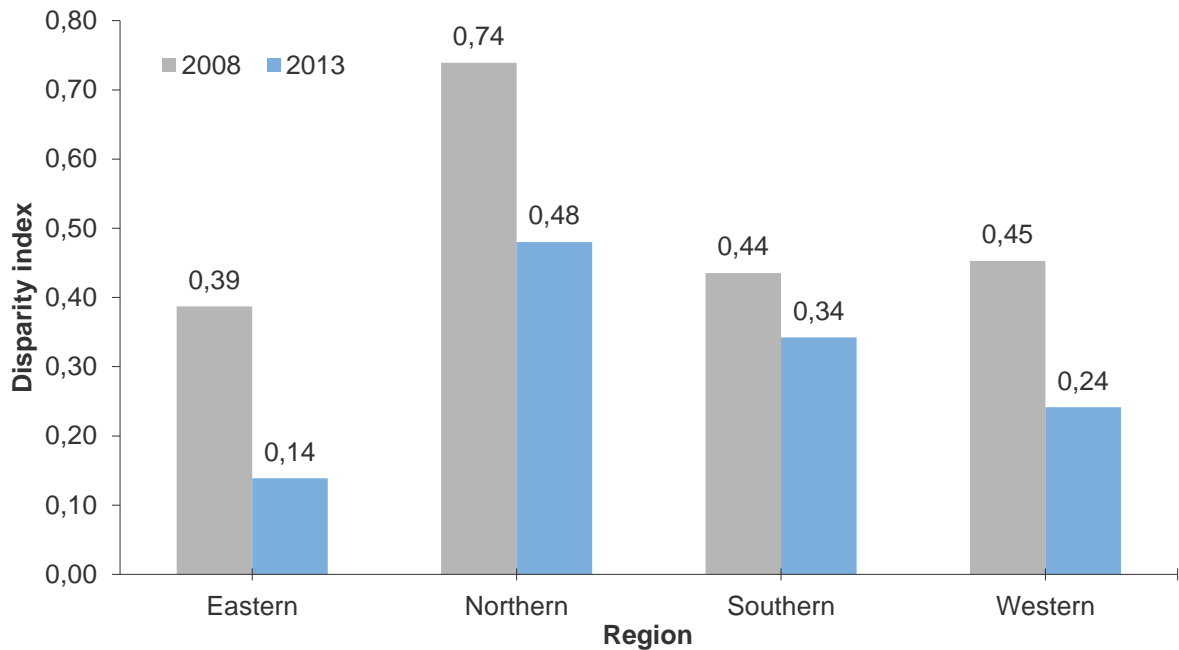
Figure 5.15 shows residence-based disparities in the use of skilled birth attendants by region. The disparities in the use of skilled birth attendants favoured women from urban areas of residence. Pro-urban disparities in the use of skilled birth attendants were high across all regions in 2008. Likewise, the Northern and Southern region had high disparities in the use of skilled birth attendants in 2013. However, in the same year, the Eastern and Western region had moderate disparities in the use of skilled birth attendants.

Figure 5.15: Index of residence-based disparities in the births assisted by a skilled birth attendant by region, Sierra Leone DHS 2008 & 2013
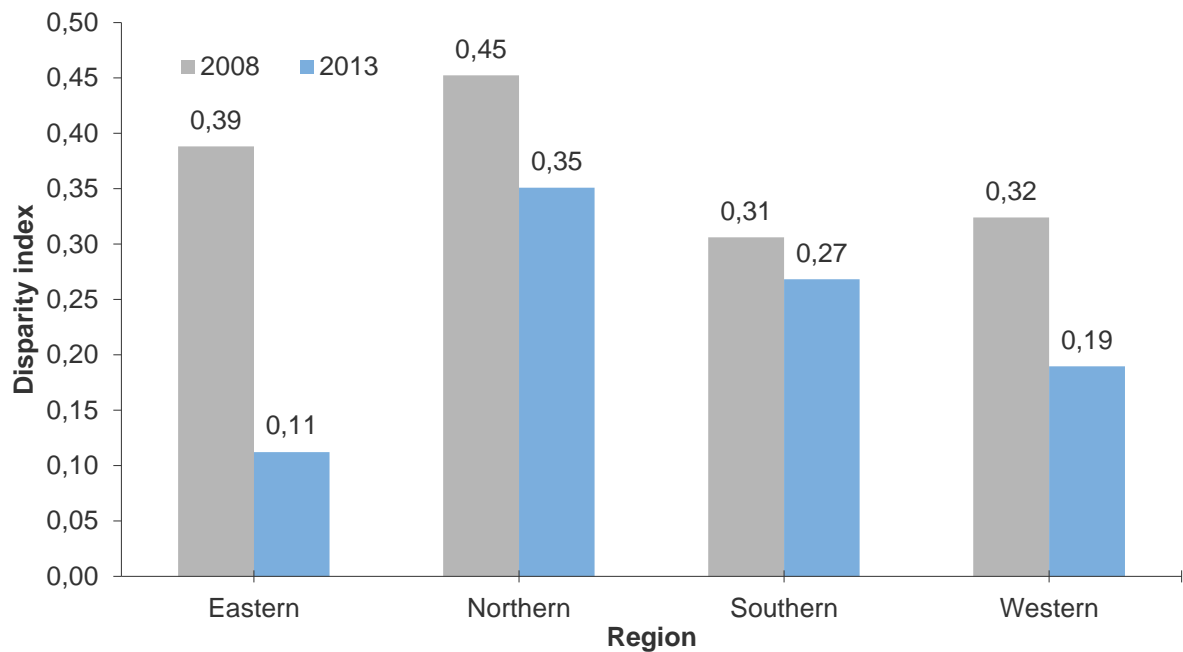
Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

Disparities in any method of contraception

Figure 5.16 shows wealth-based disparities in the use of any method of contraception by region. The disparities in the use of any method of contraception favoured women from the richest households. Pro-rich disparities in the use of any method of contraception were high across all regions in 2013. Likewise, the Eastern, Northern and Southern region had high disparities in the use of any method of contraception in 2008. In fact, the Eastern region had very high pro-rich disparities in the use of any method of contraception in 2008.

Figure 5.16: Index of wealth-based disparities in the use of any method of contraception by region, Sierra Leone DHS 2008 & 2013
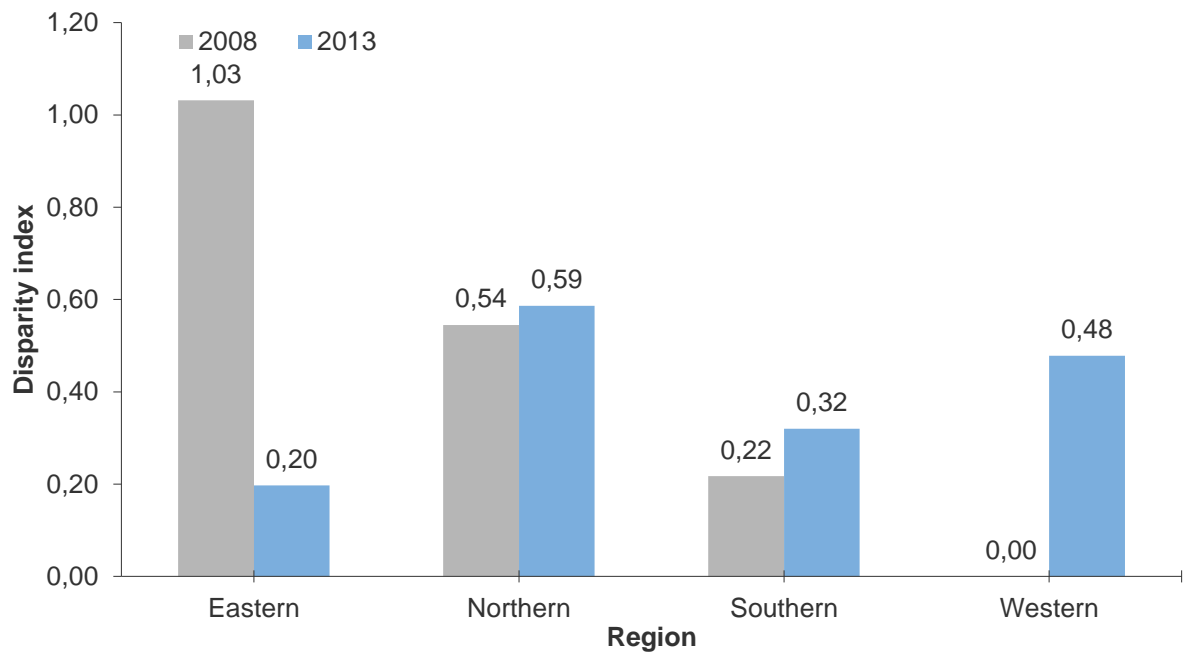
Figure 5.17 shows education-based disparities in the use of any method of contraception by region. The disparities in the use of any method of contraception favoured women with higher levels of education. In 2008, there were high disparities in the use of any method of contraception across all regions. However, in 2013, there were variations in disparities with regard to the use of any method of contraception. In this year, the Eastern, Northern, and Western regions had high disparities in the use of any method of contraception, while the Southern region had moderate disparities.

Figure 5.17: Index of education-based disparities in the use of any method of contraception by region, Sierra Leone DHS 2008 & 2013
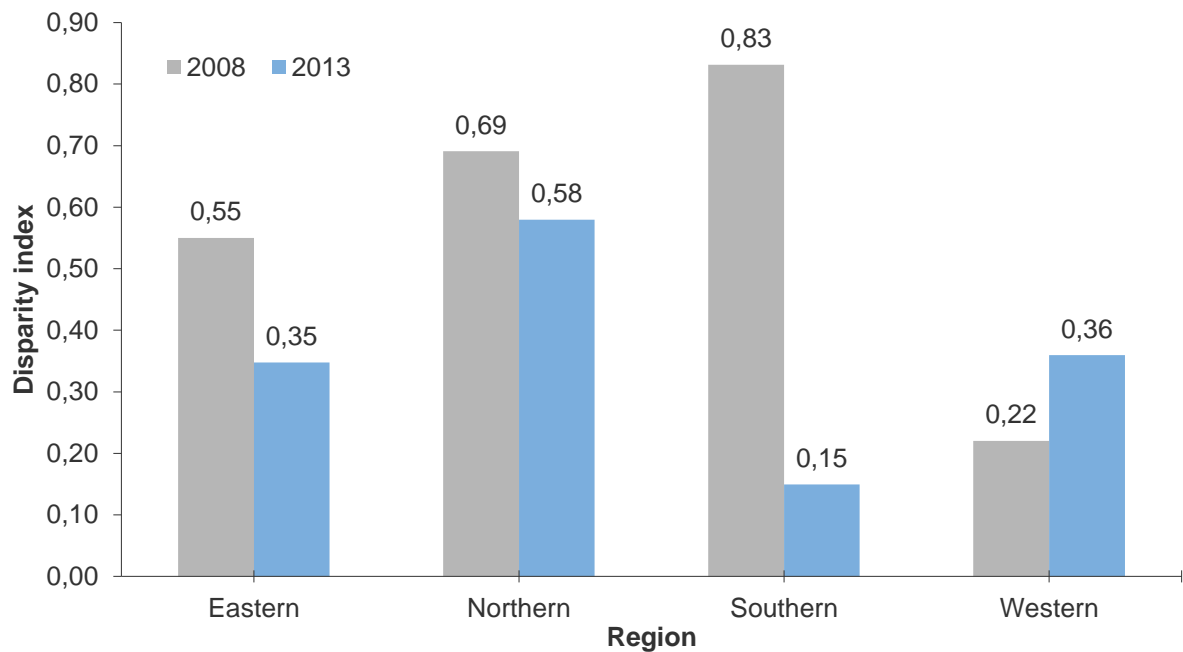
Figure 5.18 shows residence-based disparities in the use of any method of contraception by region. The disparities in the use of any method of contraception favoured women from urban areas of residence. In 2008, there were high disparities in the use of any method of contraception in the Eastern and Northern regions. In 2013, there were high disparities in the use of any method of contraception in the Eastern, Northern, and Southern regions. The Western region had low disparities in the use of any method of contraception for both periods.

Figure 5.18: Index of residence-based disparities in the use of any method of contraception by region, Sierra Leone DHS 2008 & 2013
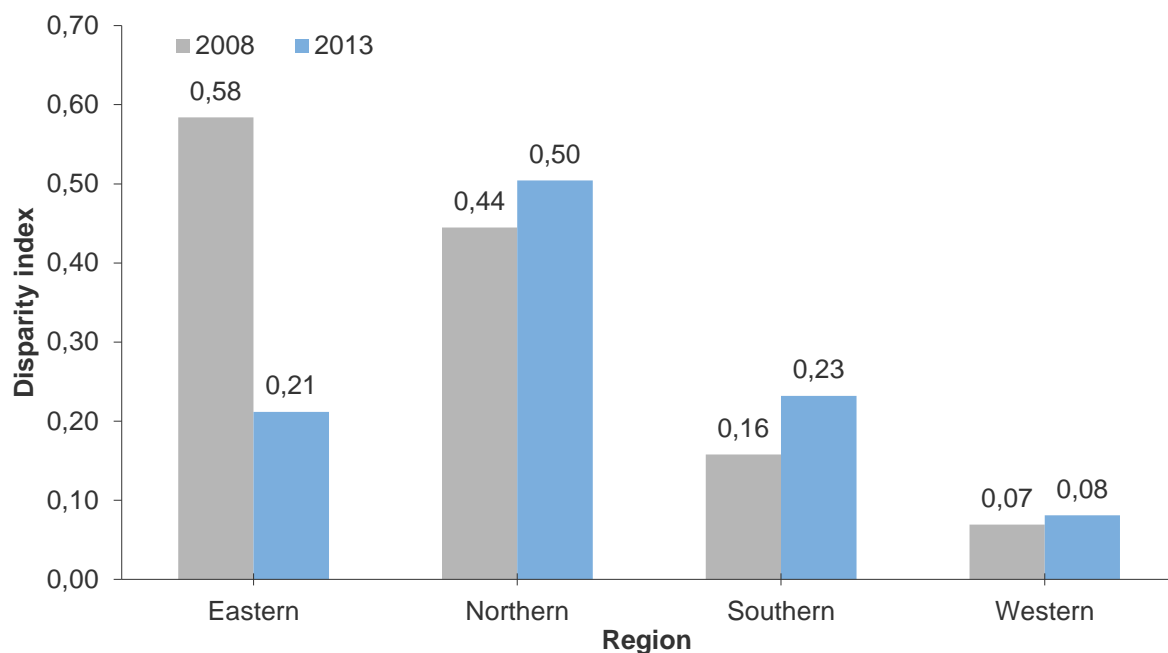
Concentration of socioeconomic inequalities in maternal and reproductive health use

Concentration curves

The assessment of concentration curves shows that there is inequity in use of all five maternal and reproductive health interventions favouring those with higher socioeconomic position (women with higher levels of education and women from the richest households). For instance, there is disproportionately higher use of these health interventions by wealthier women than by poorer women both periods, 2008 and 2013 (Figure 5.19-5.23). The concentration curves also show that there is decreasing inequality over time, depicted by the narrowing of the curves, particularly with regard to the use of antenatal services. Figure 5.19-5.20 show that the inequality gap has closed over time, which suggests that the uptake

of antenatal services has increased across all socioeconomic groups. Moreover, by 2013, inequality in the use of antenatal services had almost reached the line of equality, suggesting that these services is almost at *perfect equity* across the socioeconomic groups. Furthermore, the results show that there is high inequality in the use of health facilities for delivery, skilled birth attendants, and any contraceptive method, as marked by the deep curves.

Figure 5.19: Concentration curves showing wealth-and-education-based inequality in the use of four or more antenatal visits in Sierra Leone, 2008 & 2013
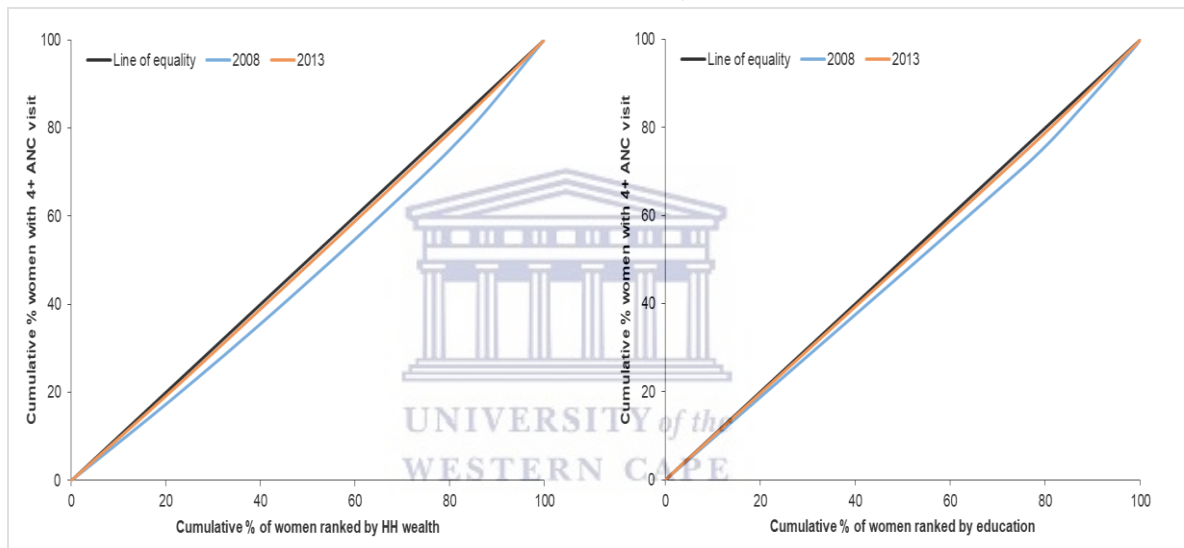
Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

Figure 5.20: Concentration curves showing wealth-and-education-based inequality in the use of skilled antenatal services in Sierra Leone, 2008 & 2013
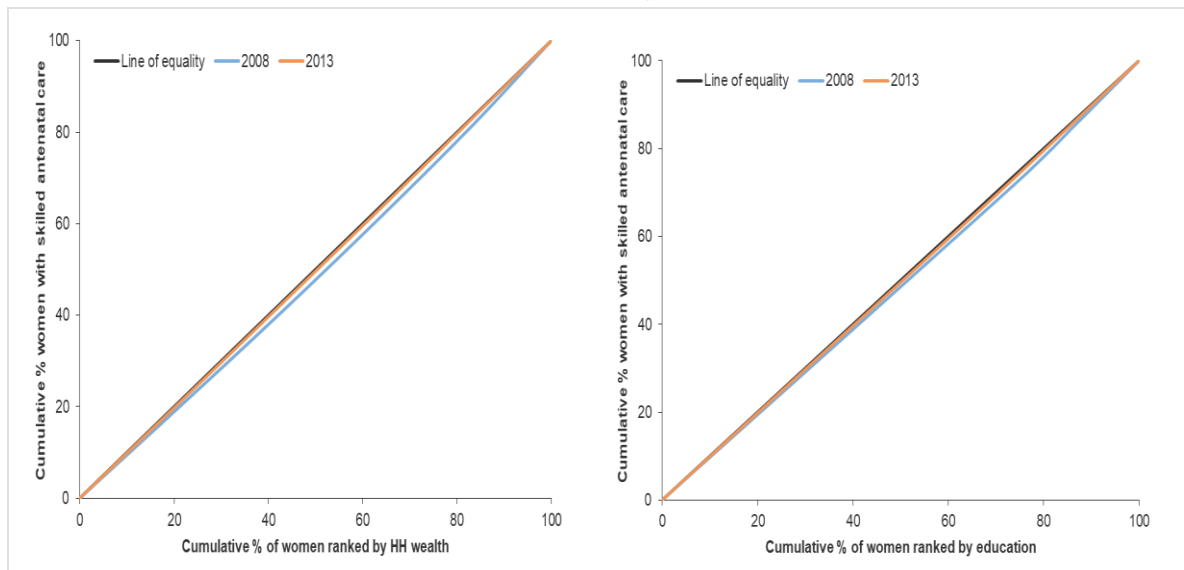
Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

Figure 5.21: Concentration curves showing wealth-and-education-based inequality in the use of health facilities for delivery in Sierra Leone, 2008 & 2013

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

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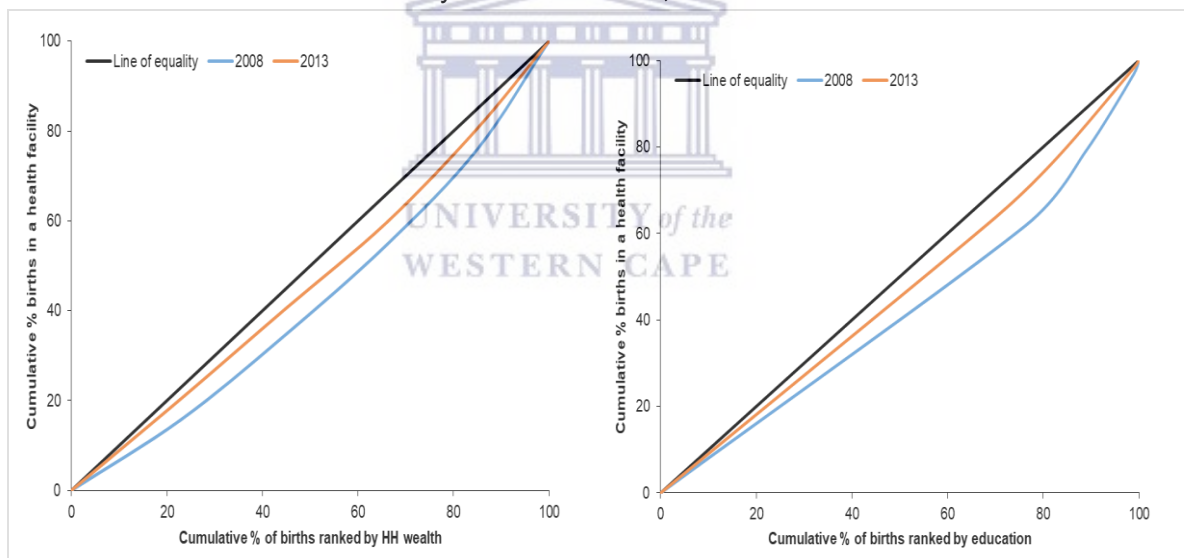
Figure 5.22: Concentration curves showing wealth-and-education-based inequality in the use of skilled birth attendants in Sierra Leone, 2008 & 2013
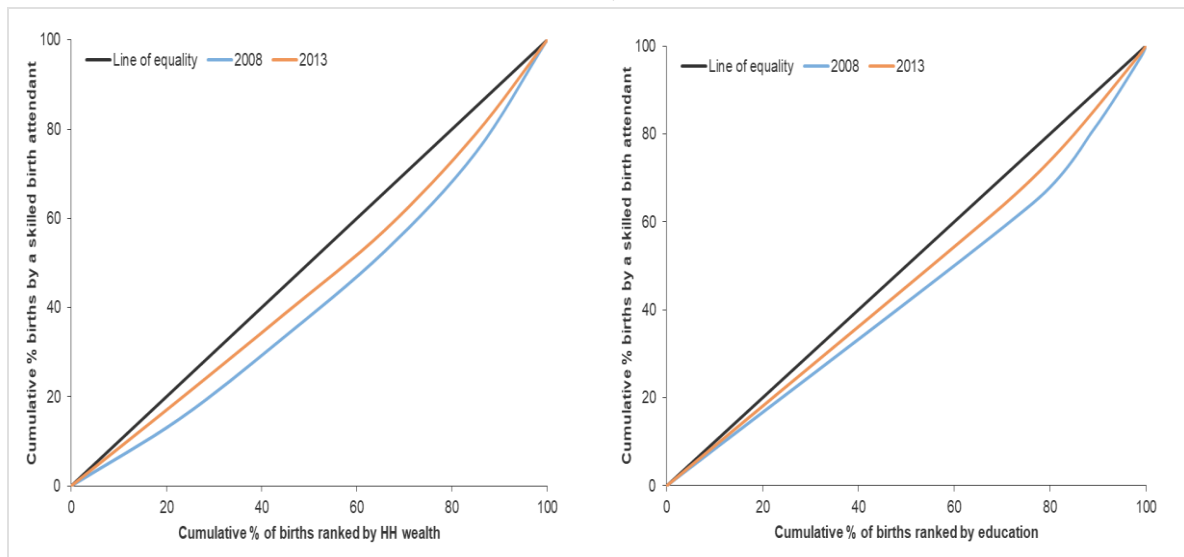
Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

Figure 5.23: Concentration curves showing wealth-and-education-based inequality in the use of any contraceptive method in Sierra Leone, 2008 & 2013
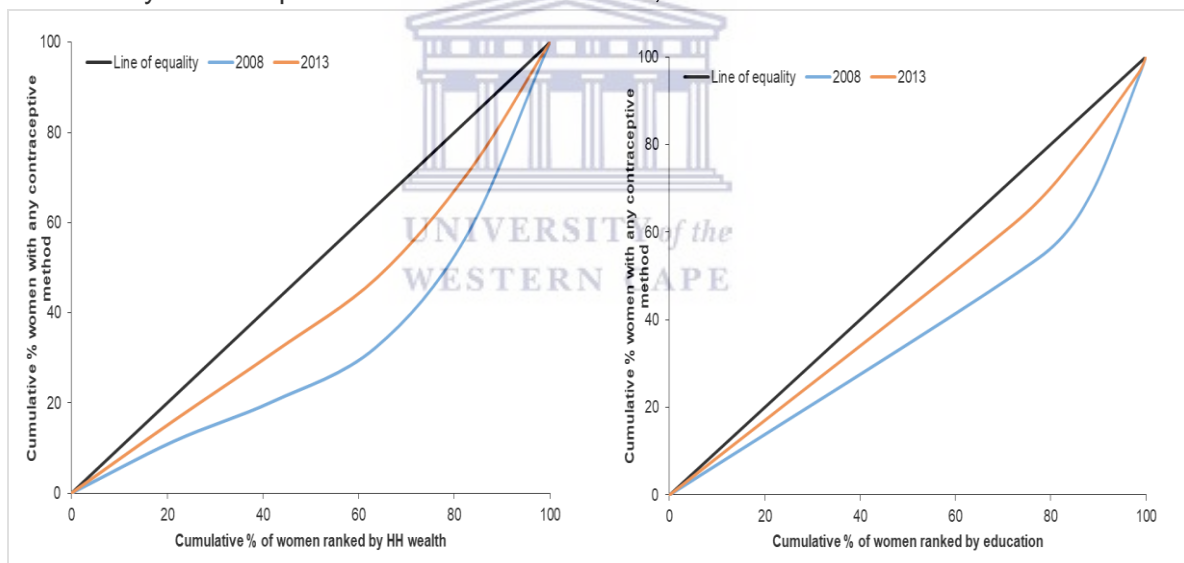
Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

Concentration indices

As stated earlier, the rate ratio focuses only on two extremes of the inequality stratifier (i.e. highest to the lowest) and ignores the other groups within this stratifier. To counter this, we used the concentration indices to assess inequalities in the use of maternal and reproductive health interventions. The wealth-based and the maternal-education-based concentration indices show that there has been improvements in inequality in the use of maternal and reproductive health service use over the period of about five years, 2008-2013 (Table 5.5-5.6). The greatest decrease in the concentration index was for the use of four or more antenatal visits, which decreased from 0.197 to 0.052 for the wealth-based indices and from 0.128 to 0.038 for the maternal-education-based indices. Moreover, in 2013, the indices were closer to zero, indicating almost perfect equality in the use of four or more antenatal care visits as well as skilled antenatal care providers. However, there was high inequality in the use of births assisted by skilled birth attendants followed by the use of births delivered in a facility, for both 2008 and 2013. Overall, the results (Table 5.5-5.6) show that the household wealth status generally contributes to more inequalities than maternal education.

Table 5.5: Concentration indices showing wealth-based inequality in the use of maternal and reproductive health services in Sierra Leone, 2008 & 2013

Health indicator	Survey year	Conc. Index (CI)	SE (CI)	95% CI	
				Low	High
Four or more antenatal care visits	2008	0.197*	0.023	0.152	0.243
	2013	0.052*	0.013	0.026	0.077
Skilled antenatal care provider	2008	0.104*	0.017	0.070	0.138
	2013	0.022*	0.005	0.012	0.032
Births delivered in a facility	2008	0.202*	0.024	0.155	0.249
	2013	0.196*	0.024	0.148	0.244
Births assisted by a skilled birth attendant	2008	0.330*	0.026	0.279	0.382
	2013	0.250*	0.023	0.206	0.295
Any method of contraception	2008	0.127*	0.012	0.103	0.152
	2013	0.124*	0.012	0.101	0.148

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013
Note: * = p<0.001

Table 5.6: Concentration indices showing education-based inequality in the use of maternal and reproductive health services in Sierra Leone, 2008 & 2013

Health indicator	Survey year	Conc. Index (CI)	SE (CI)	95% CI	
				Low	High
Four or more antenatal care visits	2008	0.128*	0.015	0.099	0.157
	2013	0.038*	0.009	0.021	0.056
Skilled antenatal care provider	2008	0.070*	0.010	0.050	0.090
	2013	0.026*	0.004	0.018	0.034
Births delivered in a facility	2008	0.170*	0.015	0.141	0.200
	2013	0.160*	0.013	0.135	0.185
Births assisted by a skilled birth attendant	2008	0.230*	0.016	0.199	0.261
	2013	0.179*	0.013	0.155	0.204
Any method of contraception	2008	0.096*	0.010	0.077	0.116
	2013	0.085*	0.008	0.068	0.101

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013
Note: * = p<0.001

5.5   Discussion

5.5.1 Key study findings

This study aimed to assess inequality in the use of five maternal and reproductive and health services in Sierra Leone using Demographic and Health Survey data from 2008 and 2013. The findings show that considerable progress has been made in both the uptake of maternal and reproductive and health services as well as improvements in inequality. Profiling maternal and reproductive health services is not enough without looking at inequalities in these services. The measures we employed in the study (rate ratios, disparity indices, concentration curves, and concentration indices) indicate that inequality in maternal and reproductive and health use has declined over time. We found that inequalities in these health interventions favour women from wealthy households, educated women, as well as women from urban areas. Moreover, the use of the antenatal services (four or more antenatal visits) was almost at perfect equality in 2013 for both socioeconomic stratifiers (household wealth and maternal education). Even though inequality declined over time, the use of delivery services (skilled birth attendants and facility-based deliveries) remained highly unequal. In general, analysis of the concentration indices, and concentration curves, show that inequalities were largest by household wealth index, and a bit smaller by maternal education.

5.5.2 Study findings in relation to other studies

The findings of this study are similar to those of existing studies, where several studies have found considerable inequalities in the use of delivery services. Similar to the current study, these studies also show that there is high socioeconomic inequalities in the use of maternal and reproductive health services, especially with regard to skilled birth attendants and facility-based deliveries. For instance, studies in developing countries have found inequalities in skilled birth attendance as well as facility deliveries which favour wealthier and more educated women (Axelson et al., 2012; Hajizadeh et al., 2014; Bobo et al., 2017). Moreover, the findings of this study show some degree of inequality favouring urban areas of residence, and the literature shows that women in urban areas tend to use maternal and reproductive health services more than rural women (Collin et al., 2007; Zere et al., 2010).

5.5.3 Explanations of study findings

Sierra Leone has consistently been among countries with high levels of maternal mortality (Statistics Sierra Leone and ICF Macro, 2009; Statistics Sierra Leone and ICF International, 2014; Sharkey et al., 2017). After years of struggles within the health system, particularly in dealing with high maternal mortality levels, the Sierra Leone government introduced the Free Health Care Initiative (FHCI) as means of improving the prospects of maternal and child healthcare (Bertone et al., 2014; Edoka et al., 2017). This initiative removed user fees for women and young children in need of healthcare. Financial costs often become a barrier to healthcare use, particularly life-saving maternal and reproductive health services, more so in

rural areas (Harris et al., 2011; Silal et al., 2012). In communities where individuals are already poor, out of pocket (OOP) expenditure on health becomes unrealistic; hence, we find that poor countries tend to have poor health outcomes. Literature suggests that there is some evidence that since its implementation around 2010, the FHCI has made some strides in improving women and children's health in the country (Koroma, 2017; Sharkey et al., 2017). It is possible that the implementation of the FHCI has made considerable contributions to the increase in the uptake of maternal and reproductive health services as well as the reduction of inequality in such services. Comprehensive analysis related to the impact of this initiative (and other related initiatives) on maternal and reproductive health services needs to be made.

5.6   Conclusions

Sierra Leone has made considerable improvements in the uptake of maternal and reproductive health services as well as the reduction of inequalities in the use of these services. This study has highlighted the importance of assessing inequalities in maternal and reproductive health services, and not just merely profiling health use trends and levels. In line with other similar studies, this study has showed that inequalities in maternal and reproductive health services favour women with high levels of wealth, better levels of education, and women from urban areas. We found higher levels of inequality in the use of delivery care services (skilled birth attendance and facility-based deliveries). Nonetheless, there has been generally positive trends in inequality, where inequality in antenatal services (four or more antenatal visits and use of skilled antenatal providers) has significantly improved

over time and has reached levels close to *perfect equality* in 2013. These findings are found in the backdrop of an initiative, together with other governmental drives, to increase the uptake of maternal and child health services and reduce inequalities in these services. Further research is needed to study the specific impact of user-fee abolition initiatives on the use of maternal and reproductive health services in the country. Moreover, policy initiatives need to prioritise the most unequal maternal and reproductive health services, such as the use of skilled birth attendants and facility-based deliveries, as well as increase the use of these services among poor women and those from rural areas.

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5.7   References

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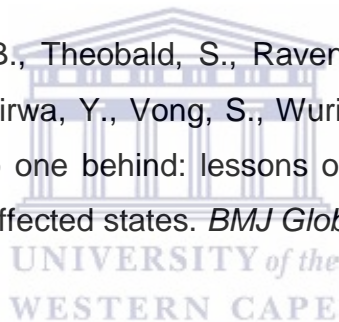
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CHAPTER 6: EXAMINING INEQUALITY OF OPPORTUNITY IN THE USE OF MATERNAL AND REPRODUCTIVE HEALTH INTERVENTIONS IN SIERRA LEONE

6.1   Abstract

Background: Poor countries, such as Sierra Leone, often have poor health outcomes, whereby the majority of the population cannot access lifesaving health services. Access to, and use of, maternal and reproductive health services is crucial for human development, especially in developing regions. However, inequality remains a persistent problem for many developing countries. Moreover, we have not found empirical studies, which have examined inequalities in maternal and reproductive health in Sierra Leone.

Method: We used data collected from the Sierra Leone Demographic and Health Surveys (DHS) conducted in 2008 and 2013. Five maternal and reproductive health indicators were selected for this study, including: four or more antenatal care visits, skilled antenatal care provider, births delivered in a facility, births assisted by a skilled birth attendant, and any method of contraception. To measure inequalities, we adopted the Human Opportunity Index (HOI). Using this measure, we measured differentials over the two periods, and decomposed it to measure the contribution of the selected circumstance variables to inequality.

Results: Inequalities declined over time, as shown by the decrease in the dissimilarity index. Due to the drop in the dissimilarity index, the HOI increased for all the selected maternal and reproductive health indicators. Moreover, antenatal services were closer to equality compared to the other selected services. Overall, we found that household wealth status, maternal education, and place of

residence, are the most important factors contributing to the inequality in the use of maternal and reproductive health services.

Conclusions: Even though there are improvements in inequalities over time, there are variations in the way in which inequality within the different indicators has improved. In order to improve the use of maternal and reproductive health services, and to reduce inequalities in these services, the government will have to invest in: (i) increasing the educational levels of women, (ii) improving the standard of living, as well (iii) bringing maternal and reproductive health services closer to rural populations.

Keywords: Maternal and reproductive health services, inequality of opportunity, human opportunity index, dissimilarity index, Shapley decomposition

6.2   Background

Poor countries (such as Sierra Leone) tend to have poor health outcomes, whereby the majority of the population, such as the poorest populations (often in rural areas), cannot access lifesaving health services (Peters et al., 2008). Sierra Leone faces various developmental challenges, which can exacerbate the current healthcare situation. Access to, and use of, maternal and reproductive health services is crucial for human development (Axelson et al., 2012). Studies have found that investing in Reproductive, Maternal, Newborn, and Child Health (RMNCH) drastically improves maternal mortality rates (Regassa, 2011; Susuman, 2012; Pell et al., 2013). In Sierra Leone, there are variations in the uptake of maternal and reproductive health interventions; findings from the 2008 and 2013 suggest that the use of these health interventions has been on the rise, but with varying levels. For instance, the use of four or more antenatal visits

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increased by 19.9 percentage points (from 56.1% to 76.0%, in 2008 and 2013 respectively), and the use of facility-based delivery services increased by 29.6 percentage points, from 25.3% to 59.7%, in 2008 and 2013 respectively (Statistics Sierra Leone and ICF Macro, 2009; Statistics Sierra Leone and ICF International, 2014).

These variations may be due to some levels of inequality across health interventions. Inequality remains a persistent problem for many developing countries. Therefore, studying inequalities in access to, and use of, maternal and reproductive health interventions is important, especially with regard to uncovering the main drivers of such inequalities. However, we have not found empirical studies, which have examined inequalities in maternal and reproductive health in Sierra Leone. In order to address this gap, we examined the extent to which inequalities are related to the socioeconomic factors.
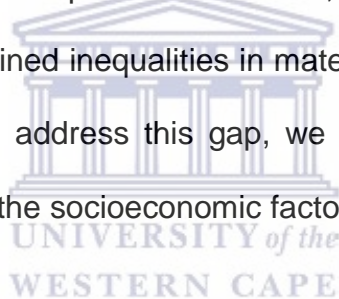
There are various measures of health inequalities, which have been brought forward. The various measures of health inequalities allow researchers to make certain conclusions based on the chosen measure as well as the study's research questions and objectives. For this study, we adopt the health opportunity approach, specifically the Human Opportunity Index (HOI). This approach takes into consideration the correlates of inequalities, the life circumstances of individuals as well as the efforts in examining and explaining health inequalities (de Barros et al. 2009; Ersado and Aran, 2014). The literature suggests that the health opportunity approach provides informative findings, which are good when it

comes to informing health policies geared towards reducing health inequalities (Sanoussi, 2017). Therefore, using the HOI, this study has two objectives: (a) to examine the prevalence of maternal reproductive health services as well as the share of inequality of opportunity among these services, taking into consideration the selected circumstances, and (b) to estimate the contribution of the selected circumstances to unequal opportunities. With this study, we aim to contribute to the literature by closing the gap with regard to inequality of opportunity studies in Sierra Leone.

6.3   Data and methods

6.3.1   Data sources

We used data collected from the Sierra Leone Demographic and Health Surveys (DHS) in 2008 and 2013. The Demographic and Health Surveys collect comparable and nationally representative data on various health and socio-demographic factors. Literature related to studies that have used secondary data from various Demographic and Health Surveys to analyse trends, determinants, and inequalities in maternal, child, and reproductive health interventions as well as service coverage exists (Boutayeb and Helmert, 2011; Sanoussi, 2017). The Sierra Leone Demographic and Health Surveys used nationally representative sampling techniques to sample 7 758 households in 2008 and 13 006 households in 2013, with response rates of 98% and 99% respectively (Statistics Sierra Leone and ICF Macro, 2009; Statistics Sierra Leone and ICF International, 2014). For both data collection periods, women of reproductive age (15-49 years) who were

present in the household on the night before the survey were eligible to be interviewed.

6.3.2 Selected indicators

The following indicators were selected for this study, use of: (i) four or more antenatal care visits (*percentage of women with four or more antenatal care visits for their most recent pregnancy*), (ii) skilled antenatal care provider (*percentage of women whose antenatal visits were attended by a skilled provider*), (iii) births delivered in a facility (*percentage of births that were delivered in a facility*), (iv) births assisted by a skilled birth attendant, (*percentage of births that were assisted by a skilled birth attendant, such as doctor/nurse/midwife and MCH Aide*), and (v) any method of contraception, (*percentage of women, in union, using any method of contraception*). We dichotomised all the selected indicators, where zero represented non-use and one represented use of the indicator. In order to examine inequalities in family planning, we considered the use of contraceptive services by women who are in union (married or cohabiting). We considered these indicators as opportunities in the analysis of the Human Opportunity Index. We removed 'missing' and/or 'do not know' cases from all of the selected indicators.

6.3.3 Human Opportunity Index

We selected nine circumstance variables to examine inequality of opportunity in the use of maternal and reproductive health interventions in Sierra Leone. These variables include: (i) maternal age, (ii) marital status, (iii) maternal education, (iv) media saturation (access radio, television, and newspaper at least once a week), (v) household wealth, (vi) number of living children, (vii) number of household members, (viii) place of residence, and (ix) region. As part of our analyses, using each of our indicators, we calculated the human opportunity as well as the dissimilarity indices in order to measure inequality of opportunity based on methodologies applied by previous studies (de Barros et al., 2009; Yalonetzky, 2009). The Human Opportunity Index calculates the coverage rate of a certain indicator and adjusts it by how equally distributed this indicator is across the selected circumstances (Ersado and Aran, 2014). The formula for the Human Opportunity Index is as follows:
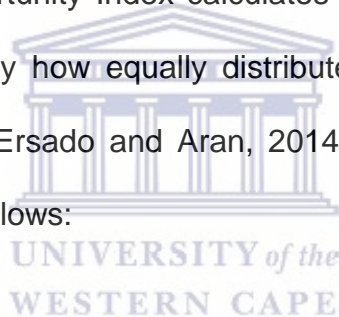
$$HOI = \overline{p}(1-D)$$

Where D denotes the dissimilarity index, which measures the inequality in the rates of maternal and reproductive health services use defined by the selected circumstances, and compared with the average use rate to the same service for the population as a whole (de Barros et al. 2009; Ersado and Aran, 2014). The coverage rate, denoted by $\overline{p}$, allows for computation using household survey data (Ersado and Aran, 2014). Moreover, Ersado and Aran (2014) state that if the use

of health services is independent of the circumstances, then $(1-D)$ will be equal

to one, and HOI will have the same value as $\bar{p}$. Therefore, the dissimilarity index

is computed as follows:

$$D = \frac{1}{2p}\left(\sum_{k=1}^{m} \alpha_k \mid \bar{p} - p_k \mid\right)$$

where k denotes the group of circumstances; p_k denotes the average coverage

rate of group k; α_k denotes the share of group k in total population of children;

and m denotes the numbers of disjoint groups defined by circumstances (Ersado

and Aran, 2014). When the coverage rate is the same as the average coverage

rate for all circumstance groups, the dissimilarity index is equal to zero (Ersado

and Aran, 2014). The dissimilarity index is the proportions of the opportunities

which needs to be shifted, based on the selected circumstances, to ensure

equality in the use of such opportunities (Sanoussi, 2017). Therefore, the

dissimilarity index ranges from 0 to 1 (when considering a percentage, the 0 to

100), and it is equal to zero when there is perfect equality (Ersado and Aran, 2014).

Changes in HOI

We also examined changes in inequality of opportunity between the two data

points (2008 and 2013). We decomposed the changes in the human opportunity

index, between 2008 and 2013, by scale and distribution effects in order to

understand the drivers of the estimated change over time (de Barros et al., 2009;

Sanoussi, 2017). Therefore, a change in the human opportunity index can be seen either as a characteristic of a difference in the coverage rate (scale effect), or difference in the index of inequality of opportunity (distribution effect):

Variation of HOI: $HOI^{final} - HOI^{initial} = \Delta \bar{p} + \Delta D$

Scale effect: $Scale_n = C_A\left(1 - D_B\right) - C_B\left(1 - D_B\right)$

Distribution effect: $Distribution_n = C_A\left(1 - D_A\right) - C_A\left(1 - D_B\right)$

where C_A is the coverage rate in 2013 and C_B is the coverage rate in 2008. D_A denotes the dissimilarity index in 2013 and D_B denotes the dissimilarity index in 2008.

Decomposition of the dissimilarity index

We decompose the contribution of each circumstance variable to inequality of opportunity using the Shapley decomposition procedure (Ersado and Aran, 2014). This procedure examines the marginal contribution of each circumstance to inequality in the uptake of maternal and reproductive health services (Amara and Jemmali, 2017). The assumption is that the human opportunity index relies on a set of circumstances, and adding other circumstances to these tends to increase the value of the dissimilarity index (Amara and Jemmali, 2017; Sanoussi, 2017).

The formula used to compute the impact of adding a circumstance (A) is given by the following formula:

$$D_A = \sum_{S \subseteq N \setminus \{N\}} \frac{|s|!(n-|s|-1)!}{n!} \left[D(S \cup \{A\}) - D(S) \right]$$

where N denotes the overall number of circumstances, and n denotes the number of selected circumstances in N (Amara and Jemmali, 2017; Sanoussi, 2017). Moreover, s denotes the subset of N circumstances without A (Amara and Jemmali, 2017; Sanoussi, 2017). $D(S)$ denotes the dissimilarity index estimated using a set of circumstances S and $D(S \cup \{A\})$ denotes the estimated dissimilarity index based on a set of circumstances S as well as circumstance A (Amara and Jemmali, 2017). We then used the Shapley decomposition procedure, to examine the contribution of the omitted circumstance (A) to the dissimilarity index by using the following formula:

$$M_A = \frac{D_A}{D(N)}, \text{ where } \sum_{i \in N} M_i = 1$$

Using the Shapley decomposition, the sum of contributions of all the selected circumstances adds up to 100%. We used the *hoi* and *hoishapley* commands in Stata to examine and decompose health inequalities in maternal and reproductive

health services (Azevedo et al., 2010; Suarez, 2013). We analysed the data using Stata version 14 and Microsoft Excel.

6.3.4 Ethical considerations

We conducted all analyses using publicly available data from the Sierra Leone Demographic and Health Surveys. The Institutional Review Board of Macro International, Inc. reviewed and approved the collection of data for both periods of the Sierra Leone Demographic and Health Surveys. The authors submitted a request for the use of this data to the DHS Program and permission was granted to download and use the data as per the request.

6.4   Results

Table 6.1 presents findings based on the coverage, dissimilarity index, and HOI by selected maternal and reproductive health indicators. The coverage rates show an increase in the use of all selected maternal and reproductive health services. Use of delivery services (births delivered in a facility and births assisted by a skilled birth attendant) and contraception remains low in the country, even though births delivered in a health facility had the highest percentage point increase between 2008 and 2013. This is an impressive development over five-year period. Moreover, the dissimilarity index (D-Index) dropped across all selected maternal and reproductive health indicators. For instance, the dissimilarity index among women who attended four or more antenatal care visits decreased from 6.3% to 1.6%, and from 2.8% to 0.7% among women who reported that they used a skilled

antenatal care provider during their previous pregnancy in the five years preceding the survey. The low dissimilarity index shows that antenatal services are more equitable compared to the other selected services. Furthermore, relatively higher D-indices were found for the following health services births delivered in a facility, births assisted by a skilled birth attendant, and use of any method of contraception, indicating higher inequalities in the use of these services.

Due to the drop in the D-index, the HOI increased for all the selected maternal and reproductive health indicators. The highest HOI was found among women who attended antenatal services provided by a skilled provider, and the lowest was found among women who reported use of any method of contraception. The low HOI is indicative of the low use of contraception among women in the country. In 2013, 13,3% of the use of contraception in Sierra Leone was distributed inequitably among women of reproductive age. This HOI value was much lower for the same service in 2008. In contrast, the high HOI value for antenatal services indicates high use of these services among women of reproductive age. For instance, in 2013, 96,4% of skilled antenatal care provider use, and 85,9% of four or more antenatal visits, were available and equitably allocated. The use of skilled birth attendants showed the highest penalty, opportunities that were incorrectly allocated, between 7% and 6% in 2008 and 2013 respectively.

Table 6.1: Distribution of the coverage, dissimilarity index and HOI by maternal and reproductive health services

Health indicator	Survey year	Coverage	D-Index	HOI
Four or more antenatal care visits	2008	68,1	6,3	63,8
	2013	87,3	1,6	85,9
Skilled antenatal care provider	2008	86,9	2,8	84,5
	2013	97,1	0,7	96,4
Births delivered in a facility	2008	25,3	18,0	20,7
	2013	54,9	8,9	50,0
Births assisted by a skilled birth attendant	2008	42,4	17,1	35,2
	2013	59,7	10,2	53,6
Any method of contraception	2008	8,2	36,0	5,3
	2013	16,6	20,1	13,3

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

Figure 6.1-6.3 show changes in the HOI using various measures, as outlined above. Figure 6.1 particularly shows the variations in the coverage rate of the selected maternal and reproductive health indicators; this variation estimates the number of opportunities present in a given society, which are allocated based on the principle of equal opportunity. As mentioned above, the coverage rates, for all the selected maternal and reproductive health indicators, increased between 2008 and 2013. There was an increase of 29.3 percentage points in the HOI for the use of any method of contraception, and the lowest increase, of 17% percentage points in the HOI was for the use of any method of contraception. Use of four or more antenatal visits also increased by over 20 percentage points in the HOI.

The increase in the use of maternal and reproductive health services is explained by the combined effect (Figure 6.2) of an increase in the coverage rate and an increase in the HOI. For instance, the scale effect explains 83% of the increase in the use of skilled antenatal services and facility-based deliveries. Moreover, the

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scale effect explains about 67% (the lowest) of the increase in the use of any method of contraception. Furthermore, 32.8% of the increase in the use of nay method of contraception, and about 17% in the use of skilled antenatal services and facility-based deliveries, was due to changes in the distribution of circumstances. (Figure 6.3).

Figure 6.1: Variation of the HOI between 2008 and 2013
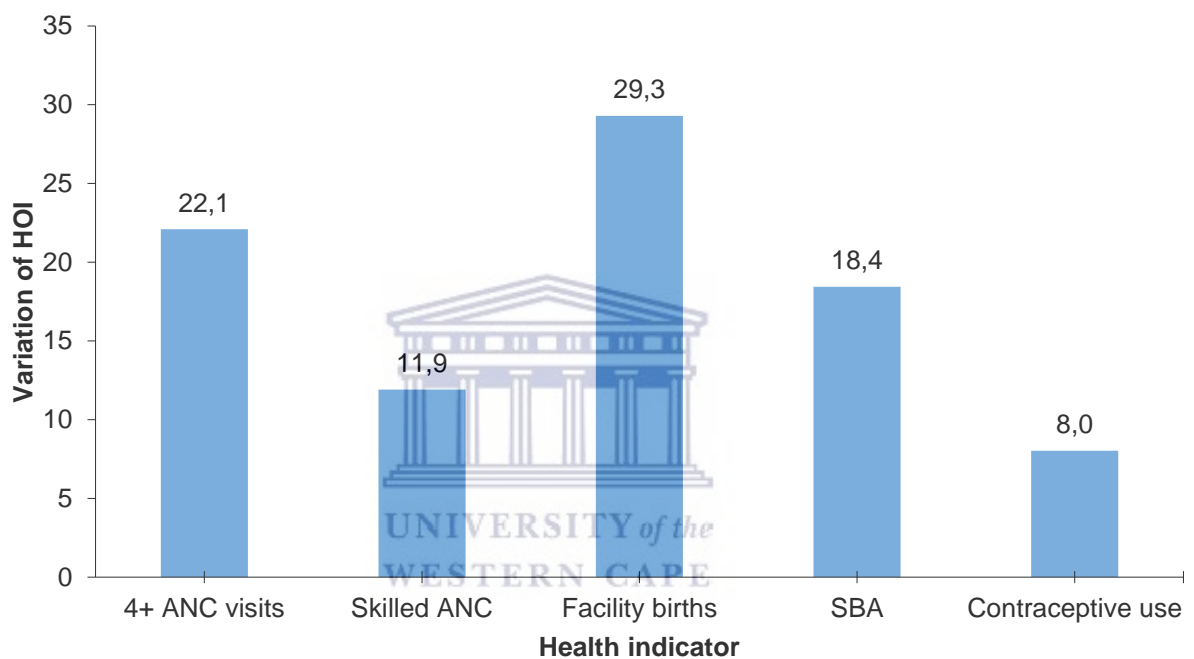
Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

Figure 6.2: Decomposition of the HOI in terms of scale effects
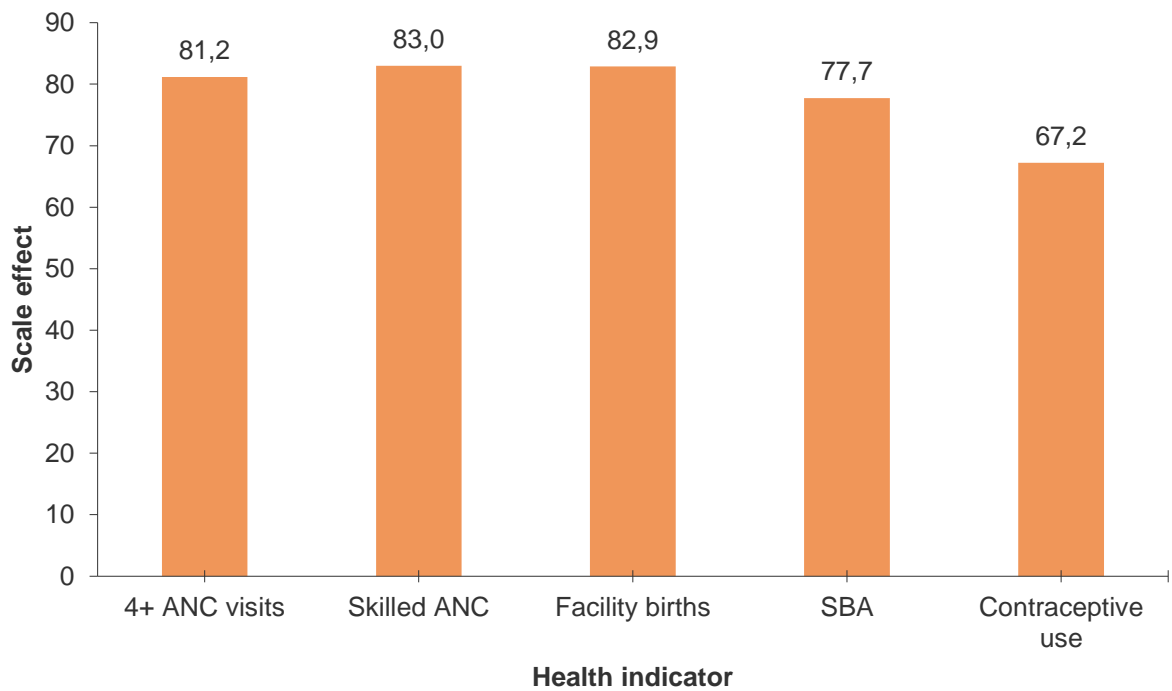
Figure 6.3: Decomposition of the HOI in terms of distribution effects

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The contribution of each variable of circumstance variable to the inequality opportunity is presented in Table 6.2. The decomposition of the dissimilarity index indicates that the household wealth status, maternal education, and residence, are most important factors contributing to the inequality in the use of maternal and reproductive health services. The findings show certain variations in the contributions of these variables to inequality. For instance, in 2013, maternal age had the second highest contribution (24.8%) to the inequality in the use of skilled antenatal services, whereas in 2008 maternal age contributed just only 6.0% to inequality in the use of this service. The contribution of maternal education to inequalities in the use of four or more antenatal visits, skilled antenatal services and facility-based deliveries increased between 2008 and 2013. The contribution of household wealth to inequalities in the use of facility-based deliveries increased between 2008 and 2013, whereas it decreased for other indicators. Moreover, the contribution of household wealth to inequalities in the use of any method of increased between 2008 and 2013. Overall, all the selected circumstance variables made an important contribution to maternal and reproductive health inequalities. For instance, the number of living children was seen as an important contributor to inequalities in maternal and reproductive health services.

Table 6.2: Shapley decomposition of the contribution of circumstance variables to indicators of the use of maternal and reproductive health services

Variable	4+ ANC visits		Skilled ANC		Facility births		SBA		Contraception	
	2008	2013	2008	2013	2008	2013	2008	2013	2008	2013
Age	0,7	6,3	6,0	24,8	1,8	4,9	1,4	5,6	5,1	4,6
Marital status	2,1	2,4	2,0	4,7	1,2	2,7	1,3	2,2	0,1	2,4
Education	21,2	29,3	24,2	32,6	24,9	25,9	22,6	21,1	17,8	15,3
Wealth	24,9	22,4	26,9	15,2	14,4	17,3	21,6	24,3	23,4	21,3
Media	1,3	0,9	1,0	0,7	1,4	1,3	1,0	1,1	1,3	1,2
# of living children	1,4	4,9	1,6	9,4	7,5	8,5	3,8	7,9	13,8	21,4
# of members	5,1	3,3	0,1	1,3	3,9	6,5	2,4	5,2	1,4	0,6
Residence	30,9	26,4	29,1	9,7	36,9	26,8	37,3	30,4	19,4	25,6
Region	12,5	4,2	9,0	1,6	8,0	6,0	8,6	2,4	17,8	7,5

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

6.5   Discussion

The findings show that inequality of opportunity declined for all the selected maternal and reproductive health services between 2008 and 2013. Generally, the use of maternal and reproductive health services has increased over time, as shown by the higher coverage rates in 2013 compared to 2008 across all the selected maternal and reproductive health interventions. The changes in the coverage rate also brought about changes in the dissimilarity index as well as the HOI. Using the HOI, the findings showed that antenatal services were available and equitably allocated in Sierra Leone. Moreover, antenatal services (four or more antenatal visits and skilled antenatal services) are closer to equality compared to the other selected services. However, the HOI was low for the use of any method of contraception, indicating that there is a lot that needs to be done to increase the uptake of contraceptive services in the country. With regard to the changes in HOI over time, we found that, in general, there was an increase in the contribution of all the selected circumstance variables over the period between

2008 and 2013. Overall, the scale and distribution effects positively affected the rate of maternal and reproductive health service use.

Furthermore, we found that household wealth status, maternal education, and place of residence, are the most important factors contributing to the inequality in the use of maternal and reproductive health services. From the few studies that have been conducted using the HOI, our findings echoed those studies, which found that geographical location (region and residence), educational level of parents, as well as household wealth status significantly influence health inequality (Collin et al., 2007; Zere et al., 2010; Axelson et al., 2012; Hajizadeh et al., 2014; Bobo et al., 2017). Interestingly, over 60% of the Sierra Leonean population lives in rural areas (Weekes and Bah, 2017), hence place of residence is among the main contributors to inequality. Moreover, the contribution of these factors (or circumstance variables) to inequality increased over time for certain opportunity indicators. Overall, other apart from the circumstance variables mentioned above, all the selected circumstance variables had a particular contribution to the inequality in the use of maternal and reproductive health services.

Limitations

We used cross-sectional data from the Sierra Leone Demographic and Health Surveys. Therefore, this data is subjected to limitations related to cross-sectional surveys, whereby one cannot establish causality among variables. Moreover, the data may also be subjected to recall bias, where respondents have to report of past events (usually up to the five years preceding the survey), especially with

regard to the use maternal and reproductive health services. Furthermore, the selected list of circumstances used in computing the HOI for a given opportunity is important for the measure. Therefore, the limitation is that the HOI is estimated for a specified list of circumstances and if this list changes, then the estimation of inequality and HOI changes. Nonetheless, even though the HOI of a given opportunity is dependent on the number of circumstances used to compute it, it does not necessarily become higher when more circumstances are added to the selected list of circumstances set.

6.6   Conclusion

The findings suggest that there has been improvements in the use of maternal and reproductive health services, and a reduction in inequality of these services over time. Even though there are improvements, there are variations in the way in which inequality within these indicators has improved. For instance, antenatal services have had the most considerable improvement in inequalities and have moved closer to equality than the other selected services. There is a need for further improvements in order to reduce inequalities in the use of other services (such as delivery and contraceptive services). The decomposition analysis showed that socioeconomic (maternal education and household wealth) and geographical (place of residence) indicators explained most of the inequalities in maternal and reproductive services in Sierra Leone. Therefore, to improve the use of maternal and reproductive health services, and reduce inequalities in these services, the government will have to invest in maternal education, improving the standard of

living, as well bringing maternal and reproductive health services closer to the people, especially those in rural area.

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CHAPTER 7: INVESTIGATING INEQUALITIES IN MATERNAL & REPRODUCTIVE HEALTH SERVICES IN SIERRA LEONE: A DECOMPOSITION ANALYSIS

7.1 Abstract

Background: Even though measuring socioeconomic inequality in population health indicators such as the use of maternal and reproductive health services, it is more interesting for policy purposes is go deeper into trying to explain these inequalities. The objective of this chapter is to decompose wealth-based inequalities in the use of maternal and reproductive health services into their contributing factors.

Methods: The chapter used two rounds (2008 and 2013) of the Sierra Leone Demographic and Health Survey datasets. Using widely used decomposition analysis techniques, the concentration index is decomposed to explain the determinants of inequalities.

Results: The findings show that inequalities in maternal and reproductive health services declined between 2008 and 2013. The proportions of health use indicate a general increase in the use of maternal and reproductive health services between these two periods. Furthermore, maternal education was found to be the most prominent factor that explains inequalities in maternal and reproductive health services.

Conclusion: Although the country has achieved near perfect equality in terms of the use of four or more antenatal visits, there is still a long way to go in reducing inequalities in other maternal and reproductive health interventions, and thus achieving universal health coverage. Maternal education was found to be the

common explanatory factor across all the health outcomes considered. Therefore, the government needs to target the educational attainment of women (through increasing their level of education and training them on the importance of using maternal reproductive health services).

Keywords: Inequality, concentration index, Erreygers, decomposition analysis

7.2   Background

A clear understanding of factors that enable health inequalities to exist should be among the paramount objectives of any government, especially in developing countries. Researchers worldwide have focused on various aspects of health inequality and have advocated for inequality-free health systems as well as proper implementation of health policies aimed at eliminating health inequalities (Van Malderen et al., 2013; Liu et al., 2014; Rarani et al., 2017). This much-needed focus on health inequalities shows that there are many issues that governments need to consider in order to achieve equal and better health among populations. Moreover, various studies have been conducted to find evidence on how socioeconomic, and other factors, determine the extent to which health inequalities exist among populations (Van Malderen et al., 2013; Egondi et al., 2015).

The African continent is presented with various challenges, such as corruption, poverty, poor health systems, inaccessibility of healthcare, and other factors that may hinder the equal distribution and use of healthcare services. Sierra Leone has some poor health outcomes, with one of the highest maternal mortality ratios in the world. In this country, factors such as poor road infrastructure, distance and

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unaffordable cost of transportation to health facilities contribute to poor health outcomes (Treacy & Sagbakken, 2015; Treacy et al., 2018). Besides these challenges, the country has experienced some positive outcomes and has made valuable gains in certain health outcomes. According to surveys conducted in the country, the use of antenatal care services has reached universal coverage, whiles there has been increases in other maternal and reproductive health services Statistics (Sierra Leone and ICF Macro, 2009; Statistics Sierra Leone and ICF International, 2014).

This chapter builds on the previous chapters and provides a decomposition analysis of factors that could explain the extent of inequalities in the country. Even though measuring socioeconomic inequality in population health indicators such as the use of maternal and reproductive health services is crucial, what is more interesting for policy purposes is to go deeper into trying to explain these inequalities using various analysis techniques such as decomposition analysis. In this way decomposition analysis, with regard to health inequalities, has major advantages. One of these advantages is that it is a crucial policy tool that could be used to pinpoint strategies that can be used to decrease inequalities (Hosseinpoor et al., 2006; Rarani et al., 2017). Through the decomposition analysis, one is able to measure the extent to which certain factors contribute to health inequalities (Hosseinpoor et al., 2006; Egondi et al., 2015). There is not much known about the extent of health inequalities and contributing factors in Sierra Leone. Therefore, the main objective of this study is to decompose wealth-based inequalities in the use of maternal and reproductive health services into their contributing factors. With these decompositions, this study will serve as an

important policy discussion point regarding maternal and reproductive health inequalities in the country, particularly with regard to how the government can reduce these inequalities.

7.3   Data and methods

7.3.1   Data sources

Data from two nationally representative Sierra Leone Demographic and Health Surveys (SLDHS) rom 2008 and 2013 were used in this chapter. Statistics Sierra Leone in collaboration with the Ministry of Health and Sanitation of Sierra Leone, with support from various international agencies (i.e. ICF Macro/International, WHO, and other agencies), collected the SLDHS data. The SLDHS are nationally representative household surveys conducted at five-year intervals. The data had a response rate of 98% in 2008 and 99% in 2013 (Statistics Sierra Leone and ICF Macro, 2009; Statistics Sierra Leone and ICF International, 2014). For both data collection points, women of reproductive age (15-49 years) who were either usual household members or women present in the household on the night before the survey were eligible for interviews. The SLDHS datasets are publicly available upon request through Measure DHS website (https://dhsprogram.com/).

7.3.2 Inequality stratifier

In order to measure and decompose inequalities in maternal and reproductive health services, the wealth index was used as an inequality stratifier. The wealth index is based on data on living conditions and ownership of household assets. Therefore, the wealth index is computed as a proxy for the measurement of living

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standards, in the absence of economic (*income* and *expenditure*) variables in the DHS.

7.3.3 Analysis variables

7.3.3.1   Dependent variables

Five independent variables were selected for this chapter. These include: antenatal care (which includes two variables: four or more antenatal care visits, and skilled antenatal care provider), delivery care (which also includes two variables: births delivered in a facility and births assisted by a skilled birth attendant), and any method of contraception. Four or more antenatal visits refers the percentage (or number) of women with four or more antenatal care visits for their most recent pregnancy and is coded as: 1 if a woman had 4+ visits, or else 0. Skilled antenatal care provider refers to the percentage of women whose antenatal visits (for the most recent birth) were attended by a skilled provider (i.e., doctor, nurse/midwife, etc.) and is coded as: 1 if a woman was attended by a skilled antenatal care provider, or else 0. Births delivered in a facility refers the percentage of births that were delivered in a facility and is coded as: 1 if a woman gave birth in a healthcare facility, or else 0. Skilled birth attendant which refers to the percentage of births that were assisted by a skilled birth attendant [doctor/nurse/midwife, Maternal and Child Health (MCH) Aide] and is coded as: 1 if a woman was assisted by a skilled birth attendant during birth, or else 0. Any method of contraception is the percentage of women, in union (married or cohabiting) using any method of contraception and is coded as: 1 if a woman reported use of any method of contraception, or else 0.

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7.3.3.2   Independent variables

Eight independent variables were selected for this chapter. These variables include: (i) maternal age, (ii) marital status, (iii) maternal education, (iv) household wealth, (v) number of living children, (vi) media exposure (access radio, television, and newspaper at least once a week), (vii) Decision-making power, (viii) place of residence, and (ix) region. The selected independent variables serve as explanatory variables in the regression and decomposition analysis. Use of skilled antenatal care was added as an additional independent variable in the decomposition of inequalities related to delivery care. The independent variables are further defined in the appendices, Table A7.1.

7.3.4 Measuring inequality

The concentration index was used to measure inequalities. A concentration index provides a good measure of wealth-related inequalities in the use of maternal and reproductive health (as well as other health) services. The concentration index quantifies the degree of wealth-based inequality in a given wealth variable, and is a typical instrument for the measurement of wealth-based inequalities in health. Moreover, the concentration index is able to measure the magnitude to which a health intervention is concentrated among the poor (low socioeconomic status) or rich (high socioeconomic status) individuals or households, where the index value is negative if the health intervention is concentrated among the poor and is positive if it is concentrated among the rich (WHO, 2013). In this chapter, all the dependent variables are dichotomous, and Erreygers concentration index was used, as it is

recommended when the variable is binary (Erreygers, 2009). Erreygers concentration index can be computed using this formula:

$$E(h) = 4 \frac{\mu}{(b_h - a_h)} * C(h) \qquad (1)$$

where b_h and a_h are the maximum and minimum bounds of the binary health indicator (i.e. antenatal services), μ is the mean of the health indicator, and $C(h)$ is the concentration index[17] (Purohit, 2017). The concentration index used in this chapter was computed using the *conindex* command of Stata (O'Donnell et al., 2016).

7.3.5 Generalized Linear Model

The regression analysis approach adopted for this chapter is based on the Generalized Linear Models (GLM). The GLM generalizes the general linear model and allows it to be connected to the response variable through a link function. The GLM reduces the requirement for homogeneity in variances that is typically for hypothesis testing in conventional linear models. The link function links the random and systematic components. It has been stated elsewhere (Yiengprugsawan et al., 2010) that the use of a GLM together with a binomially dispersed variable (attached to the identity link function) is a good choice in decomposing dichotomous dependent variables because it allows the 'decomposition model to

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[17] Further information on the concentration index can be obtained here:
http://siteresources.worldbank.org/INTPAH/Resources/Publications/459843-1195594469249/HealthEquityCh8.pdf

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hold and produces good coefficient estimates that do not vary based on the chosen of reference category'.

7.3.6 Inequality decomposition

In order to explain the socioeconomic determinants of maternal and reproductive health service inequalities, decomposition of the concentration index was done. To decompose the concentration index, the following formula can be used:

$$CI = \sum_{k} \left(\frac{\beta_k \bar{x}_k}{\mu} \right) CI_k + \frac{GCI_e}{\mu} \qquad (2)$$

where β_k represents the coefficients from regressions of the health outcome on each k determinant; $\bar{x}_k$ represents the mean of each k determinant; μ is the mean of the health outcome; and CI_k represents the concentration index (Erreygers) for the kth determinant computed using the *conindex* command. GCI_e represents the generalized concentration index for the error term. Therefore, the decomposition analysis makes use of the formula above and attaches it to the GLM regression analysis, using Stata's *glm* command (StataCorp, 2015). All analyses were carried out using Stata and Microsoft Excel. The *svyset* command was used to account for clustering, sample weight and stratification. This procedure uses sample weights to adjust the estimates for the effects of oversampling and under-sampling in smaller enumeration areas (StataCorp,

2015). Therefore, the *svy* prefix command was used for analyses in this chapter (StataCorp, 2015).

7.3.7 Ethical considerations

All analyses were conducted using publicly available data from the Sierra Leone Demographic and Health Surveys. The Institutional Review Board of Macro International, Inc. reviewed and approved the collection of data for both periods of the Sierra Leone Demographic and Health Surveys. The authors submitted a request for the use of this data to the DHS Program and permission was granted to download and use the data as per the request.

7.4   Results

7.4.1   Antenatal care

Summary statistics

Table 7.1 shows the summary statistics, in proportion form, for antenatal care. These results are the same as some of those presented in chapter four (but are in proportion form here). Generally, the proportions show that the use of antenatal care increased over time. The proportion of women using antenatal care increased with level of education, and was higher among women with decision-making autonomy and those in urban areas of residence. These findings are also used to feed into the decomposition analysis as shown in equation two.

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Table 7.1: Summary statistics for the use of antenatal care in Sierra Leone, 2008 and 2013

Characteristics	Antenatal visits				Skilled antenatal care			
	2008		2013		2008		2013	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Maternal age								
<20	0.6586	0.4843	0.8563	0.3545	0.8895	0.3167	0.9859	0.1199
20-29	0.6842	0.4650	0.8908	0.3111	0.8787	0.3277	0.9792	0.1422
30-39	0.7033	0.4562	0.8624	0.3474	0.8596	0.3470	0.9621	0.1920
40-49	0.6068	0.4817	0.8437	0.3532	0.8361	0.3620	0.9490	0.2151
Marital status								
Never married	0.7725	0.4562	0.8757	0.3362	0.9342	0.2676	0.9752	0.1595
In union	0.6759	0.4642	0.8718	0.3341	0.8642	0.3400	0.9696	0.1714
Formerly married	0.6395	0.4871	0.8819	0.3107	0.8605	0.3500	0.9844	0.1204
Maternal education								
No education	0.6420	0.4682	0.8593	0.3456	0.8452	0.3538	0.9629	0.1879
Primary	0.7518	0.4501	0.8680	0.3337	0.9265	0.2693	0.9796	0.1396
Secondary+	0.8448	0.3953	0.9203	0.2787	0.9504	0.2362	0.9922	0.0908
Number of living children								
None	0.6962	0.4801	0.8664	0.3450	0.8603	0.3636	0.9577	0.2050
One child	0.6942	0.4731	0.8874	0.3210	0.8842	0.3287	0.9854	0.1222
Two-to-three children	0.6848	0.4629	0.8754	0.3281	0.8629	0.3434	0.9699	0.1692
Four or more children	0.6675	0.4636	0.8604	0.3451	0.8674	0.3325	0.9632	0.1876
Women's decision-making								
All three decisions	0.7054	0.4463	0.8919	0.3140	0.8965	0.2999	0.9754	0.1558
Some joint-decisions	0.6605	0.4573	0.8658	0.3385	0.8535	0.3428	0.9593	0.1960
None	0.6718	0.4878	0.8592	0.3456	0.8544	0.3635	0.9722	0.1640
Media exposure								
No	0.6770	0.4673	0.8721	0.3339	0.8679	0.3381	0.9708	0.1684
Yes	0.9450	0.2407	0.9061	0.2948	0.9514	0.2339	0.9759	0.1541
Place of residence								
Urban	0.8162	0.4333	0.9100	0.3124	0.9392	0.2671	0.9816	0.1473
Rural	0.6281	0.4589	0.8583	0.3356	0.8408	0.3469	0.9668	0.1722
Region								
Eastern	0.7330	0.5084	0.8967	0.2888	0.8963	0.3512	0.9830	0.1234
Northern	0.5801	0.4246	0.8328	0.3729	0.8186	0.3296	0.9550	0.2071
Southern	0.7459	0.4802	0.9096	0.3097	0.9028	0.3239	0.9819	0.1444
Western	0.8479	0.3824	0.8876	0.2976	0.9414	0.2500	0.9765	0.1413
Total	**0.6812**	**0.4597**	**0.8727**	**0.3353**	**0.8692**	**0.3353**	**0.9709**	**0.1686**

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013
Note: SD = standard deviation

Decomposition findings

The complete decomposition analysis table is located in the appendices (appendix Table A7.2-A7.11). With regard to four or more antenatal visits, the overall concentration index was 0.1975 in 2008 and 0.0516 in 2013, showing that the use of four or more antenatal visits was higher among women from wealthier

households in both years (appendix Table A7.2). Between 2008 and 2013, socioeconomic inequality declined by (0.1459); this suggests that inequality in four or more antenatal visits has moved 0.1459 units closer to the equality line over this period. Therefore, there was a 73.9% decrease[18] in inequality in the use of four or more antenatal visits between 2008 and 2013. Furthermore, the concentration indices of the explanatory factors showed that media exposure was mostly concentrated among women of lower socioeconomic status in 2008, and the concentration indices for all other variables showed that they were concentrated among women with a higher socioeconomic status in both periods (appendix Table A7.3).

In 2008, maternal education, maternal age, marital status, region, and women's decision-making made a positive contribution to inequalities in four or more antenatal visits (Figure 7.1); while in 2013, media exposure, maternal education, maternal age, women's decision-making, and number of living children made a positive contribution to inequalities in four or more antenatal visits. In terms of the percentage contribution, in 2008, the largest contribution to inequality in four or more antenatal visits was attributable to maternal education (24%). This suggests that if maternal education was equally distributed among women from different socioeconomic groups, then inequality in four or more antenatal visits would be reduced by 24% (appendix Table A7.3). Maternal age (22%), marital status (15%), region (4%), and women's decision-making (2%) also made some contribution to inequality in four or more antenatal visits. In 2013, the largest contribution to

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[18] Not shown in Table

inequality in four or more antenatal visits was attributable to media exposure (12%). Maternal education (8%), maternal age (7%), women's decision-making (3%), and number of living children (3%) also made some contribution to inequality in four or more antenatal visits.

Figure 7.1: Contributions of determinants to socioeconomic inequality in the use of four or more antenatal visits
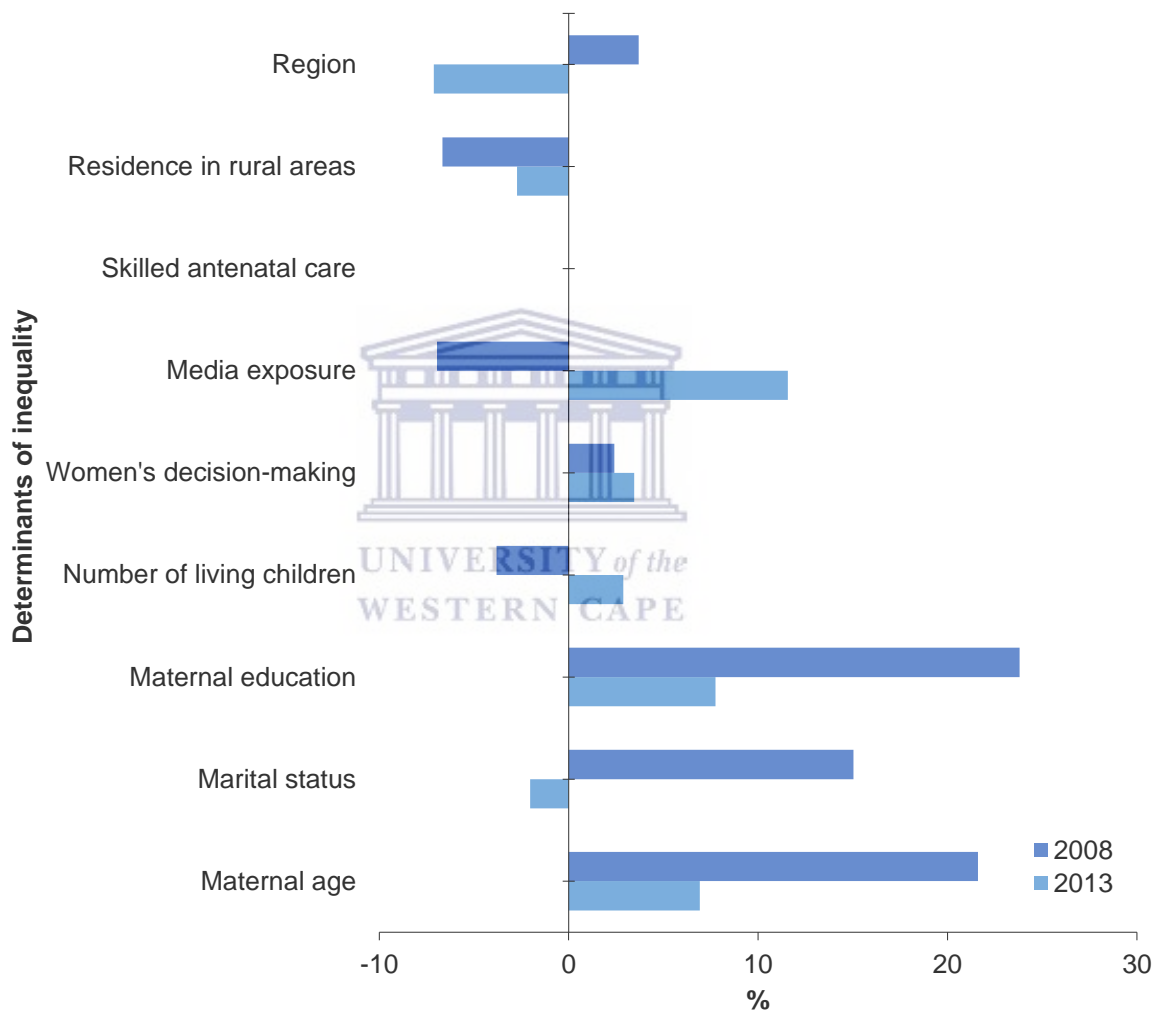
In terms of the use of skilled antenatal providers, the overall concentration index was 0.1043 in 2008 and 0.0218 in 2013, showing that the use of skilled antenatal providers was higher among women from wealthier households in both years

(appendix Table A7.4). Between 2008 and 2013, socioeconomic inequality declined by (0.0825). Overall, there was a 79.1% decrease[19] in inequality in the use of skilled antenatal care between 2008 and 2013. Moreover, in 2008, maternal age, maternal education, number of living children, marital status, and women's decision-making made a positive contribution to inequalities in skilled antenatal care (Figure 7.2); while in 2013, maternal age, number of living children, maternal education, and media exposure made a positive contribution to inequalities in skilled antenatal care.

In terms of the percentage contribution, in 2008, the largest contribution to inequality in skilled antenatal care was attributable to maternal age (10%). This suggests that if maternal age was equally distributed among women from different socioeconomic groups, then inequality in skilled antenatal care would be reduced by 10% (appendix Table A7.3). Maternal education (5%), number of living children (4%), marital status (3%), and women's decision-making (3%) also made some contribution to inequality in skilled antenatal care. In 2013, maternal age (4%), number of living children (4%), maternal education (1%), and media exposure (1%) made some contribution to inequality in skilled antenatal care. In 2013, skilled antenatal care was almost at universal coverage, which could explain the negligible contributions to inequality for these factors (as suggested by the concentration index of 0.0218, skilled antenatal care is almost at perfect equality).

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[19] Not shown in Table

Figure 7.2: Contributions of determinants to socioeconomic inequality in the use of skilled antenatal care
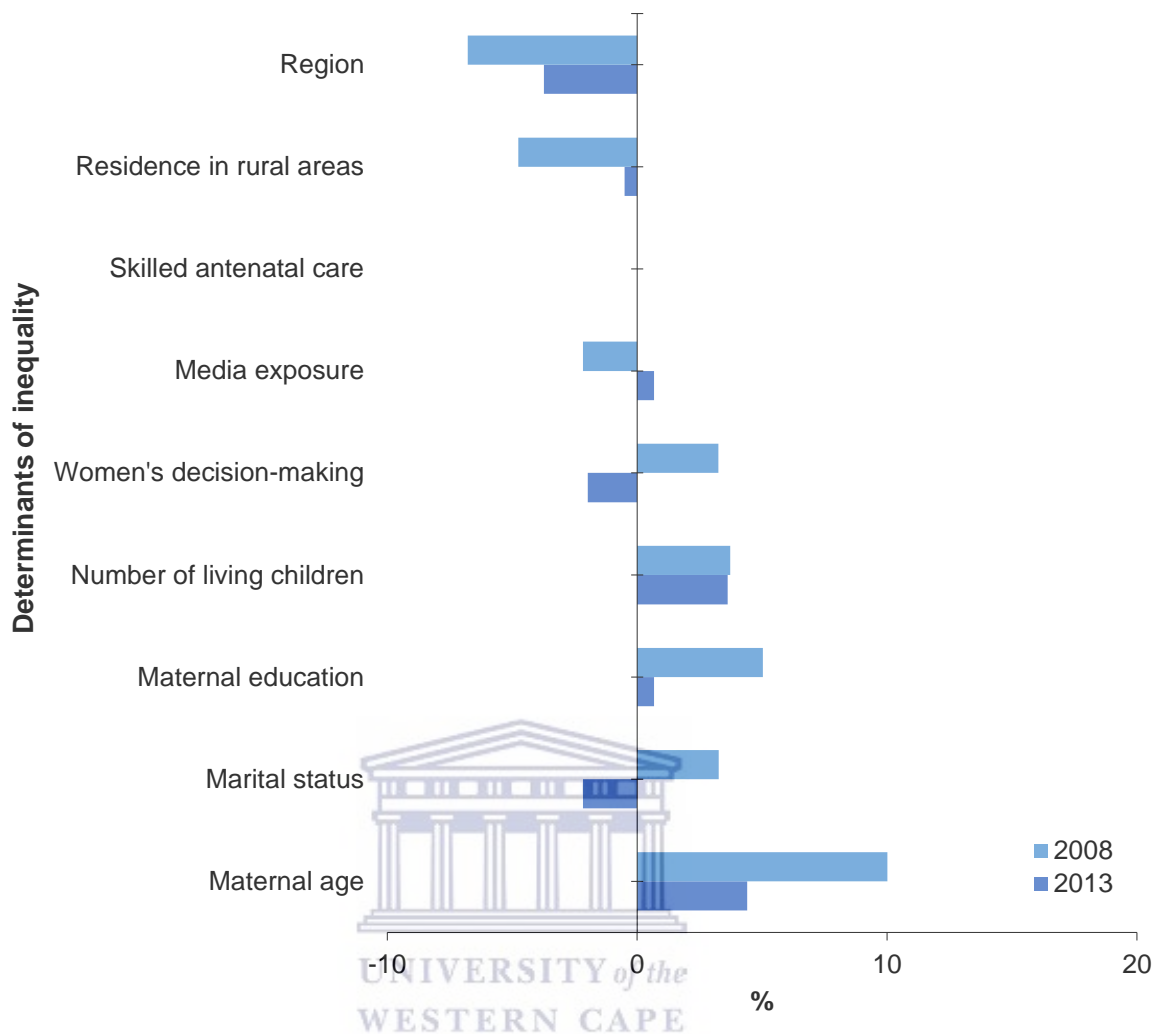
Source: Author's computations from Sierra Leone DHS data, 2008 and 2013
Note: Residual is 0.0922 (for 2008) and 0.0216 (for 2013)

7.4.2 Delivery care

Summary statistics

Table 7.2 shows the summary statistics, in proportion form, for delivery care. Generally, the proportions show that the use of delivery care increased over time. Moreover, the proportion of women using delivery care increased with level of education, and was lower for women with a large number of living children they have had.

Table 7.2: Summary statistics for the use of delivery care in Sierra Leone, 2008 and 2013

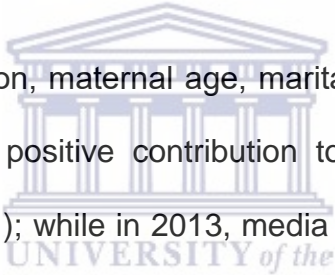| Characteristics	Facility-based deliveries				Skilled birth attendants			
	2008		2013		2008		2013	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Maternal age								
<20	0.2644	0.4436	0.5951	0.4988	0.4085	0.4950	0.6507	0.4850
20-29	0.2600	0.4410	0.5774	0.4907	0.4418	0.4996	0.6354	0.4781
30-39	0.2528	0.4326	0.5134	0.5047	0.4209	0.4912	0.5533	0.5020
40-49	0.2053	0.3969	0.5014	0.4910	0.3515	0.4688	0.5248	0.4901
Marital status								
Never married	0.3777	0.5236	0.6728	0.4824	0.6303	0.5217	0.7432	0.4492
In union	0.2415	0.4257	0.5363	0.4980	0.4075	0.4886	0.5810	0.4927
Formerly married	0.3039	0.4577	0.5466	0.4819	0.4737	0.4989	0.6156	0.4714
Maternal education								
No education	0.2053	0.3959	0.4994	0.4980	0.3574	0.4696	0.5420	0.4965
Primary	0.3447	0.4908	0.5821	0.4863	0.5593	0.5130	0.6296	0.4755
Secondary+	0.4739	0.5456	0.7218	0.4605	0.7313	0.4854	0.7927	0.4161
Number of living children								
None	0.3965	0.5156	0.6012	0.5020	0.5522	0.5255	0.6654	0.4844
One child	0.3040	0.4709	0.6320	0.4902	0.4680	0.5109	0.6952	0.4683
Two-to-three children	0.2659	0.4436	0.5601	0.4927	0.4448	0.4993	0.6102	0.4840
Four or more children	0.2071	0.3977	0.4939	0.4993	0.3743	0.4745	0.5318	0.4983
Women's decision-making								
All three decisions	0.2249	0.4109	0.5159	0.5043	0.3929	0.4808	0.5613	0.5006
Some joint-decisions	0.2228	0.4053	0.5128	0.4956	0.3991	0.4777	0.5603	0.4918
None	0.2967	0.4702	0.5972	0.4884	0.4679	0.5132	0.6480	0.4760
Media exposure								
No	0.2477	0.4312	0.5449	0.4979	0.4190	0.4928	0.5922	0.4914
Yes	0.6744	0.5122	0.8526	0.3584	0.8572	0.3853	0.9515	0.2162
Skilled antenatal care								
Unskilled	0.1917	0.3894	0.4759	0.4962	0.3216	0.4617	0.5075	0.4964
Skilled	0.2892	0.4562	0.5812	0.4948	0.4890	0.5035	0.6377	0.4822
Place of residence								
Urban	0.4064	0.5491	0.6899	0.5079	0.6692	0.5261	0.7887	0.4473
Rural	0.1956	0.3777	0.5011	0.4822	0.3325	0.4485	0.5315	0.4816
Region								
Eastern	0.2916	0.5206	0.7315	0.4203	0.5014	0.5737	0.7697	0.3995
Northern	0.1600	0.3131	0.3739	0.4851	0.2740	0.3805	0.4150	0.4943
Southern	0.3418	0.5148	0.6116	0.5274	0.5316	0.5423	0.6395	0.5195
Western	0.3622	0.5160	0.6189	0.4510	0.6367	0.5170	0.7420	0.4052
Total	**0.2530**	**0.4335**	**0.5491**	**0.4983**	**0.4243**	**0.4926**	**0.5971**	**0.4913**

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013
Note: SD = standard deviation

Decomposition findings

For facility-based deliveries, the overall concentration index was 0.2022 in 2008 and 0.1963 in 2013, showing that the use of facility-based deliveries was higher among women from wealthier households in both years (appendix Table A7.6). Between 2008 and 2013, socioeconomic inequality in facility-based deliveries

declined by (0.0059). Overall, there was a 2.9% decrease[20] in inequality in the use of facility-based deliveries between 2008 and 2013. Moreover, in 2008, media exposure, maternal education, region, maternal age, skilled antenatal care, and marital status made a positive contribution to inequalities in facility-based deliveries (Figure 7.3); while in 2013, maternal education, maternal age, marital status, skilled antenatal care, and media exposure made a positive contribution to inequalities in facility-based deliveries.

With regard to the percentage contribution, in 2008, the largest contribution to inequality in facility-based deliveries was attributable to media exposure (147%). This suggests that if media exposure was equally distributed among women from different socioeconomic groups, then inequality in facility-based deliveries would be reduced by 147% (appendix Table A7.7). Maternal education (45%), region (19%), maternal age (16%), skilled antenatal care (11%), and marital status (3%) also contributed to inequality in facility-based deliveries in 2008. In 2013, the largest contribution to inequality in facility-based deliveries was attributable to maternal education (25%). Maternal age (17%), marital status (11%), skilled antenatal care (11%), and media exposure (1%) also contributed to inequality in facility-based deliveries in the same year. Although inequality in the use of facility-based deliveries decreased by only 2.9%, the concentration indices show that inequality in the use of this service remains very high.

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[20] Not shown in Table

Figure 7.3: Contributions of determinants to socioeconomic inequality in the use of facility-based deliveries
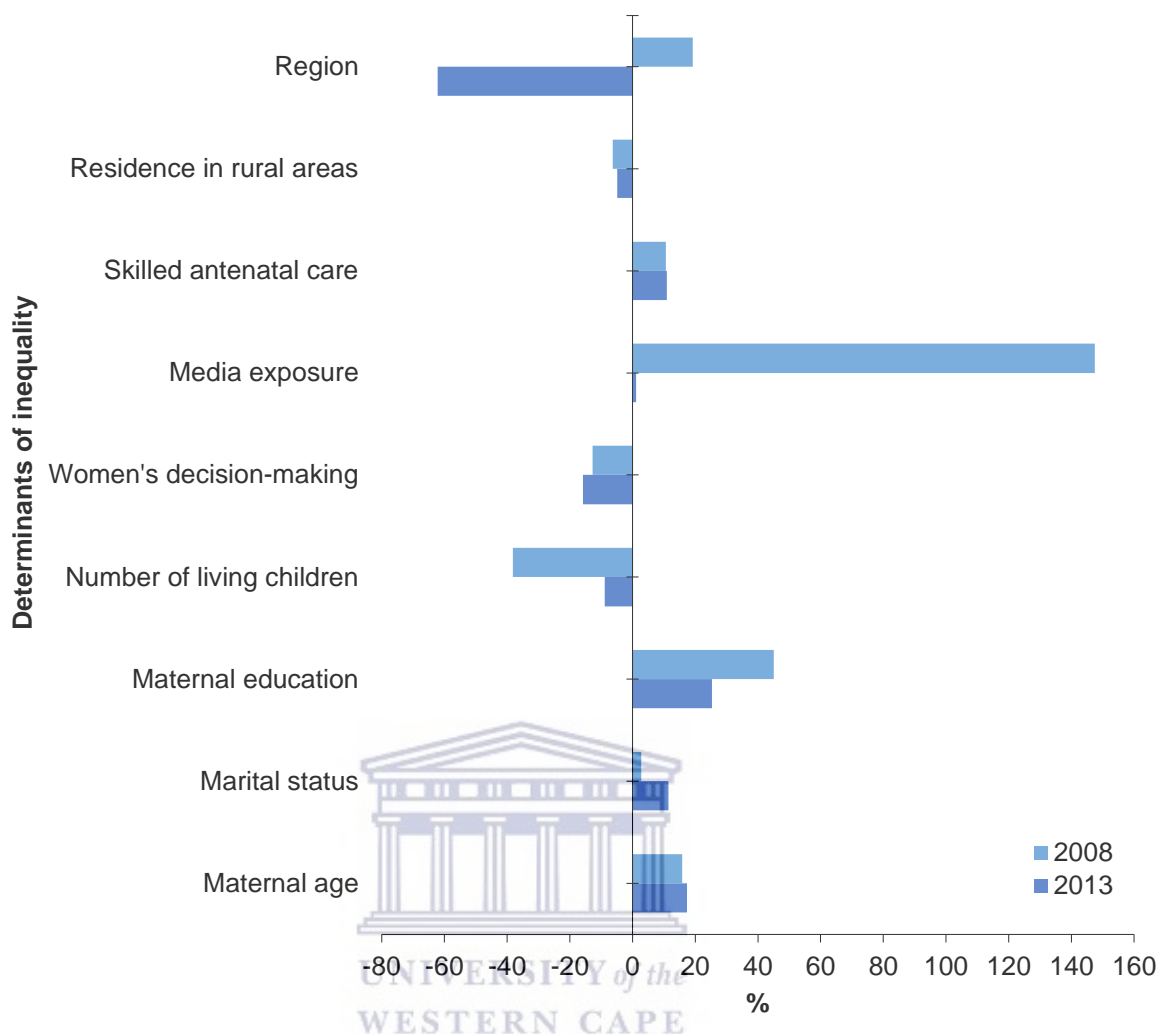
Source: Author's computations from Sierra Leone DHS data, 2008 and 2013
Note: Residual is -0.1693 (for 2008) and 0.2462 (for 2013)

In terms of skilled birth attendants, the overall concentration index was 0.3302 in 2008 and 0.2503 in 2013, showing that the use of skilled birth attendants was higher among women from wealthier households in both years (appendix Table A7.8). Between 2008 and 2013, socioeconomic inequality in skilled birth attendants declined by (0.0800). Overall, there was a 24.2% decrease[21] in inequality in the use of skilled birth attendants between 2008 and 2013. Moreover, in 2008, maternal education, media exposure, maternal age, skilled antenatal

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[21] Not shown in Table

care, region, and marital status made a positive contribution to inequalities in skilled birth attendants (Figure 7.4); while in 2013, maternal education, maternal age, skilled antenatal care, and marital status made a positive contribution to inequalities in skilled birth attendants.

With regard to the percentage contribution, in 2008, the largest contribution to inequality in skilled birth attendants was attributable to maternal education (56%). This suggests that if maternal education was equally distributed among women from different socioeconomic groups, then inequality in skilled birth attendants would be reduced by 56% (appendix Table A7.9). Media exposure (26%), maternal age (22%), skilled antenatal care (20%), region (13%), and marital status (9%) also contributed to inequality in skilled birth attendants in 2008. In 2013, the largest contribution to inequality in skilled birth attendants was attributable to maternal education (33%). Maternal age (27%), skilled antenatal care (14%), and marital status (12%) also contributed to inequality in skilled birth attendants in the same year.

Figure 7.4: Contributions of determinants to socioeconomic inequality in the use of skilled birth attendants
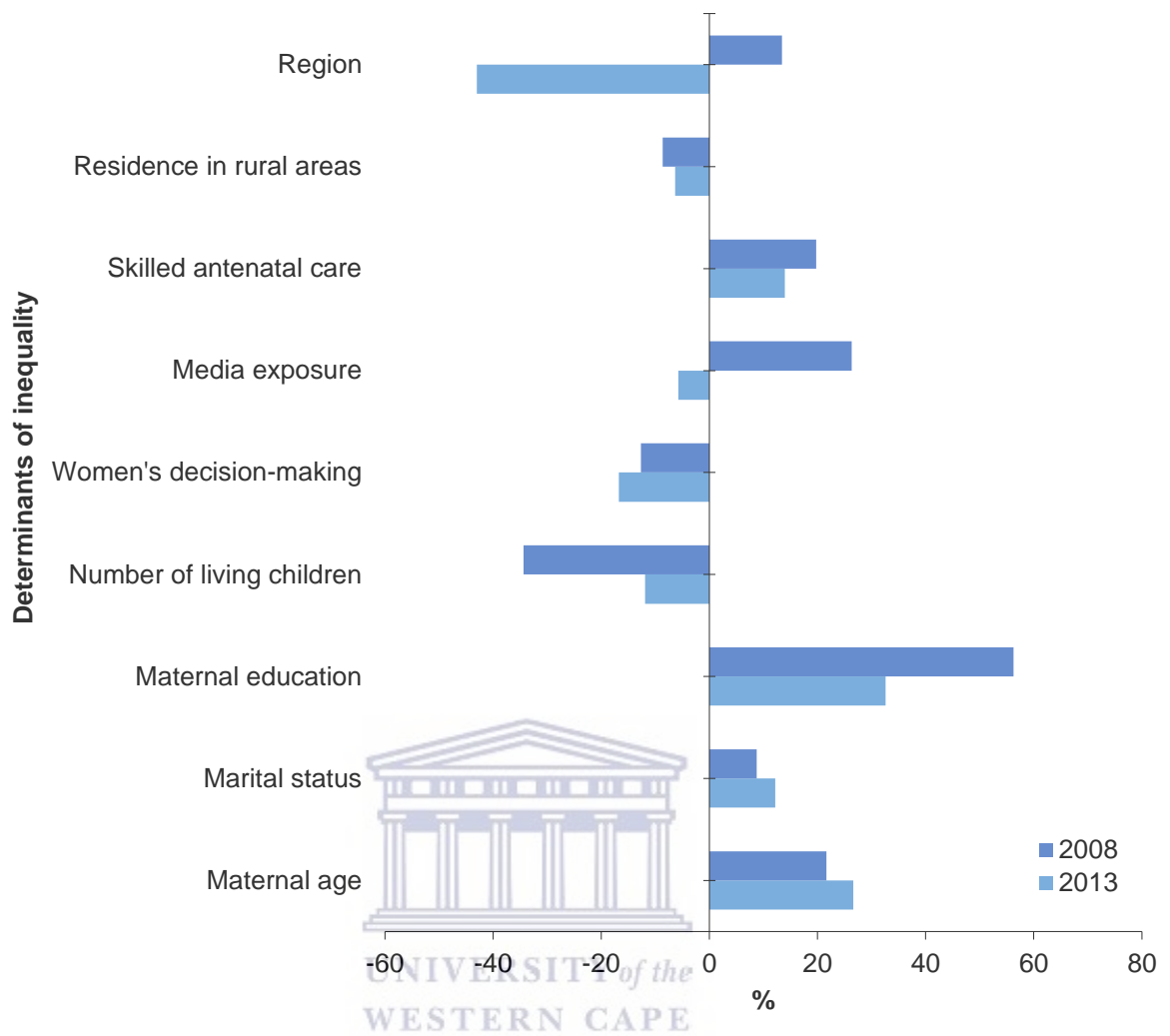
7.4.3 Contraceptive use

Summary statistics

Table 7.3 shows the summary statistics, in proportion form, for the use of contraception. Generally, the proportions show that the use of contraception increased over time. The proportion of women using contraception was higher among women aged 30-39 years, women who reported that they were cohabiting and those from urban areas. Moreover, the results showed that the use of contraceptive increased with level of education.

Table 7.3: Summary statistics for the use of contraception in Sierra Leone, 2008 and 2013

Characteristics	2008		2013	
	Mean	SD	Mean	SD
Maternal age				
<20	0.0119	0.1069	0.0776	0.2704
20-29	0.0688	0.2509	0.1516	0.3567
30-39	0.1038	0.3071	0.2027	0.4038
40-49	0.0951	0.2967	0.1558	0.3620
Marital status				
Married	0.0819	0.2747	0.1626	0.3694
Cohabiting	0.0829	0.2728	0.2470	0.4217
Maternal education				
No education	0.0571	0.2280	0.1425	0.3485
Primary	0.1085	0.3198	0.1925	0.3899
Secondary+	0.2229	0.4522	0.2595	0.4490
Number of living children				
None	0.0177	0.1308	0.0497	0.2187
One child	0.0527	0.2267	0.1396	0.3504
Two-to-three children	0.0842	0.2794	0.1645	0.3691
Four or more children	0.1124	0.3118	0.2018	0.4008
Women's decision-making				
All three decisions	0.0997	0.2985	0.1843	0.3914
Some joint-decisions	0.0869	0.2783	0.1740	0.3751
None	0.0558	0.2329	0.1343	0.3390
Media exposure				
No	0.0796	0.2703	0.1639	0.3700
Yes	0.2340	0.4673	0.2942	0.4668
Place of residence				
Urban	0.1625	0.4100	0.2660	0.4841
Rural	0.0504	0.2084	0.1298	0.3236
Region				
Eastern	0.0616	0.2768	0.1733	0.3598
Northern	0.0439	0.1758	0.1228	0.3270

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Characteristics	2008		2013	
	Mean	SD	Mean	SD
Southern	0.0844	0.3013	0.1723	0.4109
Western	0.2115	0.4315	0.2712	0.4196
Total	**0.0821**	**0.2732**	**0.1663**	**0.3733**

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013
Note: SD = standard deviation

Decomposition findings

With regard to contraception, the overall concentration index was 0.1273 in 2008 and 0.1244 in 2013, showing that the use of contraception was higher among women from wealthier households in both years (appendix Table A7.10). Between 2008 and 2013, socioeconomic inequality in any method of contraception declined by (0.0028). Overall, there was a 2.2% decrease[22] in inequality in contraception between 2008 and 2013. Moreover, in 2008, media exposure, region, maternal education, number of living children, and women's decision-making made a positive contribution to inequalities in any method of contraception (Figure 7.5); while in 2013, number of living children, maternal education, marital status, women's decision-making, region, and maternal age made a positive contribution to inequalities in any method of contraception.

In terms of the percentage contribution, in 2008, the largest contribution to inequality in any method of contraception was attributable to media exposure and region (both at 44%). This suggests that if media exposure and region were equally distributed among women from different socioeconomic groups, then inequality in any method of contraception would be reduced by 44% (appendix Table A7.11). Maternal education (43%), Number of living children (26%), and women's

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[22] Not shown in Table

decision-making (9%) also contributed to inequality in any method of contraception in 2008. In 2013, the largest contribution to inequality in any method of contraception was attributable to the number of living children (39%). Maternal education (25%), marital status (18%), women's decision-making (11%), region (8%), and maternal age (4%) also contributed to inequality in any method of contraception in the same year. Although inequality in the use of contraception decreased by only 2.2%, the concentration indices show that inequality in the use of this service remains quite high.

Figure 7.5: Contributions of determinants to socioeconomic inequality in contraceptive use
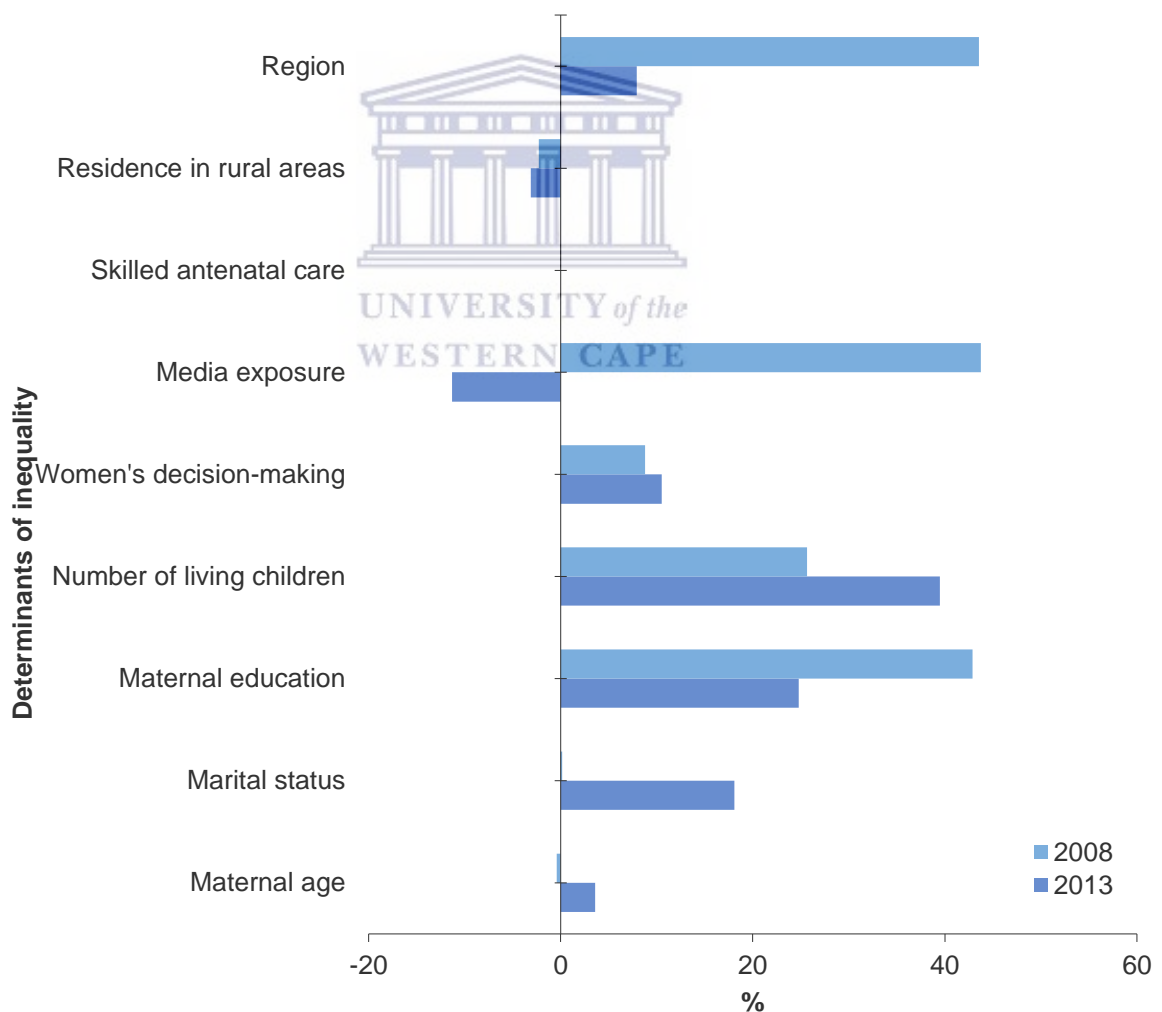
Source: Author's computations from Sierra Leone DHS data, 2008 and 2013
Note: Residual is -0.0790 (for 2008) and 0.0126 (for 2013)

7.5   Discussion

Key findings

The main aim of this chapter was is to decompose wealth-based inequalities in the use of maternal and reproductive health services in order to find factors that contribute to inequalities in the health interventions. The findings generally show that inequalities in maternal and reproductive health services have declined (at varying levels) between 2008 and 2013. Moreover, the proportions of health use indicate a general increase in the use of maternal and reproductive health services between these two periods. Inequalities in four or more antenatal visits decreased by over seventy per cent. Moreover, the decomposition analysis showed that maternal education contributed the majority of inequalities in four or more antenatal visits in 2008, while the highest contributor was media exposure in 2013. Common factors that contributed to inequalities in the use of four or more antenatal visits in both periods included: maternal education, maternal age, and women's decision-making.

With regard to the use of skilled antenatal care providers, the findings show that there were slight pro-rich inequalities observed over time, as shown by the concentration indices which do not deviate much from perfect equality, especially in 2013. The findings also show that inequalities in the use of skilled antenatal care providers decreased by over seventy per cent. Moreover, in 2008, the largest contribution to inequality in skilled antenatal care was attributable to maternal age. Common factors that contributed to inequalities in the use of skilled antenatal care in both periods included: maternal age, maternal education, and number of living children. For the 2013 survey periods, over ninety per cent of women reported that

they used skilled antenatal care, which could potentially explain the small contributions to inequality for the selected factors.

In terms of facility-based deliveries, the findings show that there were considerable pro-rich inequalities observed over time. The findings also show that inequalities in the use of facility-based deliveries decreased by about three per cent. Moreover, in 2008 the largest contribution to inequality in facility-based deliveries was attributable to media exposure, while it was attributable to maternal education in 2013. Common factors that contributed to inequalities in the use of facility-based deliveries in both periods included: maternal education, maternal age, skilled antenatal care, marital status, and media exposure. Even though there was a decrease in inequalities in the use of facility-based deliveries, inequality in the use of this service remains quite high. Furthermore, with regard to skilled birth attendants, the findings also show that there were considerable pro-rich inequalities observed over time. The findings also show that inequalities in the use of skilled birth attendants decreased by about twenty-four per cent. Moreover, in 2008 the largest contribution to inequality in skilled birth attendants was attributable to maternal education, it was also attributable to maternal education in 2013. Common factors that contributed to inequalities in the use of skilled birth attendants in both periods included: maternal education, maternal age, skilled antenatal care, and marital status. Even though there was a decrease in inequalities in the use of skilled birth attendants, inequality in the use of this service remains quite high.

With regard to contraception, the findings also show that there were pro-rich inequalities observed between 2008 and 2013. The findings also revealed that inequalities in the use of contraception decreased by about two per cent. Moreover, in 2008 the largest contribution to inequality in contraception was attributable to media exposure and region, while it was attributable to the number of living children in 2013. Common factors that contributed to inequalities in the use of contraception in both periods included: maternal education, women's decision-making, and region.

Study findings in relation to other studies

To the best of my knowledge, this is the first study of this kind in Sierra Leone. Here, using the concentration index, an attempt is made to find factors that contribute to inequalities in maternal and reproductive health services. There were varying findings with regard to inequalities in the selected health interventions. Even though these differences existed, the findings across the five selected health interventions shows that inequality in the use of these health interventions favours women from wealthier households. These findings are similar to those of (Zere et al., 2011) who also found that inequalities in the use of skilled providers favoured women from wealthier households. The study found that maternal education, maternal age, women's decision-making, number of living children, skilled antenatal care, media exposure, marital status, and region are factors that mainly explain inequalities in the use of maternal and reproductive health services.

Furthermore, maternal education was found to be the most prominent factor that explains inequalities across all the five outcome variables. Educational attainment is often seen as a good predictor of maternal and reproductive health care use because it has a positive impact on people's health (through being able to evaluate and make informed choices about where one should seek health care services). Maternal education also has socioeconomic (and financial) implications, in the sense that women with higher levels of education are often employed and thus have financial autonomy when it comes to being able to afford health care services. Similar studies have also found maternal education to be an important determinant of maternal and reproductive health (Zere et al., 2011; Karkee et al., 2014; Gitimu et al., 2015). Moreover, other studies found that maternal education is one of the biggest factors that explain inequalities in the use of maternal and reproductive health services (Zere et al., 2011; Liu et al., 2014; Hodge et al., 2016).
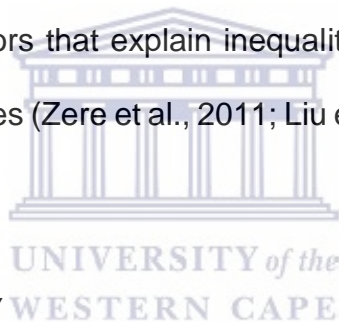
Limitations of this study

One of the major advantages of Demographic and Health Surveys is that they are comparable over time (given that questions are standardised). However, SLDHS data are cross-sectional in nature; this limits the drawing of causal inferences with proper reasoning and logic that can authenticate the findings. Furthermore, due to the longer recall time, there may be recall bias whereby respondents have to report on past occurrences in relation to their use of maternal and reproductive health services.

7.6   Conclusion

Although the country has achieved near perfect equality in terms of the use of four or more antenatal visits, there is still a long way to go in reducing inequalities in other maternal and reproductive health interventions, and thus achieving universal health coverage. There is evidence of pro-rich inequalities in the use of maternal and reproductive health services in Sierra Leone. The majority of inequalities in the use of maternal and reproductive health services was found to be explained by maternal education, maternal age, women's decision-making, number of living children, skilled antenatal care, media exposure, marital status, and region. In fact, maternal education was found to be the common explanatory factor across all the health outcomes considered. Therefore, there is a need, therefore, to push for efforts towards the implementation of pro-poor and equitable maternal and reproductive health care services in the country in order to address existing inequalities. Moreover, the government needs to target the educational attainment of women (through increasing their level of education and training them on the importance of using maternal reproductive health services). Apart from this, inequalities in maternal and reproductive health services need to be tackled so that the country can achieve universal coverage, especially with regard to delivery care and contraceptive use.

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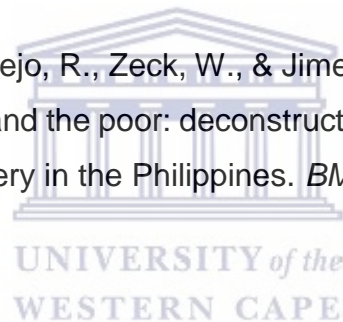
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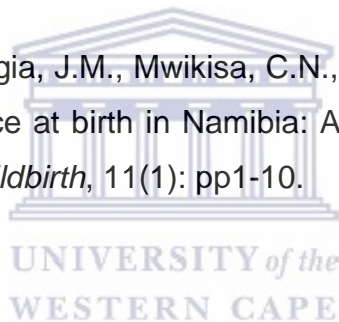
CHAPTER 8: SUMMARY & CONCLUSIONS

8.1   Introduction

The African continent many population health challenges, such as poor health systems, inaccessibility of healthcare, and other factors that often impede the utilization as well as equal distribution of healthcare services. Sierra Leone is known to be among the countries with poor health outcomes. The country has one of the world's highest maternal mortality ratios. In this country, factors such as poor road infrastructure, distance and unaffordable cost of transportation to health facilities contribute to poor health outcomes. This thesis attempted to provide a good understanding of factors that enable health inequalities to exist in Sierra Leone. This is a timely topic in population health studies and it addresses very important questions on the research agenda in the context of sub-Saharan Africa, particularly in a country with poor health outcomes such as Sierra Leone. A proper understanding of (not only the coverage rates of population health outcomes) the extent of health inequalities as well as the factors that contribute to these inequalities is crucial for any government, more so in the African continent where poor health systems prevail.

This thesis applied various techniques in the analysis of DHS data in an attempt to answer the research questions. As mentioned in chapter one, the analysis chapters (chapter 4-7) in this thesis are written in journal paper format. The first analysis chapter (chapter four), used bivariate and multivariate analysis to answer questions related to the prevalence and determinants of maternal and reproductive health services. Due to the nature of the dependent variables selected in this

thesis, binary logistic regression was deemed an appropriate method of analysis in order to flush out the determinants of maternal and reproductive health services. In chapter five and seven, the concentration index was used. A concentration index is a widely used analysis technique for analysis health inequalities in the fields of population, public, and economic health. Chapter five also made use of other relevant analysis techniques which are often used in health inequality analysis. Chapter seven provided further analysis through the decomposition of the concentration index. Decomposition of the concentration index is necessary in trying to find factors which explain inequalities in the use of healthcare services. Chapter six, on the other hand, deviates from the use of the widely used concentration index analysis, and provides a fresh angle into health inequality analysis. This chapter adopts the Human Opportunity Index technique, which takes into consideration the correlates of inequalities, the life circumstances of individuals as well as their efforts in examining and explaining health inequalities.
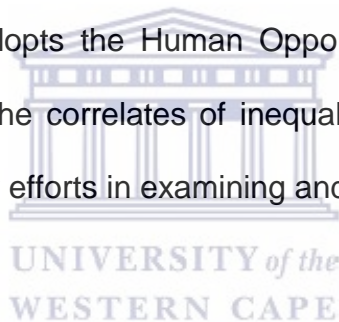
8.2   Prevalence and determinants of maternal and reproductive health use

One of the research questions of this thesis was to find factors which determine the use of maternal and reproductive health services in Sierra Leone. Before finding these determining factors in maternal and reproductive health use, we first had to measure the coverage rate of these services. The results showed that there was a general increase in the use of maternal and reproductive health services between 2008 and 2013, although the use of delivery care services as well as contraception remained rather low. Through the application of the binary logistic regression analysis technique, we found that maternal age, marital status,

socioeconomic status (maternal education and household wealth), number of living children, decision-making power, media exposure, skilled antenatal care, and geographic location (place of residence and region) were important determinants of the use of maternal and reproductive health services in the country. Of course, other studies have found similar results, but Sierra Leone presents its own context in the sense that these results can never truly be the same as those of another country.

8.3   Socioeconomic inequalities in maternal and reproductive health services

In an attempt to measure the extent of maternal and reproductive health inequalities in Sierra Leone, maternal education and household wealth (wealth index) were used as inequality stratifiers. In chapter five, we found that although inequalities declined over time, inequalities were largest by household wealth index, and a bit smaller by maternal education. We also found high socioeconomic inequalities in the use of maternal and reproductive health services, especially with regard to skilled birth attendants and facility-based deliveries. This is not different to other developing countries. It is evident that many countries, especially those on the African continent struggle to ensure equal distribution of delivery care services. One can argue that there is an over-focus on urban areas (where the population has higher socioeconomic status) than the poorer rural areas. In this sense, health services are more focused on urban areas that rural areas and this exacerbates these health inequalities. On a more positive note, we found that use of antenatal services was almost at perfect equality, which is good and points to

good strides made by the Sierra Leonean government in raising the levels of antenatal service use.

Chapter six introduced fresh methodologies in the analysis of health inequalities. Using the Human Opportunity Index (HOI), we found that inequalities declined over time, as shown by the decrease in the dissimilarity index. Due to the drop in the dissimilarity index, the HOI increased for all the selected maternal and reproductive health indicators. Which suggests that the country is on the right track in terms of its fight against health inequalities, although a lot still needs to be done. Largely, we found that household wealth status, maternal education, and place of residence, were the most important factors contributing to the inequality in the use of maternal and reproductive health services.
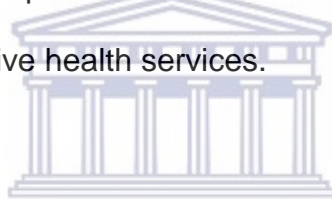
8.4   Explaining inequalities in the use of maternal and reproductive health services

In order to answer the question on which demographic and socioeconomic factors explain inequalities in the use of maternal and reproductive health services in Sierra Leone, we applied a decomposition of the concentration index. This methodology is often applied to population health, public health, economic health and other related studies. This type of analysis allows for researchers to pinpoint factors that explain health inequalities and, in this way governments can be able to make informed choices in their health planning. If one knows the extent to which certain factors contribute to health inequality, then they are better able to create

targeted responses in dealing with such health inequalities. We found that inequalities in the use of maternal and reproductive health services…

8.5   Conclusion & policy Implications

This thesis extends the literature on the trends and magnitude of health inequalities in the area of maternal and reproductive health services in Sierra Leone, and particular across sub-Saharan Africa. This thesis has several strengths. One of the main strengths is its ability to address an existing problem in line with the international agenda on maternal and reproductive health. With this thesis, one can be able to provide some answers to the question of health inequalities amongst women in Sierra Leone. Another strength of this thesis was the analyses of large-scale data from the two rounds of DHS conducted in Sierra Leone. Using two rounds of DHS data allowed for checking of changes in the use of maternal and reproductive health services to be analysed. Although the thesis has the strengths highlighted above, it is not without any limitations. The data are cross-sectional in nature; this limits the drawing of causal inferences with proper reasoning and logic that can authenticate the findings. Moreover, there may be recall bias whereby respondents have to report on past occurrences in relation to their use of maternal and reproductive health services.

The thesis has revealed some important policy points. We found that even though the Sierra Leone government implemented some good policies (e.g. the FHCI) in order to increase the use of maternal and reproductive health services, the use of delivery care services and contraception remains very low. Thus, there is a need

for further policy debates aimed at boosting the use of these health services in ensuring universal coverage. Moreover, future researchers could conduct primary research (probably qualitative research) to elucidate the reasons for the observed decline in inequalities with regard to the use of these health services. In this way, this type of research would answer some of the questions that are beyond the scope of this thesis, such as: (a) did health inequalities really decrease or is there methodological issues with the data used? (b) If health inequalities really did decrease, what could be the drivers of such decline? Furthermore, with regard to health inequalities, there's a need for prioritisation of initiative towards the most unequal maternal and reproductive health services (i.e. delivery care). Overall, the government needs to invest in: (a) increasing the educational levels of women, (b) improving the standard of living, as well (c) bringing maternal and reproductive health services closer to rural populations as means of reducing inequalities in these services.
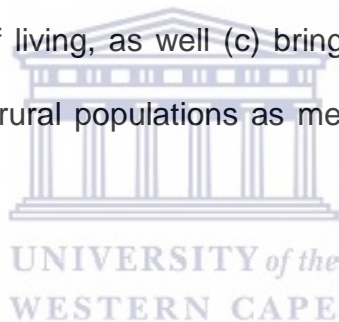
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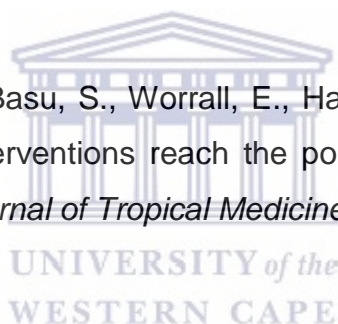
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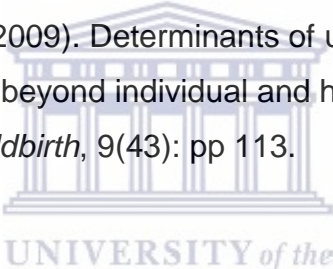
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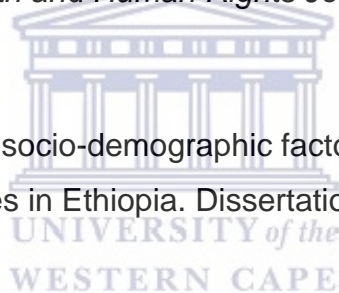
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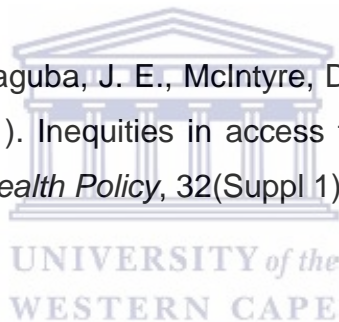
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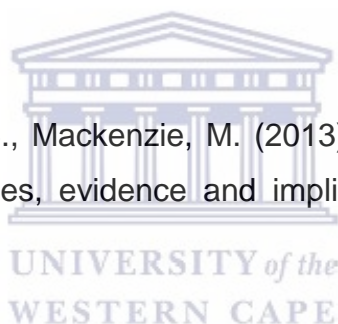
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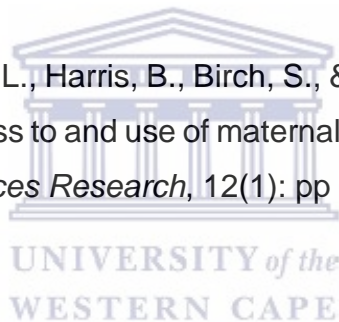
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APPENDICES

Chapter 1-3 appendices

Table A1.1: Selection criteria for the country of study

Country	Has latest std. DHS data as of 2015 [2013+]*	At least two std. DHS data points	Skilled birth attendants [less than 60%] - latest	4+ Antenatal visits [Less than 80%]	CPR [Less than 20%] - Married women	Civil war in the 90s to early 2000s	Main DHS report language is English**	MMR of more than 700 deaths per 100 000 live births	Number of criteria met [out of 8]	Total criteria % met
Benin	No									-
Burkina Faso	No									-
Cape Verde	No									-
Ivory Coast	No									-
Gambia	Yes									-
Ghana	**Yes**	**Yes**	**73.7**	**87.3**	**26.7**	**No**	**Yes**	**No**	**3**	**37.5**
Guinea	No									-
Guinea-Bissau	No									-
Liberia	**Yes**	**Yes**	**61.1**	**78.1**	**20.2**	**Yes**	**Yes**	**Yes**	**6**	**75.0**
Mali	Yes	Yes					No			-
Mauritania	No									-
Niger	No									0.0
Nigeria	**Yes**	**Yes**	**35.8**	**51.1**	**15.1**	**No**	**Yes**	**Yes**	**7**	**87.5**
Saint Helena	No data									-
Senegal	No									-
Sierra Leone	**Yes**	**Yes**	**59.7**	**76.0**	**16.6**	**Yes**	**Yes**	**Yes**	**8**	**100.0**
Sao Tome and Principe	No									-
Togo	Yes						No			-

Note: Countries without the latest or any DHS data, and with non-English DHS latest reports were automatically disqualified; Indicators according to latest published DHS full report results as of 1 July 2015

Sierra Leone chosen because it met all the selection criteria

Table A1.2: Selected sample sizes for study[23]

Survey year	4+ antenatal visits	Skilled antenatal care	Facility-based deliveries	Skilled birth attendants	Contraceptive use
2008	3 380	4 103	5 651	5 811	5 525
2013	7 532	8 647	12 079	12 198	10 903

Source: Author's calculations from SLDHS 2008 and SLDHS 2013 datasets

Chapter 4 appendices

Table A4.1: Definition of independent variables

Variable	Definition
Predisposing factors	
Maternal age	Categorical variable, grouped into: 1=<20; 2=20-29; 3=30-39; 4=40-49
Marital status[24]	Categorical variable, grouped into: 0=Never married; 1=In union; 2=Formerly married
Maternal education	Categorical variable, grouped into: 0=No education; 1=Primary; 2=Secondary/higher
Number of living children	Categorical variable, grouped into: 0=None; 1=One child; 2=Two-to-three children; 3=Four or more children
Decision-making power	Categorical variable, grouped into: 1=All three decisions[25]; 2=Some joint-decisions[26]; 3=None
Enabling factors	
Household wealth	Categorical variable, grouped into: 1=Poor; 2=Average; 3=Rich
Media exposure	Dichotomous variable, grouped into: 0=No; 1=Yes
Need factors	
Antenatal care[27]	Defined as above (see subsection on dependent variables)
External environment	
Place of residence	Dichotomous variable, grouped into: 1=Urban; 2=Rural
Region	Categorical variable, grouped into: 1=Eastern; 2=Northern; 3=Southern; 4=Western

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[23] The dependent variables exclude missing cases

[24] Variable only considers women in union in the analysis of contraceptive use and is coded as: 0=Married; 1=Cohabiting.

[25] All three decisions is a combination of: (a) final say on own health care, (b) final say on making large household purchases, and (c) final say on visits to family or relatives. Here, the woman makes these decisions alone, without partner/husband

[26] Refers to decision-making jointly with partner/husband

[27] Antenatal care variable (*skilled antenatal care*) is used as an independent variable only for delivery care analysis

Table A4.2: Characteristics of the sample – Antenatal visits

Characteristics	2008				2013			
	None/<4	4+ visits	Total	%	None/<4	4+ visits	Total	%
Predisposing factors								
Maternal age								
<20	93	179	272	8.0	109	648	757	10.1
20-29	516	1 119	1 635	48.4	372	3 032	3 404	45.2
30-39	341	808	1 149	34.0	357	2 236	2 593	34.4
40-49	127	196	323	9.6	122	657	779	10.3
Mean age (SD)		28.8(7.2)				28.9(7.5)		
Marital status								
Never married	56	190	246	7.3	108	764	873	11.6
In union	964	2 011	2 975	88.0	809	5 504	6 313	83.8
Formerly married	57	102	159	4.7	41	306	346	4.6
Maternal education								
No education	908	1 629	2 537	75.1	697	4 256	4 953	65.8
Primary	102	310	412	12.2	143	941	1 084	14.4
Secondary+	67	365	432	12.8	119	1 376	1 495	19.8
Number of living children								
None	21	47	68	2.0	25	160	185	2.5
One child	234	531	765	22.6	202	1 589	1 791	23.8
Two-to-three children	438	952	1 391	41.2	361	2 532	2 892	38.4
Four or more children	385	772	1 157	34.2	372	2 292	2 664	35.4
Decision-making power								
All three decisions	360	863	1 223	36.2	305	2 514	2 819	37.4
Some joint-decisions	276	538	814	24.1	197	1 271	1 469	19.5
None	441	903	1 344	39.8	457	2 788	3 245	43.1
Enabling factors								
Household wealth								
Poor	566	877	1 443	42.7	480	2 726	3 205	42.6
Average	256	498	754	22.3	201	1 367	1 567	20.8
Rich	256	928	1 183	35.0	278	2 481	2 760	36.6
Media exposure								
No	1 075	2 253	3 327	98.4	946	6 454	7 401	98.3
Yes	3	50	53	1.6	12	119	132	1.8
External environment								
Place of residence								
Urban	175	779	955	28.3	189	1 906	2 095	27.8
Rural	902	1 524	2 426	71.8	770	4 667	5 438	72.2
Region								
Eastern	179	492	671	19.9	173	1 504	1 677	22.3
Northern	667	922	1 589	47.0	507	2 523	3 030	40.2
Southern	151	444	595	17.6	159	1 594	1 753	23.3
Western	80	445	525	15.5	121	952	1 072	14.2
Total	**1 078**	**2 303**	**3 380**	**100.0**	**959**	**6 574**	**7 532**	**100.0**

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

Table A4.3: Characteristics of the sample – Skilled antenatal care

Characteristics	2008				2013			
	Unskilled	Skilled	Total	%	Unskilled	Skilled	Total	%
Predisposing factors								
Maternal age								
<20	36	294	330	8.0	12	847	859	9.9
20-29	245	1 772	2 017	49.7	81	3 834	3 915	45.3
30-39	193	1 184	1 377	33.2	114	2 884	2 998	34.7
40-49	62	317	379	8.9	45	831	875	10.1
Mean age (SD)		28.7(7.1)				28.9(7.5)		
Marital status								
Never married	20	285	305	7.4	24	951	975	11.3
In union	488	3 105	3 592	87.5	221	7 053	7 274	84.1
Formerly married	29	177	206	5.0	6	392	398	4.6
Maternal education								
No education	472	2 579	3 051	74.4	214	5 554	5 768	66.7
Primary	38	477	515	12.6	25	1 178	1 203	13.9
Secondary+	27	510	537	13.1	13	1 663	1 676	19.4
Number of living children								
None	12	77	89	2.2	9	200	208	2.4
One child	108	824	931	22.7	30	2 008	2 038	23.6
Two-to-three children	231	1 454	1 685	41.1	100	3 237	3 337	38.6
Four or more children	185	1 213	1 398	34.1	113	2 951	3 064	35.4
Decision-making power								
All three decisions	151	1 310	1 461	35.6	79	3 129	3 208	37.1
Some joint-decisions	143	831	974	23.7	69	1 623	1 692	19.6
None	243	1 426	1 668	40.7	104	3 643	3 747	43.3
Enabling factors								
Household wealth								
Poor	300	1 434	1 734	42.3	136	3 574	3 710	42.9
Average	126	768	893	21.8	59	1 738	1 797	20.8
Rich	111	1 365	1 476	36.0	57	3 084	3 140	36.3
Media exposure								
No	534	3 507	4 040	98.5	248	8 253	8 501	98.3
Yes	3	60	63	1.5	4	142	146	1.7
External environment								
Place of residence								
Urban	72	1 111	1 183	28.8	44	2 343	2 387	27.6
Rural	465	2 455	2 920	71.2	208	6 053	6 260	72.4
Region								
Eastern	84	725	809	19.7	35	2 019	2 054	23.8
Northern	339	1 530	1 869	45.6	152	3 233	3 385	39.1
Southern	76	707	783	19.1	36	1 946	1 982	22.9
Western	38	604	642	15.6	29	1 197	1 226	14.2
Total	**537**	**3 567**	**4 103**	**100.0**	**252**	**8 396**	**8 647**	**100.0**

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

Table A4.4: Characteristics of the sample – Facility-based deliveries

Characteristics	2008				2013			
	Non-facility	Facility	Total	%	Non-facility	Facility	Total	%
Predisposing factors								
Maternal age								
<20	281	101	382	6.8	400	588	988	8.2
20-29	2 096	737	2 833	51.5	2 401	3 280	5 682	47.0
30-39	1 449	490	1 939	34.3	2 084	2 199	4 283	35.5
40-49	395	102	497	7.1	561	564	1 126	9.3
Mean age (SD)		28.8(6.9)				29.0(7.2)		
Marital status								
Never married	217	131	348	6.2	357	735	1 093	9.0
In union	3 807	1 212	5 019	88.8	4 847	5 604	10 451	86.5
Formerly married	198	86	284	5.0	243	292	535	4.4
Maternal education								
No education	3 426	885	4 311	76.3	4 160	4 150	8 310	68.8
Primary	457	240	697	12.3	712	992	1 704	14.1
Secondary+	338	305	643	11.4	575	1 491	2 065	17.1
Number of living children								
None	62	41	103	1.8	91	137	227	1.9
One child	698	305	1 002	17.7	827	1 421	2 248	18.6
Two-to-three children	1 784	646	2 430	43.0	2 205	2 807	5 011	41.5
Four or more children	1 677	438	2 115	37.4	2 324	2 268	4 592	38.0
Decision-making power								
All three decisions	1 564	454	2 018	35.7	2 220	2 366	4 585	38.0
Some joint-decisions	1 072	307	1 379	24.4	1 206	1 269	2 475	20.5
None	1 585	669	2 254	39.9	2 021	2 997	5 019	41.6
Enabling factors								
Household wealth								
Poor	1 999	484	2 482	43.9	2 737	2 688	5 426	44.9
Average	953	299	1 252	22.2	1 280	1 267	2 547	21.1
Rich	1 269	647	1 917	33.9	1 429	2 677	4 106	34.0
Media exposure								
No	4 198	1 383	5 581	98.8	5 423	6 493	11 916	98.7
Yes	23	47	70	1.2	24	139	163	1.3
Need factors								
Skilled antenatal care								
Unskilled	1 693	401	2 095	37.1	1 933	1 756	3 689	30.5
Skilled	2 528	1 028	3 556	62.9	3 514	4 876	8 390	69.5
External environment								
Place of residence								
Urban	914	626	1 540	27.3	952	2 118	3 070	25.4
Rural	3 307	804	4 111	72.7	4 495	4 514	9 009	74.6
Region								
Eastern	809	333	1 142	20.2	791	2 153	2 944	24.4
Northern	2 129	405	2 535	44.9	2 950	1 762	4 711	39.0
Southern	767	398	1 166	20.6	1 109	1 746	2 855	23.6
Western	516	293	809	14.3	598	971	1 568	13.0
Total	**4 221**	**1 430**	**5 651**	**100.0**	**5 447**	**6 632**	**12 079**	**100.0**

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

Table A4.5: Characteristics of the sample – Skilled birth attendants (SBA)

Characteristics	2008				2013			
	Unskilled	Skilled	Total	%	Unskilled	Skilled	Total	%
Predisposing factors								
Maternal age								
<20	229	158	387	6.7	347	646	993	8.1
20-29	1 618	1 281	2 899	51.9	2 091	3 643	5 733	47.0
30-39	1 161	844	2 004	34.2	1 934	2 395	4 329	35.5
40-49	338	183	521	7.4	543	600	1 143	9.4
Mean age (SD)		28.9(7.0)				29.0(7.2)		
Marital status								
Never married	130	222	352	6.1	282	815	1 097	9.0
In union	3 064	2 107	5 171	89.0	4 427	6 139	10 566	86.6
Formerly married	152	137	288	5.0	206	330	535	4.4
Maternal education								
No education	2 855	1 588	4 443	76.5	3 845	4 550	8 394	68.8
Primary	314	398	713	12.3	639	1 086	1 725	14.1
Secondary+	176	479	655	11.3	431	1 648	2 079	17.0
Number of living children								
None	46	57	104	1.8	76	152	228	1.9
One child	546	480	1 026	17.7	687	1 566	2 253	18.5
Two-to-three children	1 386	1 110	2 496	43.0	1 980	3 099	5 080	41.6
Four or more children	1 368	818	2 186	37.6	2 171	2 467	4 638	38.0
Decision-making power								
All three decisions	1 260	816	2 076	35.7	2 031	2 598	4 629	37.9
Some joint-decisions	853	567	1 420	24.4	1 099	1 401	2 500	20.5
None	1 232	1 084	2 316	39.9	1 785	3 285	5 070	41.6
Enabling factors								
Household wealth								
Poor	1 743	804	2 547	43.8	2 660	2 815	5 474	44.9
Average	791	497	1 288	22.2	1 203	1 370	2 573	21.1
Rich	812	1 164	1 976	34.0	1 051	3 099	4 151	34.0
Media exposure								
No	3 335	2 405	5 740	98.8	4 906	7 125	12 032	98.6
Yes	10	61	71	1.2	8	158	166	1.4
Need factors								
Skilled antenatal care								
Unskilled	1 523	722	2 245	38.6	1 873	1 930	3 803	31.2
Skilled	1 823	1 744	3 567	61.4	3 042	5 354	8 396	68.8
External environment								
Place of residence								
Urban	524	1 061	1 585	27.3	657	2 454	3 112	25.5
Rural	2 821	1 405	4 226	72.7	4 257	4 830	9 087	74.5
Region								
Eastern	583	586	1 170	20.1	681	2 276	2 958	24.2
Northern	1 904	719	2 623	45.1	2 778	1 971	4 749	38.9
Southern	556	631	1 187	20.4	1 043	1 850	2 892	23.7
Western	302	529	831	14.3	413	1 187	1 600	13.1
Total	**3 345**	**2 466**	**5 811**	**100.0**	**4 914**	**7 284**	**12 198**	**100.0**

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

Table A4.6: Characteristics of the sample – Any method of contraception

Characteristics	2008				2013			
	Not using	Using	Total	%	Not using	Using	Total	%
Predisposing factors								
Age								
<20	354	4	359	6.5	673	57	729	6.7
20-29	2 087	154	2 241	34.0	3 303	590	3 893	35.7
30-39	1 722	199	1 922	43.9	3 195	812	4 007	36.8
40-49	908	95	1 004	21.0	1 919	354	2 273	20.8
Mean age (SD)		30.9(8.1)				31.7(8.4)		
Marital status								
Married	4 401	393	4 794	86.8	8 734	1 696	10 430	95.7
Cohabiting	671	61	732	13.2	356	117	473	4.3
Maternal education								
No education	4 036	245	4 280	77.5	6 748	1 122	7 870	72.2
Primary	536	65	601	10.9	1 151	275	1 426	13.1
Secondary+	500	144	644	11.7	1 190	417	1 607	14.7
Number of living children								
None	507	9	516	9.3	789	41	830	7.6
One child	919	51	970	17.6	1 488	241	1 729	15.9
Two-to-three children	1 973	181	2 155	39.0	3 432	676	4 108	37.7
Four or more children	1 673	212	1 885	34.1	3 382	855	4 236	38.9
Decision-making power								
All three decisions	2 032	225	2 257	40.9	4 039	912	4 951	45.4
Some joint-decisions	1 351	129	1 480	26.8	2 110	444	2 555	23.4
None	1 689	100	1 788	32.4	2 941	456	3 397	31.2
Enabling factors								
Household wealth								
Poor	2 230	92	2 322	42.0	4 091	574	4 664	42.8
Average	1 132	54	1 186	21.5	2 012	295	2 307	21.2
Rich	1 711	307	2 018	36.5	2 987	945	3 932	36.1
Media exposure								
No	5 006	433	5 439	98.4	8 947	1 754	10 701	98.1
Yes	66	20	86	1.6	143	59	202	1.9
External environment								
Place of residence								
Urban	1 307	254	1 561	28.3	2 146	777	2 923	26.8
Rural	3 765	200	3 965	71.8	6 944	1 036	7 980	73.2
Region								
Eastern	965	63	1 028	18.6	2 114	443	2 558	23.5
Northern	2 327	107	2 434	44.1	3 858	540	4 399	40.3
Southern	1 104	102	1 206	21.8	2 015	420	2 434	22.3
Western	676	181	858	15.5	1 102	410	1 512	13.9
Total	**5 072**	**453**	**5 525**	**100.0**	**9 090**	**1 813**	**10 903**	**100.0**

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

Chapter 5 appendices

Figure A.5.4: Index of wealth-based disparities in the use of four or more antenatal care visits by region, Sierra Leone DHS 2008 & 2013
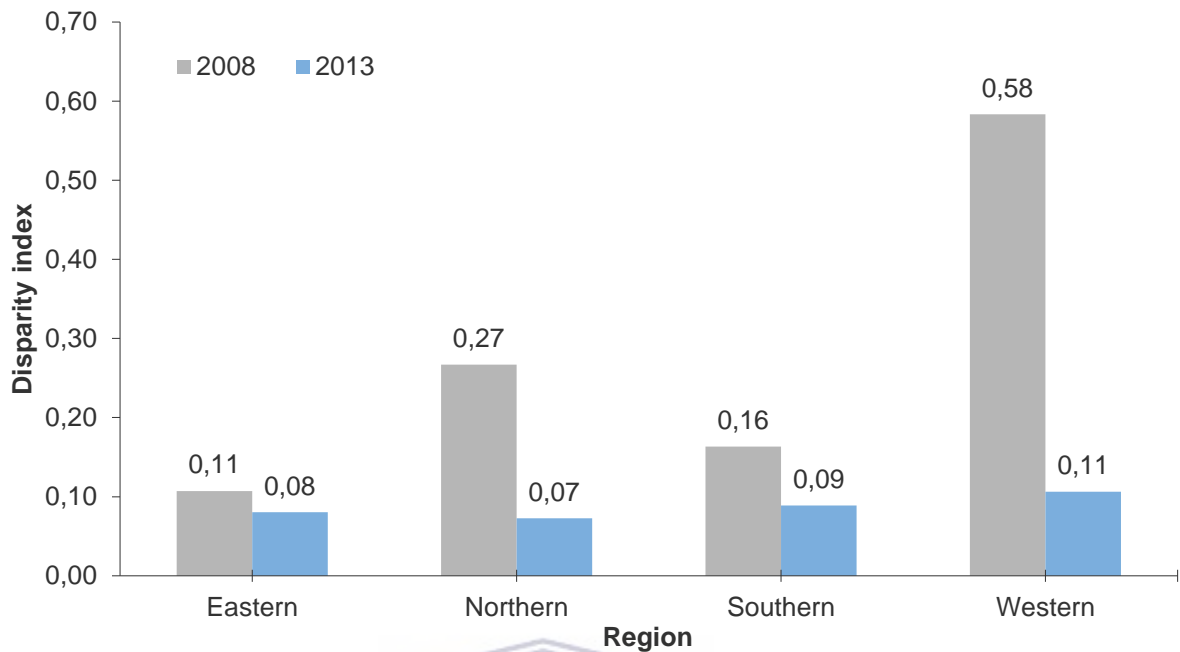
Figure A.5.5: Index of education-based disparities in the use of four or more antenatal care visits by region, Sierra Leone DHS 2008 & 2013
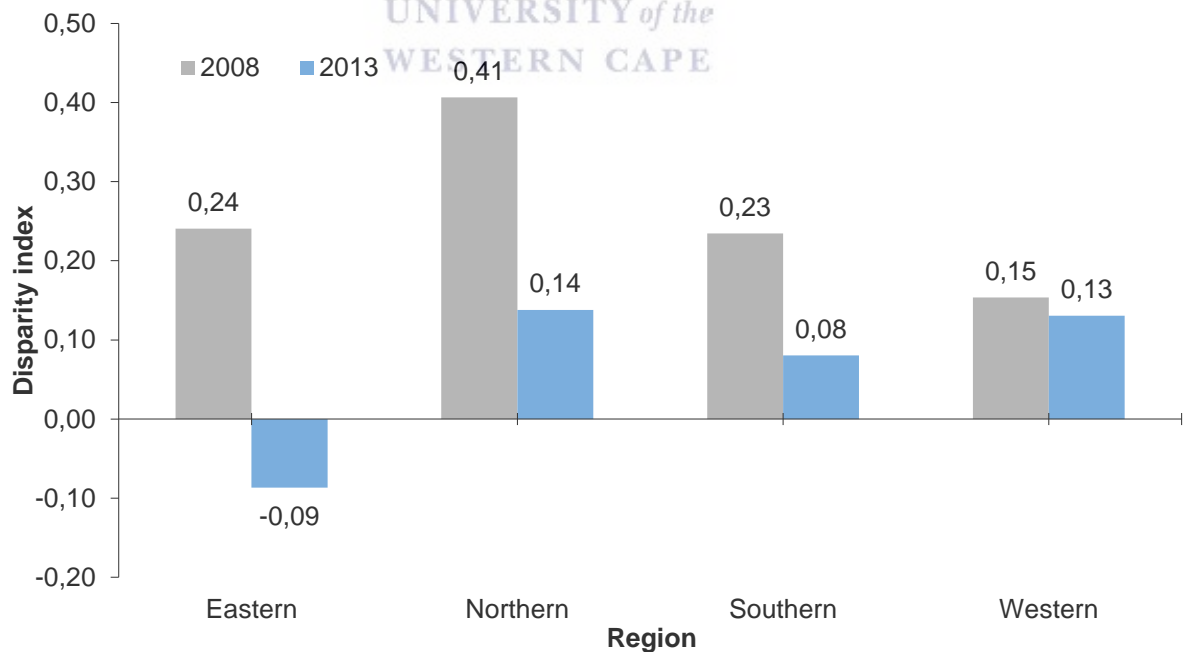
Figure A.5.6: Index of residence-based disparities in the use of four or more antenatal care visits by region, Sierra Leone DHS 2008 & 2013
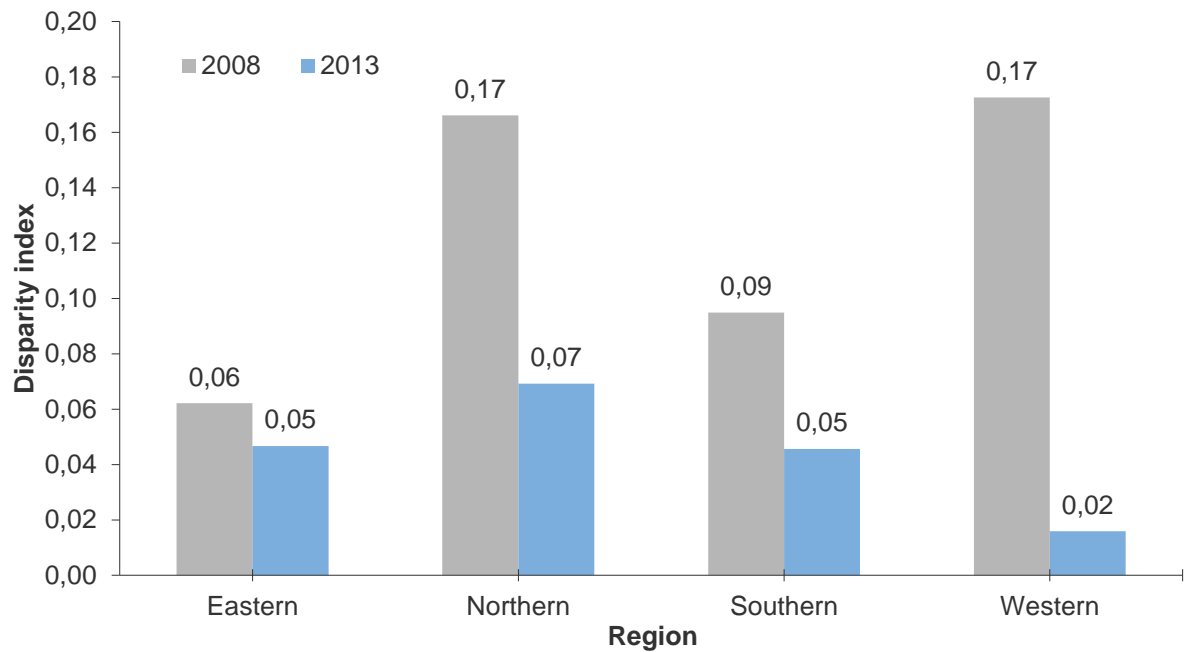
Figure A.5.7: Index of wealth-based disparities in the use of skilled antenatal care providers by region, Sierra Leone DHS 2008 & 2013
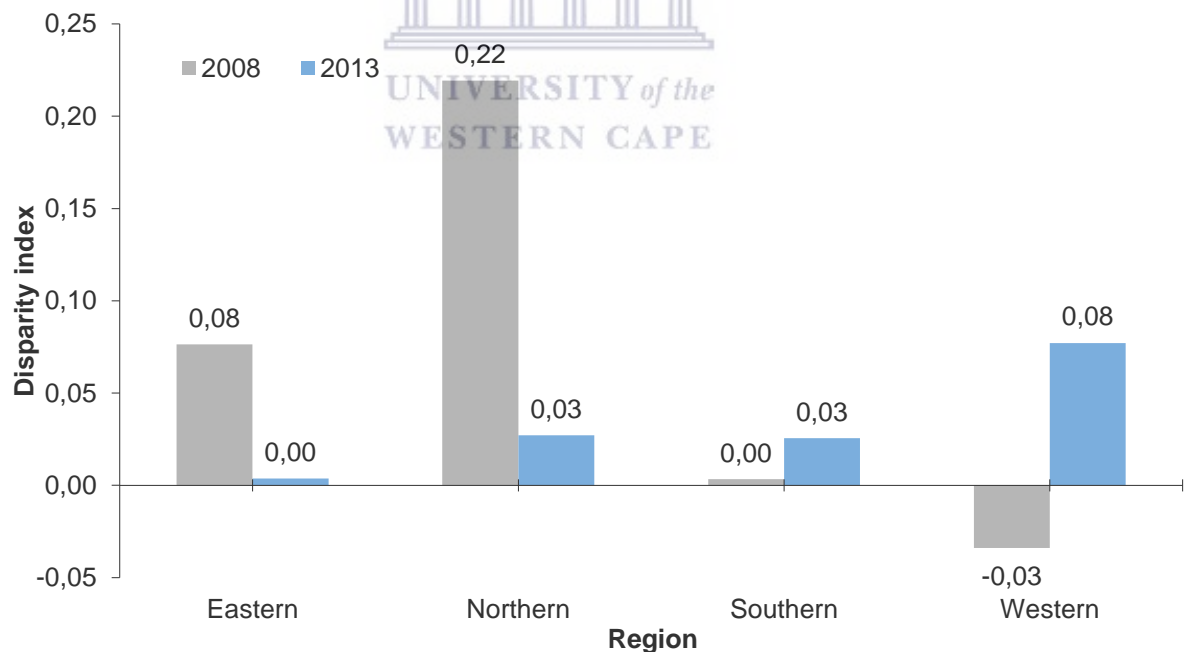
Figure A.5.8: Index of education-based disparities in the use of skilled antenatal care providers by region, Sierra Leone DHS 2008 & 2013
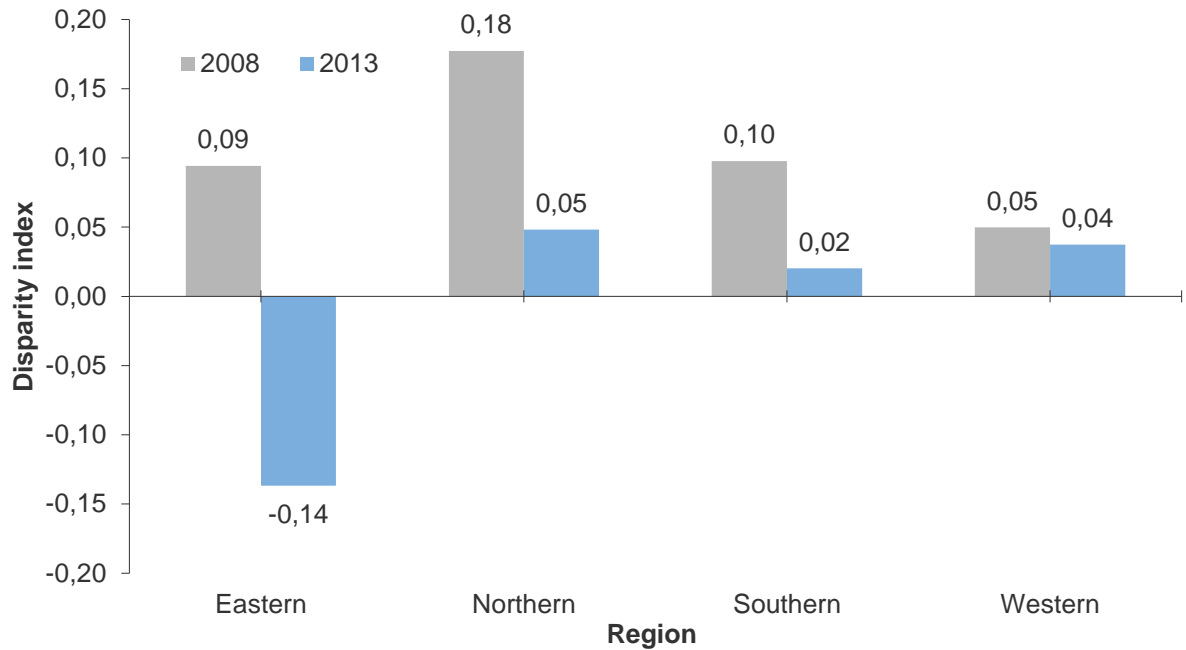
Figure A.5.9: Index of residence-based disparities in the use of skilled antenatal care providers by region, Sierra Leone DHS 2008 & 2013

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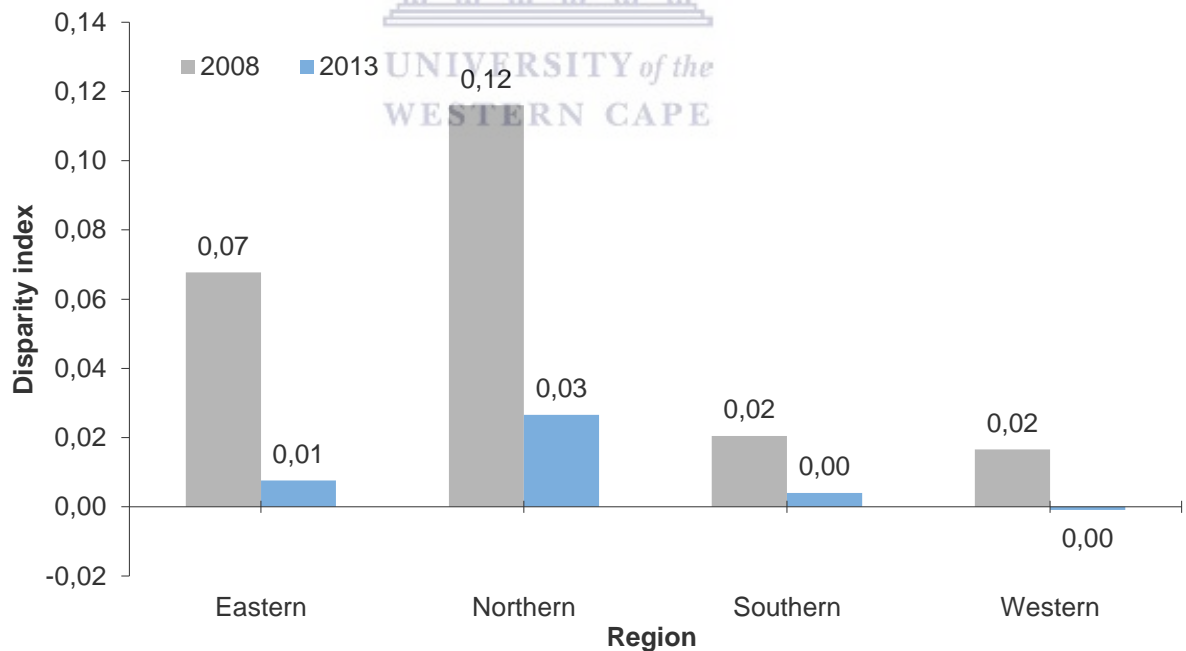
Figure A.5.10: Index of wealth-based disparities in the use of healthcare facilities for birth by region, Sierra Leone DHS 2008 & 2013
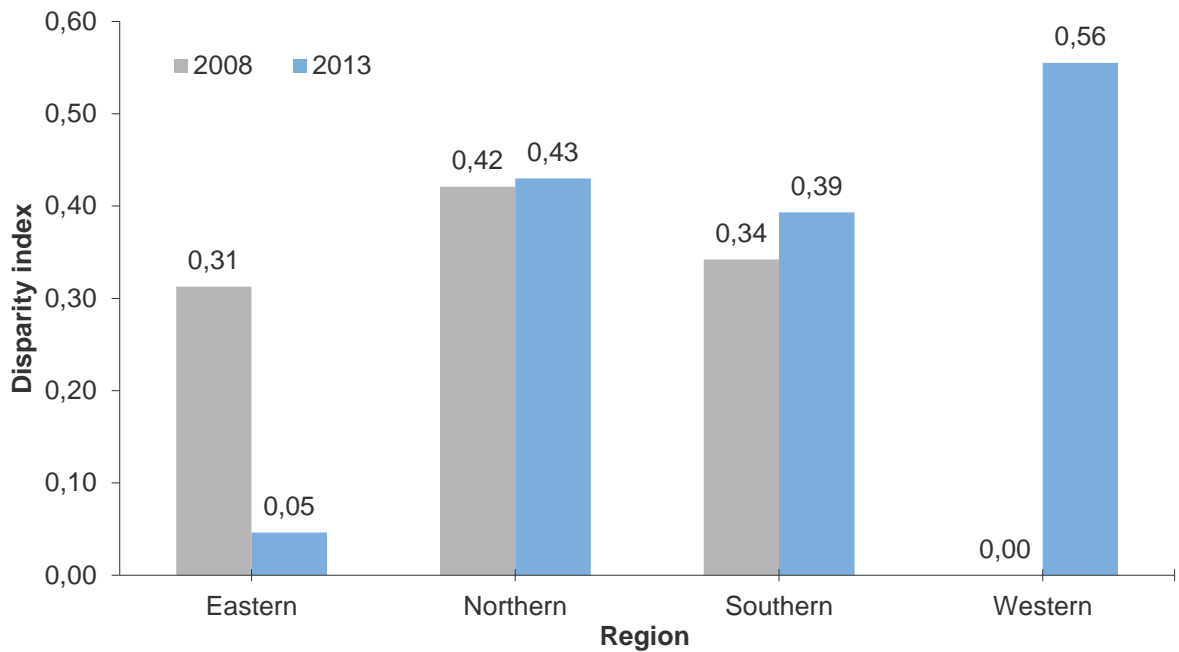
Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

Figure A.5.11: Index of education-based disparities in the use of healthcare facilities for birth by region, Sierra Leone DHS 2008 & 2013
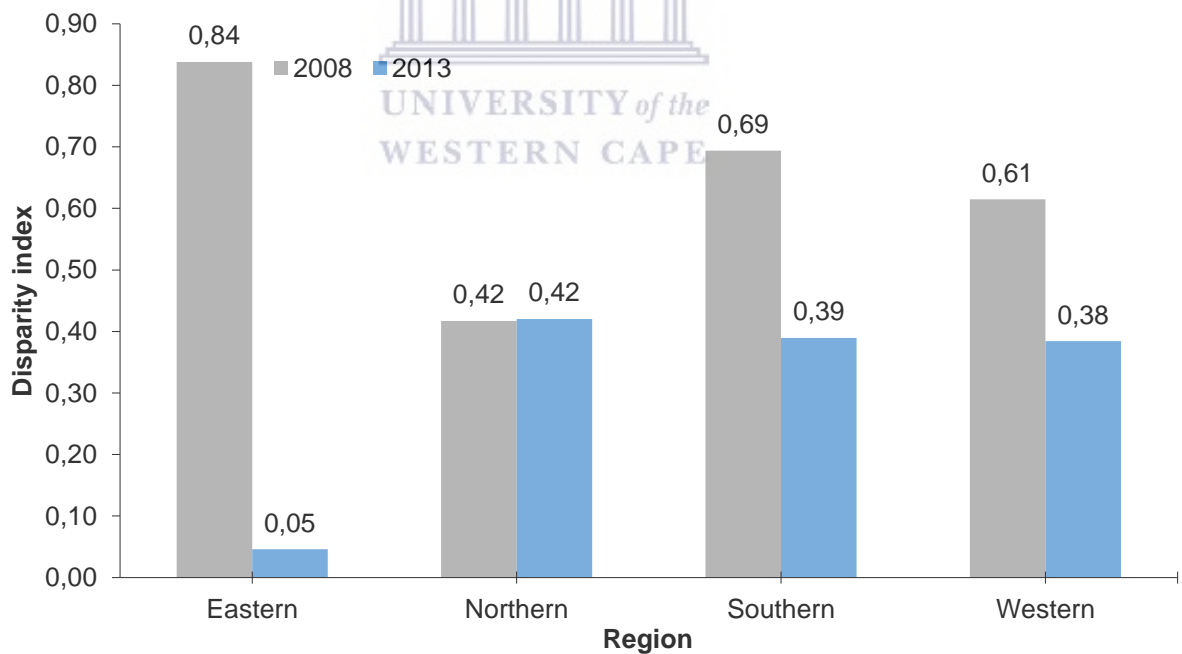
Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

Figure A.5.12: Index of residence-based disparities in the use of healthcare facilities for birth by region, Sierra Leone DHS 2008 & 2013
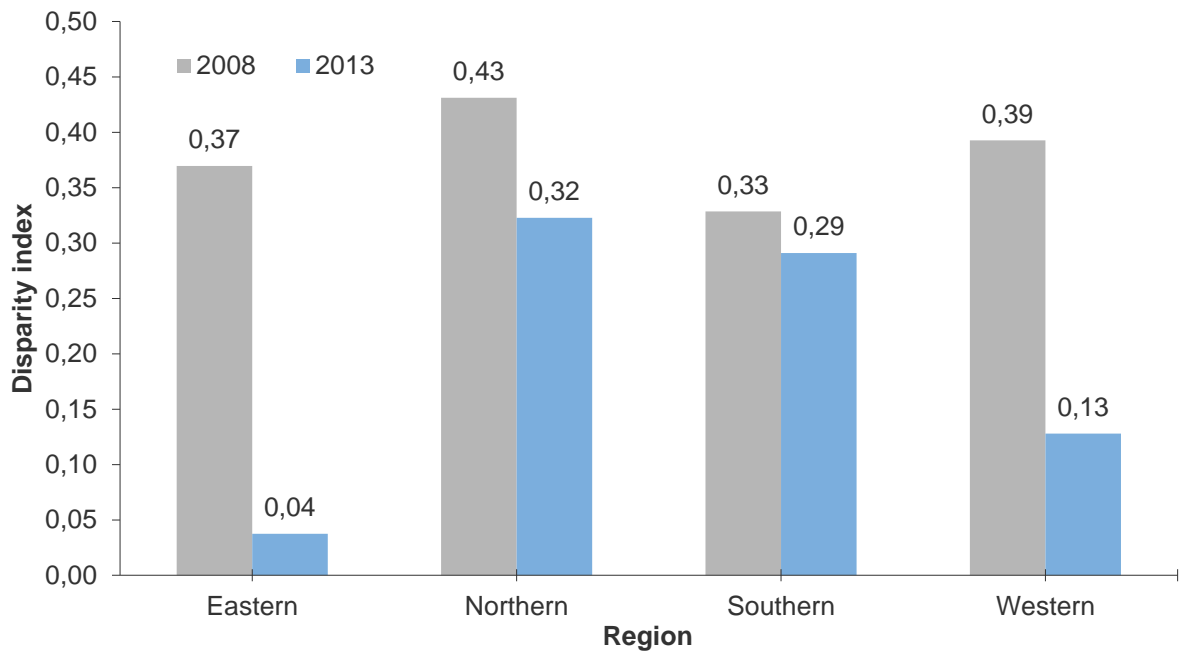
Figure A.5.13: Index of wealth-based disparities in the births assisted by a skilled birth attendant by region, Sierra Leone DHS 2008 & 2013

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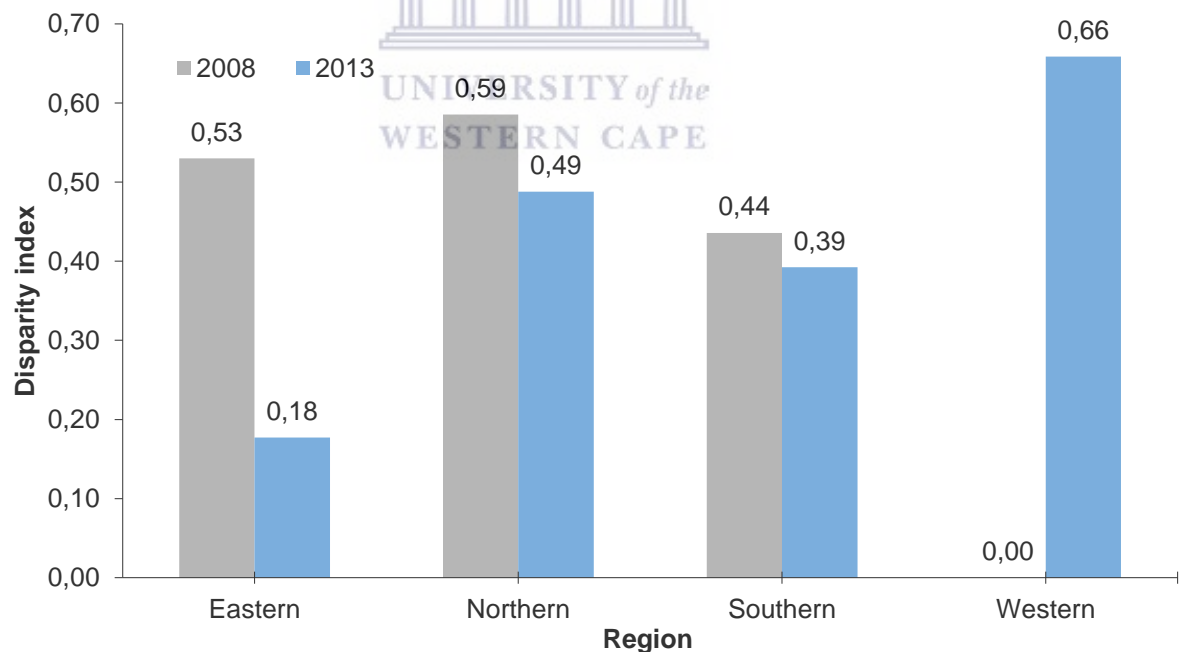
Figure A.5.14: Index of education-based disparities in the births assisted by a skilled birth attendant by region, Sierra Leone DHS 2008 & 2013
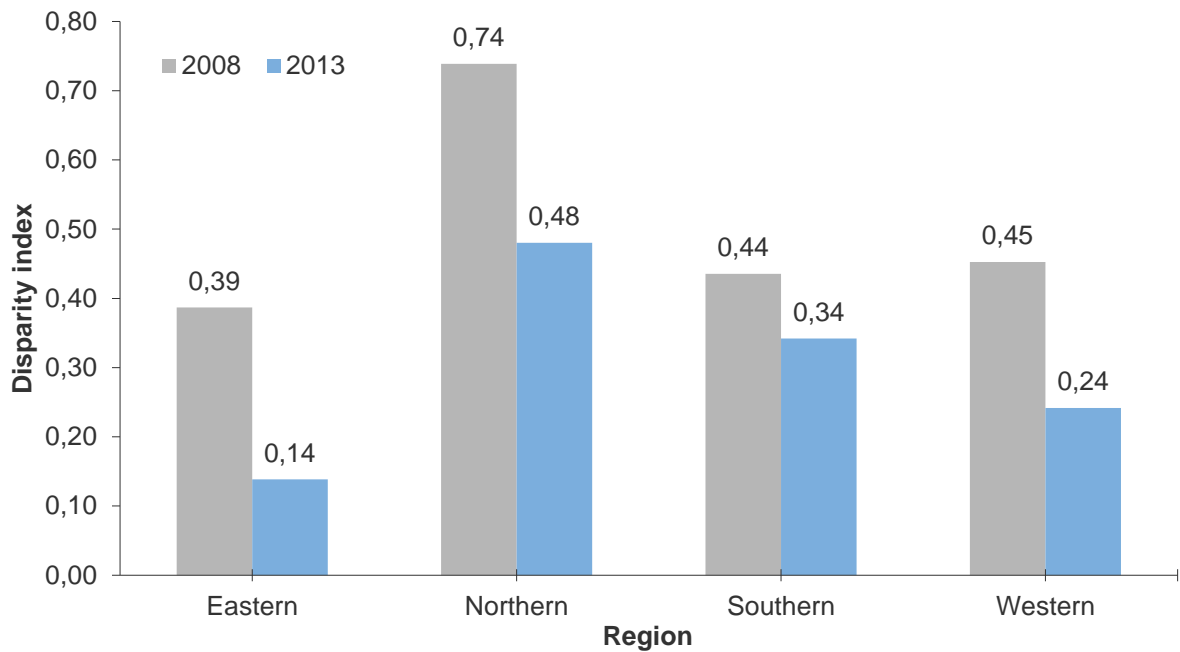
Figure A.5.15: Index of residence-based disparities in the births assisted by a skilled birth attendant by region, Sierra Leone DHS 2008 & 2013

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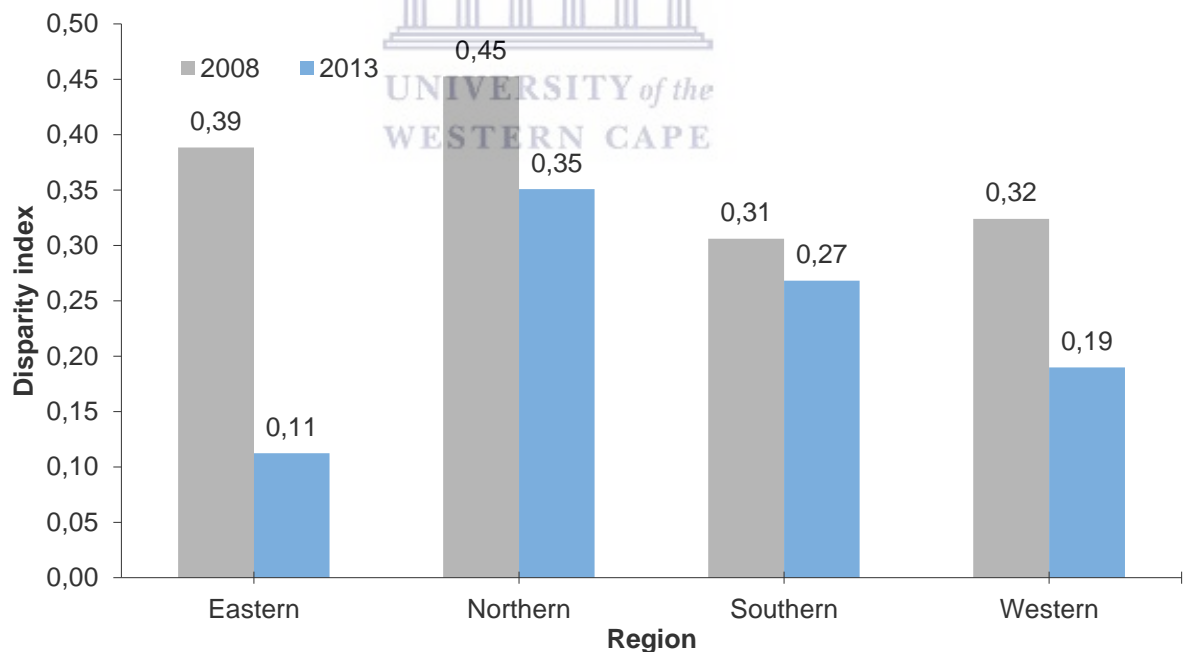
Figure A.5.16: Index of wealth-based disparities in the use of any method of contraception by region, Sierra Leone DHS 2008 & 2013
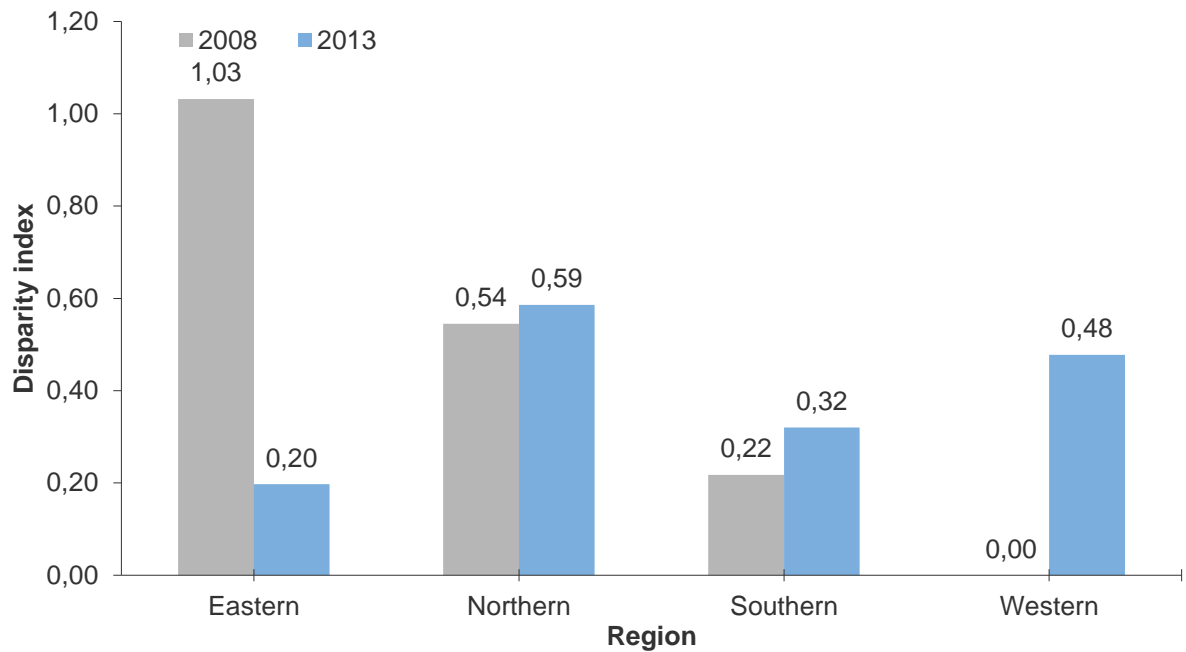
Figure A.5.17: Index of education-based disparities in the use of any method of contraception by region, Sierra Leone DHS 2008 & 2013

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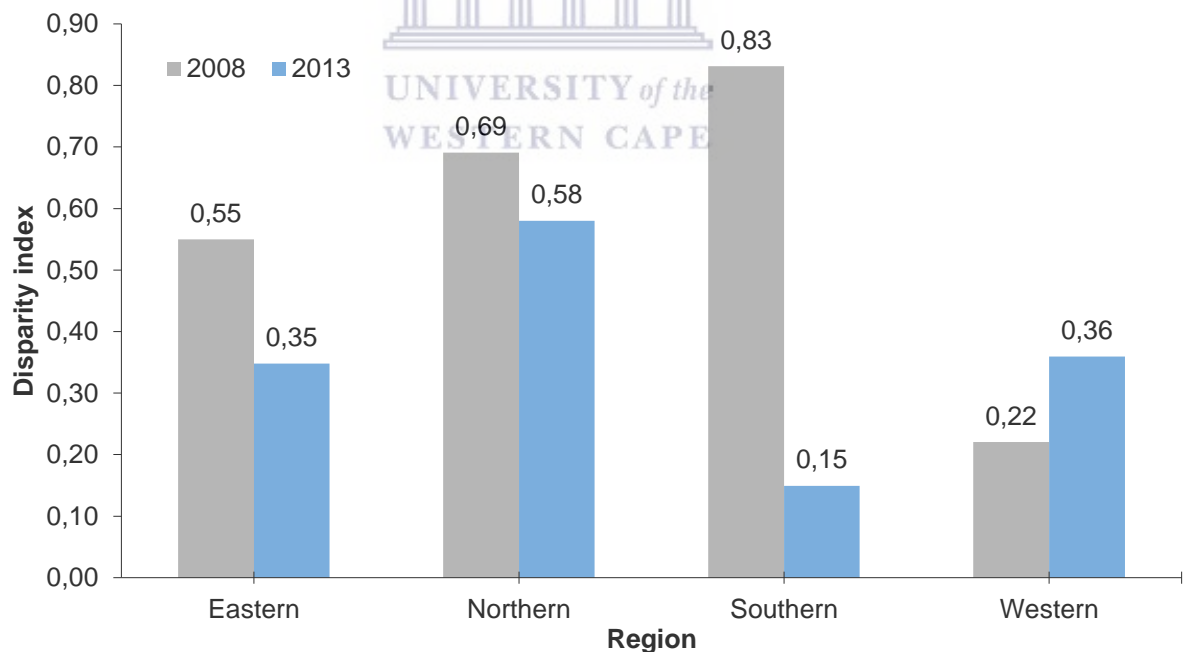
Figure A.5.18: Index of residence-based disparities in the use of any method of contraception by region, Sierra Leone DHS 2008 & 2013
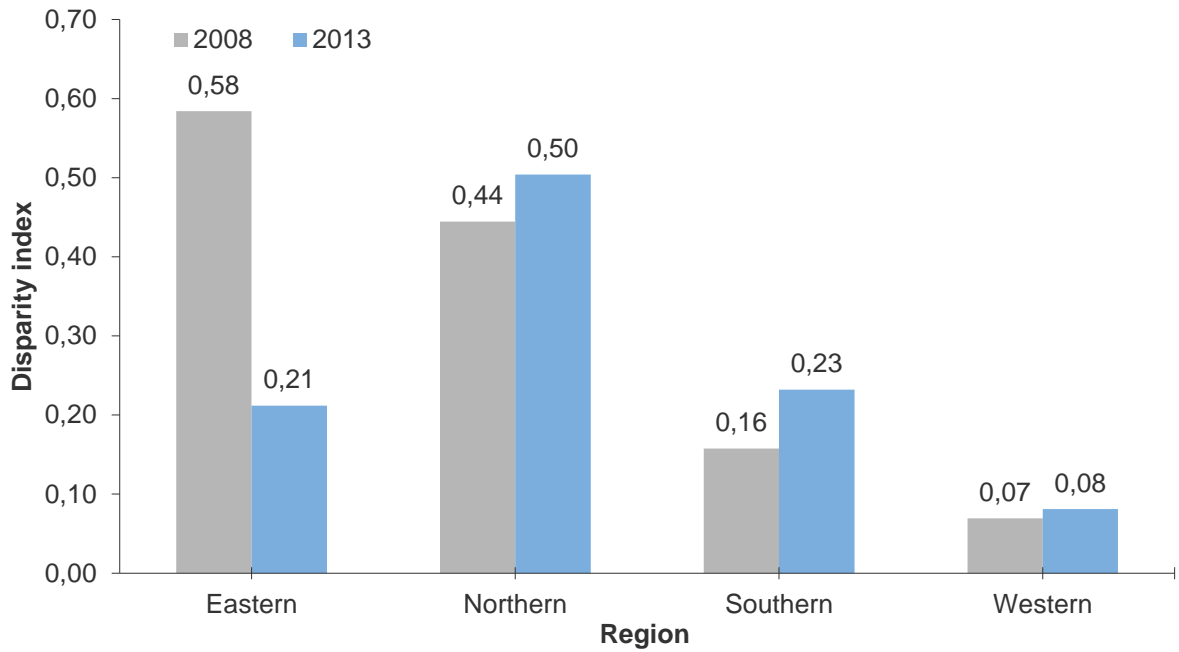
Chapter 7 appendices

Table A7.1: Definition of independent variables

Variable	Definition
Predisposing factors	
Maternal age	Categorical variable, grouped into: 1=<20; 2=20-29; 3=30-39; 4=40-49
Marital status[28]	Categorical variable, grouped into: 0=Never married; 1=In union; 2=Formerly married
Maternal education	Categorical variable, grouped into: 0=No education; 1=Primary; 2=Secondary/higher
Number of living children	Categorical variable, grouped into: 0=None; 1=One child; 2=Two-to-three children; 3=Four or more children
Decision-making power	Categorical variable, grouped into: 1=All three decisions[29]; 2=Some joint-decisions[30]; 3=None
Enabling factors	
Household wealth	Categorical variable, grouped into: 1=Poor; 2=Average; 3=Rich
Media exposure	Dichotomous variable, grouped into: 0=No; 1=Yes
Need factors	
Antenatal care[31]	Defined as above (see subsection on dependent variables)
External environment	
Place of residence	Dichotomous variable, grouped into: 1=Urban; 2=Rural
Region	Categorical variable, grouped into: 1=Eastern; 2=Northern; 3=Southern; 4=Western

Table A7.2: Erreygers concentration indices for four or more antenatal visits in Sierra Leone, 2008 and 2013

Index	Index value		Robust SE		p-value		CI(2013)-CI(2008)
	2008	2013	2008	2013	2008	2013	
Erreygers normalised CI	0.1975	0.0516	0.023	0.013	0.000	0.000	-0.1459

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

Note: SE = standard error; CI = concentration index.

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[28] Variable only considers women in union in the analysis of contraceptive use and is coded as: 0=Married; 1=Cohabiting.

[29] All three decisions is a combination of: (a) final say on own health care, (b) final say on making large household purchases, and (c) final say on visits to family or relatives. Here, the woman makes these decisions alone, without partner/husband

[30] Refers to decision-making jointly with partner/husband

[31] Antenatal care variable (*skilled antenatal care*) is used as an independent variable only for delivery care analysis

Table A7.3: Decomposition of inequality in four or more antenatal visits in Sierra Leone (2008 and 2013) and their changes

Characteristics	Coefficient		Elasticity		CI		Absolute contribution		% contribution		Change
	2008	2013	2008	2013	2008	2013	2008	2013	2008	2013	
Maternal age											
<20	0.0518	0.0126	0.0501	0.0123	0.1345	0.0193	0.0067	0.0002	3	0	-0.0065
20-29	0.0775	0.0471	0.0778	0.0481	0.2024	0.0499	0.0157	0.0024	8	5	-0.0133
30-39	0.0965	0.0187	0.0996	0.0185	0.2026	0.0500	0.0202	0.0009	10	2	-0.0193
40-49	-	-	-	-	-	-	-	-	-	-	-
Sum							*0.0427*	*0.0036*	*22*	*7*	*-0.0391*
Marital status											
Never married	0.1330	-0.0062	0.1508	-0.0062	0.1506	0.0923	0.0227	-0.0006	12	-1	-0.0233
In union	0.0364	-0.0101	0.0362	-0.0101	0.1927	0.0476	0.0070	-0.0005	4	-1	-0.0074
Formerly married	-	-	-	-	-	-	-	-	-	-	-
Sum							*0.0297*	*-0.0011*	*15*	*-2*	*-0.0307*
Maternal education											
No education	-	-	-	-	-	-	-	-	-	-	-
Primary	0.1099	0.0087	0.1212	0.0086	0.1331	0.0161	0.0161	0.0001	8	0	-0.0160
Secondary+	0.2029	0.0610	0.2516	0.0643	0.1227	0.0599	0.0309	0.0039	16	7	-0.0270
Sum							*0.0470*	*0.0040*	*24*	*8*	*-0.0430*
Number of living children											
None	-	-	-	-	-	-	-	-	-	-	-
One child	-0.0020	0.0211	-0.0020	0.0214	0.2115	0.0672	-0.0004	0.0014	0	3	0.0019
Two-to-three children	-0.0114	0.0090	-0.0115	0.0090	0.1982	0.0358	-0.0023	0.0003	-1	1	0.0026
Four or more children	-0.0286	-0.0060	-0.0281	-0.0059	0.1716	0.0474	-0.0048	-0.0003	-2	-1	0.0045
Sum							*-0.0075*	*0.0015*	*-4*	*3*	*0.0090*
Women's decision-making											
All three decisions	0.0337	0.0327	0.0349	0.0334	0.2017	0.0356	0.0070	0.0012	4	2	-0.0058
Some joint-decisions	-0.0112	0.0066	-0.0109	0.0065	0.2078	0.0908	-0.0023	0.0006	-1	1	0.0029
None	-	-	-	-	-	-	-	-	-	-	-
Sum							*0.0048*	*0.0018*	*2*	*3*	*-0.0030*
Media exposure (Yes)	0.2680	0.0340	0.3717	0.0353	-0.0369	0.1690	-0.0137	0.0060	-7	12	0.0197
Residence in rural areas	-0.1881	-0.0516	-0.1734	-0.0508	0.0759	0.0278	-0.0132	-0.0014	-7	-3	0.0118
Region											
Eastern	-	-	-	-	-	-	-	-	-	-	-
Northern	-0.1529	-0.0639	-0.1302	-0.0610	0.1697	0.0563	-0.0221	-0.0034	-11	-7	0.0187
Southern	0.0129	0.0128	0.0142	0.0134	0.1333	0.0546	0.0019	0.0007	1	1	-0.0012
Western	0.1149	-0.0092	0.1430	-0.0093	0.1922	0.1041	0.0275	-0.0010	14	-2	-0.0285

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Characteristics	Coefficient		Elasticity		CI		Absolute contribution		% contribution		Change
	2008	2013	2008	2013	2008	2013	2008	2013	2008	2013	
Sum							*0.0073*	*-0.0037*	*4*	*-7*	*-0.0110*
Total observed							0.0970	0.0106	49	21	-0.0864
Residual							*0.1005*	*0.0409*	51	79	-0.0596
Total							0.1975	0.0516	100	100	-0.1459

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

Note: CI = concentration index.

Table A7.4: Erreygers concentration indices for skilled antenatal care in Sierra Leone, 2008 and 2013

Index	Index value		Robust SE		p-value		CI(2013)-CI(2008)
	2008	2013	2008	2013	2008	2013	
Erreygers normalised CI	0.1043	0.0218	0.017	0.005	0.000	0.000	-0.0825

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

Note: SE = standard error; CI = concentration index.

Table A7.5: Decomposition of inequality in skilled antenatal care in Sierra Leone (2008 and 2013) and their changes

Characteristics	Coefficient		Elasticity		CI		Absolute contribution		% contribution		Change
	2008	2013	2008	2013	2008	2013	2008	2013	2008	2013	
Maternal age											
<20	0.0534	0.0369	0.0547	0.0375	0.0514	-0.0006	0.0028	0.0000	3	0	-0.0028
20-29	0.0426	0.0302	0.0430	0.0305	0.1125	0.0259	0.0048	0.0008	5	4	-0.0041
30-39	0.0235	0.0131	0.0232	0.0130	0.1200	0.0148	0.0028	0.0002	3	1	-0.0026
40-49	-	-	-	-	-	-	-	-	-	-	-
Sum							*0.0104*	*0.0010*	*10*	*4*	*-0.0095*
Marital status											
Never married	0.0736	-0.0092	0.0791	-0.0093	0.0381	0.0183	0.0030	-0.0002	3	-1	-0.0032
In union	0.0036	-0.0148	0.0036	-0.0148	0.1068	0.0205	0.0004	-0.0003	0	-1	-0.0007
Formerly married	-	-	-	-	-	-	-	-	-	-	-
Sum							*0.0034*	*-0.0005*	*3*	*-2*	*-0.0039*
Maternal education											
No education	-	-	-	-	-	-	-	-	-	-	-
Primary	0.0813	0.0167	0.0866	0.0169	0.0124	0.0204	0.0011	0.0003	1	2	-0.0007
Secondary+	0.1051	0.0293	0.1150	0.0299	0.0363	-0.0065	0.0042	-0.0002	4	-1	-0.0044

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Characteristics	Coefficient		Elasticity		CI		Absolute contribution		% contribution		Change
	2008	2013	2008	2013	2008	2013	2008	2013	2008	2013	
Sum							*0.0052*	*0.0001*	*5*	*1*	*-0.0051*
Number of living children											
None	-	-	-	-	-	-	-	-	-	-	-
One child	0.0239	0.0277	0.0243	0.0281	0.1237	0.0145	0.0030	0.0004	3	2	-0.0026
Two-to-three children	0.0026	0.0122	0.0026	0.0122	0.1126	0.0256	0.0003	0.0003	0	1	0.0000
Four or more children	0.0071	0.0055	0.0071	0.0054	0.0830	0.0126	0.0006	0.0001	1	0	-0.0005
Sum							*0.0039*	*0.0008*	*4*	*4*	*-0.0031*
Women's decision-making											
All three decisions	0.0421	0.0032	0.0434	0.0032	0.0808	0.0142	0.0035	0.0000	3	0	-0.0035
Some joint-decisions	-0.0009	-0.0129	-0.0009	-0.0128	0.1266	0.0374	-0.0001	-0.0005	0	-2	-0.0004
None	-	-	-	-	-	-	-	-	-	-	-
Sum							*0.0034*	*-0.0004*	*3*	*-2*	*-0.0038*
Media exposure (Yes)	0.0835	0.0051	0.0914	0.0051	-0.0247	0.0287	-0.0023	0.0001	-2	1	0.0024
Residence in rural areas	-0.0984	-0.0147	-0.0951	-0.0147	0.0522	0.0074	-0.0050	-0.0001	-5	-1	0.0049
Region											
Eastern	-	-	-	-	-	-	-	-	-	-	-
Northern	-0.0777	-0.0280	-0.0731	-0.0275	0.1407	0.0260	-0.0103	-0.0007	-10	-3	0.0096
Southern	0.0065	-0.0010	0.0068	-0.0011	0.0338	0.0259	0.0002	0.0000	0	0	-0.0003
Western	0.0451	-0.0064	0.0488	-0.0065	0.0612	0.0109	0.0030	-0.0001	3	0	-0.0031
Sum							*-0.0071*	*-0.0008*	*-7*	*-4*	*0.0063*
Total observed							0.0121	0.0002	12	1	-0.0119
Residual							*0.0922*	*0.0216*	*88*	*99*	*-0.0707*
Total							0.1043	0.0218	100	100	-0.0825

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

Note: CI = concentration index.

Table A7.6: Erreygers concentration indices for facility-based deliveries in Sierra Leone, 2008 and 2013

Index	Index value		Robust SE		p-value		CI(2013)-CI(2008)
	2008	2013	2008	2013	2008	2013	
Erreygers normalised CI	0.2022	0.1963	0.024	0.024	0.000	0.000	-0.0059

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

Note: SE = standard error; CI = concentration index.

Table A7.7: Decomposition of inequality in for facility-based deliveries in Sierra Leone (2008 and 2013) and their changes

Characteristics	Coefficient		Elasticity		CI		Absolute contribution		% contribution		Change
	2008	2013	2008	2013	2008	2013	2008	2013	2008	2013	
Maternal age											
<20	0.0591	0.0936	0.0618	0.1015	0.1742	0.1722	0.0108	0.0175	5	9	0.0067
20-29	0.0547	0.0760	0.0562	0.0799	0.2049	0.1802	0.0115	0.0144	6	7	0.0029
30-39	0.0475	0.0120	0.0474	0.0112	0.2046	0.2056	0.0097	0.0023	5	1	-0.0074
40-49	-	-	-	-	-	-	-	-	-	-	-
Sum							*0.0320*	*0.0342*	*16*	*17*	*0.0022*
Marital status											
Never married	0.0737	0.1262	0.1101	0.1546	0.1579	0.1572	0.0174	0.0243	9	12	0.0069
In union	-0.0624	-0.0104	-0.0596	-0.0101	0.1970	0.1859	-0.0117	-0.0019	-6	-1	0.0099
Formerly married	-	-			-		-	-	-	-	-
Sum							*0.0056*	*0.0224*	*3*	*11*	*0.0168*
Maternal education											
No education	-	-	-	-	-	-	-	-	-	-	-
Primary	0.1394	0.0827	0.1899	0.0876	0.0953	0.0806	0.0181	0.0071	9	4	-0.0110
Secondary+	0.2687	0.2224	0.5033	0.2924	0.1451	0.1461	0.0730	0.0427	36	22	-0.0303
Sum							*0.0911*	*0.0498*	*45*	*25*	*-0.0414*
Number of living children											
None	-	-	-	-	-	-	-	-	-	-	-
One child	-0.0925	0.0308	-0.1112	0.0354	0.1960	0.2032	-0.0218	0.0072	-11	4	0.0290
Two-to-three children	-0.1306	-0.0411	-0.1372	-0.0419	0.2484	0.1759	-0.0341	-0.0074	-17	-4	0.0267
Four or more children	-0.1894	-0.1073	-0.1550	-0.0965	0.1377	0.1777	-0.0213	-0.0171	-11	-9	0.0042
Sum							*-0.0772*	*-0.0173*	*-38*	*-9*	*0.0599*
Women's decision-making											
All three decisions	-0.0719	-0.0813	-0.0639	-0.0764	0.1994	0.2003	-0.0127	-0.0153	-6	-8	-0.0026
Some joint-decisions	-0.0740	-0.0845	-0.0651	-0.0789	0.2008	0.2001	-0.0131	-0.0158	-6	-8	-0.0027
None	-	-	-	-	-	-	-	-	-	-	-
Sum							*-0.0258*	*-0.0311*	*-13*	*-16*	*-0.0053*
Media exposure (Yes)	0.4267	0.3076	1.1374	0.4777	0.2622	0.0048	0.2982	0.0023	147	1	-0.2959
Skilled antenatal care	0.0975	0.1053	0.1114	0.1114	0.1937	0.1933	0.0216	0.0215	11	11	0.0000
Residence in rural areas	-0.2108	-0.1888	-0.1630	-0.1723	0.0789	0.0558	-0.0129	-0.0096	-6	-5	0.0032
Region											
Eastern	-	-	-	-	-	-	-	-	-	-	-
Northern	-0.1316	-0.3576	-0.0832	-0.2435	0.1465	0.2053	-0.0122	-0.0500	-6	-25	-0.0378
Southern	0.0503	-0.1199	0.0679	-0.1335	0.2134	0.2663	0.0145	-0.0356	7	-18	-0.0500

Characteristics	Coefficient		Elasticity		CI		Absolute contribution		% contribution		Change
	2008	2013	2008	2013	2008	2013	2008	2013	2008	2013	
Western	0.0706	-0.1126	0.1011	-0.1269	0.3609	0.2884	0.0365	-0.0366	18	-19	-0.0731
Sum							*0.0388*	*-0.1221*	*19*	*-62*	*-0.1609*
Total observed							0.3714	-0.0499	184	-25	-0.4214
Residual							*-0.1693*	*0.2462*	*-84*	*125*	*0.4155*
Total							0.2022	0.1963	100	100	-0.0059

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

Note: CI = concentration index.

Table A7.8: Erreygers concentration indices for skilled birth attendants in Sierra Leone, 2008 and 2013

Index	Index value		Robust SE		p-value		CI(2013)-CI(2008)
	2008	2013	2008	2013	2008	2013	
Erreygers normalised CI	0.3302	0.2503	0.026	0.023	0.000	0.000	-0.0800

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

Note: SE = standard error; CI = concentration index.

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Table A7.9: Decomposition of inequality in for skilled birth attendants in Sierra Leone (2008 and 2013) and their changes

Characteristics	Coefficient		Elasticity		CI		Absolute contribution		% contribution		Change
	2008	2013	2008	2013	2008	2013	2008	2013	2008	2013	
Maternal age											
<20	0.0570	0.1259	0.0549	0.1372	0.3249	0.2298	0.0178	0.0315	5	13	0.0137
20-29	0.0903	0.1106	0.0940	0.1177	0.3371	0.2423	0.0317	0.0285	10	11	-0.0032
30-39	0.0694	0.0285	0.0689	0.0264	0.3184	0.2510	0.0219	0.0066	7	3	-0.0153
40-49	-	-	-	-	-	-	-	-	-	-	-
Sum							*0.0714*	*0.0667*	*22*	*27*	*-0.0048*
Marital status											
Never married	0.1566	0.1277	0.2326	0.1589	0.2125	0.2411	0.0494	0.0383	15	15	-0.0111
In union	-0.0662	-0.0346	-0.0636	-0.0336	0.3217	0.2323	-0.0204	-0.0078	-6	-3	0.0126
Formerly married	-	-			-	-	-	-	-	-	-
Sum							*0.0290*	*0.0305*	*9*	*12*	*0.0015*
Maternal education											
No education	-	-	-	-	-	-	-	-	-	-	-
Primary	0.2019	0.0876	0.2661	0.0924	0.2898	0.1318	0.0771	0.0122	23	5	-0.0649
Secondary+	0.3739	0.2506	0.6445	0.3327	0.1686	0.2087	0.1086	0.0694	33	28	-0.0392
Sum							*0.1857*	*0.0816*	*56*	*33*	*-0.1041*
Number of living children											
None	-	-	-	-	-	-	-	-	-	-	-
One child	-0.0842	0.0298	-0.0929	0.0347	0.3455	0.2673	-0.0321	0.0093	-10	4	0.0414
Two-to-three children	-0.1074	-0.0552	-0.1126	-0.0564	0.3683	0.2309	-0.0415	-0.0130	-13	-5	0.0284
Four or more children	-0.1779	-0.1335	-0.1569	-0.1189	0.2545	0.2182	-0.0399	-0.0259	-12	-10	0.0140
Sum							*-0.1135*	*-0.0297*	*-34*	*-12*	*0.0838*
Women's decision-making											
All three decisions	-0.0750	-0.0867	-0.0694	-0.0815	0.3184	0.2445	-0.0221	-0.0199	-7	-8	0.0022
Some joint-decisions	-0.0688	-0.0876	-0.0647	-0.0822	0.3053	0.2680	-0.0198	-0.0220	-6	-9	-0.0023
None	-	-	-	-	-	-	-	-	-	-	-
Sum							*-0.0419*	*-0.0420*	*-13*	*-17*	*-0.0001*
Media exposure (Yes)	0.4382	0.3593	0.8853	0.5726	0.0981	-0.0251	0.0869	-0.0144	26	-6	-0.1013
Skilled antenatal care	0.1674	0.1302	0.1929	0.1391	0.3383	0.2509	0.0653	0.0349	20	14	-0.0304
Residence in rural areas	-0.3367	-0.2572	-0.2638	-0.2289	0.1083	0.0695	-0.0286	-0.0159	-9	-6	0.0127
Region											
Eastern	-	-	-	-	-	-	-	-	-	-	-
Northern	-0.2274	-0.3546	-0.1469	-0.2465	0.1927	0.2473	-0.0283	-0.0610	-9	-24	-0.0327
Southern	0.0302	-0.1301	0.0379	-0.1394	0.3365	0.2717	0.0127	-0.0379	4	-15	-0.0506

Characteristics	Coefficient		Elasticity		CI		Absolute contribution		% contribution		Change
	2008	2013	2008	2013	2008	2013	2008	2013	2008	2013	
Western	0.1353	-0.0277	0.2030	-0.0344	0.2949	0.2549	0.0599	-0.0088	18	-4	-0.0686
Sum							*0.0443*	*-0.1076*	*13*	*-43*	*-0.1519*
Total observed							0.2987	0.0041	90	2	-0.2946
Residual							*0.0316*	*0.2461*	*10*	*98*	*0.2146*
Total							0.3302	0.2503	100	100	-0.0800

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

Note: CI = concentration index.

Table A7.10: Erreygers concentration indices for contraception in Sierra Leone, 2008 and 2013

Index	Index value		Robust SE		p-value		CI(2013)-CI(2008)
	2008	2013	2008	2013	2008	2013	
Erreygers normalised CI	0.1273	0.1244	0.012	0.012	0.000	0.000	-0.0028

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

Note: SE = standard error; CI = concentration index.

Table A7.11: Decomposition of inequality in for contraception in Sierra Leone (2008 and 2013) and their changes

Characteristics	Coefficient		Elasticity		CI		Absolute contribution		% contribution		Change
	2008	2013	2008	2013	2008	2013	2008	2013	2008	2013	
Maternal age											
<20	-0.0832	-0.0782	-0.0121	-0.0365	0.0044	0.0747	-0.0001	-0.0027	0	-2	-0.0027
20-29	-0.0263	-0.0042	-0.0220	-0.0038	0.1085	0.1464	-0.0024	-0.0006	-2	0	0.0018
30-39	0.0087	0.0469	0.0110	0.0571	0.1720	0.1355	0.0019	0.0077	1	6	0.0058
40-49	-	-	-	-	-	-	-	-	-	-	-
Sum							*-0.0005*	*0.0044*	*0*	*4*	*0.0050*
Marital status (cohabiting)	0.0010	0.0843	0.0010	0.1252	0.1719	0.1796	0.0002	0.0225	0	18	0.0223
Maternal education											
No education	-	-	-	-	-	-	-	-	-	-	-
Primary	0.0513	0.0500	0.0679	0.0579	0.1421	0.1545	0.0096	0.0090	8	7	-0.0007
Secondary+	0.1658	0.1170	0.4503	0.1827	0.0998	0.1199	0.0449	0.0219	35	18	-0.0230
Sum							*0.0546*	*0.0308*	*43*	*25*	*-0.0237*
Number of living children											
None	-	-	-	-	-	-	-	-	-	-	-

Characteristics	Coefficient		Elasticity		CI		Absolute contribution		% contribution		Change
	2008	2013	2008	2013	2008	2013	2008	2013	2008	2013	
One child	0.0350	0.0899	0.0225	0.0755	0.0978	0.1657	0.0022	0.0125	2	10	0.0103
Two-to-three children	0.0665	0.1148	0.0683	0.1136	0.1484	0.1517	0.0101	0.0172	8	14	0.0071
Four or more children	0.0947	0.1521	0.1297	0.1845	0.1566	0.1050	0.0203	0.0194	16	16	-0.0009
Sum							*0.0326*	*0.0491*	*26*	*39*	*0.0165*
Women's decision-making											
All three decisions	0.0439	0.0499	0.0533	0.0553	0.1372	0.1455	0.0073	0.0081	6	6	0.0007
Some joint-decisions	0.0311	0.0396	0.0329	0.0414	0.1174	0.1214	0.0039	0.0050	3	4	0.0012
None	-	-	-	-	-	-	-	-	-	-	-
Sum							*0.0112*	*0.0131*	*9*	*11*	*0.0019*
Media exposure (Yes)	0.1544	0.1303	0.4402	0.2306	0.1265	-0.0611	0.0557	-0.0141	44	-11	-0.0698
Residence in rural areas	-0.1121	-0.1362	-0.0688	-0.1063	0.0420	0.0364	-0.0029	-0.0039	-2	-3	-0.0010
Region											
Eastern	-	-	-	-	-	-	-	-	-	-	-
Northern	-0.0177	-0.0505	-0.0095	-0.0373	0.0680	0.1227	-0.0006	-0.0046	-1	-4	-0.0039
Southern	0.0228	-0.0010	0.0234	-0.0010	0.0597	0.0826	0.0014	-0.0001	1	0	-0.0015
Western	0.1499	0.0978	0.3864	0.1595	0.1415	0.0909	0.0547	0.0145	43	12	-0.0402
Sum							*0.0554*	*0.0098*	*44*	*8*	*-0.0456*
Total observed							0.2062	0.1119	162	90	-0.0943
Residual							*-0.0790*	*0.0126*	*-62*	*10*	*0.0915*
Total							0.1273	0.1244	100	100	-0.0028

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

Note: CI = concentration index.

Selected Stata codes

Four or more antenatal visits

```stata
clear all

set matsize 800

set mem 1g

cd "…"

use "SLBR61FL ", clear

set more off



***************************************************************************



** WEIGHT VARIABLE

gen weight = v005/1000000



** SURVEY SET

gen psu =     v021

gen strata = v023

svyset psu [pw = weight], strata(strata) vce(linearized)



***************************************************************************
** RECODES



** For thesis

cap drop four_visits

recode m14 (98/99=.) (0 1/3 =0 "None or <4") ///

(4/32=1 "4+ visits"), gen(four_visits)

label var four_visits "Four antenatal visits"

label val four_visits four_visits



*****************************************************************************

qui regr four_visits [pw=weight]

drop if e(sample)!=1



** CHECK

tab four_visits [iw=weight]
```

```
svy: tab four_visits, count format(%4.0f)

svy: tab four_visits, percent format(%4.1f)

*****************************************************************************
```

Skilled antenatal care

```
clear all

set matsize 800

set mem 1g

cd "…"

use " SLBR61FL", clear

set more off


*****************************************************************************


** WEIGHT VARIABLE

gen weight = v005/1000000


** SURVEY SET

gen psu =    v021

gen strata = v023

svyset psu [pw = weight], strata(strata) vce(linearized)


*****************************************************************************

** RECODES

** For thesis

gen skilled_ANC    =        0

label define skilled_ANC 0"Unskilled" 1"Skilled provider"

label var skilled_ANC "Antenatal care from a skilled provider"

label val skilled_ANC skilled_ANC

foreach xvar of varlist m2a m2b m2c {

replace skilled_ANC=1 if `xvar'==1

}

*

*****************************************************************************
```

```
qui regr m2a m2b if v208 >0 & v208 !=. [pw=weight]

drop if e(sample)!=1

*******************************************************************************

** CHECK

tab skilled_ANC [iw=weight]


svy: tab skilled_ANC, count format(%4.0f)

svy: tab skilled_ANC, percent format(%4.1f)

*******************************************************************************
```

Facility-based deliveries

```
clear all

set matsize 800

set mem 1g

cd "…"

use " SLBR61FL", clear

set more off



*****************************************************************



** WEIGHT VARIABLE

gen weight = v005/1000000



** SURVEY SET

gen psu =     v021

gen strata = v023

svyset psu [pw = weight], strata(strata) vce(linearized)



*****************************************************************

** RECODES



** For thesis

recode m15 (99=.) (11/12 96 = 0 "Non-facility deliveries") ///

(21/36 = 1 "Facility-based deliveries"), gen(facility_delivery)
```

211

```
label var facility_delivery "Facility-based deliveries"

label val facility_delivery facility_delivery


******************************************************************************

qui regr facility_delivery [pw=weight]

drop if e(sample)!=1

******************************************************************************

** CHECK

tab facility_delivery [iw=weight]


svy: tab facility_delivery, count format(%4.0f)

svy: tab facility_delivery, percent format(%4.1f)

******************************************************************************
```

Skilled birth attendants

```
clear all

set matsize 800

set mem 1g

cd "…"

use " SLBR61FL", clear

set more off

****************************************************************


** WEIGHT VARIABLE

gen weight = v005/1000000


** SURVEY SET

gen psu =     v021

gen strata = v023

svyset psu [pw = weight], strata(strata) vce(linearized)

****************************************************************


** RECODES
```

```
** For thesis

gen skilled_birth = 0

label define skilled_birth 0"Unskilled" 1"Skilled"

label var skilled_birth "Birth delivered by skilled birth attendant"

label val skilled_birth skilled_birth


** SKILLED BIRTH ATTENDANTS RECODE

foreach xvar of varlist m3a m3b m3c {

replace skilled_birth=1 if `xvar'==1

}

*

*******************************************************************************

qui regr m3a m3b m3c if v208 >0 & v208 !=. [pw=weight]

drop if e(sample)!=1

*******************************************************************************

** CHECK

tab skilled_birth [iw=weight]


svy: tab skilled_birth, count format(%4.0f)

svy: tab skilled_birth, percent format(%4.1f)

*******************************************************************************
```

213
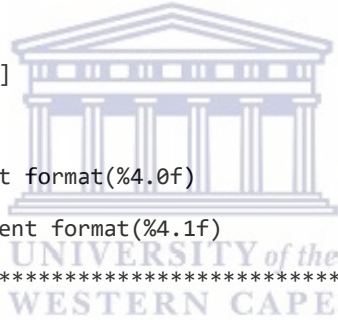
Contraceptive use

```
clear all

set matsize 800

set mem 1g

cd "…"

use " SLIR61FL", clear

set more off

***************************************************************************


** WEIGHT VARIABLE

gen weight = v005/1000000


** SURVEY SET

gen psu =    v021

gen strata = v023

svyset psu [pw = weight], strata(strata) vce(linearized)

***************************************************************************


** RECODES

** For thesis

recode v364 (3/4 =0 "Not using") (1/2=1 "Using"), gen(contraception)

label var contraception "Using contraceptive methods"

label val contraception contraception


** Marital status

recode v501 (0=0 "Never married") (1/2 = 1 "Married/Cohabiting") ///

(3/5=2 "Widowed/Divorced/Separated"), gen (marital_stat)

label var marital_stat "Marital status"

label val marital_stat marital_stat


****************************************************************************

qui regr contraception if marital_stat == 1 & marital_stat !=. [pw=weight]

drop if e(sample)!=1

****************************************************************************
```

214

```
** CHECK

tab contraception [iw=weight]


svy: tab contraception, count format(%4.0f)

svy: tab contraception, percent format(%4.1f)

********************************************************************************
```

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