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Inequalities in maternal and child health service utilization and health related quality of life in four emerging regions of Ethiopia: Implications for fertility and child survival

By: Tigist Shumet (MPH)

Supervisor: Professor Negatu Regassa (PhD)

March 2024

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A PhD Research dissertation submitted to Center for Population Studies, College of Development Studies, Addis Ababa University for the fulfillment of the requirements for the Degree of Doctor of Philosophy (PhD) in Population Studies

By: Tigist Shumet (MPH)

Supervisor: Professor Negatu Regassa

March 2024

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AUTHOR'S STATEMENT

I hereby, declare that this dissertation is my original work and that all sources of materials used for this dissertation have been duly acknowledged. The dissertation is submitted to the requirements for the Degree of Doctor of Philosophy (PhD) in Population Studies, at Addis Ababa University, Center for Population Studies, College of Development Studies.

I also declare that this dissertation is not submitted to any other institution anywhere for the award of any academic degree, diploma, or certificate.

Name: Tigist Shumet Signature_____ Date_____

DISSERTATION APPROVAL SHEET

This is to certify that the dissertation prepared by Tigist Shumet entitled: Inequalities in maternal and child health service utilization and health related quality of life in four emerging regions of Ethiopia: Implications for fertility and child survival. Submitted in fulfillment of the requirements for the degree of Doctoral Philosophy in Population Studies complies with the regulations of the university and meets the accepted standards with respect to originality and quality.

Signed by the examining committee:

External Examiner:_____ Signature _____Date_____

Internal Examiner: _____ Signature _____Date_____

Principal Advisor:_____ Signature _____Date_____

_____

Name and Signature of the Chair of the Examining Committee

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DEDICATION

Dedicated to my husband (Addis Tedla) and children (Yoakin and Eyoas)

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LIST OF ABBREVIATIONS AND ACRONYMS

AAU	Addis Ababa University
AIC	Akaike information Criterion
AIDS	Acquired Immune Deficiency Syndrome
ANC	Antenatal Care
AOR	Adjusted odd Ratio
BCG	Bacillus Calmette Guerin
BIC	Bayesian Information Criterion
BMI	Body Mass Index
CI	Confidence Interval
CI	Concentration Index
CoDs	Collage of Development Studies
COR	Crude Odd Ratio
CPR	Contraceptive Prevalence Rate
CSA	Central Statistics Agency
CSDH	Commission on Social Determinants of Health
DHS	Demography Health Survey
EA	Enumeration Areas
ECD	Childhood Development
EDHS	Ethiopian Demographic Health Survey
EFMOH	Ethiopia Federal Ministry of Health
EMDHS	Ethiopian Mini Demographic Health Survey
EmONC	Emergency Obstetric Newborn Care
EPHI	Ethiopian Public Health Institute
ESS	Ethiopian Statistics Service
FAC	Factor Analysis Score
FANC	Focus Antenatal Care
FGD	Focus Group Discussion
FMoH	Federal Ministry of Health
GTP	Growth and Transformation Plan
HEW	Health Extension Worker
HIV	Human Immune Virus
HRQoL	Health Related Quality of Life
HSDP	National Health Sector Development Program
HSTP	Health Sector Transformation Plan
IBM	International Business Machine Corporation
ICC	Intraclass Correlation Coefficient
IDIs	In-depth Interviews
IESO	Integrated Emergency Obstetric and Surgical Officers
IPV	Intimate Partner Violence

IUD	Intrauterine Devices
KII	Key Informant Interview
LBW	Low birth weight
LMICs	low- and Middle-Income Countries
LR	Log-likelihood Ratio
MCH	Maternal and Child Health
MDG	Millennium Development Goal
MoH	Ministry of Health
MOR	Median Odd Ratio
NGO	Non-Governmental organization
OLS	Ordinary Least Square
OR	Odd Ratio
PAF	Population Attributable Fractions
PCA	Principal Component Analysis
PHC	Population and Housing Census
PNC	Postnatal Care
QoL	Quality of Life
RII	Relative Index of Inequality
SaLTS	Saving Lives Through Safe Surgery
SBCC	Social Behavioral Communication and Counselling
SCI	Save the Children International
SD	Standard Deviation
SDGs	Sustainable Development Goals
SII	Slope Index of Inequality
SNNPR	Southern Nations Nationalities and Peoples Region
SPSS	Statistical Package for Social Science
TAF	Total Attributable Fraction
TFR	Total Fertility Rate
UNFPA	United Nations Fund for Population Activities
UNHCR	United Nation high Commissioner for Refuge
UNICEF	United Nations International Children's Emergency Fund
UN-IGME	United Nations Inter-Agency Group for Child Mortality Estimation
USAID	United States Agency for International Development
VIF	Variance Inflation Factor
WHDA	Women Health Development Army
WHO	World Health Organization

ABSTRACT

Background: *According to the 2021 UN Sustainable Development Report, Ethiopia ranks 136 out of 165 countries in terms of performance of the SDG 3.2, with a statistical performance index of 53.6 in a scale of 0 (Worst) to 100 (best). The 2016 Ethiopian Demographic and Health Survey (2016 EDHS) shows an increase in the coverage of maternal health services that includes antenatal care (ANC), delivery care, and postnatal care for the mother. However, such improvements are accompanied by a substantial increase in geographic and social inequalities in the utilization of the services. The inequalities are visible and unacceptably high between geographically bordering emerging regions of Ethiopia (Afar, Somali, Gambela and Benishangul) and other regions of the country. Therefore, this study aimed to examine the levels of inequalities in key maternal and child health service utilization in four emerging regions of Ethiopia: namely Afar, Somali, Benishangul Gumuz, and Gambela Regions, and its implications for fertility and child survival.*

Methods: *This study used data extracted from the 2016 Ethiopian Demographic and Health Survey, which was collected at the national level from January 18, 2016, to June 27, 2016, using a stratified two-stage cluster sampling method. The study focused on women aged 15-49 years living in those emerging regions of Ethiopia: However, in addressing the fourth objective of the study, a scoping review and qualitative primary data were collected from the two emerging regions of Ethiopia (i.e., Afar and Somali regions). This research had six objectives, and except for the 4th objective of this study, the remaining used univariate analysis to describe the characteristics of the women included in this study. The study used various analysis techniques that matched its specific objectives, based on the relevant literature. For the quantitative data, multivariate mixed effect logistic regression, Blinder-Oaxaca decomposition, partial ecological approach, and Population Attributable Fraction (PAF) were used to examine the associations, inequalities, predictors, and impacts of maternal health service utilization in Ethiopia. For the qualitative data, thematic analysis was conducted to explore experiences and practice of women and health workers regarding barriers in contraceptive utilization.*

Results*: This study found that women living in rural areas had a lower quality of life than those who are living in urban areas. Two socioeconomic factors, wealth index and educational attainment, explained a larger part of this inequality. The study also showed that there was a huge inequality in the demand and unmet need for contraception among women of age 15 to 49 years in the four regions. Several factors, such as women's and husband's education status, household wealth index, age of husband, husband's working status, region, and residence, were important predictors of the demand for contraception and*

unmet needs for contraception. The study revealed that there were significant urban-rural inequalities in the utilization of maternal health care services, such as antenatal care (ANC), place of delivery, and postnatal care (PNC), in the four regions. The study demonstrated that key maternal health services, such as place of delivery and current contraceptive use, and socioeconomic factors, such as religion, type of place of residence, and wealth index, influenced the inequalities in fertility preference among high-parity women in the four regions. In addition, the study also indicated that Current contraceptive use and place of delivery accounted for 117% of the conventional risk factors for fertility preference in those emerging regions. Finally, the study also indicated that ANC and place of delivery accounted for 49% of the conventional risk factors for child survival in those emerging regions.

***Conclusion**: The study examined the inequalities in MCH service utilization and HRQoL in four emerging regions of Ethiopia, and their effects on fertility and child survival. The study found significant urban-rural and socioeconomic inequalities in the quality of life, demand and unmet need for contraception, maternal health care services, fertility preference, and child survival among women and children in the four regions. The key factors that influenced these inequalities and outcomes were wealth index, education level, region, residence, religion, husband's working status, age of husband, ANC utilization, place of delivery, and current contraceptive use. The study also identified key maternal health services, such as place of delivery and current contraceptive use that accounted for half of the conventional risk factors that raised women's fertility preferences and reduced child survival in the study population.*

***Recommendation:** The study recommends that policymakers, stockholders, and researchers consider the following. Policymakers and local administrators should pay more attention to interventions that promote education and reduce the wealth gap among households in emerging regions of Ethiopia. Additionally, the government should enhance access to maternal health services, improve and reinforce existing fertility control programs and strategies, and advocate the benefits of using maternal health services in those regions. This would decrease inequalities in the use of key maternal health services and their impact on fertility and child survival in these four emerging regions. Finally, the study suggests that the government should prioritize improving service access and utilization by providing more budget and other resources to the respective disadvantaged regions and this will also help the desired decrease for existing inequalities. For future research, researchers may need to consider adopting a longitudinal design to track changes. They should also include other relevant variables that were omitted from this study, such as husband's perception, attitude, and influence on contraception use and unmet need, availability of service, and distance to the health facility.*

CHAPTER ONE

Introduction

1.1. Background

Maternal health refers to the health of women during pregnancy, childbirth, and the postpartum period. Maternal health is important for the families and for the communities as well as for the nation at large since it has a great implication for the health of women, the survival of the neonates and children (World Health organization (WHO), 2022). In low-income countries, primary cause of death in reproductive age is related to pregnancy complications (Jain et al., 2016; World Health Organization (WHO), 2022). The outcome of maternal health can be positive or negative for any reason related to childbirth or its management. The positive or favorable results include maternal satisfaction, positive birth outcomes (live births) without or with a medical intervention. Unfavorable or the negative outcomes of maternal health, in contrast, can include maternal illnesses (morbidities) of various kinds, miscarriage, stillbirth and death (Srivastava et al., 2015). The most commonly known maternal health interventions includes antenatal care service, delivery at health facilities, and postnatal care services (World Health organization (WHO), 2022).

Antenatal care (ANC) is a service given to pregnant women by a skilled health care provider. This service is given during pregnancy to ensure better health outcomes to both the mother and the newborn (Stenberg et al., 2021). Studies indicated that ANC could reduce both morbidity and/or mortality and improves newborn health (Gabrysch & Campbell, 2009; Mpembeni et al., 2007). Antenatal care service was initiated in the 1900s in most developing countries (Mcdonagh, 1996). Initially, traditional antenatal care model was applied for pregnant mothers. This Model of antenatal care requires a number of routine and frequent visits by pregnant women to the healthcare facility (make up to 16 antenatal visit regardless of their risk status)(Mcdonagh, 1996). And then starting from 2002, focused antenatal care (FANC) was introduced.

In FANC models in the case of uncomplicated pregnancies, there will be at least four antenatal care visits (WHO, 2003). But recent evidence compared the traditional model and the FANC model; and the FANC model is associated with more adverse events especially increased perinatal mortality. Therefore, WHO in 2016 recommended eight contacts rather than four visits, among other interventions (World Health Organization(WHO), 2016). In this regard, insufficient

ANC visits or delays in visits or reduced number of ANC visits may lead to poor pregnancy outcomes(World Health Organization (WHO), 2022). On the other hand, previous study argue that except where the antenatal care service is becoming a bridge to birth in the health facility, it cannot help much to identify and treat the major obstetric complications that commonly occur during and after delivery (USAID, 2007).

Another key maternal and child health intervention is health facility delivery. Giving birth in a healthcare facility with the assistance of skilled birth attendants can significantly reduce the rates of maternal morbidity and mortality (Mselle et al., 2013). Using health facility during birth is also playing a crucial role in prevention of stillbirths and enhance the survival of a new-born child (Gabrysch & Campbell, 2009). But there was a controversy on home birth and facility delivery; some believe that home birth method has significant psychological advantages (Zielinski et al., 2015). As women are surrounded by their families, the bond between the baby and mother is strengthened. Many are concerned on the intervention provided in hospital which is an excessive intervention in which they consider to be a childbirth is a natural event (Davis et al., 2011). In addition, some of the intervention provided in hospital are considered as unnecessary (e.g. cesarean section, episiotomy, oxytocin stimulation, and routine monitoring of the fetal heart rate) (Davis et al., 2011). On the other hand, hospitals can manage different severe birth complications, such as eclampsia, hemorrhage (due to placenta previa or abruptio placenta), and uterine rapture. Since those severe complications are difficult to predict or manage outside of the hospital, timely medical intervention within a hospital setting is crucial for ensuring the safety of both the mother and the baby (WHO, 2017).

One of the needed services that must be provided in the first two months after delivery is Postnatal Care (PNC). It is crucial to maximize maternal and newborn health. Postnatal care is usually considered as a golden opportunity for health service providers to train mothers on healthy breastfeeding practices, to screen mothers for a postpartum depression, monitor the infant growth and overall health status, to observe and treat childbirth-related complications, advice those women about the existing family planning options and refer/ link the mother and baby for specific care if needed, among other services (Jain et al., 2016; World Health Organization (WHO), 2013, 2022). According to a WHO recommended guideline, women and the newborn should get at least four postnatal care contacts with the health service provider after

childbirth. The first visit should be made as early as possible within 24 hours of birth. The remaining three recommended visit should be made between 48 and 72 hours, day 7 and 14th, and at six weeks postpartum(World Health Organization (WHO), 2022).

Another essential maternal and child health intervention is contraceptive use. Contraception is defined as the intentional prevention of conception through the use of various devices, sexual practices, chemicals, drugs, or surgical procedures. Contraceptive methods are classified into traditional and modern methods (Rakhi & Sumathi, 2011). There is a link between contraceptive use and fertility reduction (including planning, delaying and spacing pregnancies), unwanted pregnancy , and fall in maternal, infant and child mortality (United Nations, 2019; United Nations Department of Economic & Social Affairs, 2022). By utilizing their preferred contraceptive method, women can avoid the health risks associated with unwanted pregnancy (Kantorová et al., 2020). Previous studies around the world indicate that family planning increases survivability of both mothers and their infants (Boonstra, 2002; Brhanie & Tsegaye, 2016). Globally, use of modern family planning methods is saving over two million newborns and children every year (Rutstein, 2005). In addition, the level of contraceptive choice and use is a good proxy for the level of fertility (United Nations Department of Economic & Social Affairs, 2022; WHO, 2019)

However, there is also unmet need for FP where women experience an unsatisfied demand on contraception. Women with unmet need are the ones who are sexually active and fecund but they are not using any method of birth control, and they also do not want to have any more children or they usually need to delay their next child (Bongaarts & Bruce, 1995). Unmet need for FP is an additional contributor for higher rates of fertility which typically leads to a rapid increase in population (Wudineh et al., 2018). Moreover, unmet need for FP is a major cause for unwanted pregnancies and it has a huge contribution for mortality of mothers and children (Sedgh et al., 2016). Due to the unmet need, women's reproductive health is negatively affected. Further, it also affects women's participation in their economic and educational activities which is a critical step for a society which can be used to tackle a cycle of poverty and ill-health (Kabagenyi et al., 2014; Mosha et al., 2013).

In 2020, globally there was high under five mortalities i.e., on average, there were about 13,800 deaths daily. The main causes of high under five deaths are preventable diseases like pneumonia,

diarrhea, and malaria. In the same period (2020), Sub-Saharan Africa was the leading region with highest under-five mortality rate (United Nations, 2020; United Nations Inter-agency Group for Child Mortality Estimation (UN & IGME), 2021). Despite the progresses made in most sub-Saharan African countries, early mortality is still one of the most pressing public health problems there (EMoH, 2015). It is needless to mention that the role of proper maternal and child health interventions is great in the reduction of both under five mortality and morbidity among the most marginalized community members (children and women).

Population health is not merely on the basis of saving lives, but also in terms of enhancing the quality of lives and measuring quality of life among the vulnerable population (Centers for Disease Control and Prevention, 2000). The World Health Organization (WHO) described quality of life as a "state of complete physical, mental, and social well-being, and not merely the absence of disease and infirmity" (WHO, 2006). A personal well-being is defined as competence across all aspects of his/her personal life, acceptable human relationship, meaningful occupation, opportunities for contact with natural and man-made environments, social networks, creative expression, and making a positive contribution to society (WHO, 2006).

Health-Related Quality of Life (HRQoL) refers to how good a person performs in his/her life and he or she realized well-being in terms of physical, mental, and social domains of health. HRQoL also consist of whether an individual can perform a range of activities of the day-to-day life such as bathing or dressing him- or herself which is related with the physical functioning domain of health. Other related qualities of performance include the degree to which one can cooperate with family, friends, and others which is related with the social functioning domain of health. The functional element of HRQoL is composed of behaviors that can be seen by other people (Ferrans, 2018).

The presence of health inequalities in each population group indicates people in the same population group are not equally enjoying the maximum level of physical and mental health even if it is their right (NHS Health Scotland, 2015). Inequalities in access and utilization of health service is one of the most public health concerns in poor economies. Despite the modest progresses in service access and utilization, there are substantial inequalities within and between countries (WHO, 2010). Health care infrastructure, availability and readiness of the service and

maternal healthcare utilization are very low in rural areas (Ethiopian Public Health Institiute (EPHI), 2018; Kamal et al., 2016). Evidence indicates that the poor, less educated, those living in impoverished regions bear a disproportionately higher burden of ill-health and death, but contrary to expectation to have high access and intervention, in those area there is a disproportionately less access to health services and interventions than those who are better off (United Nations, 2011; Zere et al., 2007).

Ethiopia is one of the Sub-Saharan African countries with poor health service infrastructure and high health disparities across its various sub-populations (World bank, 2016). The present disparities in maternal and child health outcomes and interventions are worrisome. The Ethiopian Government claims that the country has been striving for ensuring universal access to health care through its national Health Sector Development Program (HSDP)(EMoH, 2015). Despite these efforts, the most recent national data (CSA & ICF, 2016) suggest that the country is still experiencing unacceptably high inequalities in health service access and coverage (Central Stastical Agency(CSA) & ICF, 2017). Maternal health care services are available in the four study regions (Afar, Somali, Benishangule Gumuz, and Gambela), which are also referred to is Emerging regions of Ethiopia. However, their availability varies from region to region, and the readiness of the service, which is measured by different tracer items (i.e., trained human power, equipment, commodities etc) is very low in all these study regions. In addition, the MCH service utilization is very low in the study regions (Ethiopian Public Health Institiute (EPHI), 2018).

1.2. Emerging regions of Ethiopia

This study focuses on four regions in Ethiopia: Gambela, Benishangul Gumuz, Afar, and Somali. These regions are known as the emerging regions of the country (Gebre-Egziabhere, 2018; Hussen et al., 2023; UNHCR, 2018). However, they have lagged-behind other regions in terms of development (Gebre-Egziabhere, 2018; UNHCR, 2018). They also have distinct features in their geography, demography, and economy. They have suffered from the effects of previous development policies of the country and have been marginalized and impoverished for a long time, leading to poor socio-economic outcomes and various problems such as insecurity, drought, and displacement (Gebre-Egziabhere, 2018).

The term "emerging regions" reflects the difficulties and possibilities that these regions face within the Ethiopian context. It suggests that these regions have the potential to improve their situation and actively contribute to the national development agenda and the federal system of Ethiopia. It also signifies that these regions can assert their identity and autonomy, pursuing their own interests and goals. To achieve a fair and inclusive development in these regions, it is crucial to give voice to the people residing there, particularly the youth, women, and minority groups who often face marginalization and vulnerability. It is beneficial to gain insights from the experiences and lessons of other nations or regions that have faced comparable situations of exclusion and underdevelopment. By adopting approaches that are suitable and respectful of the diverse and intricate nature of these regions, we can effectively address their challenges (UNHCR, 2018).

These regions are situated at opposite ends of the country, with pastoral communities (Ministry of Federal Affairs, 2007) residing in the east (Somali and Afar), and agro-pastoral communities in the west (Benishangul-Gumuz & Gambela). Both types of communities face various obstacles, such as water scarcity, nomadism, malaria, sleeping sickness, and underdevelopment. Additionally, the literacy rates are alarmingly low in both pastoral and agro-pastoral regions. The emerging regions have small, scattered, and nomadic populations, which pose challenges in delivering public services. Furthermore, most areas lack proper road infrastructure and social amenities. Moreover, there is a scarcity of experts in these fields. The regions are characterized by distinct ethnic groups (five each for Gambela and Benishangul-Gumuz), which significantly impact project implementation, particularly in the west where conflicts are frequent, and the security situation remains unstable (Gebre-Egziabhere, 2018; Hussen et al., 2023). In addition these regions have not witnessed significant progress or triumph over the underlying factors that have marginalized and hindered their development (Tegegne, 2015; The World Bank, 2013; UNHCR, 2018; World Bank Group, 2016).

1.3. Statement of the problem

Enhancing the maternal and child health service is an integral component of Sustainable Development Goals (SDGs). The SDG 3.2 targeted to end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to as low as

12 per 1,000 live births and under-5 mortality to 25 per 1,000 live births (WHO, UNICEF, UNFPA, 2019).

The 2021 UN sustainable development report indicated that Ethiopia ranks 136th out of 165 countries in terms of performance of the SDG 3.2, with statistical performance index of 53.6 in a scale of 0 (Worst) to 100 (best)(ONU, 2021). The 2019 Ethiopia Mini Demographic and Health Survey (2019 EMDHS) shows an increase in the coverage of maternal health services that includes antenatal care (ANC), delivery care, and postnatal care for the mother (EPHI & ICF, 2021).However, such improvements are accompanied by substantial increase in geographic and socioeconomic inequalities in the utilization of the services. The inequalities are visible and unacceptably high between geographically peripheral regions (Afar, Somali, Gambela and Benishangul) and other regions of the country.

For instance, 43% of pregnant mothers attended antenatal care four or more times but we also see a very low prevalence in regions like Afar 31%, Somali 11%, and Gambela 32%. In urban areas, 59% of pregnant mothers attended antenatal care four or more times but in the rural area only 34% of pregnant mothers attended antenatal care four or more times (EPHI & ICF, 2021). The percentage who received facility-based delivery service was 48% at national level, but in urban areas it accounts 70 % and in rural area it accounts 40 %, while the percentage of facility based delivery indicated very low in Afar region with 28% and Somali region 23% (EPHI & ICF, 2021). About 34 % of women in Ethiopia received WHO recommended postnatal care services within two days. Studies indicated in urban areas 48% and rural area 29 % of women's get WHO recommended postnatal care services ,whereas the rates are 24 % in Afar ,10 % in Somali region, 45% Benishangul Gumuz, and 55% Gambela (EPHI & ICF, 2021). The prevalence of contraceptive use in Ethiopia among currently married women is 41% nationally, but in urban areas it is 50 % and in rural areas 38%. The figure is unacceptably low in Afar with 13% and Somali with 3%. This indicates that there is significant variations across geographic region and socio-economic groups situated residing the same country (EPHI & ICF, 2021).

Given this, studies focusing on inequalities in maternal and child health service and their impacts on key health outcome (child survival and fertility) are relatively scarce in Ethiopia. The very

few studies conducted around maternal and child health were based on only one or two indicators or focused on a specific localities or region/ district (e.g Bahilu et al., 2012; Delele et al., 2021; Gurmesa, 2009; Tiruaynet & Muchie, 2019; Tsegay et al., 2013; Woyessa & Ahmed, 2019; Wudineh et al., 2018). Nearly all previous studies on maternal and child health service interventions were limited in addressing the factors / determinant of a single MCH service such as ANC and place of delivery (e.g. Oduse et al., 2021), place of delivery (e.g Habibov & Fan, 2014; Nathan & Mwanyangala, 2015). To the best of the author's knowledge, there were little attempts made to assess the implications of those commonly known MCH services on child survival and fertility, two key demographic parameters. Systematic monitoring and investigation of these impacts will provide relevant information for policymakers concerned with reducing inequalities. Further, despite the marked improvement in health-related quality of life of people at the national level, substantial inequalities among the different socio-economic subgroups persist. Following the health-related quality of life in different populations (such as rural and urban) will help and guide policies or interventions to improve the population health status and to make fare distribution of the available resources to leverage the health of the society at large.

Therefore, the proposed study will address an urgent area of need i.e., It investigated the magnitude of disparities in key MCH services (ANC, PNC, health facility delivery, and FP), and further investigated the population level impacts of these sets of variables on child survival and fertility intentions in the four regions. The techniques which were used in this study included a Population Attributable Fraction (PAF) that examined the proportional reduction in less than five mortality and fertility that would be achieved by removing the risk factors (poor utilization of MCH services), health related quality of life by using a composite indicator as outcome variables and decomposition techniques which examined the inequality.

1.4. Objectives of the study

The main objective of the study is to examine the levels of inequalities in key maternal and child health service utilization and health related quality of life in four emerging regions (Afar, Somali, Benishangul Gumuz, and Gambela) of Ethiopia and its implications for fertility and child survival.

The specific objectives include:

1. To examine the inequalities in health-related quality of life among women of reproductive age in urban and rural emerging regions of Ethiopia. (chapter 4)
2. To assess the inequalities in the demand and unmet need for contraception among women in the emerging study regions. (chapter 5)
3. To explore Barriers to modern contraceptive utilization in very high fertility regions of Ethiopia. (chapter 6)
4. To conduct ecological (cluster) analysis of maternal health care utilization (ANC, delivery in health facility, and postnatal care) in the study regions. (chapter 7)
5. To explore the impacts of utilization of key maternal health services on fertility preference among high-parity women in emerging regions. (chapter 8)
6. To assess the population level impacts of inequalities in MCH service utilization on child survival in emerging regions. (chapter 9)

1.5. Research questions

1. What are the key predictors of rural-urban disparities in maternal health related quality of life?
2. What are the key individual/ maternal/, household and community level factors predicting maternal health service utilization?
3. What are the key predictors of inequalities in the demand and unmet need for contraception?
4. What are the barriers for the use of contraception in regions with the highest fertility level (Afar and Somali regions)?
5. How much is the proportional reduction in less than five mortality and fertility attributable to MCH service utilization in the four regions of Ethiopia?

1.6. Significance of the study

The rationale of conducting this study is twofold. First, as the primary focus of this study is to examine the inequalities using comprehensive health inequality indicators from representative data, the findings is useful on a national/regional scale in assessing the progress in the fight against morbidity and mortality among women and children. It can inform planners and policymakers at both the national and regional levels, gaps and key predictors of the outcomes of interest. Many non-governmental organizations (NGOs), private organizations and community-

based organizations in Ethiopia, which are engaged in maternal and child health, will benefit from such a comprehensive study for their planning, geographic targeting and monitoring and evaluating programs. Further, adequate and reliable information can help policy makers and programme managers assess the effectiveness of strategies, formulate appropriate interventions to prevent deaths from childhood illnesses and unwanted birth, and improve the health of children and reduced high fertility in the country through improvement of access and service uptake (Azage et al., 2015). Secondly, over the past few years, there has been a growing interest in studies focusing on health inequalities, particularly in developing countries. Results obtained from this study, including the research articles to be published in peer-reviewed international journals, will add to the body of knowledge, and contribute to the discourse on issues of health inequalities among disadvantaged populations, a topic of growing importance in Ethiopia and Sub-Saharan Africa. The study also has methodological contribution/relevance as it uses certain innovative approaches in measuring inequalities (decomposition analysis) and population level impacts of service utilization (Population Attributable Fractions) which are rarely used in large scale data.

1.7. Organization of the Thesis

This study has ten chapters. The first chapter presented the background of the study, the exiting policy environment, statement of the problem, purpose/ objectives of the study, research question, significance of the study, and organization of the thesis. Chapter two presents the literature review with two major compartments i.e., the theoretical review of related literature and the empirical review of literature, accompanied by a conceptual framework of the study. Chapter three presents the methodology of the study which includes study area, data source, measurements of the study, data analysis, definitions of key terms, and ethical clearance and considerations and the list of manuscripts. Chapter-four to nine were devoted to individual papers/ manuscripts on six interrelated subjects. Chapter ten presents major findings, conclusion, and policy implication.

CHAPTER TWO

Literature Review

This chapter presents related literature which contains both theoretical and empirical reviews of previous studies. Based on the inputs from those related literatures, a conceptual framework of this study is developed.

2.1. Theoretical review of literature

2.1.1. Health inequality

Solar and Irwin (2010) develop a framework called Commission on Social Determinants of Health (CSDH) which is set up by the World Health Organization (WHO). The framework shows the different types of social determinants of health, and the causal relationship between these factors and health. In addition, this framework also assists in arranging policy interventions to deal with the various healthcare issues in an effective and efficient manner. According to CSDH framework, there are two levels of social determinants of health, namely the structural determinants and the intermediary determinants. In the structural determinants, the socioeconomic and political context generates and keeps the social hierarchies through public policies, political and social structures, education system, and the labor market. This background generates the social hierarchies through a set of structural mechanisms which includes income, education, occupation, social class, gender, and ethnicity. These mechanisms with their environment which generates them and their subsequent socioeconomic stance in general are titled the social determinants of health. Thus, the social determinants of health determine variations in people's exposure and vulnerability to an additional type of determinants which is also called the intermediary determinants of health; here the intermediary determinants of health have a direct impact on health as they determine the vulnerability and exposure to factors that affect individuals' health. Such determinants include material circumstances, psychosocial circumstances, behavioral factors, biological factors, and the health system. Therefore, the structural mechanisms that shape social hierarchies, according to these keys stratifies which are the root cause of inequities in health (Solar & Irwin., 2010) .

2.1.2. Fertility

Various studies suggested that maternal and child health services have an impact on fertility behavior. Maternal and child health services reduces mortality and because of this they were promoted as an important influencer on couples' fertility-related behaviors (Caldwell, 1986; Foster, 2015; Pebley, 1984). Family planning programs which promote contraceptive use and choices of effective FP methods, have significant impact on couples' childbearing behavior (Angeles et al., 1998; Entwisle et al., 1996). The theories suggest a person's intent to engage in a particular behavior which makes it easier for that person to practice that behavior (Moshi et al., 2020). Gender and violence norms, women's role in society, stigma and discrimination related to education, social status, ethnicity, and social capital are factors of health equity in health systems. The above mentioned factors of health equity have an impact on the women's health seeking behaviors (Moshi et al., 2020). Maternal and Child health services have limited effect on fertility behavior, but they will have more influence when combined with other family planning services and other key aspects of community contexts. Child mortality is identified as a triggering factor for high number of children since to get their minimum number of a family size, couples are usually motivated to have more children which can be concluded as having association in child mortality and fertility (Lloyd & Ivanov, 1988; Mason, 1997; Pebley, 1984; Schultz, 1978). Therefore, to maintain the health of young children, and reduce mortality, it is crucial to expand maternal and child health services which lead to the control of the number of children in a family (Sandberg, 2006).

2.1.3. Child survival

Mosley and Chen in 1984 suggested a new analytical context for the study of determinants of child survival in developing countries. Unlike other studies, their methodology combines both social and biological variables and incorporates research methods used by the social and medical researchers. It also sets measurement of morbidity and mortality in one variable. Their framework assumes that "all social and economic determinants of child mortality necessarily operate through a common set of biological mechanisms, or proximate determinants, to exert an impact on mortality". They identified five categories of proximate determinants namely maternal factor, environmental contamination, nutrient deficiency, injury, and personal illness control. Among those, the maternal factors comprise age, parity, and birth interval which have an

influence for both the pregnancy outcomes as well as child survival, and the nutrient deficiency factors include deficiencies of calories; protein; micronutrients (vitamins and minerals); here the availability of those nutrients influence both the survival of the child and the mother health. Usually intake of food which has high nutritional value during pregnancy determines the weight at birth and also the breast milk quantity and quality (Mosley &Chen, 1984).

A study done by Schultz with a goal to examine the basic biological and behavioral relationships which determine child survival allows us to evaluate the advantages of technology-based health interventions as well as the socio- economic change. Both factors affect the potential for child survival through influencing people's opportunities and by their use of health-related inputs. This study indicates, the microeconomic analysis which is the effort that describe the behavior of individuals or households economic and demographic performance placed on the hypothesis; "Individuals allocate their time and other basic types of economic resources in relation to the value of the time of each member of the household, the amount of the family's nonhuman capital endowments, and the relative prices of the family's market inputs and outputs". In many nations, giving a care to children acquired much of their mother's time, Therefore, to raise the opportunity cost of those children's to have their care, we should increase the opportunity of the women's time as compared to men's, this also reduces fertility, even there is an opportunity to income increase for the family. In Schultz study one of the priority issues taken for the research is the way in which the mother's education affects child mortality (Schultz, 1978, 1984).

2.2. Policy environment

The 1993 National Health Policy i.e., Health Policy of the transitional government of Ethiopia, takes family health services as one of its priorities together with its various developed and implemented policies and strategies. These policies encourage the prevention and elimination of maternal and child mortality and morbidity. The policies indicated adequate maternal health care and referral facilities for high-risk pregnancies as well as the intensification of family planning for the optimal health of the mother, child and family and stated as a priority for the country (EFMOH, 1993).

After the 1993 National Health Plan, Ethiopian health sector has successfully accomplished the two decades sectoral program i.e., the National Health Sector Development Program (HSDP)

which was implemented in four series of each five-year longer. They are commonly known as HSDPs I to IV which commenced in 1997/1998 with HSDP-I and ended in June 2015 with HSDP-IV. This was part of the first Growth and Transformation Plan (GTP) of the country. In those series of HSDP, the maternal health was taken as one of the top health priorities for the Ethiopian government. Here, a wide variety of political/administrative structures were developed and implemented to enhance maternal health. Moreover, other strategies such as Making Pregnancy Safer, Reproductive Health Strategy, Adolescent and Youth Reproductive Health Strategy in 2006 and the Revised Abortion Law in 2005 had mainly targeted at reducing maternal morbidity and mortality (EFMOH, 1993, 2016; Wada, 2008).

The Ethiopian government Health Care Financing Strategy was intended to provide financial protection for key maternal health services. The main intention was to implement quality improvement initiatives aimed at priority health conditions and diseases like maternal and child health, communicable diseases; malnutrition, chronic/non-communicable diseases; and clinical and surgical services (Wada, 2008). Further to the above policies and strategies, the Ethiopian Ministry of Health (MOH) has established the Millennium Development Goals' (MDGs) which was a performance package fund that gave top priority to achieve Millennium Development Goals 4 and 5 (Goal 4 Reduce child mortality, and Goal 5 Improve maternal health) which was planned to facilitate the mobilization of funding opportunities to progress the maternal health.

In addition, Ethiopia also made and implemented packages of the Health Extension Program which has training, and deployment of Health Extension Workers (HEWs). One of the major areas and packages of the Health Extension Program is family health services which indicate maternal and child health, family planning and immunization as a priority area with the aim of reducing maternal and child morbidity and mortality. Furthermore, the Health Extension Program also reinforces/ increases the engagement of the community and create a link between the health facilities and the community (Caglia et al., 2014). The Ministry of Health (MoH) also implemented Integrated Emergency Obstetric and Surgical Officers (IESO) program which is a key component of the Ethiopian Federal Ministry of Health (FMoH)'s Saving Lives through Safe Surgery (SaLTS) initiative, which is part of the Health Sector Transformation Plan (HSTP). SaLTS underscores Ethiopia's strong commitment to increase access to safe emergency surgical and obstetric care to all sections of the population (FMOH, 2021; Jain et al., 2016). Moreover,

Women Development Army was activated and specifically Women Health Development Army (WHDA) has been put in place. They usually support the HEWs to improve health care service delivery including the maternal and child health services (Jain et al., 2016).

The National Child Survival Strategy (2005 – 2015) and its subsequent second cycle (2015-2020) were instrumental in guiding the design and implementation, of high impact newborn and child health interventions in the country (FMOH, 2015). The major objective of the National Newborn and Child Survival Strategy (2015/16-2019/20) was to reduce the infant and neonatal mortalities to 29 per 1000 children, 20 per 1000 live births and 11/1,000 live births, respectively (FMOH, 2015; Federal Ministry of Health, 2015). For this reason, the strategy document identified and prioritized 39 high impact and cost effective newborn and child survival interventions (FMOH, 2015; Federal Ministry of Health, 2015).

Childhood Development (ECD) programme is another government intervention aiming for healthy, productive, and prosperous citizens. The Ethiopian government has long acknowledged the importance of investing in ECD and is committed to designing and implementing a programme across various sectors. The national ECD strategic plan 2020/21-2024/25 aims to design and implement programs that ensure all children grow and thrive in a secure, safe, and nurturing environment, supporting the Sustainable Development Goals (SDGs) agenda and the 2030 target for child health and wellbeing (FMOHE, 2020).

To sum up, the Ethiopian government has made significant financial and programming investments in the implementation of the various health policies and programs, more specifically to Ethiopian Health Sector Development Program (HSDP). It has allocated extensive resources and made educational opportunities and healthcare services available to rural communities in Ethiopia. Most policies and programs described above are relatively newer, and their impacts are yet to be seen in a few years' time. However, there are momentous changes in the health condition of the population that were apparently due to the implementation of these policies and strategies.

It is believed that the policies and strategies in place had a range of positive impacts in improving the maternal and child health status in the country. For instance, the end of HSDP-I

resulted in increasing the contraceptive prevalence rate (CPR) from 9.8% to 17.2%, ANC coverage increase from 5% to 34% and postnatal service coverage increase from 3.5% to 7%. Upon the completion of HSDP-II by the year 2004/5, CPR increased to 25.2%, ANC coverage increased to 41.5%; and postnatal care attendance increased to 13.6%. Regarding child health, DPT3 coverage has reached 70% and proportion of fully immunized children has reached 44.4% (FMOH, 2005). The achievement recorded in HSDP-III in the year 2008/09 indicated that both antenatal care and FP coverage significantly increased, the percentage of deliveries assisted by skilled health personnel reached 18.4%. While Emergency Obstetric Newborn Care (EmONC) coverage also increased, even before the end of HSDP III, Ethiopia achieved its plan for measles immunization coverage (FMOH, 2010). In addition to the above listed programs, community health extension program of Ethiopia also enabled the country to achieve significant improvements in maternal and child health services (Assefa et al., 2019).

There were also challenges and constraints in the implementation of those policies. The major challenges raised during the implementation of HSDP, and other health sector polices includes understaffing and high turnover of both professional health service providers and managerial staff at all levels, insufficient follow-up and supportive supervision, inadequate public participation, lengthy process to procure goods and to recruit consultants from the international market. Further, poor program coordination especially at regional and woreda level as well as in synchronizing the activities of various development partners and inadequate implementation capacity in undertaking civil works are also the other challenges during HSDP implementation (Assefa et al., 2019; FMOH, 2005, 2010; World Bank, 2007).

2.3. Empirical review of literature

2.3.1. Inequalities in key maternal and child health care service utilization

The UNICEF data on antenatal care indicated that globally 87 % of pregnant women get the antenatal care given by skilled health personnel at least once during their pregnancy period. The same data indicate that less than 59% of women in the world get at least four antenatal care visits. In regions that have the highest rates of maternal mortality, like Western and Central Africa and South Asia, even less number of women get at least four antenatal care visits i.e. 53% and 49 %, respectively) (United Nations International Children's Emergency Fund(UNICEF),

2021). In addition, the lowest levels of antenatal care are observed in Sub-Saharan Africa and South Asia. In Sub-Saharan Africa, 72% of pregnant women had at least one ANC check-up. Among countries in this region, Ghana (91.9%), Cameroon (83.4%) and Nigeria (60.3%) had relatively higher prevalence of ANC (Igyuse et al., 2020). Evidence indicated that, 43% of those pregnant women in Ethiopia had at least four ANC visits in 2019, here this percentage in urban area is 59% and 34% in rural area (EPHI & ICF, 2021).

In 2020, birth assisted by a skilled attendant in the world reached 83% (World Health Organization (WHO, 2021b). Similarly, there are evidence indicating disparities among countries in delivery with the assistance of a skilled attendant. For instance, a study conducted in 74 Low- and Middle-Income Countries indicated that the lowest utilization of health facility delivery was recorded in Chad (23.7%) followed by Yemen (31.4%) and Niger (33.1%) (Mehedi et al., 2021). In the same study, it was reported that there was 18.3% annual increase in the delivery of pregnant women in Cambodia i.e. this rate was 0.6% in 1990 which increased to 94% in 2018 (Mehedi et al., 2021). In the same year in Guinea, the health facility delivery was 53% (Igyuse et al., 2020). Similarly, the institutional deliveries in Ethiopia has shown significant increment, which increased from 26% in 2016 to 48% in 2019, thus, with respect to the area; 70% is from urban and 40% is from rural (EPHI & ICF, 2021). Notably, the increasing trend in the utilization of health facility delivery in Sub-Saharan Africa countries was observed among pregnant women with higher income and those residing in urban areas (Joseph et al., 2016; WHO, UNICEF, 2015). It is common that women in the highest wealth quintile deliver their babies in a health facility by the assistance of a skilled birth attendant. On the other hand, home deliveries (with or without a killed birth attendant) was commonly practiced by women living in households with the poorest quintiles (Joseph et al., 2016). Only 34% of women in Ethiopia in the age group 15-49 receive a postnatal check within two days of delivery, and the vast majorities (66%) had no postnatal check within 2 days of delivery. Among newborns, only 34% of them received a postnatal check within two days of birth; in urban area this percentage is 48% and in rural area it is 29 % (EPHI & ICF, 2021).

A family planning is also an integral part of women's health service, especially among non-pregnant women in the reproductive age. In 2021, contraceptive coverage in the world accounted 76.8% (World Health Organization(WHO), 2021b). Family planning coverage in Africa

accounted for the lowest (57.1%). However, the coverage increases substantially compared to the global increase i.e., the global FP coverage increase in the last two decades was only 4% whereas the same period countries in Africa increased the average prevalence by 52% (World Health Organization (WHO), 2021). Starting from 2005, there has been a progressive increase in modern contraceptive usage among currently married women in Ethiopia, a change from 14% in 2005 to 41% in 2019, thus in urban area this percentage is 50% and in rural area it is 38% (EPHI & ICF, 2021).

2.3.2. Determinants of maternal and child health care service utilization

Women in developing countries are most often not able to obtain equivalent maternal and childcare services due to different reasons. The cross sectional study done in Kenya among pregnant women in selected hospitals reported that age, marital status, religion and employment status were identified as key determinants (Joshua et al., 2018). Using cross-sectional design and multilevel analysis, a study done in Pakistan shows husband's education, urban areas, level of education were identified as determinants(Sahito & Fatmi, 2018). The study conducted in Bangladesh identified party, administrative division, place of residence, mothers' and fathers' educational level, media exposure, wealth quintile, ANC provider and place of receiving ANC as key predictors (Islam & Masud, 2018). A quantitative case study done in Tanzania among Pregnant Women attending Edward Michaud Memorial Hospital Kinondoni, identified that gender of head of household, marital status, insurance cover, and education were main predictors of ANC service utilization (Mwinuka & Amosi, 2021). A secondary data analysis from EDHS 2005, 2011 and 2016 in Ethiopia revealed that those living in the rural areas, having higher birth order and Muslim religion followers had lower number of antenatal visit (Ousman et al., 2019).

Following the antenatal care, pregnant women need to go to health facilities for delivery service. A cross sectional study conducted in rural Pakistan showed that women were substantially less likely to deliver at a health facility after their first birth. Women with primary or higher education were much more likely to have an institutional delivery. Age, autonomy, household wealth, proximity to a health facility and exposure to mass media were identified as a determinant of health facility delivery (Agha & Carton, 2011). Another community based qualitative study conducted in Addis Ababa showed that physical access to health facility, risk perceptions and perceived quality of care were identified as main determinants of health facility

delivery (Mirkuzie, 2014). Cross-sectional community-based quantitative and qualitative study conducted in Ethiopia Somali region reported that women whose family members preferred health facilities were 14 times more likely to deliver at health facilities than women whose family members preferred a home delivery. Women who had nearby facilities to their residents were 13 times more likely to give birth in institutions than women who had no ability to access nearby health facilities. The same study identified that husband education and ANC attendances were key determinant of health facility delivery (Zepro & Ahmed, 2016).

Once the baby is delivered, both the mother and the baby need to have a postnatal care utilization (PNC) service. A study conducted in Pakistan showed that, household wealth had the largest impact on a PNC visit. PNC visits declined with parity: women with three children had a seven-percentage point lower use of PNC while women with five children had a 12-percentage point lower use of PNC compared to women with one child. Being in middle or higher education level was associated with a nine-percentage point increase in use of PNC. Weekly exposure to mass media was associated with a four-percentage point increase in PNC (Agha & Carton, 2011). A similar study conducted in rural India showed that women's education, social group, mass media exposure, wealth quintile, birth order and interval and health provider's visit were found to be significant factors affecting postnatal care utilization. The likelihood of utilizing postnatal care was found to be nearly three times higher among women from the richest wealth quintile than among those from the poorest wealth quintile (Singh et al., 2012). A study conducted in Nigeria showed that the age of mother at birth of the child, pregnancy wontedness, mothers education, religion, wealth status, child's birth order, distance to health facility, place of delivery were found to be some of the determinants of post-natal care utilization (Somefun & Ibisomi, 2016).

A study done in Ghana identified some determinants of contraceptive use which includes reproductive wishes and contraceptive experiences, spousal communication, and FP counseling during ANC (Wuni et al., 2017). A study done by Gurmesa and Mahlet used data collected for the performance monitoring for Action (PMA) 2018 of Ethiopia Round 6 indicated parity, future birth intention, and knowledge of contraceptive methods as key determinants of contraceptive method use among young women in Ethiopia (Gurmesa & Mahilet, 2021). A study based on Pakistan Demographic and Health Surveys datasets identified women's age, marital status including the duration of marriage, monthly family income, wealth index, working status of

women, and exposure to family planning information, women's and partner's education, occupation, wealth quintile, region, place of residence, and exposure to family planning messages as the key explanatory variables (Meherali et al., 2021).

2.3.3. Trends of fertility

One of the three main components of a population dynamics which determines the size, structure and the composition of a population is fertility. In three decades, the global fertility rate dropped from 3.2 live births per woman in 1990 to 2.5 in 2019. In the same fashion in Sub-Saharan Africa, total fertility dropped from 6.3 births per woman in 1990 to 4.6 in 2019. Sub Saharan Africa is well known by the highest fertility levels among regions of the world (United Nations, 2020b). Ethiopia is one of the countries in Sub-Saharan Africa experiencing a fast population growth and has one of the highest fertility rates in the region. The TFR of Ethiopia declined from 6.9 in 1990 to 4.3 children per woman in 2019 (Misganaw et al., 2022). There is a variation in TFR between regions and residences of Ethiopia. Based on the 2016 DHS result, Somali and Afar regions had unacceptably high total fertility rate with 7.2 and 5.5 children per woman, respectively. This indicates that both regions had higher TFR compared to the national estimates (Central Stastical Agency(CSA) & ICF, 2017).

2.3.4. Trends of under-five mortality

Child mortality is sometimes referred as under-five mortality, which is the probability of a child dying with the age between birth and exactly 5 years. It is expressed per 1000 live births. In 2020, on average, 13,800 children under the age of 5 years died daily around the world which is aggregated as 5 million children under 5 years death. The leading cause of death for under five children is infectious diseases which includes pneumonia, diarrhea, and malaria. But, there are also other causes like preterm birth and intrapartum-related complications leading to under five deaths (Sharrow et al., 2022; United Nations Inter-agency Group for Child Mortality Estimation (UN & IGME), 2021).

In three decades, the global child mortality rate decreased from 93 deaths per 1000 live births in 1990 to 38 in 2020 which accounts a 61% decline (UNICEF et al., 2020). Even if there is a significant progress in reducing child and under five mortality in the world, enhancing child survival remains a matter of urgent concern (Sharrow et al., 2022; United Nations Inter-agency

Group for Child Mortality Estimation (UN & IGME), 2021). Sub-Saharan Africa still has the highest rate of under-5 mortality globally, which is estimated at 75·8 (70·2–85·9) deaths per 1000 live births in 2019 i.e. one in 13 children dying before celebrating their 5 year birthday (Sharrow et al., 2022).

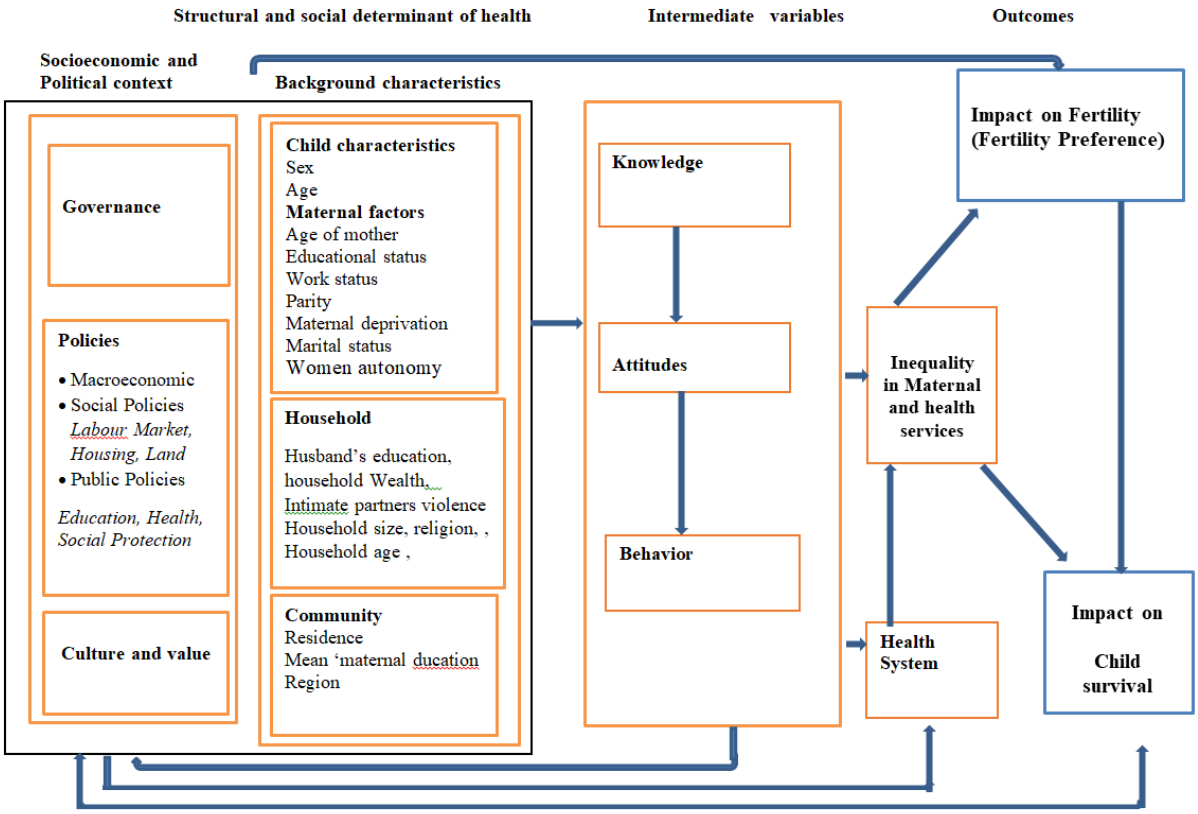
In Ethiopia, there is a considerable improvement in child mortality over time (FMOH, 2015). According to Ethiopian mini-Demographic and Health Surveys (DHS 2019), child mortality has decreased by 68; from 123 child mortality rates in 2005 to 55 deaths in 2019 per 1000 live births (CSA & ORC Macro, 2006; EPHI & ICF, 2021)

2.4. Conceptual framework of the study

There have been several efforts to unpack the complex relationship between various background variables and health outcomes. Some of these frameworks capitalize on a single outcome (such as child health/survival) and others provide a holistic picture whereby the outcome variables could be multiple.

The model introduced by Anderson illustrates the pathways through which different variables pass-through to influence health seeking behavior. The model assumes that health-seeking behavior is a function of three sets of characteristics: predisposing, enabling, and need. Anderson believes that the actual seeking of health services is assumed to be a sequential and conditional function of the individual's predisposition to use health services, their perceived need to use them, and their ability to obtain the services (Andersen, 1995). Solar and Irwin's CSDH framework describe two groups of variables, namely the structural determinant and the intermediary determinant of health variables. In this framework, they indicated structural determinant are the cause of inequality (Solar & Irwin., 2010). In their attempt to describe the determinants of fertility in selected populations, Bongaarts and Potter (1983) indicated two groups of variables: the proximate and underlying determinants. The model describes that background variables (such as women's behavior, household, and community variables) should pass through a certain proximate (direct) variable to influence fertility. In their effort in explaining the survival of children in developing countries, Mosley and Chen (1984) suggested that both direct and indirect determinants play an important role in child health and survival.

As the outcome variables of the present study are multiple, the conceptual framework shown in Figure 1 brings together the frameworks developed by the above stated authors and other similar theories of maternal health/ fertility/contraceptive use. The relationships between the background variable, intermediate variables, and their relationship with the dependent variables (service utilizations, fertility, and child survival). The framework indicates that the background factors (child Characteristics, maternal factors, household and, community) may need to pass through three most important intermediate variables (knowledge, attitudes, and behaviors) in order to influence the outcome variables. In the conceptual framework of this study, there are socio economic and political context, and intermediate variables which will not be considered in this study as variables.



Source: Developed by the Author based on review of literature

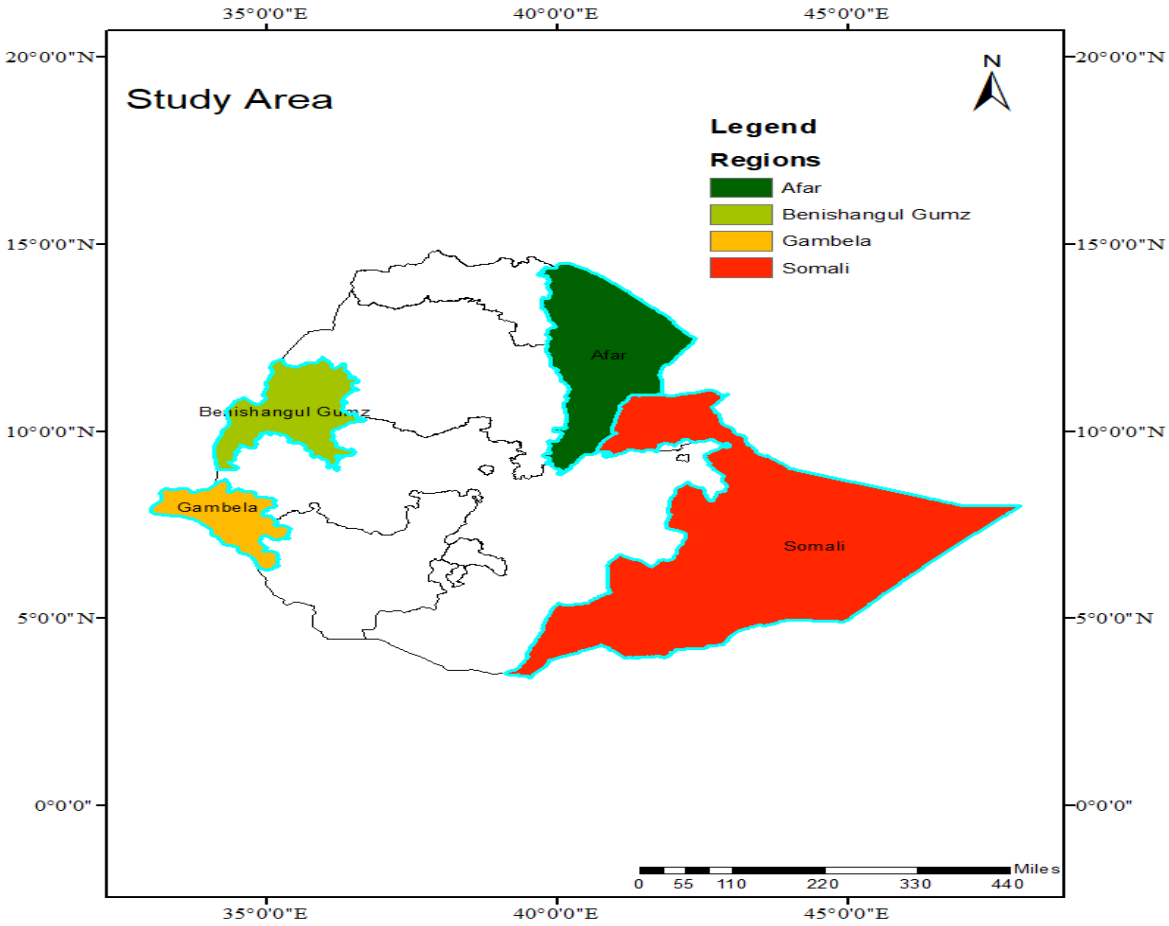
Figure 1: Conceptual framework for the study of inequalities in key Maternal health and outcomes in Ethiopia.

CHAPTER THREE

General Methodology

3.1. The study area

Ethiopia is the second most populous country in Africa, next to Nigeria. The country has an estimated population of 126.5 million people residing in thirteen Regional States, which are divided into zones, and then further subdivided into districts (*woredas*) and smaller (*kebeles*) administrative units(Worldometer, 2023).



Source: Developed by the Author using Arc GIS 10.1

Figure 2:Map of Ethiopia indicating the regions where the study was undertaken (Afar, Somali, Benishangul Gumuz, and Gambela region of Ethiopia)

The country is one of the poorest in the world and heavily relies on an agrarian economy, where agriculture accounts for more than 40% of its GDP and employs nearly 75% of its population(USAID, 2022). More description on the four study regions is given below:

Afar Region is one of the thirteen regions of Ethiopia which is home mainly of the Afar people. This region is well known by a Danakil depression which is one of the lowest points in Ethiopia as well as in Africa. This region is found in the northeastern part of Ethiopia and covers an area of 270,000 km² run up to the border with Djibouti and Eritrea. The vast majority areas in afar region is arid(SCI, 2013b). According to the projected population size of Afar region by Central Statistical Agency of Ethiopia, the total population was 1.95 million in 2020 G.C, of which 21% live in urban areas(Central Stastical Agency(CSA), 2007). According to the Ethiopia FMOH, health and health related indicators report for fiscal year 2013 EC, there were 7 functional hospitals, 97 functional and 11 under-construction health centers, 347 functional health posts and 3 under construction. There was 3.6 staffs per one thousand population in this region (Ministry Of Health-Ethiopia (MOH-E), 2020). Women in formal employment accounts 22.7%, educational attainment of the female household population in Afar was 31.3 68.7% were not educated, 71.2% women in the age group 15-49 usually make decisions on their own health care either alone or jointly with their husband. With regard to the exposure to mass media, 13.3% had access to radio,15.6% access to television, and only 3% having access to newsletter media (Central Statical Agency(CSA) & ICF, 2017).

Somali Region is the most eastern and the second largest area among the 13 regions of Ethiopia. According to the projected population size of Somali region with medium variant by Central Statistical Agency of Ethiopia, the total population of Somali region was 6.20 million in 2020 G.C, of which 15% live in urban areas and about 86% of the population lives in rural areas. The population is dominantly pastoralists and to a lesser extent, agro-pastoralists. The region is mostly affected by natural disasters such as recurrent droughts, famine, and floods(Central Stastical Agency(CSA), 2007). According to the Ethiopia FMOH, health and health related indicators report for Ethiopian fiscal year 2013, the region had 13 functional and 3 under constriction hospitals, 215 functional and 30 under-construction health centers, 1327 functional health posts and 86 under construction. The region had 2.1 health staff to one thousand

population (Ministry Of Health-Ethiopia (MOH-E), 2020). Women in formal employment accounted 18.3%, whereas educational attainment of the female household population was 24.7%. Seventy six percent women in the age group 15-49 usually make decisions on own health care either alone or jointly with their husband. Exposure to radio accounted for 4.1%, access to radio,7.9% had access to television, 1.3% had access to newsletter but the remaining don't have any access for any mass media (Central Stastical Agency(CSA) & ICF, 2017).

Benishangul-Gumuz is located in the northwestern part of the country created from the western most portion of Gojjam province (the part north of the Abay River), and the north-western portion of Welega Province (the part south of the Abay). Assosa is the regional capital city. Benishangul-Gumuz region is sub divided in three zones and twenty-one woreda administrations (SCI, 2013b; UNICEF, 2022). According to the projected population size of Benishangul-Gumuz region by Central Statistical Agency of Ethiopia, the total population of Benishangul-Gumuz region was 1.16 million in 2020 G.C; of this, 23.6% live in urban areas but about 76.4% of the population lives in rural areas (Central Stastical Agency(CSA) & ICF, 2017).

The economic activities in the region are predominantly agricultural with livestock having limited importance. Although there is high potential for agricultural development, traditional farming practices and inadequate involvement of women in all aspects of development, compounded with other factors, have considerably affected the performance of this region's agricultural production and productivity. Subsequently, abundant rural households have been subjected to food deficit and challenges in feeding their family. Besides agriculture, other means of livelihood are trade and traditional gold-washing in some rivers (SCI, 2013b).

According to the Ethiopia FMOH, health and health related indicators report for Ethiopian fiscal year 2013, there were 6 functional and 1 under construction hospitals, 60 functional and 7 under-construction health centers, 424 functional health posts and 2 under construction. There were 6.01 health staffs per one thousand population (Ministry Of Health-Ethiopia (MOH-E), 2020). Educational attainment of the female household population is 53.3%, and 46.7% did not have any education. 79.7% women in the age group 15-49 usually make decisions on own health care either alone or jointly with their husbands, Exposure to mass media (radio) accounted for 11.4%, 9.3% had access to television, 3.4% had access to newsletter but the remining do not have any access for mass media (Central Stastical Agency(CSA) & ICF, 2017).

Gambela Peoples' region is one of the 13 regional states of Ethiopia. This region is located at the western edge of the country bordering South Sudan. The capital of the region, Gambela, is 766km from Addis Ababa. This region has an estimated density of 10 people per square kilometer. Most of the people in the region are pastoralists. In some parts of the region, people produce sesame and other oil crops, mangoes, bananas, etc (SCI, 2013b). According to the projected population size of Gambela Peoples' region, the total population of the region was 0.478 million in 2020 G.C, of which 36.6% live in urban areas and about 63.4% of the population live in rural areas (Central Stastical Agency(CSA), 2007). According to the Ethiopian FMOH, health and health related indicators report for Ethiopian fiscal year 2013 that there were 5 functional hospitals, 28 functional and 4 under-construction health centers, 147 functional health posts and 6 under construction. There were 5.34 staffs per one thousand population in the region (Ministry Of Health-Ethiopia (MOH-E), 2020). Educational attainment of the female household population is 73.3% but 26.7% were not educated. 79.4% women in the age group 15-49 who usually make decisions on own health care either alone or jointly with their husbands. Exposure to mass media/radio accounted 13.8%; 25.6% had access to television, 3.5 % has access to newsletter but the remaining did not have any access for mass media (Central Stastical Agency(CSA) & ICF, 2017).

What is common for the above four regions is that they all are geographically peripheral, economically disadvantageous in terms of access to basic services, having relatively homogeneous population and distinct culture. The prevalence of most of the MCH service indicators is much lower, and they all are characterized by high fertility and poor child survival rate.

3.2. Philosophy of the research

A theoretical or philosophical ground for the research work is composed of four elements, namely ontology, epistemology, methodology and axiology (Khatri, 2020). Among those elements, this study will use an epistemology approach, since this approach concerned with the bases of human knowledge: its nature, form and how it can be acquired. It focuses on the nature of knowledge the researcher can possibly acquire to extend, broaden, and deepen our understanding of our chosen field of research (Cohen et al., 2017).

Further, this research will be conducted in the positivist school of thought, i.e., the study aims to find out the cause-and-effect relationship between the exposure and outcome variables. Where, in this thought 'positivist is concerned with surface events or appearances, establishes meaning operationally, sees its central purpose to be a prediction, and finally, deterministic and bent on certainty'(Colton & Covert, 2007) . In addition, Positivism assumes 'a stable observable reality that can be measured and observed. So, for positivists, scientific knowledge is proven knowledge, and theories are therefore derived in a systematic, rigorous way from observation and experiment' and data analysis by positivist compared to numerate data by constructing objective indicators of insiders' understandings and expressing them in a formal language, almost as a kind of measurement (Bruce et al., 2017) .Therefore, the nature of the research is applied in terms of application, descriptive in terms of objective, and quantitative in terms of inquiry mode. Since the research is based on a constructive approach that means the philosophical position of this research is positivism. Positivists usually interpret the problem of demarcation in a naturalistic way, the positivity approach followers believe they must discover a difference and existing like things (Francis, 2005). Most of the survey research is quantitative and positivistic that deploys the structured approach for information collected from the respondents (Allen & Unwi, 2002). Positivists are happy to see it lapse into the realm of the dispensable, contenting themselves with the laws of observable phenomena alone (Harre, 2002). Therefore, the study was observe reality with the retrospective lens.

3.3. Data sources and study population

The main data sources for this study were generated from the fourth round or the 2016 Ethiopian Demographic and Health Survey (EDHS) and qualitative data was collected from Somali and Afar regions of Ethiopia for objective four. The 2016 EDHS was conducted by the Ethiopian Central Statistical Agency (CSA). The target groups were women in the age group 15-49 and children 0-59 months (Central Stastical Agency(CSA) & ICF, 2017). The main reason to use this secondary data for this study is that DHS data are collected in all the regions of the country at community level which makes is country representative. In addition, DHS data are collected using methodologically valid tools which make it more reliable to use. It is also publicly

available, which anyone can access at no cost. Moreover, the current security situation in the country is not inviting to gather primary data at household level.

The data were collected from nine regions and two administrative cities of Ethiopia (i.e. from Tigray, Afar, Amhara, Oromia, Somali, SNNPR, Benishangul Gumuz, Gambela, Harari, Addis Ababa and Dire Dawa). A wide range of information was collected, including, but not limited to, background characteristics of the respondents, fertility, marriage, fertility preferences, awareness and the use of family planning methods, child feeding practices, nutritional status of women and children, adult and childhood mortality, awareness and attitudes regarding HIV/AIDS, female genital mutilation, domestic violence, and height and weight of women and children the age 0-5. A total of 15,683 female respondents were interviewed nationally for 2016 EDHS. However, for this study we used a data collected from only these four emerging regions of Ethiopia (1128 from Afar ,1391 from Somali , 1126 from Benishangul Gumuz ,and 1035 from Gambela) (Central Stastical Agency(CSA) & ICF, 2017).

The questionnaires/instruments used for the surveys were based on the DHS program i.e., standard Demographic and Health Survey questionnaires, have been adapted to reflect on the population and health issues relevant to Ethiopia. The questionnaires used were Household Questionnaire, Woman's Questionnaire, and the Health Facility Questionnaire (Central Stastical Agency(CSA) & ICF, 2017). The qualitative guide used for this study was to develop based on the scoping review.

3.4. Study design

The present study was used as a combination of cross sectional and ecological designs. The EDHS survey employed cross-sectional study design which entails collection of information at a specific point in time in the lives of the respondents. Further analysis of the data was considered the use of ecological design. Ecological design entails analysis of data at group level (i.e., EA level) by pooling individual data. The use of ecological data is primarily meant to address the fourth objective of the study. In addition, for the qualitative study, the study employed a cross-sectional design, using a phenomenological approach.

3.5. Sampling design

The surveys used a stratified two-stage sampling design. The sampling frame was the sample frame of the Population and Housing Census (PHC) which was conducted in Ethiopia in 2007. The sample frame used was all census enumeration areas (EAs) created for the Ethiopian Population and Housing census (PHC) by Central Statistical Agency (CSA). In the first stage, a total of 645 EAs (202 from urban areas and 443 from rural areas) were selected, and in the second stage of selection, a fixed number of 28 households per cluster were selected with an equal probability systematic selection from the household listing. Therefore, for this study, a total of 222 EAs were used for the present study i.e., 53EAs from Afar 69EAs from Somali, and 50 EAs from Benishangul Gumuz and 50 EAs from Gambela (Central Stastical Agency(CSA) & ICF, 2017).

Similarly for qualitative data, randomly selected one urban and one rural kebele from each region. From those selected kebele, we interviewed women in reproductive age (15-49 years), health extension worker from the health post and contraception providers from health center. The actual sample size was based on the concept of saturation. A total of 20 women in reproductive age for in-depths (IDs) and 7, health extension worker and contraception providers for key informant interviewed.

3.6. Data collection method for qualitative

A guiding question was created using the scoping review as a basis. The original English version of the questionnaire was translated into three local languages. Four health professional data collectors were chosen based on their proficiency in the local language and prior expertise collecting qualitative data (1 medical doctor, 1 midwife and 2 health officers). Additionally, the data collectors had one day of training. The objective of the study, the tools components, and quality data collection procedures was included in the training and with participant permission the data were audio recorded.

3.7. Measurement of outcome and exposure variables

3.7.1. Outcome variables

The study had six outcome variables which included maternal health service utilization (ANC, health facility delivery, and PNC), unmet need and demand for Contraception, Child survival, fertility preference and health related quality of Life.

1. *Unmet need for contraception:* The survey collected information on unmet need for family planning for all currently married sexually active or in consensual union aged 15-49. The variable is code ("1" if women had unmet need for contraception and "0" if women had not unmet need for contraception)
2. *Demand for contraception*: the survey asked if women (age 15-49) who have a met need or unmet need for contraceptive, and sexually active unmarried women who had sexual intercourse within the last 30 days prior to the survey ("0" if women did not have demand for contraception use, and "1" if women had demand for contraception use).
3. *Child survival*: was generated by using Mosley and Chen (1984) framework. The framework used "weight-for-age" as a measure of health status of children. Before classifying the health status, the study compared the actual weight for age with the expected weight for age based on the standard growth rate. From this, the study found children's weight in terms of percentage of the standard weight for age. To classify the health status, the study applied five classifications: healthy (90% or higher of standard weight-for-age); Grade I (75–89% of standard); Grade II (60– 74% of standard); Grade III (below 60% of standard); and Grade IV-dead.
4. *Fertility preference*: was generated from the survey which asked all married women to state if they want more children and coded as (0=no and 1 =yes)
5. *Health Related Quality of Life (HRQoL):* was generated by using the Principal Component Analysis (PCA). This method sets a factor score which explains the maximum possible variations in the input variables used. The factor score was created from four generic indicators which comprises various variables i.e. physical quality indicators (anemia and BMI), service access indicators (ANC, PNC, contraceptive utilization, health facility delivery, and iron utilization), and household wellbeing indicators (media access, household sanitation, decision making, substance abuse, health insurance, and IPV), and functional indicator (presence of temporary or permanent stop doing normal activity). The Factor Analysis Score (FAC) which had the highest Eigen values was taken and labeled as the outcome variable of interest.
6. *Maternal health care utilization*: the three key maternal health services (ANC, delivery, and postnatal care) was used as separate outcome variable and recoded as

dummy variables (0 =ANC utilization <4,1 =ANC utilization >=4;0 =Delivery takes s place out of health facility ,1 = delivery takes place at health facility; and 0 =postnatal care not utilized ,1 = postnatal care utilized in the first two months after birth)

3.7.2. Exposure variables

Table 1: Description of Exposure Variable for the proposed study

Name of variables	Variable Description	Coding
Husband/partner education level /women educational level	Women or husband highest level of schooling attended or completed.	1.No education 2.primary education 3. secondary & above
Women age	Age in completed years	1. 15-19 2. 20-34 3. 35-49.
Residence	Place of residence is the type of place where the respondent resides.	1. Urban 2. Rural
Wealth Index	Composite measure of a household's cumulative living standard	1. Poorest 2. Poorer 3.Midle 4.Richer 5.Richest
Religion	The belief in Spiritual essence	1.Orthodox 2.Musulim 3.Other's
Sex of the household head	Of the categories (male and female)	1.Male 2. Female
Age of household head	Completed years of the length of an existence	1.15–24 y 2.25–34y 3. 34+ y
Total number of children ever born	Number of all children, both surviving and dead to all women	1. <=3, 2. >3
Household size	The number of persons in a private household.	1.<=3, 2.>3
Child Age	Age of the child	1.<=1year 2. 1-2Years 3. >2 Years
Child Sex	Sex as characteristics that are biologically determined	1. Male 2. Female
Headship	Head of households	1.Head 2. wife 2.others
Marital Status	Currently in union is obtained as a sum of legal	1.Married

	and consensual unions	2.Single 3.Divorced 4.Separated
Work status	Women/husband employed in the 12 months before the survey	1.Not working 2. working
child's birth order	The numerical sequence of a child's arrival into a family	1.First 2.second and above
Intimate partner violence	Any behavior within an intimate relationship that causes physical, psychological, or sexual harm to those in the relationship	1.No or low violence 2. Mild violence 3.High violence
Women autonomy on their own-health care	Women's ability and freedom to make independent decisions about their medical care	1.No (women with her husband / her husband/ others) 2. Yes (by her own)

3.8. Data Analysis

Data analysis was done using SPSS-v26 and STATA-v14/18. The analysis begins with describing the characteristics of respondents using frequency and percentages. We checked the basic assumption before each analysis. Multicollinearity among the explanatory variables was checked using the Variance Inflation Factor (VIF), with VIFs > 2.5 indicating multicollinearity problems. Given that the outcome variables stated above have different nature, appropriate regression techniques was employed for each type of outcome. The analyses were made following four series of steps:

1. Assessing the maternal Health Related Quality of Life (HRQL) in rural and urban areas of Ethiopia.
2. Examining the magnitude of inequalities in demand and unmet need for contraception using a range of multivariate regression techniques.
3. Estimating the cluster level (EA level) maternal health care utilization: an ecological analysis.
4. Estimating the population level impacts of the MCH services on child survival and fertility levels and intensions.

Further, the analysis included all women of reproductive age and all children under five years of age from four selected regions: Afar, Benishangul-Gumz, Gambela, and Somali. Bivariate analysis was employed to select potential variables using a cutoff p-value of less than 0.2.

Subsequently, multivariable analyses assessed the relationship between selected explanatory variables and the outcome variable. A P- value of ≤ 0.05 was used to ascertain statistical significance. Akaike Information Criteria (AIC) was used to select the most appropriate model. Additionally, regression-based Population Attributable Fractions (PAFs) were applied to measure population level impact, following the methodology introduced by Greenland and Drescher (1993) and steps identified by Rückinger et al. (2009), to calculate the PAF of the risk factor of interest.

All quantitative analyses were weighted according to DHS guidelines to adjust for differences in the probability of selection and interview among cases in the sample or due to design. This approach ensures the representativeness and reliability of the findings. A visual overview of the analysis, addressing the five specific objectives of the study, is provided in Figure 3.

For the qualitative component, the study included married/ in union women aged 15-49 from Afar and Somali regions. Data was collected through in-depth interviews and key informant interviews with health extension workers and contraception providers. The qualitative data were transcribed verbatim, translated into English, and coded using NVivo 12 software. Thematic analysis was conducted with multiple readings of the transcripts to ensure a comprehensive understanding of the data.

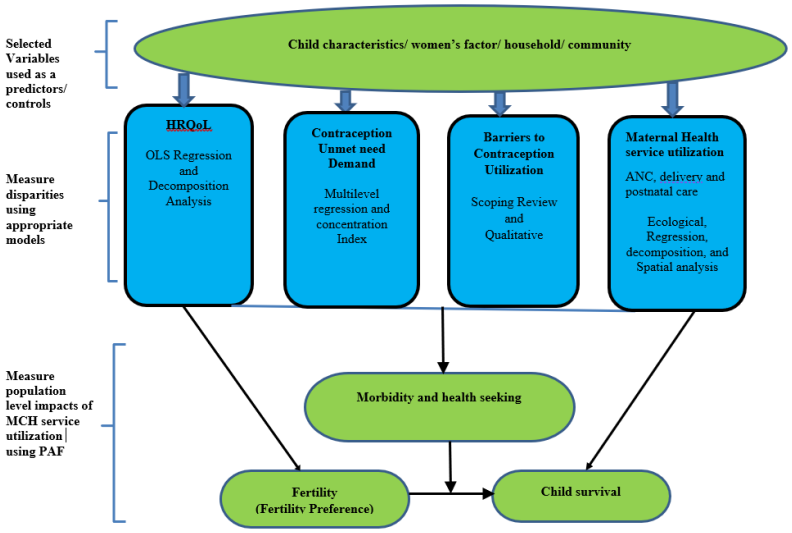


Figure 3 : Analysis steps

3.9. Definitions of Terms

- **Antenatal care utilization**: women aged 15 to 49 with a live birth in the last 12 months who attended antenatal care four or more times during that pregnancy.
- **Health facility delivery:** women with a live birth in the year preceding the survey who gave birth in a health facility.
- **Postnatal care utilization**: women with a postnatal check-up in the first two days after birth.
- **Unmet need:** women who are not pregnant and not postpartum amenorrhoeic and are considered fecund and want to postpone their next birth for or more years or stop childbearing altogether but are not using a contraceptive method, or have a mistimed or unwanted current pregnancy, or are postpartum amenorrhoeic and their last birth in the last 2 years was mistimed or unwanted.
- **Demand for contraception:** Number of women who have a met need or unmet need
- **Fertility preference:** women desire to have more children.
- **Child survival:** the inborn who survives up to age 5.

3.10. Ethical clearance and considerations

This study uses secondary analysis of DHS data and Primary qualitative data. DHS followed previously approved standard protocols, data collection tools, procedures (Rutstein & Rojas, 2006). Participation in the survey was voluntary and the DHS data are publicly available without identifiable information of respondents i.e., data from demographic health surveys (2016-EDHS). For this analysis, permission to use the data was granted by ICF and CSA for 2016 data. In addition, ethical clearance was sought from Addis Ababa University, Collage of Development and Administration, and permission was received from respective authorities during the data collection period. Eligible individual study participants were given their consents before participating in the data collection. The benefits and risk or discomfort of the survey was briefed to the participants before the interview. Privacy and confidentiality of the respondents' information was maintained. The data collector approached the participants in a non-judgmental, empathic and welcoming way. The participants were not forced to participate; and had the right to refuse or withdraw from the study.

CHAPTER FOUR

Residential Inequalities in Health-Related Quality of Life among Women of Reproductive Age in Four Regions of Ethiopia: A Decomposition Analysis

(The study was published as Shumet and Geda at BMC Women's Health (2023) 23:317. https://doi.org/10.1186/s12905-023-02465-2)

4.1. Background

Health-Related Quality of Life (HRQoL) is referring to how well a person performs in his/her life and his or her realized well-being in terms of physical, mental, and social domains of health (Abdel-Hadi, 2012; Ferrans, 2004). Health-Related Quality of Life also consists of whether an individual can perform a range of activities of day-to-day life such as bathing or dressing him- or herself which is related to the physical functioning domain of health (Ferrans, 2004). There are many ideas and notes about what HRQoL is and how it is being measured. A measure of HRQoL was the degree to which people's contentment requirements are satisfied (Livingston & Fink, 2003). Health-Related Quality of Life is also measured with mortality, morbidity, service utilization, and subjective reports of illness (Raphael et al., 1996).

An increasing concern is growing on the disparities observed in health-related quality of life of different population groups (Example: poor vs rich and rural vs urban). The leading causes of health inequalities are unequal distribution of income, power, and wealth among the population. Health inequalities within states are primarily associated with the gradient in social factors that can influence, for example, disease onset and response to treatment (Arcaya Mariana C. et al., 2015; Michael .M, 2005).

In the context of Ethiopia, inequality in maternal health and other socioeconomic dimensions are extremely high. For instance, even though the use of maternal health services had improved in Ethiopia, most of the mothers do not attend the recommended minimum number of four antenatal care (ANC) visits by WHO (Abosse et al., 2011a, 2011b; Central_stastics_Ethiopia, 2017; Mulat Getasew et al., 2015). The Ethiopian Demographic and Health Surveys (EDHS) conducted from 2000 to 2016 indicated there were significant rural-urban difference in delivery care (Central_stastics_Ethiopia, 2017). There are huge disparities in contraceptive uses and choices in Ethiopia, where there is unacceptably low contraceptive prevalence rate (CPR) in

Somali and Afar regions. This is further corroborated by very low demand for family planning (FP) in those two regions (i.e less than 30%) (Central Stastical Agency(CSA) & ICF, 2017).

The prevalence of under nutrition among women in a reproductive age remains high in Ethiopia. Both the 2011 and 2016 EDHS reported close to 30% (i.e., more than one in four) rate of under nutrition with body mass index (BMI) < 18.5 for women. The country is battling against high rates of both macro and micronutrient deficiencies. The most common forms of malnutrition in Ethiopia include acute and chronic under nutrition, vitamin A deficiency (VAD), iron deficiency anemia (IDA), and iodine deficiency disorder (IDD)(FAO, 2008). The rural-urban differences in nutrition-related indicators also remained huge during the last two decades (Central Stastical Agency(CSA) & ICF, 2017). Getting access to adequate nutrition in rural Ethiopia is a continued challenge for women. Even when food is available, women are more vulnerable to the risk of being malnourished because of their gender roles in their families with multiple responsibilities they have to carry out including but not limited to childbearing, raising kids, taking care of household chores, working on the farm, and further they are also carrying out many other social responsibilities that would add significant work burden and that increase their chance of being malnourished (FAO, 2012).

In Ethiopia, the prevalence of Intimate partner violence (IPV) which is considered an important indicator of women's health status is unacceptably high. According to 2016 Ethiopian Demographic and Health Survey (EDHS) report, nearly one-quarter (23 percent) of women had at some point in their lives experienced physical violence, while 10 percent of the women experienced sexual violence. Thirty-four percent of married women have experienced spousal violence, whether physical, sexual, or emotional, with emotional violence being the most common (Central Stastical Agency(CSA) & ICF, 2017).

In Ethiopia, despite the marked improvement in health-related quality of life of people at the national level, substantial inequalities among the different socio-economic subgroups persist. Studying the health-related quality of life in different populations i.e. rural and urban in this case would help to identify subgroups with poor health related quality of life, and this, in turn guides policy makers and other actors to improve the existing policies or interventions to enhance the population health status and make a fair distribution of the available resource to leverage the health of the society at large. To the best of the authors' knowledge, no study has been conducted

yet on the four regions of this study focusing on inequalities in HRQoL among women in the reproductive age using combined indicators as an outcome variable. But previous studies have considered a single measure (such as access to health services, income, employment, etc…) as an outcome variable. Further, those studies were conducted at the local level on a limited sample of respondents drawn from a specific region or district within Ethiopia. The present study hypothesizes that there are substantial rural-urban inequalities in HRQoL among women in four regions of Ethiopia. The study answers the following two questions: a) what are the major predictors of the health-related quality of life among women in urban and rural areas of Ethiopia? And b) what are the prime drivers of rural-urban differentials (i.e source of inequality) in health-related quality of life in four regions of Ethiopia?

4.2. Methods

4.2.1. Study setting

The study was conducted in four regions of Ethiopia, namely, Afar, Somali, Benishangul Gumuz, and Gambela regions. All these regions have the following common characteristics: geographical peripheral, economic disadvantaged in terms of access to essential amenities, relatively homogeneous population, and distinctive cultural characteristics (SCI, 2013b, 2013a; SCIl, 2013; UNICEF, 2022). According to the Central Statistical Agency (CSA) of Ethiopia's projection of population size for the year 2020, the overall population of Afar was 1.95 million, Somali was 6.20 million, Benishangul-Gumuz was 1.16 million, and Gambela was 0.478 million. When we see the percentage of populations who resides in urban areas in those study regions; Afar has 21%, Somali has 15%, Benishangul-Gumuz has 23.6%, and Gambela has 36.6% (Central Stastical Agency(CSA), 2007).

4.2.2. Data source and the study population

The study used secondary data from the 2016 EDHS. The data were collected at a national level from all nine regional states and two city administrations of Ethiopia from January 18, 2016, to June 27, 2016. But this study used data collected from only those four regions of Ethiopia (i.e., Afar, Benishangul Gumuz, Gambela, and Somali regions). During data collection, the eligibility criteria to include respondents of the study were *"all women aged 15-49 years, who were either permanent residents of the selected households or visitors who slept in the household the night*

before the survey". To generate the EDHS data, five different questionnaires were used. 4160 women were interviewed on those four regions. Among those, the present study used data collected by the household and woman's questionnaires from 2385 women who were eligible for all composite indicators of outcome variables (344 from urban and 1990 from rural) in the age group 15-49 years situated in four regions of Ethiopia. In general, EDHS used a Stratified two-stage cluster sampling. In the first stage, 645 Enumeration Areas (EA) were selected by using a probability proportional to EA size. Therefore, a total of 222 EAs were used for the present study i.e., 53EAs from Afar 69 EAs from Somali, 50 EAs from Benishangul Gumuz, and 50 EAs from Gambela, Household listing was performed to have a sample frame for the second stage sampling (i.e., for household selection). In the second stage, a fixed number of 28 households per cluster have been selected with an equal probability using a systematic random sampling technique (Central Stastical Agency(CSA) & ICF, 2017).

4.2.3. Measures of outcome variables

The main outcome variable of this study was Health-Related Quality of Life (HRQoL) which was generated by using the principal component analysis (PCA). This method sets a factor score that explains the maximum possible variations in the input variables used. The factor score was created from four generic indicators which comprise various variables i.e. physical quality indicators (anemia and BMI), service access indicators (ANC, postnatal care (PNC), contraceptive utilization, health facility delivery, and iron utilization), and household wellbeing indicators (media access, household sanitation, decision making, substance abuse, health insurance, and IPV), and functional indicator (presence of temporary or permanent quit of doing normal activity). The Factor Analysis Score (FAC) which had the highest Eigenvalues (Eigenvalue= 2.8) was taken and was used as a multiplier of all the 14 individual HRQoL indicators considered. The final aggregate indicator was labeled as the HRQoL index which had a right-skewed distribution with a mean of 2.2 and standard deviation (SD) of 31.8. The values of the outcome variable ranged between -31 and 159.

4.2.4. Exposure variables

The exposure/ independent variables of this study include woman's educational level, regions, wealth index, husband/partner education status, religion, sex of the household head, age of

household head, total number of children ever born, ethnicity, relationship to household head and marital status.

4.2.5. Statistical Analysis

Data cleaning and analysis were done using SPSS-v20 and STATA -v14. The analysis began by describing the characteristics of respondents using frequency and percentages. Multicollinearity among the explanatory variables was checked using the Variance Inflation Factor (VIF), with VIFs > 2.5 indicating significant multicollinearity problems (Hutcheson, 2011). The linearity between parameter of independent variable and outcome variable were evaluated by using a scatter plot as shown in figures 1 and 2. Linear regression models ordinary Least Square parameter estimation method were used to examine the associations between covariates and the outcome variable (Hutcheson, 2011). As a rule of thumb, potential variables with a p-value<0.20 were further tested in the multivariable Ordinary Least Square (OLS) regression. The study also used a p-value less than 0.05 and 95% confidence interval for declaration of statistical significance. The rural-urban disparities in quality of life among women were estimated using Oaxaca decomposition with the threefold (interaction) decomposition type. The technique is generally used to investigate the group differences in any (continuous and unbounded) outcome variable (Jann & Jann, 2008). The "threefold (reverse)" selection perspective of group 2 indicates that group 1 (i.e., urban adults with a higher average HRQoL) are selected as the reference group for analysis.

4.3. Results

4.3.1. Characteristics of respondents

Table2 summarizes the background characteristics of women respondents of the study. Among the total respondents, most of them (48%) were found in the age group 25 to 34 years. In addition, the study also found 70% of the study participants have no education and 61% of them were also categorized in the "poorest" household wealth group.

Table 2: Background characteristics of women respondents, EDHS 2016, n=2385

Characteristics	Number	Percent
women age		
15-24	694	29.1
25-34	1138	47.7
>34	553	23.2
Women education		
No education	1668	69.9
Primary	502	21.0
secondary and higher	215	9.0
Working status		
Not working	1717	72.0
Working	668	28.0
Household age		
15-24	251	10.5
25-34	878	36.8
>34	1256	52.7
Husband education		
No education	1338	59.6
Primary	486	21.7
secondary and higher	420	18.7
Sex of household head		
Male	1616	67.8
Female	769	32.2
Household size final		
<=3	377	15.8
>=4	2008	84.2
Wealth index combined		
Poorest	1456	61.0
Poorer	276	11.6
Middle	172	7.2
Richer	183	7.7
Richest	298	12.5
Total	**2385**	**100.0**

4.3.2. Rural-Urban differentials in the predictors of health-related quality of life

The result in table 3 presented the bivariate OLS regression. It is noted that, except marital status all the other independent variables of the study had a ***p***-value < 0.2, and hence, all of those with ***p***-value < 0.2 were considered for further analysis in the multiple ordinary least square regression model.

Table 3: Bivariate ordinary least square regression for selected predictors of HRQoL in urban and rural Ethiopia

	Urban				Rural			
	Beta	**(95%CI)**		**p-value**	**Beta**	**(95%CI)**		**p-value**
Women Age								
15-24 [RC]								
25-34	-0.09	-16.56	-2.43	**0.14**	-0.05	-4.72	-0.19	**0.07**
>34	-0.18	-31.56	-6.83	**0.00**	-0.06	-6.29	-0.57	**0.02**
Household age								
15-24 [RC]								
25-34	-0.11	-25.90	-5.93	0.22	0.05	-1.15	-6.02	**0.18**
>34	-0.19	-31.14	-0.20	**0.05**	0.04	-3.23	-3.67	0.90
Household Size								
<=3 [RC]								
>=4	-0.27	-31.51	-11.78	**0.00**	-0.05	-6.43	-5.60	**0.02**
Women Education								
No education	0.27	16.47	34.73	**0.00**	0.27	13.57	18.50	**0.00**
Primary	0.51	37.36	54.87	**0.00**	0.23	20.11	29.15	**0.00**
Secondary								
Region								
Afar [RC]								
Somali	0.34	-40.51	-18.17	**0.00**	0.01	-1.99	-3.09	0.67
Benishangul	0.13	2.99	-34.11	**0.00**	0.42	20.17	-25.48	**0.00**
Gambela	0.01	-13.43	-16.24	0.81	0.19	8.47	-14.22	**0.00**
Religion								
Orthodox [RC]								
Protestant	-0.44	-54.63	-31.26	**0.00**	-0.32	-23.30	-14.91	**0.00**
Muslin	-0.57	-57.20	-36.94	**0.00**	-0.46	-27.35	-19.88	**0.00**
Other	-0.08	-44.84	-4.61	**0.11**	-0.17	-30.39	-16.89	**0.00**
Wealth Index								
Poorest [RC]						.	.	.
Poorer	0.05	-10.32	27.55	0.37	0.29	18.09	23.18	**0.00**
Middle	0.06	-7.68	-31.74	0.23	0.32	24.96	31.30	**0.00**
Richer	0.12	1.74	33.38	**0.03**	0.41	34.15	40.58	**0.00**
Richest	0.60	42.53	64.63	**0.00**	0.31	46.49	58.36	**0.00**
Household sex								
Male [RC]								
Female	-0.08	-15.68	-1.74	**0.12**	-0.08	-6.49	-2.04	**0.00**
Husband/Partner education								
No education [RC]								
Primary	0.33	23.71	46.72	**0.00**	0.27	12.84	17.80	**0.00**
Secondary	0.48	30.49	48.19	**0.00**	0.24	13.40	19.49	**0.00**
Women employment								
Not working [RC]								
working	0.30	17.44	34.34	**0.00**	0.22	9.31	13.89	**0.00**
Marital status								
otherwise [RC]								

Married	0.13	-12.09	15.70	0.80	-0.01	-5.09	3.52	0.72
Relationship with household head								
other [RC]								
Head	0.16	-11.18	40.08	0.27	0.04	-5.56	9.84	0.58
Wife	0.26	-3.50	46.48	**0.09**	0.13	-1.33	13.76	**0.11**
Daughter	0.18	-1.61	55.43	**0.06**	0.02	-6.24	10.93	0.59
Daughter in low	0.02	-43.32	62.08	0.73	0.05	0.08	26.06	**0.05**
Total children ever born								
<=2	-0.33	-37.08	-19.79	**0.00**	-0.09	-7.13	-2.11	**0.00**
3-5	-0.32	-45.51	-23.46	**0.00**	-0.16	10.91	-5.67	**0.00**
>=6 [RC]								

RC =reference category

Table 4 presents the results of a multiple ordinary least square regression. The result revealed that in rural parts of those four regions of the study, the mean HRQoL is higher for women with a primary level of education by 11% compared with the reference no-education category. Similarly, women with secondary and higher education had higher mean HRQoL compared to women with no education (i.e., increased by 11%). The HRQoL is higher for women living in richer and richest households by 29% and 25%, respectively (i.e. $\beta = 0.29$ and $\beta = 0.25$, respectively) compared to the reference i.e., those living in poorest households in the same locality. When we see the regression output for urban (model 2), it is observed that the mean HRQoL is higher by 10% for those women richer household wealth index ($\beta = 0.10$, 99.5% CI: -0.43, 27.41). And higher by 40% for those women with richest household wealth index ($\beta = 0.40$, 95% CI: 25.49, 45.58). The mean HRQoL is higher for those women with secondary and higher by 23% compared to women with no education ($\beta = 0.23$).

Table 4: Multiple ordinary least square regression for selected predictors of HRQoL among women in rural and urban Ethiopia (n=2385)

	Rural				**Urban**			
	Beta	**95% CI)**		**p-value**	**Beta**	**95% CI)**		**p-value**
Women Age								
15-24 [RC]								
25-34	0.02	-1.92	3.61	0.55	0.08	-2.30	14.90	0.15
>34	0.03	-2.15	5.40	0.40	0.03	-9.23	16.49	0.58
Household head age								
15-24 [RC]								
25-34	0.02	-2.30	4.42	0.54	-0.07	0.38	-19.28	7.38
>34	0.04	-2.07	5.81	0.35	-0.11	0.22	-24.09	5.66
Household Size [RC]								

<=3	-0.03	-5.08	0.74	0.14	0.02	0.71	-7.34	10.79
>=4								
Women Education								
No education [RC]								
Primary	0.11	4.21	9.11	**0.00**	0.08	-1.34	17.05	0.09
Secondary and higher	0.11	7.79	16.97	**0.00**	0.23	10.39	31.33	**0.00**
Region								
Afar [RC]								
Somali	-0.06	-5.40	-0.99	**0.00**	-0.07	0.26	-16.10	4.33
Benishangul	0.15	5.30	11.54	**0.00**	0.08	0.10	-2.21	24.45
Gambela	0.14	4.44	12.80	**0.00**	0.11	0.11	-1.97	20.50
Religion								
Orthodox [RC]								
Protestant	-0.25	-19.07	-11.20	**0.00**	-0.38	-47.88	-25.38	**0.00**
Muslin	-0.04	-5.83	1.53	0.25	-0.22	-29.21	-7.78	**0.00**
Other	-0.07	-15.14	-3.99	**0.00**	-0.06	-38.87	3.68	**0.11**
Wealth Index								
Poorest [RC]								
Poorer	0.21	11.94	17.30	**0.00**	0.00	-15.19	16.88	0.92
Middle	0.23	17.22	23.83	**0.00**	0.07	-2.54	31.35	0.09
Richer	0.29	22.55	29.47	**0.00**	0.10	0.43	27.41	**0.04**
Richest	0.25	35.17	46.95	**0.00**	0.40	25.49	45.58	**0.00**
Household Sex								
Male [RC]								
Female	-0.05	-8.48	3.63	0.43	-0.09	0.44	-28.82	12.60
Husband/Partner education								
No education [RC]								
Primary	0.09	2.81	7.26	**0.00**	0.10	1.36	20.99	**0.03**
Secondary	0.07	2.26	8.30	**0.00**	0.16	3.75	22.15	**0.01**
Women employment								
Not working [RC]								
working	0.04	0.31	4.37	**0.02**	0.07	0.11	-1.25	12.83
Relationship with household head								
other [RC]								
Head	0.06	-5.04	8.91	0.59	0.22	0.08	-2.13	43.57
Wife	0.00	-5.39	8.22	0.68	0.18	0.21	-8.85	39.87
Daughter	-0.01	-8.80	6.57	0.78	0.19	0.01	9.00	54.72
Daughter in low	0.03	-2.71	19.13	0.14	0.02	0.65	-28.99	46.46
Total children ever born								
<=2 [RC]								
3-5	-0.04	-4.61	0.85	0.18	-0.13	-20.09	-2.08	**0.02**
>=6	-0.03	-4.94	1.75	0.35	-0.01	-13.66	12.06	0.90
Number of obs = 1900	AIC= 3293	BIC =3401			Number of obs =344		AIC=16391	BIC =16547

4.3.3. Decomposition analysis

Table 5 presented the Oaxaca decomposition with the threefold (interaction) decomposition type. In this study, the "threefold (reverse)" selection perspective of group 2 indicates that group 1 (i.e., urban adults with a higher average HRQoL) are selected as the reference for the analysis.

In this study, the mean predicted HRQoL among women was 40.956 for women residing in urban (group_1) and -4.829 for women residing in rural (group_2) Ethiopia, which yields a HRQoL disparity of 45.785. In general, about 507% (34.778/6.862) of the disparity was due to the difference in the distribution of the predictors (endowments). Among them, the wealth index (28.92/6.862 = 421%) contributed a substantial portion of the disparities. The differential effect of women age (9.044/6.862= 132%) had the greatest contribution and was attributed to the differential effect of the covariate entered in the model (coefficients effect) including the general effect of unknown factors (_cons).

As shown in table 5, the differences in the level of observed covariates (the explained component) accounted for about 90.94% (41.64/45.785) of the total disparity.

Table 5: Blinder-Oaxaca decomposition for selected risk factors of women health-related quality of life for rural urban Ethiopia

Group 1: Urban	Group 2: Rural					
overall	**Coef.**	**Std.Err.**	**Z**	**P>z**	**95% CI**	
group_1	40.956	2.241	18.280	0.000	36.564	45.348
group_2	-4.829	0.544	-8.880	0.000	-5.895	-3.764
difference	45.785	2.306	19.860	0.000	41.266	50.305
endowments	34.778	1.591	21.860	0.000	31.660	37.896
coefficients	4.145	3.573	1.160	0.246	-2.857	11.148
interaction	6.862	3.420	2.010	0.045	0.160	13.564
Endowments						
women age	-0.126	0.100	-1.260	0.207	-0.322	0.070
Household age	-0.001	0.006	-0.090	0.931	-0.013	0.012
Women education	2.922	0.620	4.720	0.000	1.708	4.137
household size	0.207	0.124	1.670	0.096	-0.037	0.450
Region	-0.130	0.178	-0.730	0.466	-0.478	0.219
Sex of household	-0.047	0.057	-0.830	0.407	-0.159	0.064
Religion	0.342	0.221	1.550	0.121	-0.091	0.775
Household wealth index	28.920	1.474	19.620	0.000	26.031	31.809
Husband education	1.904	0.518	3.680	0.000	0.890	2.919

Employment status	0.071	0.106	0.670	0.505	-0.138	0.280
Marital status	0.372	0.159	2.340	0.019	0.061	0.683
Relationship to the household	-0.003	0.018	-0.200	0.844	-0.038	0.031
Total children ever born	0.346	0.261	1.330	0.184	-0.165	0.857
Coefficients						
women age	9.044	6.625	1.370	0.172	-3.941	22.029
Household age	-11.730	8.299	-1.410	0.158	-27.996	4.536
Women education	1.731	0.877	1.980	0.048	0.013	3.449
household size	-0.705	9.107	-0.080	0.938	-18.554	17.145
Region	-3.490	4.745	-0.740	0.462	-12.790	5.810
Sex of household	-3.798	5.642	-0.670	0.501	-14.856	7.261
Religion	-23.804	6.418	-3.710	0.000	-36.383	-11.225
Household wealth index	-0.328	2.097	-0.160	0.876	-4.438	3.782
Husband/ partner education	1.087	1.217	0.890	0.372	-1.298	3.472
Employment status	-4.317	11.906	-0.360	0.717	-27.653	19.019
Marital status	5.903	4.836	1.220	0.222	-3.575	15.380
Relationship to the household	10.528	6.467	1.630	0.104	-2.148	23.203
Total children ever born	-2.110	3.403	-0.620	0.535	-8.781	4.561
_cons	26.134	20.761	1.260	0.208	-14.557	66.825
interaction						
women age	-0.354	0.320	-1.110	0.269	-0.982	0.273
Household age	-0.020	0.183	-0.110	0.912	-0.378	0.338
Women education	3.355	1.715	1.960	0.050	-0.007	6.717
household size	0.028	0.365	0.080	0.938	-0.687	0.743
Region	-0.485	0.665	-0.730	0.466	-1.788	0.818
Sex of household	-0.104	0.174	-0.600	0.551	-0.444	0.237
Religion	2.531	0.798	3.170	0.002	0.967	4.095
Household wealth index	-0.533	3.403	-0.160	0.876	-7.202	6.136
Husband education	1.488	1.669	0.890	0.373	-1.783	4.759
Employment status	0.084	0.235	0.360	0.721	-0.376	0.544
Marital status	0.339	0.306	1.110	0.268	-0.260	0.939
Relationship to the household	-0.088	0.224	-0.390	0.696	-0.526	0.351
Total children ever born	0.620	1.003	0.620	0.537	-1.347	2.586

4.4. Discussion

The present study assessed the inequality in health-related quality of life among women in urban and rural settings of four regions of Ethiopia using 2016 EDHS data. Among all predictors, wealth index, educational level of women and their husbands (partners) had a substantial contribution to the existing rural-urban differentials of inequality in the quality of life of women.

The study found that there was a significant variation in the quality of life among women residing in urban and rural areas in the four regions of Ethiopia; it was found that women residing in rural areas had far lower HRQoL than those women residing in urban areas. This finding is consistent with previous studies conducted around the world (Ali & Chauhan, 2020; Nabolsi et al., 2020; Samuel et al., 2021).

In the decomposition analysis, the household wealth index, educational level of women, and their husband (partner) were found to explain the inequality in health-related quality of life among women in both urban and rural Ethiopia. This study revealed both of those explaining factors i.e., household wealth index and the educational level (socio-economic variables) of those women were contributing to broadening the gap in health-related quality of life among women in rural-urban areas of Ethiopia. This finding is consistent with a study done by Abosse and colleagues (2021) who found significant urban-rural inequalities in maternal healthcare utilization in selected countries in Sub-Saharan Africa which included Ethiopia (Abosse et al., 2011a). The finding of this study also coincides with the study done by other scholars which highlight the need to minimize the wealth imbalance and to improve the low levels of education between mothers to enhance the usage of maternal health service in sub-Saharan African countries (Yaya et al., 2016). Furthermore, previous studies also indicated that education is a fundamental determinant of QOL of individuals i.e., individuals who have limited educational preparation (skills and competencies) may be barred from securing good jobs and have fewer outlooks for economic prosperity; in addition, those individuals who are early schools' leavers encounter higher risk of social exclusion, poverty and usually may have a very little opportunity in participation for voting and political affairs. Since, education usually increases individuals perception of the world they live in, and their ability how to influence others (European commission, 2020; Ezat et al., 2019).

Even though the EDHS-type surveys used advance survey methodology and large sample size used for the present analysis, the cross-sectional nature of the data limits the possibilities of establishing cause-effect relationship between the factors and the outcome of interest. As EDHS surveys are primarily designed to track trends in population, health, and nutritional programs in Ethiopia, they lack some relevant variables for the construction of the HRQoL index. In addition, there may be data quality differences from respondents drawn from rural and urban areas.

Despite these limitations, this study can be taken as a springboard for further analysis on the subject i.e., inequality in the health-related quality of life. In addition, the findings can be useful at both national as well as regional levels as input for formulation of strategies for reducing the inequalities in HRQoL among women who reside in rural and urban areas.

4.5. Conclusion

The study found a substantial inequality in the quality of life among women who reside in rural and urban areas in the four concerned regions of Ethiopia. The finding further witnessed that two socioeconomic factors (namely, wealth index and educational attainment) explained a larger proportion of the inequality in the quality of life of women in urban/ rural areas in the four regions of Ethiopia. The findings imply that policymakers and local administrators should pay more attention to interventions that promote education and narrow down the gap in wealth status of households.

CHAPTER FIVE

Inequalities in the Demand and Unmet Need for Contraception among Women in Four Regions of Ethiopia

(Manuscript submitted and under review for publication @ PLoS ONE, and; authors are Tigist Shumet and Nigatu Regassa)

5.1. Introduction

Contraception has several benefits for women and the communities they live in. It enables women to space childbirth, prevent unwanted pregnancy, and reduce the risk of morbidity and mortality from childbirth. It also reduces the incidence of abortions. Family planning (FP) is one of the most efficient programs a government can implement (UNFPA, 2012; WHO, 2022b). According to estimates, by meeting the unmet need for contraception and removing the barriers to contraception use, the world could avoid 74 million unintended pregnancies, 25 million unsafe abortion, and 47 thousand maternal death that occur annually in low and medium income countries (WHO, 2020).

Unmet need for contraception refers to a situation where women who are fecund and sexually active but do not use any forms of contraceptives, even though they do not want to have any more children or wants to delay their next birth (Bongaarts & Bruce, 1995; United Nations Department of Economic & Social Affairs Population Division, 2014). Unmet need for FP contribute to high fertility rates, which lead to rapid population growth (Wudineh et al., 2018). Unmet need for contraception is also a major cause of unintended pregnancies and a significant factor in maternal and infant mortality (Sedgh et al., 2016). Moreover unmet need for contraception, adversely affects women reproductive health (Kabagenyi et al., 2014; Mosha et al., 2013).

Women's limited access to contraception services remains a critical factor to the social and public health problem in the world. In 2019, 75.7% of women of reproductive age who needed contraception services (i.e., 842 million out of 1.11 billion) used a modern contraception method. However, 270 million of them had unmet needs (Kantorová et al., 2020b). In developing countries , including Ethiopia, the number of women with unmet need for contraception services

raised to 232 million, despite their desire to use a modern contraception method (UNFPA, 2020). The 2016 Ethiopia Demographic Health Survey showed that the unmet need for modern contraceptive methods among married women and sexually active unmarried women in Ethiopia was 15% and total demand for FP was 40%. However, there was a large variation among regions (i.e., the unmet need in the four study regions was 13% in Afar, 9% in Somali, 17% in Benishangul Gumuz and 17% in Gambela region). The demand for contraceptive use was 23% in Afar, 10% in Somali, 38% in Benishangul Gumuz and 43% in Gambela (Central Stastical Agency(CSA) & ICF, 2017).

Given this, the Ethiopian government allocated huge resources for the implementation of reproductive health programs that aim to increase the availability and of quality of contraception services and reduce the unmet need for contraception from 22% to 10%, and enhance the contraception use among married women to 55% by 2030 (Ministry of Health, Ethiopia, 2020). Addressing the unmet need for contraception is vital not only for improving health outcomes, such as reducing maternal and infant mortality, but also for enhancing the educational and economic opportunities of girls and women (Yaya et al., 2018).

The studies we found on unmet need for contraception in the four regions of Ethiopia (i.e., Afar, Benishangul Gumuz, Gambela and Somali regions) were very limited. In addition, the few existing studies on demand and unmet need for contraception in other parts of Ethiopia were done either by using small sample size (G/Meskel et al., 2021; Girma Garo et al., 2021; Hailemariam & Haddis, 2011; Kebede et al., 2019) or ignored the inequality aspects. These four regions selected for this study are recognized as some of the most disadvantaged and marginalized regions in Ethiopia. These areas face challenges such as low socioeconomic development, inadequate infrastructure, and limited access to health services, including family planning (FP). However, these regions also share a relatively homogeneous cultural and religion, characterized by a more nomadic lifestyle (Gatzweiler & Baumüller, 2014; Gebre-Egziabhere, 2018; Hussen et al., 2023; Ministry of Federal Affairs, 2007). Thus, we selected those four regions for our study; since we need to focus on the regions with low FP utilization rates and they also represent the most vulnerable and underserved populations in Ethiopia which needs a very crucial support to enhance the utilization of FP.

Therefore, this study aimed to examine the inequalities in the demand and unmet need for contraception among women in the four regions of Ethiopia by using decomposition of concentration index within the context of two theoretical models: the Anderson health seeking behavioral model and the Solar and Irwin's Commission on Social Determinants of health framework (CSDH). The study conducted a literature search to compare the models based on their scope, components, and applicability. The Anderson model identified three sets of characteristics that affected health seeking behavior: predisposing, enabling, and need (Andersen, 1995). The CSDH framework distinguished between structural and intermediary determinants of health and health inequities (Solar & Irwin., 2010). The study analyzed the following variables: age, education, and occupation as predisposing factors; wealth index and residence as enabling factors; but there are other socioeconomic and political context which are not considered in this study as a variable from the CSDH framework.

Further, this study sought to answer the following research questions "What are the main factors that have significantly associated with the demand and unmet need for contraception in the four regions?" and "Which of those key factors have larger contribution to the inequality among women in the study regions?" Given limited availability of large-scale studies in Ethiopia, this study will provide useful information for program managers of FP programs and policymakers both the national and regional levels. They can use this study finding as an input for their geographic targeting, planning, monitoring, and evaluation of FP programs. The findings of this study will also be helpful in the development of a mitigation strategy to increase the demand for contraception and to reduce the unmet need for contraception in the study region and the country as a whole.

5.2. Methods

5.2.1. Study area

This study was done in four regions of Ethiopia, namely, Afar, Somali, Benishangul Gumuz, and Gambela regions. Those four study regions have common features which includes: they all are geographically peripheral, they are economically disadvantageous in terms of access to basic services, they have relatively homogeneous population and distinct culture (SCI, 2013a, 2013b; SCIl, 2013; UNICEF, 2022). The prevalence of most of the Maternal and Child Health (MCH) service indicators for the study regions are much lower compared to other regions of the country.

They also have higher unmet need and low demand for contraception (Central Stastical Agency(CSA) & ICF, 2017). According to the 2020 projected population size by Central statistics Agency (CSA) of Ethiopia in 2007, the total population of Afar was 1.95 million, Somali region 6.20 million, Benishangul-Gumuz 1.16 million, and Gambela 0.478 million (Central Stastical Agency(CSA), 2007). The proportions of urban population were 21% in Afar, 15% in Somali, 23.6% Benishangul-Gumuz and 36.6% in Gambela (Central Stastical Agency(CSA), 2007). Women in formal employment accounted for 22.7% in Afar, 18.3% in Somali, 49.7% in Benishangul-Gumuz, and 41.6% in Gambela. The educational attainment of the female household population was 31.3% in Afar, 24.7%.in Somali, 53.3% in Benishangul-Gumuz and 73.3% in Gambela (Central Stastical Agency(CSA), 2007).

5.2.2. Source of data and population of the study

Data from the Ethiopian Demographic Health Survey (EDHS) 2016 was used in this study (Central Stastical Agency(CSA) & ICF, 2017). A cross-sectional survey design was used, and the data were collected from all regions and city administrations of Ethiopia during the study period from March 2016 to July 2016. The present analysis extracted data for 3343 women from EDHS-2016 data set collected from the four regions of the study. The sample women were married or in union and sexually active women who had sexual intercourse within 30 days before the data collection date. During data collection, the eligibility criteria to select respondents of the study was "all women between the ages 15 to 49 years and who stayed overnight in the selected households either as a permanent residents or as a visitor for the night before the survey" (Central Stastical Agency(CSA) & ICF, 2017). The EDHS used five different questionnaires, and the present analysis used data collected by woman's questionnaires from 4680 women with ages between 15 to 49 years who were living in the four study regions. A two–stage sampling method was used by EDHS to include the eligible respondents on the survey i.e., The EDHS used a two-stage sampling method to include the eligible respondents. This method selects a sample from a population in two steps: first, it randomly chooses some groups (called primary sampling units or PSUs) from the population; and second, it randomly chooses some individuals (called secondary sampling units or SSUs) from each group. This makes the sample

representative and lowers the cost and reduces data collection difficulties (Central Stastical Agency(CSA) & ICF, 2017).

5.2.3. Variables of the study

The analysis used two dependent variables (i.e., unmet need and demand for contraception). Unmet need for contraception is defined as women who are sexually active and fecund, but they did not use any method of birth control and did not want to have any more children or generally women's having a need to delay getting their next child. The variable was code as "1" if women who had unmet need for contraception and "0" if women who did not have unmet need for contraception.

Demand for contraception was found by calculating all women in the reproductive age group (15 to 49 years) who has both met or unmet need for contraception, and sexually active unmarried women who had sexual intercourse within 30 days before the data collection date. The variable was coded as "0" if women did not have demand for contraception use, and "1" if women had demand for contraception use.

The exposure variables summery

Table 6: Description of exposure variables of the study

Name of variables	Variable Description	Coding
Husband/partner education level /women educational level	Women aged 15-49 or husband by highest level of schooling attended or completed.	1.No education 2.Primary educ, 3.Secondary & above
Women age	Age in completed years	1. 15-19 2. 20-34 3. 35-49.
Residence	Place of residence is the type of place where the respondent resides.	1.Urban 2. Rural
Wealth Index	Composite measure of a household's cumulative living standard	1.Poorest 2. Poorer 3.Midle 4.Richer 5.Richest
Husband/partner Age	Completed years of the length of an	1.15–24

	existence	2.25–34 3. 34-45 4.>45
Total number of children ever born	Number of all children, both surviving and dead to all women	1.<=3 2. >3
Household size	The number of persons in a private household.	1.<=3 2.>3
Work status	Women/husband employed in the 12 months before the survey	1.Not working 2. working

Please note that we excluded region from the list of exposure/explanatory variables, because the 2016 Ethiopia Demographic Health Survey report had already analyzed and revealed significant variations in unmet need and demand for contraception among the study regions.

5.2.4. Statistical analysis

For the data cleaning and analysis, the study used SPSS-v26 and STATA-v17 statistical software's. The data analysis began with a descriptive analysis to portray the respondent's profile/ characteristics. Next, a bivariate mixed effect logistic regression analysis was used, and those with a significant p-value < 0.2 were included in the multivariable mixed effect logistic analysis to see the association of the outcome variable and independent variables of the study. For multivariable mixed effect logistic regression analysis, the study employed a p-value <0.05 with 95% confidence interval to declare the statistically significant associations. The best model fitted for multilevel analysis was chosen using the Intraclass Correlation Coefficient (ICC), Median Odd Ratio (MOR), Likelihood Ratio test (LR), and Criteria information test (AIC and BIC). The model with the smallest value of AIC was better. Moreover, the study also applied a decomposition concentration index to analyze and see the socioeconomic inequalities.

Concentration Index (CI)

A socioeconomic inequality in specific health sector variables does exist and whether it's more distinctive at some point from another or differs from one country/ location to another. To identify those inequalities; scholars used concentration curves, but those curves do not provide a measure for it levels of disparity that can easily compare disparities over several time periods, nations, or localities. Therefore, the concentration curve is directly associated with the concentration index and it quantifies the degree of inequalities in a health variable which are

related to socioeconomic factors (Kakwani et al., 1997). The concentration indices (CIs) are derived from its related concentration curves, and it valued as double the area between concentration curve and the 45-degree line, which represents the line of equality. So, if the concentration index value becomes zero; it means there is no socio-economic related inequality. When the concentration curve lies over the line of equality *C (P),* conventionally the concentration index takes a negative value. As an example; the population's health care utilization is concentrated among the poor; it means the index values remains between −1 and 0, but in contrary; the convention says a positive value taken; when the curve lies under the line of equality $C(P^*)$. we can take as an illustration; the population's health care utilization is concentrated among the rich when the index values remains between 0 and 1 (Phiri & Ataguba, 2014).

Therefore, generally the index ranges from -1 to + 1, where the sign points in the direction of the existing association, however the magnitude result shows the strength of the relationship (Das et al., 2022). The concentration index (CI) can be computed by using "convenient covariance" with the formula below:

$$C = \frac{2}{\mu} cov\,(y_i, R_i) \quad \text{..... (I)}$$

Where C stands for the concentration index y_i for the health variable where the inequality is being calculated, μ is its mean, R_i is the i^{th} individual's fractional rank in the socioeconomic distribution, and cov (.,.) is the covariance. Usually for the weighted data, it is expected to do a computation of the weighted covariance, and we need to generate a weighted fractional rank (Hastie et al., 2009).

Wagstaff et.al. (2001) established how the health concentration index can be decomposed into distinct factors of income-related health inequality, where each contribution is a product of the sensitivity of heath relative to that factor and the level of income-related inequality to the already identified factor. For every linear regression of health model (y), such as

$$y = \alpha + \sum k\beta k\, xk + \varepsilon, \quad \text{..... (II)}$$

the concentration index for *y,* C, can be written as follows:

$$C = \sum_k (\beta_k \bar{x}_k/\mu)\, C_k + GC_\varepsilon/\mu, \quad \text{..... (III)}$$

Where μ is the mean value of y, $\bar{x}_k$ is the mean value of x_k, C_k is the concentration index for x_k (defined analogously to C), and GC_ε is the generalized concentration index for the error term (ε). Formula number III shows, C is equal to a weighted sum of the concentration indexes of the k regressors, where the weight for x_k is the elasticity of y relative to x_k. The remaining component taken by the last term indicates; income-related inequality in health which is not explained by systematic variation in the regressors by income, that should approach to zero for a well-specified model (Wagstaff et al., 2001).

5.3. Results

5.3.1. Respondents' general information

Table 7 summarizes the characteristics of the study respondents. Among the total respondents, 39.9% were found in the age group between 25 to 34 years. 67.5% of respondents of the study were illiterate, and the majority (81.5%) of respondents lived in rural area. More than half (56.1%) of the respondent were residing in poorest households, and 69.4% of respondents were not working during the survey period.

Table 7: Background characteristics of the respondents, N=3343.

Characteristics	Number	Percent
Women's age		
15-24	993	29.7
25- 34	1334	39.9
35-49	1016	30.4
Women Education		
Not able to read and write	2257	67.5
Primary	738	22.1
Secondary and above	348	10.4
Region		
Afar	868	26.0
Somali	975	29.2
Benishangul	797	23.8
Gambela	703	21.0
Residence		
Urban	618	18.5
Rural	2725	81.5
Household wealth index		
Poorest	1875	56.1
Poorer	363	10.9

Middle	263	7.9
Richer	290	8.7
Richest	552	16.5
Women work status		
No	2321	69.4
Yes	1022	30.6

5.3.2. Result from bivariate mixed effect logistic regression

The result in Table 8 showed the bivariate mixed effect logistic regression model results i.e., the model which was used to determine the bivariate relationship of each potential predictor variable with the outcomes of interest. Women's age, age of husband, women employment status, women education status, husband education status, household wealth index, total children ever born, and place of residence were important factors for the demand for contraception since all those variables have a p-value < 0.2. Similarly, the results in Table 3 also showed women age, women education status, household size, husband education status, husband working status , households wealth index, ages of husbands, husband work status and place of residence as important predictors of unmet need for contraception. Therefore, the study considered 8 variables to determine association in both demand and unmet need contraception in the multivariable mixed effect logistic regression.

Table 8: Results of Bivariate mixed effect logistic regression for demand and unmet need for contraception use, Ethiopia, N=3343

	Demand for contraception use				**Unmet need for contraception use**			
	UOR	**95%CI**		**P-value**	**UOR**	**95%CI**		**P-value**
Women's age								
15-24 [RC]								
25-34	0.79	0.64	0.96	**0.02** *	0.86	0.69	1.07	**0.19 ***
35-49	0.51	0.40	0.64	**0.00** *	0.79	0.62	1.00	**0.06 ***
Women work status								
Not working [RC]								
Working	1.41	1.16	1.71	**0.00** *	1.01	0.82	1.24	0.95
Women educational status								
Not able to read and write [RC]								
Primary	2.23	1.81	2.74	**0.00** *	1.52	1.22	1.89	**0.00** *

Secondary and above	2.09	1.55	2.83	**0.00** *	0.93	0.66	1.31	0.69
Household size								
<=5 RC								
>5	0.93	0.78	1.11	0.44	1.29	1.07	1.56	**0.01** *
Husband education								
Not able to read and write RC								
Primary	1.32	1.06	1.64	**0.01** *	0.79	0.62	1.02	**0.07** *
Secondary and above	1.76	1.38	2.24	**0.00** *	1.10	0.85	1.41	0.47
Household wealth index								
Poorest RC								
Poorer	1.57	1.18	2.11	**0.00** *	1.09	0.81	1.47	0.58
Middle	1.59	1.14	2.22	**0.01** *	0.69	0.47	1.01	0.06 *
Richer	1.97	1.41	2.76	**0.00** *	0.71	0.49	1.04	0.08 *
Richest	3.18	2.30	4.39	**0.00** *	0.58	0.42	0.81	**0.00** *
Total children ever born								
<= 3 RC								
>3	0.68	0.57	0.80	**0.00** *	1.03	-0.22	0.85	0.24
Age of husbands								
15-24 RC								
25-34	0.50	0.35	0.73	**0.00** *	0.56	0.38	0.81	**0.00** *
35-45	1.99	0.35	0.72	**0.00** *	0.59	0.40	0.85	**0.01** *
>45	3.77	0.18	0.39	**0.00** *	0.44	0.29	0.66	**0.00** *
Husband work status								
Not working RC								
Working	1.08	0.84	1.37	0.55	0.65	0.52	0.83	**0.00** *
Residence								
Urban RC								
Rural	0.40	0.26	0.62	**0.00** *	1.34	0.98	1.84	**0.07** *

RC=Reference Category, * P < 0.2

5.3.3. Result from mixed effect multivariable logistic regression

Table 9 presents the result for mixed effect multivariable logistic regression for demand and unmet need for contraception in four regions of Ethiopia. The preliminary analysis indicated that age of the women and age of the husbands had significant multicollinearity with Variable Inflation Factor (VIF) >2.5. Therefore, the study excluded those two predictors from mixed effect multivariable logistic regression.

Women's working status, women's education status, household wealth index, and total children ever born had a statistically significant association with demand for contraception. The

likelihood of demand for contraception was 1.34 times (AOR=1.34; 95% CI (1.10, 1.62), P-Value = 0.00) for working women compared to non-working women. Based on the women's education status, the likelihood of demand for contraception was 1.51 times (AOR=1.51; 95% CI (1.53, 2.42), P-Value = 0.02) for respondents who completed secondary and above education, and 1.92 times (AOR=1.92; 95% CI (1.06, 2.15), p-value = 0.00) for those completed primary school compared to the illiterate women. This study also revealed an increase in demand for contraception use when we go from the middle wealth indexed women to richest wealth indexed women i.e., the likelihood of demand for contraception was 1.42 times higher (AOR=1.42; 95%CI (1.01, 1.99), P-Value = 0.04) for middle wealth index, 1.69 times (AOR=1.69; 95%CI (1.20,2.38), p-value = 0.00) for richer household wealth index, and 2.37 times (AOR=2.37; 95% CI(1.57,3.58), p-value =0.00 for a richest household wealth index compared to women living in poorest household wreath index. The ICC value in the final model for demand for contraception is 0.18, while the value of MOR and log-likelihood ratio result was 2.23 and 0.99 respectively, which indicates that the model used in this study is best fitting model.

Table 9: Multivariable mixed effect logistic regression for demand and unmet need for contraception use, Ethiopia, N=3343

	Demand for Contraception use				**Unmet need for contraception use**			
	AOR	**95%CI**		**P-value**	**AOR**	**95%CI**		**P-value**
Random effect only model: EAs	**0.84**	**0.7**	**1.01**		**0.52**	**0.39**	**0.7**	
Women work status								
Not working [RC]								
Working	1.34	1.10	1.62	**0.00***				
Women education status								
Not able to read and write [RC]								
Primary	1.92	1.53	2.42	**0.00***	1.87	1.45	2.41	**0.00***
Secondary and above	1.51	1.06	2.15	**0.02***	1.21	0.80	1.83	0.37
Household size								
<=5 members [RC]								
>5 members					1.34	1.10	1.63	**0.00***
Husband's education status								
Not able to read and write [RC]								
Primary	1.01	0.80	1.27	0.94	0.77	0.58	1.00	0.06
Secondary and above	1.06	0.79	1.40	0.71	1.14	0.83	1.55	0.42
Household wealth index								
Poorest [RC]								

Poorer	1.44	1.07	1.93	**0.01***	1.11	0.81	1.50	0.52
Middle	1.42	1.01	1.99	**0.04***	0.69	0.47	1.02	0.07*
Richer	1.69	1.20	2.38	**0.00***	0.69	0.47	1.01	0.06*
Richest	2.37	1.57	3.58	**0.00***	0.51	0.32	0.81	**0.00***
Total children ever born								
<= 3 [RC]								
>3	0.83	0.69	0.99	**0.05***				
Husband working status								
not working [RC]								
Working					0.68	0.54	0.87	**0.00***
Residence								
Urban [RC]								
Rural	1	0.63	1.58	0.99	0.94	0.6	1.47	0.79
Number of groups =220	AIC=3734.36		BIC=3813.71		AIC=3020.02		BIC=3099.37	
	ICC=0.18		MOR=2.23		ICC=0.08		MOR=1.65	
	Likelihood ratio=P value =0.99				Likelihood ratio=P value= 0.80			

RC= Reference Category

The result in Table 9 also indicates that women education status, household size, wealth index and husband working status had a statistically significant association with unmet need for contraception. The likelihood of met need for contraception was 1.87 times higher (AOR=1.87; 95% CI (1.45, 2.41), P-value = 0.00) for women who had a primary education status compared to illiterate women. The likelihood of unmet need for contraception was 1.34 times higher (AOR=1.34; 95% CI (1.10, 1.63), P-Value = 0.00) for women living in households with a size greater than 5 compared to households with a size of less than and equal to 5. In addition, the likelihood of met need for contraception was 0.51 times higher (AOR= 0.51; 9%CI (0.32, 0.81), p-value = 0.00) for those women who reside in richest wealth households compared to those women living in the poorest household wealth index category. The value of ICC was 0.08 and the result for MOR and Log-likelihood Ratio (LR) test was 1.65 and 0.80 respectively for the unmet need for contraception; this result also revealed the model was the best fit.

Result from concentration index

The result in Table 10 summarizes the concentration index for demand and unmet need for contraception in the four study regions of Ethiopia. The results indicate that the demand for contraception was highly concentrated among women and their husband having better educational status (at least completed a primary school and more), younger women, living in less than or equal to five household size, husbands with working status and those who lived in urban areas. In addition, the result also confirmed that the decrease in unmet need for contraception was heavily concentrated in working women, women with less than or equal to five household size and women who had children less than or equal to three. Further, the unmet need for contraception use was highly concentrated when the women and their husbands had greater than or equal to primary school.

Table 10: Concentration Index for demand and unmet need for contraception use, four regions of Ethiopia (N=3343).

	Demand for contraception use			**Unmet need for contraception use**		
	Index value	**Robust std.**	**p-value**	**Index value**	**Robust std.**	**p-value**
Women age						
15-24	0.3	0.05	**0.00**	-0.08	0.07	0.24
25-34	0.35	0.05	**0.00**	0.03	0.06	0.6
35-49	0.16	0.06	**0.01**	-0.03	0.07	0.64
Women work status						
Not working	0.26	0.05	**0.00**	0.01	0.04	0.77
Working	0.22	0.05	**0.00**	-0.15	0.06	**0.02**
Women education status						
Not able to read and write	0.21	0.04	**0.00**	0.02	0.05	0.67
Primary	0.15	0.06	**0.02**	-0.15	0.07	**0.02**
Secondary and above	0.15	0.07	**0.04**	-0.22	0.11	**0.05**
Household size						
<=5 members	0.35	0.05	**0.00**	-0.08	0.05	**0.08**
>5 members	0.2	0.05	**0.00**	0.05	0.05	0.34
Husband's education						
Not able to read and write	0.18	0.04	**0.00**	0.03	0.05	0.52
Primary	0.28	0.06	**0.00**	-0.12	0.06	**0.07**
Secondary and above	0.23	0.06	**0.00**	-0.14	0.07	**0.07**

Total children ever born						
<= 3	0.3	0.04	**0.00**	-0.14	0.05	**0.00**
>3	0.22	0.05	**0.00**	0.07	0.05	**0.17**
Age of husband						
15-24	0.3	0.11	**0.01**	-0.11	0.11	0.32
25-34	0.33	0.06	**0.00**	-0.06	0.06	0.34
35-45	0.26	0.05	**0.00**	-0.01	0.05	0.87
>45	0.19	0.08	**0.02**	0.02	0.09	0.81
Husband work status						
Not working	0.03	0.08	0.65	-0.01	0.08	0.91
Working	0.31	0.04	**0.00**	-0.02	0.04	0.65
Residence						
Urban	0.23	0.05	**0.00**	0.00	0.08	0.95
Rural	0.21	0.05	**0.00**	-0.01	0.04	0.83

5.3.4. Result from decomposition of concentration index

The result in Table 11 shows the contribution of factors based on decomposition concentration index for demand and unmet need for contraception use in four regions of Ethiopia. The findings in the table shows the socioeconomic factors considered in this study played a significant contribution for the existing inequality in the demand and unmet need for contraception among women situated in the four regions of the study. In case of demand for contraception, illiteracy of the respondents (56%), richest economic status/ wealth index (41%) and women of not working status (21%) contributed larger proportion of the variations in inequality in demand for contraception among women in the four regions of Ethiopia. The highest elasticity was observed with respect to wealth index i.e., poorest (0.3060) and richest (0.1147), and women with less than and equal to 3 children ever born (0.1283). In case of unmet need for contraception, the larger contribution of inequality is from illiteracy of the husband (197%) and the household size less than or equal to five (184%) but illiteracy of respondent (-249%) and unemployment status of respondents (-119%) contributes to decrease the inequality in unmet need for contraception. The maximum elasticity was detected on total children ever born which is less than and equal to 3 children (0.0892) and illiteracy of husbands (0.0886).

Table 11: Contribution of factors based on decomposition of concentration index analysis of for demand and unmet need for contraception, four regions of Ethiopia, N=3343

	Demand for contraception				Unmet need for contraception			
	Elasticity	**CI**	**Absolute contribution**	**percent contribution**	**Elasticity**	**CI**	**Absolute contribution**	**percent Contribution**
Women age								
15-24	-0.0110	0.0331	-0.0004	0				
25-34	0.0102	-0.0196	-0.0002	0				
35-49[RC]								
Women work status								
Not working	-0.2273	-0.2620	0.0596	21	-0.0908	-0.2620	0.0238	-119
Working [RC]								
Women education status								
Not able to read and write	-0.3193	-0.4952	0.1582	56	-0.1008	-0.4952	0.0499	-249
Primary	0.0000	0.3352	0.0000	0	0.0506	0.3352	0.0170	-85
Secondary and above [RC]								
Household size								
<=5 members	-0.1002	0.1567	-0.0157	-6	-0.2361	0.1567	-0.0370	184
>5 members [RC]								
Husband education								
Not able to read and write	0.0649	-0.4454	-0.0289	-10	0.0886	-0.4454	-0.0395	197
Primary level	0.0328	0.1926	0.0063	2	-0.0206	0.1926	-0.0040	20
Secondary and above [RC]								
Total children ever born								
<= 3	0.1283	0.2058	0.0264	9	0.0892	0.2058	0.0183	-91
>3 [RC]								

Age of husband								
15-24	0.0059	0.0152	0.0001	0				
25-34	-0.0567	0.0338	-0.0019	-1				
35-45	-0.0587	-0.0597	0.0035	1				
>45 [RC]								
Husband working status								
Not working [RC]								
Working [RC]	0.0718	0.1865	0.0134	5				
Residence								
Urban	-0.0287	0.8131	-0.0233	-8				
Rural [RC]								
Household wealth index								
Poorest [RC]								
Poorer	0.3060	0.2970	0.0091	3	0.0075	0.2970	0.0022	-11
Middle	0.0227	0.4939	0.0112	4	-0.0102	0.4939	-0.0051	25
Richer	0.0381	0.6606	0.0252	9	0.0040	0.6606	0.0027	-13
Richest	0.1147	1.0000	0.1147	41	-0.0335	1.0000	-0.0335	-3

5.4. Discussion

This study was primarily aimed at exploring inequalities in the demand and unmet need for contraception among married/ in-union and sexually active women in four regions (Afar, Benishangul Gumuz, Gambela and Somali) of Ethiopia. The findings of the study provided several prominent results on the individual, household, and community variables predicting the two outcome variables of the study.

The findings from the mixed effect multivariable logistic regression for demand and unmet need for contraception indicated that women's education had a positive association with demand and unmet need contraception in the study regions. The finding is consistent with others' studies around the world: studies conducted in Saudi Arabia (Khalil et al., 2018), in Nigeria (Fagbamigbe et al., 2018), in Uganda (Tetui et al., 2021), and in different districts of Ethiopia (Asmamaw & Negash, 2023; G/Meskel et al., 2021; Girma Garo et al., 2021; Kebede et al., 2019; Mekonnen & Worku, 2011). Further, the result of the decomposition concentration index signified that women's education status is one of the significant contributors for the existing inequality in demand and unmet need contraception in the study regions. The most plausible explanation for this could be when women become educated, they get better opportunity to get autonomy and decision-making power on health service utilization. Also, educated women have better knowledge on the contraception choices, sources, benefit and possible adverse effects as they have ample access to printed media and different messages delivered in health facilities (Baldwin et al., 2008; G/Meskel et al., 2021; Girma Garo et al., 2021; Janet Núñez Gough, 2007; Mekonnen & Worku, 2011).

Another noteworthy finding was the significant association between household wealth index with both demand and unmet need for contraception. Thus, better household wealth tends to increase the demand for contraception and decreases the unmet need contraception. The decomposition of concentration index further signifies that wealth index is one of the major contributors of demand for FP and a reduction of unmet need contraception among women in the study regions. The finding is consistent with other studies done in Sub-Saharan African countries (Ekholuenetale et al., 2022; Mutua, et al., 2021) and a recent study done in Ethiopia (Asmamaw & Negash, 2023; Tsehay, 2022). If households have a higher wealth index, it may imply that they would have an access for different resources, giving them a very good purchasing power (Asresie et al., 2020; Rakotomanana et al., 2017). Given that the government does not have the capacity to avail all kinds of contraception methods with the

required quantity and quality (Tsehay, 2022; UNFPA & WHO, 2015), women in the poorest households may be limited to get full access to FP services as they usually cannot afford to visit private health care service providers/ pharmacies. In-addition, physical distances of the health facilities may also impose additional transport cost on women residing in poor/poorest households (Samuel et al., 2021).

Interestingly, the findings in this study revealed that working women were more likely to have demand for contraception. Similarly, these women who have a working husband are less likely to have unmet need for contraception. Indeed, the decomposition of concentration index also indicated the significant contribution of parental work status for the prevailing inequalities in the demand for contraception among women. One plausible reason for this could be that raising or giving care to children is one of the hardest jobs which need time, money, and other resources. Given most women in Ethiopia are living in households with limited resources; some parents may decide to limit or space birth. Such decision, in fact, is an opportunity cost for the family to use the time and other available resources to improve the existing family well beings (De Jong et al., 2016; Mwaikambo et al., 2011). Women employment status can also be inferred from an increase in their freedom of movement and decision making, which enhances their ability to interact with friends and family (Grown et al., 2005).

The total number of children ever born is another significant predictor of demand for contraception which also appeared as one of the largest contributors of the inequality in the decomposition analysis. One of the possible explanation for increased demand for contraception with higher parity is that through time parents tend to realize the economic and social burden child-care requires (such as increasing cost of education, declined need for child labor)(Asmamaw & Negash, 2023; Creanga et al., 2011; Ngome & Odimegwu, 2014; Teshale et al., 2020). Furthermore, previous studies conducted by Melkalem et.al. in Ethiopia also indicate that women who have more than three children and are exposed to various insights regarding family planning utilization will experience a significant negative effect on their unmet need for family planning (Azanaw et al., 2022).

A closely related variable, family size also had an important association with unmet need contraception. Larger families typically have lower rates of unmet need for contraception. This is consistent with a previous study done in Nigeria which indicated that women who

desired extended family size were associated with unmet need for contraception compared to those who desired smaller household size (Solanke et al., 2022).

Decomposition analysis result indicated that paternal education had significantly larger contribution to inequalities in the demand and unmet need contraception among women in the study regions. This is not surprising as a study done in other regions of Ethiopia also provide consistent conclusion. For instance, a study done in Butajira District , south central Ethiopia (Mekonnen & Worku, 2011) reported that husbands had significant role in their wives' use of contraception. One possible pathway for husbands' higher education to influence FP service utilization could be the likelihood of providing their wives more freedom, supports, and autonomy to make independent decisions (Abate & Belachew, 2017; Allen & Daly, 2007; Ashmad et al., 2012). Further, more educated husbands provide ample opportunity to have good knowledge of limiting and spacing birth, thereby promoting open discussion and communication with their wives. A study conducted in Ethiopia witnessed that educated husbands are more willing to host their spouse for discussions about using contraception compared to those illiterate husbands (Mekonnen & Worku, 2011).

Finally, it is worth mentioning that the present study has strengths as well as some limitations. To start from its strength; this study used a representative data collected from all four regions of the study. The results of the study can be used by the authorities of those study regions as a base for their planning, monitoring, and evaluation of the family planning programs. In addition, this study used a unique inequality analysis technique which provided more rigorous findings. Furthermore, the EDHS survey used internationally validated and standard data collection tools with a slight modification by considering a country specific context with the use of well-designed standard procedures that ensured the validity and reliability of the collected data. The study is not immune to some limitations. One peculiar limitation we observed in this study is EDHS used a cross-sectional design, which entails collection of information at a specific period of- time. This limits the ability of the study to make casual inferences. Also, some essential variables like husband perception on contraception use and unmet need, and attitude towards the different method of contraception was not included in our analysis due to the limitations of getting adequate data.

5.5. Conclusions

This study has shown that there is huge inequality in the demand and unmet need for contraception among women of age 15 to 49 years in the four study regions of Ethiopia.

These regions are among the most disadvantaged in the country, according to the World Bank. However, our study also revealed that there are significant variations in the demand and unmet need for contraception within these regions, depending on the socioeconomic characteristics of the women and their husbands. This suggests that even within the low-performing regions, there are groups of women who face more barriers and challenges in accessing and using family planning services than others. Therefore, we conclude that there are multiple layers of disparities in the reproductive health outcomes of women in these regions, and that addressing them requires tailored and targeted interventions that consider the specific needs and preferences of different subgroups of women. The findings imply an urgent need for narrowing down the unacceptably high level of socioeconomic inequalities to reduce unmet need for FP and increase the demand for contraception in those parts of country. The study strongly recommended implementation of multidimensional and multisectoral approaches to significantly reduce the inequalities in the two outcome variables.

CHAPTER SIX

Barriers to modern contraceptive utilization in very high fertility regions of Ethiopia

(Manuscript submitted for publication @ Journal of Family and Reproductive Health (JFRH), and; authors are Tigist Shumet, Nigatu Regassa, and Jemal Ali)

6.1. Introduction

One of the goals of the Sustainable Development Goals (SDGs), Goal 3, is to ensure that everyone has access to sexual and reproductive healthcare services, including access to contraceptives, information, and education, and the incorporation of reproductive health into national plans and programmes by 2030 (WHO, 2022a). The use of contraception has several advantages for both the women who use it and the society in which they live. The main advantages of contraception are that it allows women to have the number of children they wish, space out pregnancies, prevent unintended pregnancies, lower the risk of morbidity and mortality from childbirth, and reduce the likelihood of abortions (UNFPA, 2012; WHO, 2022b). Approximately 214 million women in developing countries who are of reproductive age and wish to avoid pregnancy do not use a modern contraceptive method. In addition, almost half of the pregnancies are unintended. Unplanned pregnancies are more common in the poorest regions of the world (World Health Organization(WHO), 2020).

Of the married or in-union women in 2022, the prevalence of any method of contraception was estimated to be 65% and that of using modern methods was 58.7% (World Health Organization(WHO), 2023b). According to the most recent Ethiopia Demographic and Health Survey (EDHS) of 2019, the prevalence of utilization of modern contraceptive methods was 40.5% at national level, 12.7% in Afar, and 3.4% in Somali in 2019 (EPHI & ICF, 2021). Moreover, the fertility rate in Ethiopia remains high especially in Afar and Somali Region of Ethiopia which account for 5.5 and 7.2 children per woman, respectively (Central Stastical Agency(CSA) & ICF, 2017). In addition, 84% of health facilities provided any modern contraceptive method nationally, 89% in Afar, and 82% of health facilities in Somali region provided contraceptive methods (EPHI & ICF, 2021).

The use of contraception was influenced by several factors, as revealed by previous studies, including gender preference, family size, maternal age, parity, education (Alsaleem et al., 2018; Wondimagegne et al., 2023). Lack of awareness, poor knowledge, fear of side effects,

low self-esteem, inability to afford the cost of services, poor parent-child communication regarding sexual and reproductive health, parents' negative attitudes towards sexual education, lack of privacy and confidentiality in the health system, stock-outs of contraceptive commodities, judgmental attitudes of health workers, and a lack of staff members who are knowledgeable about adolescent sexual and reproductive health, social shaming and religious intolerance, unfavorable peer and media influences, a lack of sexuality education in schools, a lack of social networks in communities, and poor economic situations for adolescents are common barriers that affect contraceptive utilization of adults (Ezenwaka et al., 2020).

Contraception is one of the most effective government programmes that can be implemented in the future. The health system of Ethiopia has three levels: primary, secondary, and tertiary, connected through a referral system. Primary health systems provide services for 100,000 people with primary hospitals, health centers serving 25,000, and satellite health posts. Level two includes general hospitals covering 1 million people, and level three includes specialized hospitals covering 5 million people. Contraceptive service provide all level of health facilities (MoFED, 2010). In order to increase the use of contraception among married women to 55% by 2030, the Ethiopian government committed significant resources to the implementation of reproductive health programmes that encourage the use of high-quality contraceptive services (Ministry of Health Ethiopia, 2020). Therefore, the study addresses vital areas of need as it identifies barriers, and it helps to design appropriate strategies which required improving the service utilization.

Given the two study regions are currently experiencing unacceptably high fertility rate and lower contraceptive use prevalence, it is imperative to examine the key barriers and challenges for the adoption of modern contraceptive methods. In those two regions (i.e. Afar and Somali) of Ethiopia, and as far as the authors are aware, there is huge gap in our knowledge of the dynamics of the sociocultural barriers to the use of modern contraception. Therefore, the current study aimed to explore the barriers of contraceptive use among women of reproductive age in the two regions based on qualitative data. The study warrants answering one principal question "*What are the key barriers for contraceptive utilization among women of reproductive age in Afar and Somali regions of Ethiopia*?

6.2. Methods

6.2.1. Study design and approaches

The study used cross sectional study design with sequential mixed method approach, consisting of a scoping review in the first step and qualitative interviews in the second step. The interviews included in-depth interviews (IDIs) and key informant interviews (KIIs).

The scoping review was conducted following the original methodological framework developed by Arksey and O'Malley (2005) (Arksey & O'Malley, 2005). The specific aims and scope of the scoping review in this study was to map the existing evidence on barriers of modern contraceptive among women of reproductive age in Ethiopia and identifying the potential theme.

6.2.2. Eligibility criteria, search strategy, and charting process of the scoping review

The scoping review included studies that had qualitative or mixed-methods design; involve women of reproductive age (15-49 years) in Ethiopia as the target population; report on any type of contraceptive utilization (modern, traditional, long-acting, short-acting, emergency, etc.) as the main outcome; were published between 2013 and 2023; and are written in English. The review began with identifying relevant sources of information by searching the major scientific databases and the grey literature available as reports. The popular databases searched include PubMed/Medline, Embase, Cochrane Review, ISI Web of Science, and SCOPUS. The scoping review used the following keywords and Boolean operators to search the studies: ("contraceptive utilization" OR "contraceptive use" OR "family planning" OR "birth control") AND ("determinants" OR "factors" OR "barriers" OR "facilitators" OR "interventions" OR "best practices") AND "Ethiopia". In addition, apply the following filters: publication date (2013-2023), language (English), and study design (qualitative or mixed methods). This scoping review used a standardized data charting form to extract and summarize the following information from the included studies: author, year, title, journal, study design, study population, sample size, setting, and barriers and facilitators for contraceptive utilization. The scoping review used Microsoft Excel to organize and analyze the data. Some articles were excluded where the contraception type variables were not clearly indicated.

6.2.3. Study selection

After completion of search, all identified articles were collected and uploaded in to the Mendeley citation manager for the management of reference and to avoid duplicates. Figure 4 shows the detail of the selection process.

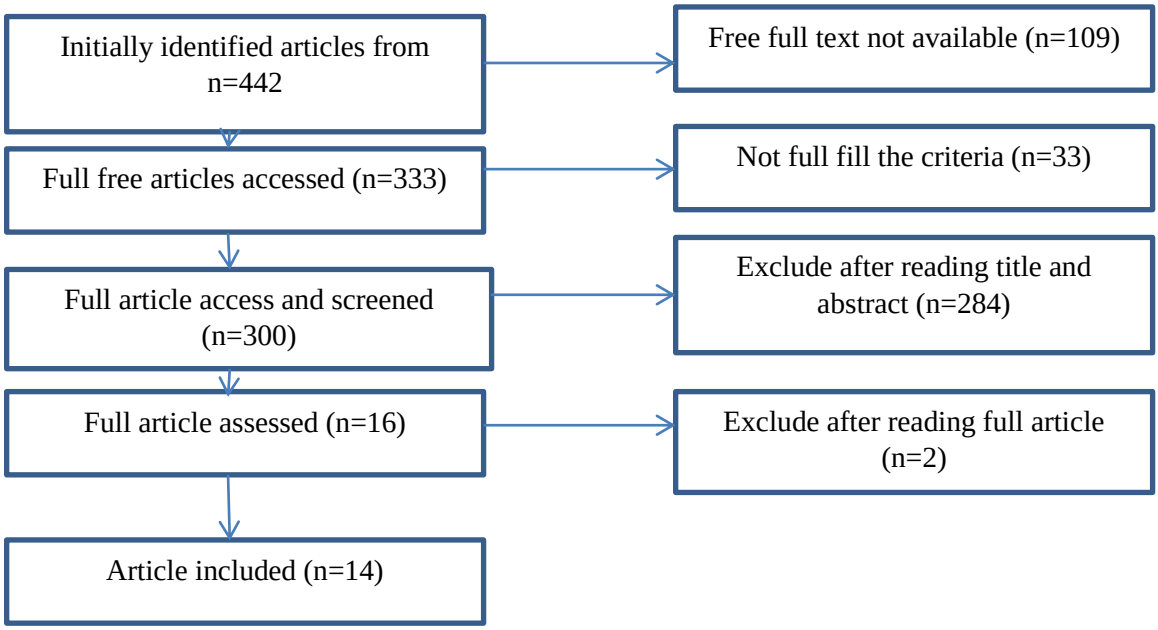


Figure 4: Flowchart for study selection and inclusion process for scoping review

6.2.4. Study setting for the qualitative study

The study was conducted in Ethiopia's Afar and Somali region from December 04, 2023, to January 15, 2024. According to Central Statistical Agency of Ethiopia projected a total population of 2.08 million in the Afar region in 2023 G.C., with 21% residing in urban areas (Central Stastical Agency(CSA), 2007). In Afar, 22.7% of women were in formal employment, 31.3% of women were educated. 71.2% women make decisions on their own health care either alone or jointly with their husband. With regard to the exposure to mass media, 13.3% had access to radio,15.6% access to television, and only 3% had access to newsletter (Central Stastical Agency(CSA) & ICF, 2017). The projected population of Somali region was 6.66 million in 2023 G.C., with 16% in urban areas (Central Stastical Agency(CSA), 2007). In Somali, 18.3% of women were in formal employment, 24.7% women were educated. 76% women make decisions on their own health care either alone or jointly with their husband. Exposure to radio accounted for 4.1%, access to radio,7.9% had access to television, 1.3% had access to newsletter but the remaining don't have any access for any mass media (Central Stastical Agency(CSA) & ICF, 2017).

6.2.5. Qualitative data collection

The study was conducted in one urban and one rural kebele selected from each region (i.e. Afar and Somali). All women aged 15-49, currently married, sexually active or in consensual union were included for the in-depth interview, and health extension worker and contraception provider from health center were interviewed as key informants. The study used in-depth interview and key informant with semi structure interview guide. A guiding question was created using the scoping review as a basis. The original English version of the questionnaire was translated into three local languages. Four health professional data collectors were chosen based on their proficiency in the local language and prior expertise collecting qualitative data (1 medical doctor, 1 midwife and 2 health officers). A total of 20 in-depth and 07 key informants were conducted. The data collectors had one day of training, and with participant permission the data was audio recorded.

6.2.6. Data analysis

All recorded qualitative data were transcribed verbatim, translated into English and coded in NVivo 12 qualitative software to generate query reports which was narrated thematically. Field notes were translated into English and selected quotations were presented in the text. Data were analyzed and compiled using a thematic approach by conducting an on-going content analysis. Multiple readings of the KII interviews transcripts to ensure familiarity with the data, to get an understanding of the data as a whole, to begin to identify recurring ideas, and core, a typical or notable idea, and these were captured in reflective notes.

6.3. Results

6.3.1. Result of scoping review

We conducted a scoping review on the topic of contraceptive utilization and its determinants among women in Ethiopia based on 14 articles (Alem Gebremariam, 2015; Aychew et al., 2022; Bekele et al., 2021; Endriyas et al., 2018; M. Gebremedhin et al., 2017; Gonie et al., 2018; Guta et al., 2021; Henok & Takele, 2017; Jalu et al., 2019; Nega et al., 2021; Tenaw, 2022; Teshoma et al., 2023; Utaile et al., 2020; Woldeyohannes et al., 2022). The findings of the scoping review show that, in addition to barriers, those articles also cover different aspects of contraceptive utilization, such as prevalence (Alem Gebremariam, 2015; Bekele et al., 2021; Endriyas et al., 2018; M. Gebremedhin et al., 2017; Gonie et al., 2018; Guta et al., 2021; Nega et al., 2021; Seyife et al., 2019; Tenaw, 2022; Teshoma et al., 2023), preference (Endriyas et al., 2018; M. Gebremedhin et al., 2017; Henok & Takele, 2017), discontinuation

(Alem Gebremariam, 2015; Nega et al., 2021; Teshoma et al., 2023a; Utaile et al., 2020; Woldeyohannes et al., 2022), switching (Alem Gebremariam, 2015; Nega et al., 2021; Teshoma et al., 2023), and among various groups of women, such as married (Alem Gebremariam, 2015), street (Guta et al., 2021), pastoralist (Henok & Takele, 2017), and abortion-seeking (Tenaw, 2022) women in different regions of Ethiopia. The articles use different methods of data collection and analysis, such as qualitative (Endriyas et al., 2018; M. Gebremedhin et al., 2017; Henok & Takele, 2017; Jalu et al., 2019; Utaile et al., 2020; Woldeyohannes et al., 2022) or mixed methods (Alem Gebremariam, 2015; Aychew et al., 2022; Bekele et al., 2021; Endriyas et al., 2018; Gonie et al., 2018; Guta et al., 2021a; Nega et al., 2021; Seyife et al., 2019; Tenaw, 2022; Teshoma et al., 2023), and employ different sampling techniques, such as random (18,20–24), purposive (Endriyas et al., 2018; M. Gebremedhin et al., 2017; Gonie et al., 2018; Guta et al., 2021a; Henok & Takele, 2017; Jalu et al., 2019; Nega et al., 2021; Tenaw, 2022; Teshoma et al., 2023a; Woldeyohannes et al., 2022), census (Guta et al., 2021a) or convenience sampling (Utaile et al., 2020). The sample sizes range from 10 (Alem Gebremariam, 2015) to 2891(Bekele et al., 2021).

The articles report different types of contraceptive methods, such as short-acting (M. Gebremedhin et al., 2017; Seyife et al., 2019; Utaile et al., 2020), long-acting (Alem Gebremariam, 2015; Aychew et al., 2022; Bekele et al., 2021; Gonie et al., 2018; Jalu et al., 2019; Nega et al., 2021; Seyife et al., 2019; Teshoma et al., 2023; Utaile et al., 2020; Woldeyohannes et al., 2022), and emergency contraceptives (Tenaw, 2022). The most commonly used contraceptives are injectable (Aychew et al., 2022; Bekele et al., 2021; Endriyas et al., 2018; M. Gebremedhin et al., 2017; Gonie et al., 2018; Guta et al., 2021a; Henok & Takele, 2017; Nega et al., 2021; Seyife et al., 2019; Tenaw, 2022; Teshoma et al., 2023a; Utaile et al., 2020; Woldeyohannes et al., 2022), implants (Aychew et al., 2022; Bekele et al., 2021; Endriyas et al., 2018; M. Gebremedhin et al., 2017; Gonie et al., 2018; Guta et al., 2021; Henok & Takele, 2017; Nega et al., 2021; Seyife et al., 2019; Tenaw, 2022; Teshoma et al., 2023; Utaile et al., 2020; Woldeyohannes et al., 2022), (Aychew et al., 2022; Bekele et al., 2021; Endriyas et al., 2018; M. Gebremedhin et al., 2017; Gonie et al., 2018; Guta et al., 2021; Henok & Takele, 2017; Nega et al., 2021; Seyife et al., 2019; Tenaw, 2022; Teshoma et al., 2023; Utaile et al., 2020; Woldeyohannes et al., 2022), pills (Aychew et al., 2022; Bekele et al., 2021; Endriyas et al., 2018; M. Gebremedhin et al., 2017; Gonie et al., 2018; Guta et al., 2021a; Henok & Takele, 2017; Nega et al., 2021; Seyife et al., 2019; Tenaw, 2022; Teshoma et al., 2023; Utaile et al., 2020; Woldeyohannes et al., 2022), and

condoms (Alem Gebremariam, 2015; Aychew et al., 2022; Bekele et al., 2021; Endriyas et al., 2018; M. Gebremedhin et al., 2017; Gonie et al., 2018; Guta et al., 2021; Henok & Takele, 2017; Nega et al., 2021; Seyife et al., 2019; Tenaw, 2022; Teshoma et al., 2023; Utaile et al., 2020; Woldeyohannes et al., 2022). The least used contraceptives are intrauterine devices (IUDs) (Aychew et al., 2022; Bekele et al., 2021; Endriyas et al., 2018; M. Gebremedhin et al., 2017; Gonie et al., 2018; Guta et al., 2021; Henok & Takele, 2017; Nega et al., 2021; Seyife et al., 2019; Tenaw, 2022; Teshoma et al., 2023; Utaile et al., 2020; Woldeyohannes et al., 2022) and female condom (Aychew et al., 2022; Bekele et al., 2021; Endriyas et al., 2018; M. Gebremedhin et al., 2017; Gonie et al., 2018; Guta et al., 2021a; Henok & Takele, 2017; Nega et al., 2021; Seyife et al., 2019; Tenaw, 2022; Teshoma et al., 2023; Utaile et al., 2020; Woldeyohannes et al., 2022).

The articles identify various factors that influence contraceptive utilization, such as socio-demographic, economic, cultural, religious factors (Alem Gebremariam, 2015; Aychew et al., 2022; Bekele et al., 2021; Endriyas et al., 2018; M. Gebremedhin et al., 2017; Gonie et al., 2018; Guta et al., 2021; Henok & Takele, 2017; Jalu et al., 2019; Nega et al., 2021; Seyife et al., 2019; Tenaw, 2022; Teshoma et al., 2023; Utaile et al., 2020; Woldeyohannes et al., 2022), health service factors (Alem Gebremariam, 2015; Aychew et al., 2022; Bekele et al., 2021; Endriyas et al., 2018; M. Gebremedhin et al., 2017; Gonie et al., 2018; Guta et al., 2021a; Henok & Takele, 2017; Jalu et al., 2019; Nega et al., 2021; Seyife et al., 2019; Tenaw, 2022; Teshoma et al., 2023; Utaile et al., 2020; Woldeyohannes et al., 2022), and knowledge-related factors (Alem Gebremariam, 2015; Aychew et al., 2022; Bekele et al., 2021; Endriyas et al., 2018; M. Gebremedhin et al., 2017; Gonie et al., 2018; Guta et al., 2021; Henok & Takele, 2017; Jalu et al., 2019; Nega et al., 2021; Seyife et al., 2019; Tenaw, 2022; Teshoma et al., 2023; Utaile et al., 2020; Woldeyohannes et al., 2022). Some of the common factors that increase contraceptive utilization are higher education, urban residence, higher income, exposure to mass media, spousal communication, family size, and access to quality health services factors (Alem Gebremariam, 2015; Aychew et al., 2022; Bekele et al., 2021; Endriyas et al., 2018; M. Gebremedhin et al., 2017; Gonie et al., 2018; Guta et al., 2021; Henok & Takele, 2017; Jalu et al., 2019; Nega et al., 2021; Seyife et al., 2019; Tenaw, 2022; Teshoma et al., 2023a; Utaile et al., 2020; Woldeyohannes et al., 2022). Some of the common factors that decrease contraceptive utilization are lack of awareness, misconceptions, myths, side effects, fear of infertility, partner opposition, social stigma(Alem Gebremariam, 2015; Aychew et al., 2022; Bekele et al., 2021; Endriyas et al., 2018; M. Gebremedhin et al., 2017;

Gonie et al., 2018; Guta et al., 2021; Henok & Takele, 2017; Jalu et al., 2019; Nega et al., 2021; Seyife et al., 2019; Tenaw, 2022; Teshoma et al., 2023; Utaile et al., 2020; Woldeyohannes et al., 2022) , and cultural norms (Alem Gebremariam, 2015; Aychew et al., 2022; Bekele et al., 2021; Endriyas et al., 2018; M. Gebremedhin et al., 2017; Gonie et al., 2018; Guta et al., 2021; Henok & Takele, 2017; Jalu et al., 2019; Nega et al., 2021; Seyife et al., 2019; Tenaw, 2022; Teshoma et al., 2023; Utaile et al., 2020; Woldeyohannes et al., 2022).

The articles suggest various recommendations to improve contraceptive utilization, such as providing information, education and communication (IEC) programs to raise awareness, knowledge and attitude about contraceptive methods and services among the population, especially women, men, religious leaders and community health workers(Alem Gebremariam, 2015; Gonie et al., 2018; Guta et al., 2021; Nega et al., 2021; Teshoma et al., 2023) providing quality, comprehensive and client-centered counseling services to address myths, misconceptions, fears and side effects of contraceptives, and to help clients make informed choices and plan their pregnancies (Alem Gebremariam, 2015; Aychew et al., 2022; Endriyas et al., 2018; Nega et al., 2021; Teshoma et al., 2023; Utaile et al., 2020; Woldeyohannes et al., 2022), increasing access and availability of long-acting contraceptives, such as IUDs and implants, and ensuring adequate training, supplies and equipment for health care workers (Aychew et al., 2022; Guta et al., 2021; Woldeyohannes et al., 2022), empowering women and girls to participate in different forms of job, education and decision-making, and to control their fertility and prevent unwanted pregnancy and termination of pregnancy (Aychew et al., 2022; Seyife et al., 2019), strengthening health systems and policies to support contraceptive use and reproductive health, and to address transport and distance issues (Aychew et al., 2022; Woldeyohannes et al., 2022) and involving male partners and couples in contraceptive use and communication, and promoting emergency contraceptives as a backup option (Gonie et al., 2018; Tenaw, 2022).

Table 12: Characteristics of studies included in the scoping review, In December 2013 – Novemvber2023.

Author(s)Year	Contraceptives of focus	Data collection methods and sample size	Setting	Barriers for Contraceptive Utilization
Bekele et al., 2021	Modern contraceptives	15 FGD, 80IDIs, 52 KII	Four emerging regions (Afar, Benishangul-Gumuz, Gambela, and Somali)	Individual, health care system and sociocultural factors
M. Gebremedhin et al., 2017	Modern contraceptives	6FGD and 15 IDIs	Central zone, Tigray region	lack of women self-empower fear of complication and social issues
Aychew et al., 2022	Long-acting contraceptives	6 IDIs and 4 KIIs	Farta Woreda, Northwest Ethiopia	fear of side effects, misconceptions, and partner opposition
Woldeyohannes et al., 2022	Intrauterine device (IUDs)	13 IDIs	Hossana town, Southern Ethiopia	shortage of necessary supplies, poor provider–client relationships, and poor counselling by service providers
Alem Gebremariam, 2015	Various modern contraceptive methods	10 IDIs	Agarfa district, Bale Zone of southwestern Ethiopia	Side effects, desire for pregnancy or to switch to another contraceptive method, misconceptions, partner's approval, and peer influence
Nega et al., 2021	Subdermal contraceptive implant	8FGD,56 IDIs	Kersa district of southwestern Ethiopia	Side effects, desire for pregnancy or to switch to another contraceptive method, misconceptions, partner's approval, and peer influence
Guta et al., 2021a	modern contraceptive	IDS	Urban streets in Dire Dawa city, Eastern Ethiopia	a desire to have more child, religious prohibition, and inconvenience of services site
Utaile et al., 2020	Subdermal contraceptive implant (Implanon)	10 IDs and 5 KIIs	Arba Minch town, Gamo Goffa zone, South Ethiopia	Heavy and irregular bleeding, lack of information prior to insertion, being served by a midwife or nurse, and not being told to return to the health facility if any side effects were experienced
Jalu et al., 2019	RMNCH	50 IDIs and 17 FGD	Rural and urban areas in the Somali regional of Ethiopia	male dominance in decision making, the influence of the husband and society and the role of word of mouth were identified barriers at the interpersonal level and lack of acceptance, fear of modern health practices, unclean health

				facility environment, lack of well-equipped facilities shortage. of trained staffs and barriers relating to distance and transportation were barriers identified at organizational and policy level.
Henok & Takele, 2017	RHS	15 FGDs, 5 IDI and 5 KII	Rural pastoralist communities in the Bench Maji zone of southwestern Ethiopia	Decision making barrierHealth facility related barriers
Gonie et al., 2018	Various modern contraceptive methods	24FGDs and 36KIIs	Rural and urban areas in the Bale Eco-Region of Southeast Ethiopia	Spousal (husband's) opposition, religious beliefs, concern and fear of side effects, and distance of family planning service were the reasons for not using contraceptive methods.
Tenaw, 2022	emergency contraceptive	13 IDIs	Rural and urban areas in the Northwest Ethiopia	Not discussing contraceptives with sexual partner, having a history of abortion, having secondary education, and Having no living children
Teshoma et al., 2023b	long acting	12 IDIs	Rural and urban public health facilities in the Toke Kutaye district of West Shoa Zone, Oromia Region, Ethiopia	fear of side effects, lack of adequate information, religion, and misconceptions
Endriyas et al., 2018	long acting	5 FGDs, 10KIIs, and 50 IDIs	Rural and urban areas in the SNNPR of Ethiopia	fears, myths, and misconceptions

6.3.2. Qualitative findings

We used qualitative methods to explore barriers to modern contraceptive utilization in very high fertility regions of Ethiopia. The description of the qualitative sample respondents by their key socio-demographic characteristics is presented in Tables 13 and 14 as follows:

Seven key informant contraceptive providers were included in this study. Among KIIs participants 3 of them were health extension workers (HEW). The ages range from 26 to 35.

Table 13: Key informant interview participants' information in Afar and Somali regions of Ethiopia, 2024

KII Respondents	Sex	Age	Education level	Year of Experience
KII-1	Male	31	BSC Nurse	13 Years
KII -2	Female	27	HEW level -3	9 years
KII-3	Female	36	Clinical nurse	5 years
KII-4	Female	32	Mid wife	6 years
KII-5	Female	35	Mid wife	8 years
KII-6	Female	30	HEW level -4	6 years
KII-7	Female	26	HEW level -3	4 Years

In this study, we included a total of 20 participants in in-depth interviews (IDIs). The age distribution of these IDI participants revealed that 50% fell within the 25-34 age group, while 30% were older than 34. In terms of education, 45% had no formal education. Regarding religion, 80% identified as Muslim, and 20% as Orthodox. In relation to employment status, 75% were not employed. Considering the age of their husbands, 50% were older than 34. As for husband education levels, 60% had no education. Finally, the current utilization of contraception was equally divided, with 50% using contraception and 50% not using it (see Table 14).

Table 14: In-depth interview participants' information in Afar and Somali regions, 2023

Variables	Characteristics	Number	Percent
Age	<=24	4	20
	25-34	10	50
	>34	6	30
Education level	Not educated	9	45
	Primary	4	20
	Secondary and above	7	35
Religion	Orthodox	4	20
	Muslim	16	80

Working status	No	15	75
	Yes	5	25
Husband Age	<=24	1	5
	25-34	9	45
	>34	10	50
Husband education level	Not educated	12	60
	Primary	3	15
	Secondary and above	5	25
Total number of children	<5	15	75
	>=5	5	25
Current utilization of contraception	No	10	50
	Yes	10	50

To identify comprehensively the qualitative findings on barriers of modern contraceptive utilization in the Somali and Afar regions of Ethiopia, we conducted in-depth interviews and key informant interviews. We analyzed the data to identify common themes. From these findings, we categorized 13 barriers that participants frequently mentioned into four main themes: personal beliefs and attitudes, interpersonal factors, service availability and accessibility, and health worker factors.

Personal beliefs and attitudes: This theme includes barriers that are related to how the individual perceives and feels about modern contraception. The specifically mentioned barriers by the interviewees include religious or cultural beliefs, myths and misconceptions, fear of side effects, lack of knowledge and misinformation, and negative attitude towards contraceptives. Both key informants and in-depth interviewees mentioned these barriers as influencing women contraceptive choices.

A 25-year-old woman who was an in-depth interviewee (IDI) participant from Arebhara kebele of Afar Region said that:

"…*family planning services are contrary to my religious beliefs.”* (Participant/ **IDI-2**)

A 35-year-old woman participant from Awbare kebele in the Somali region, as an in-depth interviewee, said that:

"… *if a woman takes contraception while breastfeeding, the baby might become malnourished, and the mother could face difficulties*." Additionally, she stated: "…*I don't need contraception because Allah has planned for me.”* (Participant/ **IDI-11**)

A 28-year-old woman participant from Gedeb kebele in the Somali region, as an in-depth interviewee, expressed that:

"…*in my community, we do not want any medication that prevents pregnancy…, if Allah grants you a child, you must give birth. If there is a gap between children, that is okay; otherwise, we should continue without contraception. Since, contraception is forbidden in our religion, and one must rely on Allah*." (Participant/ **IDI-14**)

A 25-year-old woman participant from Arebhara kebele in the Afar region, as an in-depth interviewee, expressed that:

"In my opinion, the reason women don't use family planning is due to insufficient knowledge. They believe that using family planning will render them infertile and prevent them from having children. Consequently, Afar women avoid family planning because they lack adequate information about it." (Participant/ **IDI-09**)

Another 40-year-old woman from Gedeb kebele in the Somali region, who participated as an in-depth interviewee, expressed that:

"… *Contraceptives have many side effects. Many women couldn't become pregnant for a long time, and they start to conceive after the medication fades from their body. It may cause infertility and many problems."* (Participant/ **IDI-13**)

In addition, a clinical nurse who participated as a KII from the Arebhara kebele in the Afar region indicated that due to women's religious beliefs, they do not use contraceptives.

"…*there are women who say that they do not use contraceptive services because it is not allowed in Islam."* (Participant/**KII-2**)

Another midwife who participated as a KII from the Gobyare kebele in the Somali region also said that:

"...some women also believe that using contraceptive implants will result in infertility. ...Additionally, some women experience menstrual irregularities as a side effect. Despite being informed that there is no problem with the implant, they insist on discontinuing its use. When one woman shares her experience, others are also hesitant to use it" (Participant/**KII-5**)

Interpersonal factors: This theme includes barriers that involve the impact of other people on the individual's decision to use modern contraception. The specific mentioned barriers by the interviewees include partner opposition, socio-cultural factors, fear of being judged by family and friends, and lack of communication between husband and wife, and husband altitude. Both key informants and in-depth interviewees mentioned these barriers as affecting women contraceptive behavior.

A 25-year-old woman who was an in-depth interviewee (IDI) participant from Arebhara kebele of Somali region said that:

"…it's unfortunate that some of our husbands are not supportive of family planning. They desire more children and resist using family planning services." (Participant/ **IDI-2**)

A 35-year-old woman who was an in-depth interviewee (IDI) participant from Gedeb kebele of Somali region said that:

"…In our non-urban community, husbands are often absent during critical moments. While urban husbands are actively involved and informed; here, wives bear all the risks—whether it's caring for a sick child, being pregnant, or giving birth while breastfeeding. Our husbands' involvement is minimal; they don't care about you, and their role is limited to witnessing the delivery. There is little discussion between spouses. (Participant/ **IDI-12**)

A 40-year-old woman from Gedeb kebele in the Somali region, who participated as an in-depth interviewee, expressed that:

"…I take family planning measures in secret because my husband opposes it. He questions why I prevent pregnancy when he needs more children. Telling my choice could lead to conflict." (Participant/ **IDI-13**)

A 25-year-old woman from Arebhara kebele in the Afar region, who participated as an in-depth interviewee, expressed that:

"…I kept my use of family planning a secret from my husband. He wanted more children and discouraged me from using family planning. To avoid conflict, I made the decision independently and started using the service discreetly." (Participant/ **IDI-09**)

A 25-year-old woman from Arebhara kebele in the Afar region, who participated as an in-depth interviewee, expressed that:

"…*while I personally don't face any issues, the community here is predominantly shy**.** This shyness stems from religious pressure. For instance, there's a prevailing belief that a child is a gift from the creator**.** Some hold the mistaken view that a child's growth is solely determined by luck. Consequently, these cultural and religious perspectives discourage many from utilizing family planning services*." (Participant/ **IDI-03**)

Another 38-year-old woman from Gedeb kebele in the Somali region, who participated as an in-depth interviewee, expressed that:

"…people in our community believe that preventing children gifts bestowed by Allah using medication is a mistake. This viewpoint often leads to conflicts between husbands and wives. In some cases, couples even separate due to this disagreement. I recall a woman who secretly used contraceptives without informing her husband. When he eventually discovered her actions, he confronted her, asking why she took them. The result was their separation. They had four children: two males and two females. He took custody of the boys, while she cared for the girls." (Participant/ **IDI-15**)

In addition, KII indicated that male partners are responsible for women not using contraceptives.

"…. some husbands prevent their wives from using family planning methods, and we've heard from women who faced this situation. To overcome this, some women secretly seek help from female workers who discreetly provides them with contraceptive services. In our rural community, many are illiterate, and if they see a woman seeking contraception, gossip spreads, and she may feel ashamed. Additionally, there are women who avoid using family planning due to fear of their husbands. These husbands often declare it forbidden, leading women to hide their contraceptive use. Ultimately, fear drives many women to conceal their actions, worried about what others might think or say." (Participant/ **KII 5**)

Another health extension worker who participated as a KII from the Doho kebele in the Somali region also said that:

"*…women often hide their contraceptive use from their husbands, making it a challenging situation. If the husband discovers it, he might even consider divorce and accuse her."* (Participant/ **KII 6**)

Service availability and accessibility: This theme includes barriers that refer to the difficulties of accessing and using contraceptive services. Here the individual barriers included in this theme are distance from health facility, availability of service and different contraceptive choice, separate room for family planning services, and cost of contraceptive method and transportation. Both key informants and in-depth interviewees mentioned these barriers as limiting women contraception options.

A 35-year-old woman from Gedeb kebele in the Somali region, who participated as an in-depth interviewee, expressed that:

"*…in our community, there is no contraceptive service available at the nearest health facility. As a result, we must spend six hundred to seven hundred birrs for transportation alone to reach health facilities that provide such services. Additionally, we need to cover our own meal expenses without any support for medication costs."* (Participant/ **IDI-11**)

Another 28-year-old woman from Gedeb kebele in the Somali region, who participated as an in-depth interviewee, said that:

"…unfortunately, contraceptive services are not available here in our area." (Participant/ **IDI-14**)

Similarly, KII noted that in Gedeb kebele in the Somali region are not providing contraceptive services.

In addition, KII also highlighted that the limited contraceptive options and the absence of dedicated rooms for family planning services pose significant challenges and barriers to contraceptive use.

i.e., MW who participated as a KII from the Gobyare kebele in the Somali region also said that:

"… for mothers who cannot take injections, we provide combined oral contraceptives (COC). If COC is not available, we offer progestin-only pills (POP). Typically, COC is more readily accessible than POP. Unfortunately, injections are also unavailable." (Participant/ **KII 5**)

Another health extension worker who participated as a KII from the Doho kebele in the Afar region also said that:

"*…our biggest challenge lies in resource scarcity. Specifically, we lack proper examination beds.... Additionally, I recommend having a separate room where patients and professionals can meet privately."* (Participant/ **KII-03**)

Health worker factors: This theme includes barriers that relate to the distrust or fear of the health workers who provide contraceptive services. It may be caused by the perceived or experienced lack of skill, confidentiality, respect, or empathy of the health workers. Both key informants and in-depth interviewees mentioned this barrier as discouraging women's from seeking contraceptive services.

A 24-year-old woman from Doho kebele in the Afar region**,** who participated as an in-depth interviewee, said that:

"*...the health professionals didn't provide any information about the pros and cons of birth control. While it has helped me, I remain uncertain about potential harms."* (Participant/ **IDI-07**)

Another 28-year-old woman from Gobyare kebele in the Somali region, who participated as an in-depth interviewee, said that:

"*…I've considered asking one of the staff members about contraceptive, but I feel afraid. Perhaps another day, I'll gather the courage to inquire her*." (Participant/ **IDI-18**)

Further, the health extension worker who participated as a KII from the Gobyare kebele in the Somali region said that:

"*...mothers often need Implanon, and I am the only one who can provide it. It's crucial that all maternal and child health (MCH) professionals receive training in family planning.*" (Participant/ **KII-06**)

The MW who participated as a KII from the Gobyare kebele in the Somali region also said that:

"… e*xpanding this health post would be beneficial because many people lack trust in health post services*." (Participant/ **KII-04**)

6.4. Discussion

The findings of this study revealed that the major barriers to modern contraceptive utilization in very high fertility regions of Ethiopia are teamed as personal beliefs and attitudes, interpersonal factors, service availability and accessibility, and health workers factors. These barriers are consistent with previous studies conducted in Ethiopia and other developing countries(Aychew et al., 2022; Bekele et al., 2021; Endriyas et al., 2018; Gonie et al., 2018; Jalu et al., 2019; Ouma et al., 2021; Seyife et al., 2019; Teshoma et al., 2023).

In the personal beliefs and attitudes team, the specific barriers that are pointed out by the IDI and KII respondents of this study include the influence of religious or cultural beliefs, myths and misconceptions, lack of knowledge and misinformation, and the negative attitude towards contraceptives. Thus, interviewees/respondents who indicate the influence of religious or cultural beliefs as a barrier to modern contraceptive decision-making express that using modern contraceptives is against their faith or tradition, and further they indicate that they do not need to use contraception since they believe children are a gift from their god and their god has a plan for them. This finding is in line with the studies by various scholars, which also found that women have negative perceptions of modern contraceptives due to their religious or cultural beliefs and they think using modern contraceptive is considered as a sin by the followers of some religions (Bekele et al., 2021; Endriyas et al., 2018; Gonie et al., 2018; Seyife et al., 2019; Teshoma et al., 2023).

Interviewees who have myths and misconceptions about modern contraceptives in this study believe that modern contraceptives could cause infertility or other health problems. These myths and misconceptions are also common in other parts of Ethiopia and in developing countries, as shown by different studies (Aychew et al., 2022; Endriyas et al., 2018; Ouma et al., 2021; Teshoma et al., 2023; Utaile et al., 2020). Some women who are interviewees in this study indicate lack of knowledge and misinformation about modern contraceptives as a barrier and admit that they do not have enough information about contraceptives, including their benefits

and their risks, and that they rely on hearsay or rumors from their peers or relatives. This finding is similar to the findings of the studies by Alemayehu et al. and Misganu et al., which indicated that some women have low awareness of the availability and accessibility of contraceptives, and that they receive inaccurate or incomplete information from health workers or mass media (Endriyas et al., 2018; Ouma et al., 2021). Further, some women whose responses indicate the negative attitude towards contraceptives in this study express that they do not like or trust modern contraceptives, and they prefer to have many children or space their births naturally in the will of their god. This is consistent with the study by Bekele et al., which found that some women in the emerging regions of Ethiopia have low demand for contraceptives due to their preference for large family size or their fear of social stigma (Bekele et al., 2021).

In the interpersonal factors team, the IDI and KII interviewees pointed out that the main challenge that women face in using contraceptives is the opposition or coercion from their partners, who may not approve of modern methods and may threaten them with divorce, violence, or infidelity if they use them without their consent. This is a common finding in Ethiopia and other developing countries (Aychew et al., 2022; Endriyas et al., 2018; Gonie et al., 2018; Seyife et al., 2019; Utaile et al., 2020). Another barrier mentioned by interviewees is the socio-cultural factors that shape women's reproductive choices, such as the norms and expectations of their family, community, or religion, which may pressure them to have large families, avoid family planning, or adhere to myths and fears about contraceptives (Bekele et al., 2021). They also indicated their fear of being judged or stigmatized by their relatives or peers for using contraceptives, which may lead them to hide their use or avoid seeking information or services (Ouma et al., 2021). In addition, the other barrier that is mentioned by this study's interviewees is the lack of communication and support from their spouses regarding contraceptive use, which may result from the male dominance and the limited power and agency of women in their reproductive health. Some women do not discuss or negotiate their reproductive intentions and preferences with their husbands, and face difficulties in persuading them to use contraceptives (Kapadia-Kundu et al., 2022).

In the service availability and accessibility team, the IDI and KII interviewees indicate distance from health facility, availability of services, separate room for family planning services, and cost of contraceptive method and transportation as barriers to modern contraceptive utilization. These

barriers affect women's ability and opportunity to obtain modern contraceptive services, especially in rural areas where the health system is inadequate, and transportation is scarce and expensive. Women may have to travel long distances, sometimes on foot, to reach the nearest health facility that offers family planning services, which may consume their time and resources, expose them to potential risks, and limit their follow-up visits and continuity of care (Bekele et al., 2021; Gonie et al., 2018; Jalu et al., 2019; Seyife et al., 2019).

Moreover, the health system may not meet the demands and needs of women seeking modern contraceptive services, due to stock-outs of contraceptive commodities, a shortage of trained and qualified health workers, insufficient equipment and supplies, poor quality of care, and limited range and diversity of contraceptive methods (Jalu et al., 2019; Ouma et al., 2021; Seyife et al., 2019). These factors may erode women's trust and satisfaction with the health system, discourage them from using contraceptive services or considering alternative methods, and impede their autonomy and agency in making informed and voluntary decisions about their reproductive health (Ouma et al., 2021; Seyife et al., 2019).

Furthermore, women may lack privacy and confidentiality in the provision of contraceptive services, as they may have to discuss their reproductive health issues or receive contraceptive services in a crowded or shared space, where they may be overheard or seen by other clients, health workers, or community members (Ouma et al., 2021; Seyife et al., 2019). This may affect their willingness and ability to express their needs and concerns, and to access the most appropriate and effective modern contraceptive method for them. Additionally, women may face financial constraints in accessing and using contraceptive services, as they may incur out-of-pocket expenses for transportation, registration, consultation, or other fees, even though contraceptive methods are supposed to be free or subsidized by the government (Potasse & Yaya, 2021; Utaile et al., 2020). These costs may be prohibitive for women who have low income, depend on their husbands or relatives, or have competing household needs.

Finally, in the health workers factor's theme, the respondents identified the distrust or fear of the health workers who provide contraceptive services as a barrier to modern contraceptives in those two regions. This barrier was mentioned by both key informants and in-depth interviewees as a factor that discourages women from seeking modern contraceptive services. This finding is consistent with other qualitative studies conducted in Ethiopia and other developing countries,

which have identified health worker factors as a major challenge for contraceptive use. In relation to this, some studies in Ethiopia found that lack of skilled and trained health workers, poor quality of care, inadequate counselling, and negative attitudes of health workers were some of the barriers to contraceptive use (Bekele et al., 2021; Endriyas et al., 2018).Similarly, a study by Abera et al.(2023), in Dire Dawa, Eastern Ethiopia, reported that clients' satisfaction with family planning services was influenced by the demonstration of how to use the methods, and maintaining privacy, which are all related to the health workers' performance and behavior (Abera et al., 2023).

Our study was not without limitations. Its qualitative nature may introduce a degree of subjectivity that could potentially bias the data collection and analysis phases. Additionally, the context-specific nature of the study hinders its generalizability, making it challenging to apply the results to broader contexts. Furthermore, the typically small sample sizes associated with qualitative research constrain the extent to which conclusions can be extrapolated to larger populations.

6.5. Conclusion

This study explored the barriers to modern contraceptive utilization among women in very high fertility regions of Ethiopia. The findings indicated that they were mainly related to personal beliefs and attitudes, interpersonal factors, service availability and accessibility, and health worker factors. These barriers affect women's reproductive health and rights and expose them to unwanted pregnancies, high fertility, and health risks. To address these barriers and promote contraceptive use, the study recommends four major interventions: providing appropriate information and counselling to couples, challenging, and transforming socio-cultural norms through (SBCC), engaging, and involving partners and community members, and improving quality of care and availability of services and contraceptive choice. These interventions should be comprehensive, context-specific, and multi-stakeholder engagement, and should aim to empower women and their partners to make informed and voluntary decisions about their fertility and contraceptive use.

CAHPTER SEVEN

Rural-urban Disparity in Maternal Health Care Service Utilization in Four Regions of Ethiopia: Ecological and Decomposition Analysis

(Manuscript submitted and accepted for publication @ International Journal of Women's Health Care, the authorship appeared as Tigist Shumet and Nigatu Regassa)

7.1. Background

Maternal health refers to the health of women during pregnancy, childbirth, and the postpartum period. Maternal health is an important indicator of wellbeing of women, and has significant implications for the survival of the neonates and children (World Health organization (WHO), 2022). The most commonly known maternal health interventions includes antenatal care service (ANC), delivery at health facilities, and postnatal care services (PNC)(World Health organization (WHO), 2022).

Antenatal care (ANC) is a service given to pregnant women by a skilled health care provider. This service is given during pregnancy to ensure better health outcomes to both the mother and the newborn (Stenberg et al., 2021). Currently, the World Health Organization (WHO) recommends that, under normal circumstances, a pregnant woman is expected to get ANC services at least eight times during her pregnancy. The first visit is recommended during the 12 weeks of pregnancy (World Health Organization(WHO), 2016). In this regard, insufficient ANC visits or delays in visits or reduced number of ANC visits may lead to poor pregnancy outcomes (Mpembeni et al., 2007).

Another key maternal and child health intervention is health facility delivery. Giving birth in a healthcare facility with the assistance of skilled birth attendants can significantly reduce the rates of maternal morbidity and mortality (Mselle et al., 2013). Using health facility during birth is also playing a crucial role in prevention of stillbirths and enhance the survival of a new-born child (Gabrysch & Campbell, 2009).

Postnatal care (PNC) must be provided in the first two months after delivery and usually considered as a golden opportunity for health service providers to train mothers on healthy

breastfeeding practices, to screen mothers for a postpartum depression, monitor the infant growth and overall health status, to observe and treat childbirth-related complications, advice those women about the existing family planning options and refer/ link the mother and baby for specific care if needed(Jain & Saad, 2016; World Health Organization (WHO), 2013). According to a WHO recommended guideline, women and the newborn should get at least three postnatal contacts with the health service provider after childbirth. The first visit should be made between 48 and 72 hours, the second visit between days 7 and 14 and the third at six weeks postpartum (World Health Organization (WHO), 2013).

Globally, an estimated 800 women die every day from complications related to pregnancy, childbirth and postpartum period in 2020 (WHO et al., 2023). In the same year, nearly 70% maternal deaths occurred in sub- Saharan Africa (WHO et al., 2023). In Ethiopia, Maternal Mortality Ratio (MMR) was estimated as 420 per 100,000 live births in 2016 (Central Stastical Agency(CSA) & ICF, 2017). Globally 87 % of pregnant women get the antenatal care services given by skilled health personnel at least once during their pregnancy period (United Nations International Children's Emergency Fund(UNICEF), 2021). The lowest levels of antenatal care service provision rates are observed in Sub-Saharan Africa and South Asia. Dickson et.al.in 2022 done a pooled analysis of the ANC utilization from data collected from year 2000 to 2018 from 32 countries from Sub-Saharan Africa using DHS surveys. The result revealed that 76% of pregnant women had at least one ANC check-up. Among countries in this region, Gambia (99%) and Burundi(8%) had relatively higher and lower prevalence of ANC (Dickson et al., 2022). Evidence from the 2019 EMDHS indicated that, 43% of pregnant women in Ethiopia had at least four ANC visits in 2019, 59% and 37% for urban and rural areas, respectively (Ethiopian public Health Institiute & ICF, 2019).

In 2020, birth assisted by a skilled attendant in the world reached 83% (Mehedi Hasan et al., 2021; World Health Organization(WHO), 2021b). Similarly in Ethiopia, birth assisted by a skilled attendant reached 50% , increasing from 26% in 2016 to 48% in 2019 , with prevalence of 70% for urban and 40% for rural areas (Ethiopian public Health Institiute & ICF, 2019). Only 34% of women in Ethiopia received a postnatal check within two days of delivery, and with prevalence of 48% for urban and 29% for rural areas 2019 (Ethiopian public Health Institiute & ICF, 2019).

Previous studies conducted in Ethiopia focused on the determinants of maternal health care service utilization (i.e., which includes ANC, health facility delivery, and PNC). For instance, some of the most commonly cited predictors of ANC included: availability, educational level (Bobo et al., 2017; Shudura et al., 2020; Tegegne et al., 2019; Tekelab et al., 2019; Tesfaye et al., 2018; Tsegaye et al., 2021), history of antenatal care use (Tesfaye et al., 2018), wealth index (Bobo et al., 2017; Tekelab et al., 2019; Tesfaye et al., 2018; Tsegaye et al., 2021), husband's attitude (Tesfaye et al., 2018), the home visits by health extension workers (Tesfaye et al., 2018), level of understanding of the health complications related to pregnancy (Tesfaye et al., 2018), health related training given to household (Tsegaye et al., 2021) and place of residence (Tekelab et al., 2019). Most frequently reported predictors of delivery at facility were wealth/income (Bobo et al., 2017; Mehedi Hasan et al., 2021), women and their husbands' education level (World Health Organization(WHO), 2021b) (Shudura et al., 2020), place of residence (Bobo et al., 2017; Mehedi Hasan et al., 2021), and the utilization of ANC (Bobo et al., 2017; Shudura et al., 2020; Tsegaye et al., 2021). Moreover, the predictors of PNC service utilization included; wealth (Bobo et al., 2017; Tiruneh et al., 2022), place of residence (Bobo et al., 2017), model family (Tiruneh et al., 2022), prenatal stay at maternity waiting homes (Tiruneh et al., 2022), antenatal care in the first trimester (Tiruneh et al., 2022), complete antenatal care service (Tiruneh et al., 2022), family conversation during pregnancy (Tiruneh et al., 2022), cesarean delivery (C-section) (Tiruneh et al., 2022), the notification of birth to health extension workers (Tiruneh et al., 2022), maternal health education(Tsegaye et al., 2021), information on postnatal care service utilization (Shudura et al., 2020; Tsegaye et al., 2021), and women autonomy (Shudura et al., 2020; Tsegaye et al., 2021).

This being the case, very little attention has been given to the study of MCH in the four study regions concerned, even though service utilization in these dominantly pastoral regions is unacceptably low (Central Stastical Agency (CSA) & ICF, 2017). Previous studies on the subject have also typically employed individual based cross-sectional data or a single indicator (such as ANC or PNC or delivery care) to estimate prevalence and determinants (Addisu et al., 2022; Carroli et al., 2001; Shudura et al., 2020; Tegegne et al., 2019; Tesfaye et al., 2018; Tiruneh et al., 2022; Tsegaye et al., 2021; Yesuf & Calderon-Margalit, 2013; Zepro & Ahmed, 2016). In addition, none of them quantified the contributions of observed and unobserved heterogeneity at the individual, household and community level through decomposition techniques. To the best of

our knowledge, very few studies were conducted in Ethiopia that examined the cluster level inequality in the three key maternal health care service utilizations. Therefore, the aim of this study is to assess the urban-rural inequality of maternal health care utilization in four regions of Ethiopia.

7.2. Methods

7.2.1. Study setting

The study was done in four more or less geographically marginalized regions of Ethiopia, namely, Afar, Benishangul Gumuz, Gambela and Somali regions. They all have similar physical characteristics i.e., all the four regions have a border line with the neighboring countries with Ethiopia. In terms of economic status, these regions are deemed disadvantageous for access to basic health services which includes maternal and child health (MCH) i.e., prevalence of most MCH service utilization is much lower compare to the remaining regions of Ethiopia (Central Stastical Agency(CSA) & ICF, 2017). According to the 2020 projected population size by Central Statistical Agency (CSA) of Ethiopia, the total women population size in Afar region was 885 thousand (46% of the total population of the region), Somali region had 2,893 thousand (48% of the total population of the region), Benishangul-Gumuz had 570 thousand (49% of the total population), and Gambela had 229 thousand (48% of the total regional population)(Central Stastical Agency (CSA), 2007).

7.2.2. Data source

This study used the 2016 Ethiopian Demographic and Health Survey (EDHS) data sets which are freely and publicly available online. The 2016 EDHS sample was designed to provide estimates for each indicator for the entire country. In addition, sample size for urban and rural areas was calculated separately. The survey was carried out by the Ethiopian Central Statistics Agency (CSA) and ICF. The data collection was done in the period from January 2016 to June 2016. Therefore, we extracted the required data for the four regions of Ethiopia (i.e., Afar, Benishangul Gumzu , Gambela and Somali regions) from the existing data set (Central Stastical Agency(CSA) & ICF, 2017).

7.2.3. Study design

In this study, combinations of cross-sectional and partial ecological designs were used. It is cross-sectional because the 2016 EDHS collected the date at a specific point in time in the lives of respondents. This makes it difficult to assess the cause-effect relationship between the outcomes and explanatory variables of interest. On the other hand, the analysis followed a partial ecological design. A partial ecological study design involves a mixture of individual level and ecological variables (group level). In ecological analysis, the unit of observation is a group, not separate individuals for one or more study variables. To make ecologic inferences about effects on group rates the study subjects were grouped by place (cluster) (Morgenstern, 1995).

7.2.4. Sampling

The EDHS 2016 survey used a two-stage stratified sample. In the first stage a total of 645 Enumeration Areas (EAs) were selected with a probability proportional to the size of the Enumeration Area (EA) and in the second stage sampling a fixed 28 households per EA were selected. Then, the data collection for maternal health care service utilization indicators were done by interviewing all women in the reproductive age group (i.e., women in the age range 15 to 49) in those fixed 28 selected households. The present analysis considered 2563 women who gave birth in five years and 1555 women who gave birth in the two years preceding the survey from 220 clusters located in those four regions.

7.2.5. Study variables

Outcome variables

Maternal health care utilization: the three key maternal health services (ANC, delivery, and postnatal care) were used as outcome variables and all of them were recoded as dummy variables (0 =ANC utilization <4, 1=ANC utilization >=4; 0 =home delivery (with no assistance health professional), 1 = delivery takes place at health facility; 0 =postnatal care not utilized, 1 = postnatal care utilized in the first 2 day after birth).

Exposure variables

Cluster level variables: Year of woman education, woman age, total children ever born, wealth index, Media access (generated from TV, Radio, internet and magazines by using

PCA), women working status, husband education, and women autonomy for own health care utilization were found by polling individual data in cluster level. To create the cluster level variable values, the study used a mean value/ proportion of the individual level data by using an aggregation technique in STATA-v17.

Individual level: Marital status, type place of residence and region.

For numerical variables, this study measured them by their mean and standard deviations. The categorical variables of the study were classified as follows: Wealth index classified in to 5 categories i.e. poorest, poorer, middle, richer, and richest. Women autonomy for own health care utilization answered as (women decision making autonomy for own health care coded as "yes" and women consultation with husband or others, and decision making by her husband or others coded as "no". Marital status was classified in to "others" and "married", Place of residence as "urban" and "rural", region was as Afar, Benishangul-Gumuz, Gambela and Somali.

7.2.6. Statistical analysis

Data cleaning and analysis were done using STATA -v17. The analysis began with aggregating the individual level variables by Enumeration Areas (EAs). The variables aggregated were woman education, woman age, total children ever born, wealth index, and media access, husband education, and women autonomy for own health care utilization and women work status. The remaining variables such as marital status, type place of residence, and region were not aggregated and were considered as individual level variables. We used ArcGIS 10.6.1 to display the utilization of maternal health care services by each EA. The Moran's Index was calculated to assess this distribution.

Spatial autocorrelation (Global Moran's I) statistic measures to see whether the optimal maternal health care services utilization patterns were dispersed, clustered, or randomly distributed in the four regions of Ethiopia. Moran's I is a spatial statistic which is valid to estimate the spatial autocorrelation by considering the entire data set but it produces a single output value which usually ranged from − 1 to + 1. The output of Moran's I values is interpreted as; when Moran's I close to − 1 indicates the maternal health care service utilization is dispersed, whereas I close to

+ 1 indicate the maternal health care service utilization clustered; and the maternal health care service utilization is said to be distributed randomly if Moran's I value is zero. A statistically significant Moran's I ($p < 0.05$) is leading to the rejection of the null hypothesis (example facility delivery is randomly distributed) and indicates the presence of spatial autocorrelation (Rahimi & Nazari, 2021) .

For the regression analysis, bivariate logistic regression was used to select the potential variables using a cut off $p< 0.2$. Those variables with $p<0.2$ were further assessed in the multivariable logistic regression analysis to see their net effect on the three outcome variables. Multicollinearity among the independent variables was checked using VIF and values >2.5 were removed. The preliminary analysis indicated that region, total children ever born, and women education had significant multicollinearity with Variable Inflation Factor (VIF) >2.5. Therefore, the study excluded those three predictors from the logistic regression analysis. The Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) were used to select the model. In addition, Blinder Oaxaca decomposition technique was used to assess rural urban disparity of MCH service utilization.

Blinder Oaxaca Decomposition Technique: is particularly useful for identifying and quantifying the individual contribution of group differences in measurable characteristics such as education, work experience, marital status, and geographic location, gender, and ethnic differences in outcomes. Although not used as often, this technique is also useful to identify reasons for geographic differences (e.g., urban/rural), time-period difference, or other categorical differences (Fairlie, 2003). In recent years, we have found studies showing how the Blinder-Oaxaca decomposition technique was used to explain inequalities in health outcomes between two groups. The technique identifies the factors that made the difference, and it is necessary to allocate the mean difference between the two groups (group 1 and group 2) for some ongoing health outcomes (Rahimi & Nazari, 2021).

For this study, the outcome variable of interest is key maternal health care service utilization (ANC, place of delivery, and PNC). To explain the rural-urban disparities in maternal health care service utilization among mothers residing in those four regions, we used the Blinder-Oaxaca decomposition. This technique decomposes the gap in maternal health care utilization between

urban and rural areas into two parts; a part that is due to a difference in the distribution of the determinants of maternal health care utilization (covariates effect) between those two areas, and another part that is due to the difference in the effect of these determinants (coefficients effect) between urban and rural areas. For example, if $\boldsymbol{y_i}$, our outcome variable, is affected by a single variable, x, and we have two groups, urban and rural, then maternal health care utilization for the rural, and urban mothers are given by Eqs.(1) and (2) respectively. The superscripts in the below equations are *r* is stands to describe rural and *u* stands to describe urban.

$$y_i{}^r = \beta^r x_i + \varepsilon_i{}^r \quad \text{(Eq.-1)}$$

$$y_i{}^u = \beta^u x_i + \varepsilon_i{}^u \quad \text{(Eq.-2)}$$

Therefore, the urban-rural gap in the mean maternal health care utilization in the four regions of Ethiopia ($y_i^u - y_i^r$), is given as in Eq. (3).

$$y^u - y^r = \beta^u x^u - \beta^r x^r \quad \text{(Eq.-3)}$$

Where x^u and x^r are the independent variables at their means for the urban and rural. The overall urban- rural gap could be decomposed into a gap attributable to the difference in the level of the covariates, X's, and a gap that is attributable to difference in coefficients, β's as in Eqs. (4) and (5):

$$y^u - y^r = \Delta x\, \beta^r - \Delta\beta x^u \quad \text{(Eq.-4)}$$

$$y^u - y^r = \Delta x\, \beta^u - \Delta\beta x^r \quad \text{(Eq.-5)}$$

Where $\Delta x = x^u - x^r$ and $\Delta\beta = \beta^u - \beta^r$. Here the study decomposition equation can be re-written as in Eq. (6):

$$y^u - y^r = \Delta x\, \beta^r + \Delta\beta x^r + \Delta\beta\Delta x$$

$$= E + C + CE \quad \text{(Eq.-6)}$$

Therefore, in this study the overall urban-rural gap in maternal health care utilization in four regions of Ethiopia consists of the gap in endowment (E), and the gap between coefficients (C), and the interactions (CE).

7.3. Results

7.3.1. Background characteristics of study participants

For the maternal health care services, a total of 2563 women were interviewed in 220 clusters (EAs) which comprise mothers who gave birth within five years before the survey. The cluster /community/ level background characteristics of those women who were included in this study from the four regions of Ethiopia is summarized and presented in table15 below. The result indicates that the mean age of women included in the study was 28.6 (SD =2.38, 95% CI (28.53-28.71)), the mean children ever born was 4.2 (SD =1.09, 95%CI (4.15- 4.24)), the mean year of school attendance was 1.51 years (SD= 1.9, 95% CI (1.45-1.58)) and on average respondents of the study had at least 1 media exposure (SD= 2.16, 95%CI (0.94-1.11) (Table 15). The individual level background characteristics of the respondents are summarized in table-16. It is seen that 93% of them were married, and 84% of them lived in the rural area (Table 16).

For PNC service utilization, the data were collected from a total of 1501 women residing in 220 clusters who delivered a baby within two years before the survey. The community level background characteristics of those women who utilized the PNC service and included in this study is summarized in table 15. It is seen that the mean age of the women was 28.48 (SD =2.33, 95% CI (28.37- 28.6*)*), the mean of children ever born was 4.24 (SD= 1.07,(4.18-4.29)), the mean year of school attendance by women was 1.46 years (SD= 1.66, 95%CI (1.37-1.54)) and on average respondents of the study had at least 1 media exposure (SD= 2.16, 95%CI (0.89-1.11). In addition, of those who utilized the PNC, about 81% of them were not working during the survey (Table 15). The individual level background characteristics of the women across the four study regions which are summarized in table-2 also indicates 95% of them married, and 84% of them lived in rural areas (Table 16).

Table 15. Community level background characteristics of women in four regions of Ethiopia

ANC and place of delivery						
	Mean	**SD**	**95%_CI**		**P25**	**P75**
Women Age	28.62	2.38	28.53	28.71	26.8	30.22
Household size	5.93	1.03	5.89	5.97	5.27	6.54
Birth order	4.2	1.09	4.15	4.24	3.5	4.88
Total children ever born	4.2	1.09	4.15	4.24	3.5	4.88

Women education status	1.51	1.69	1.45	1.58	0.2	2.5
Media exposure	1.02	2.16	0.94	1.11	0	0.81
wealth Index						
Poorest	20.0		18.50	21.60		
Poorer	20.3		18.90	22.00		
Middle	19.6		18.10	21.20		
Richer	20.2		18.70	22.00		
Richest	19.8		18.30	21.40		
Women Employment status						
Not working %	78%		77%	80%		
working %	22%		20%	23%		
PNC N=1501						
	Mean	SD	95%_CI		P25	P75
Women Age	28.48	2.33	28.37	28.6	26.71	30.08
Household size	5.96	1.02	5.91	6.01	5.29	6.56
Birth order	4.24	1.07	4.18	4.29	3.62	4.88
Total children ever born	4.24	1.07	4.18	4.29	3.62	4.88
Women education status	1.46	1.66	1.37	1.54	0.19	2.4
Media exposure	1	2.16	0.89	1.11	0	0.77
wealth Index						
Poorest	20.4		18.40	22.50		
Poorer	20.0		18.10	22.10		
Middle	20.2		18.20	22.20		
Richer	19.8		17.80	21.90		
Richest	19.6		17.60	21.70		
Women Employment status						
Not working %	81		78	82		
working %	19		18	22		

Table 16. Individual level background characteristics of women in four regions of Ethiopia

ANC and place of delivery (N= 2563)					PNC (N=1501)			
	Count	**Percent**	**95% CI**		**Count**	**Percent**	**95% CI**	
Marital status								
Others	185	7	6	8	79	5	4	7
Married	2378	93	92	94	1422	95	93	96
Residence								
Urban	411	16	15	18	241	16	14	18
Rural	2152	84	82	85	1260	84	82	86
Region								
Afar	647	25	24	27	383	26	23	28
Somali	806	31	30	33	527	35	33	38
Benishangul Gumuz	576	22	21	24	323	22	20	24
Gambela	534	21	19	22	268	18	16	20
Total	**2563**	**100**			**1501**	**100**		

7.3.2. Spatial patterns in the utilization of maternal health care in the four regions of Ethiopia

Figure 5 shows a geographic distribution of maternal health service utilization among women in the age group 15–49 in 220 clusters situated in the four regions of Ethiopia respectively. The results indicate the utilization of maternal health services (ANC, delivery at health facility and PNC) ranges from 0% to 100%. Utilization of maternal health services is lowest in Somali and Afar regions as compared to Benishangul-Gumuz, and Gambela regions. In Afar region, there are few clusters which have highest utilization of some of the maternal health services, but Somali region shows a low and very low maternal health services utilization among all the regions.

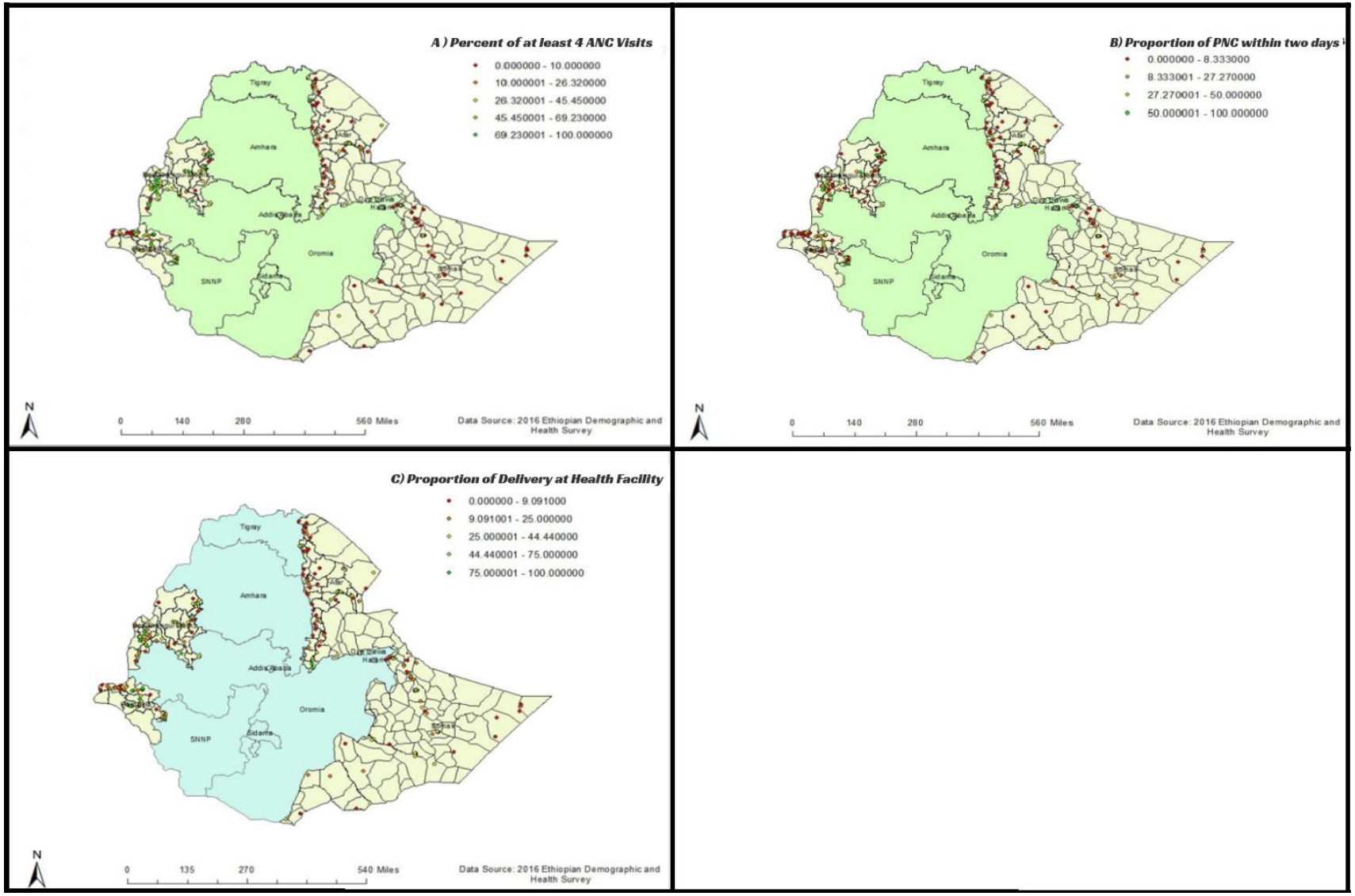


Figure 5:Maps showing geographic distribution of maternal health service utilization in 220 clusters of four regions of Ethiopia

The presence of geographical clustering was analyzed for all selected outcome indicators i.e., maternal healthcare services (ANC, place of delivery and PNC) using global spatial autocorrelation (Moran's' Index) at cluster levels as presented in figure 6. Maternal healthcare services considered in this study there were an indication of geographic clustering in the utilization of all maternal healthcare services considered in this study i.e., ANC (Moran's I = 0.185031, p = 0.011056), health facility delivery (Moran's I = 0.271865, p = 0.000209) and PNC (Moran's I = 0.315410, p = 0.000015).

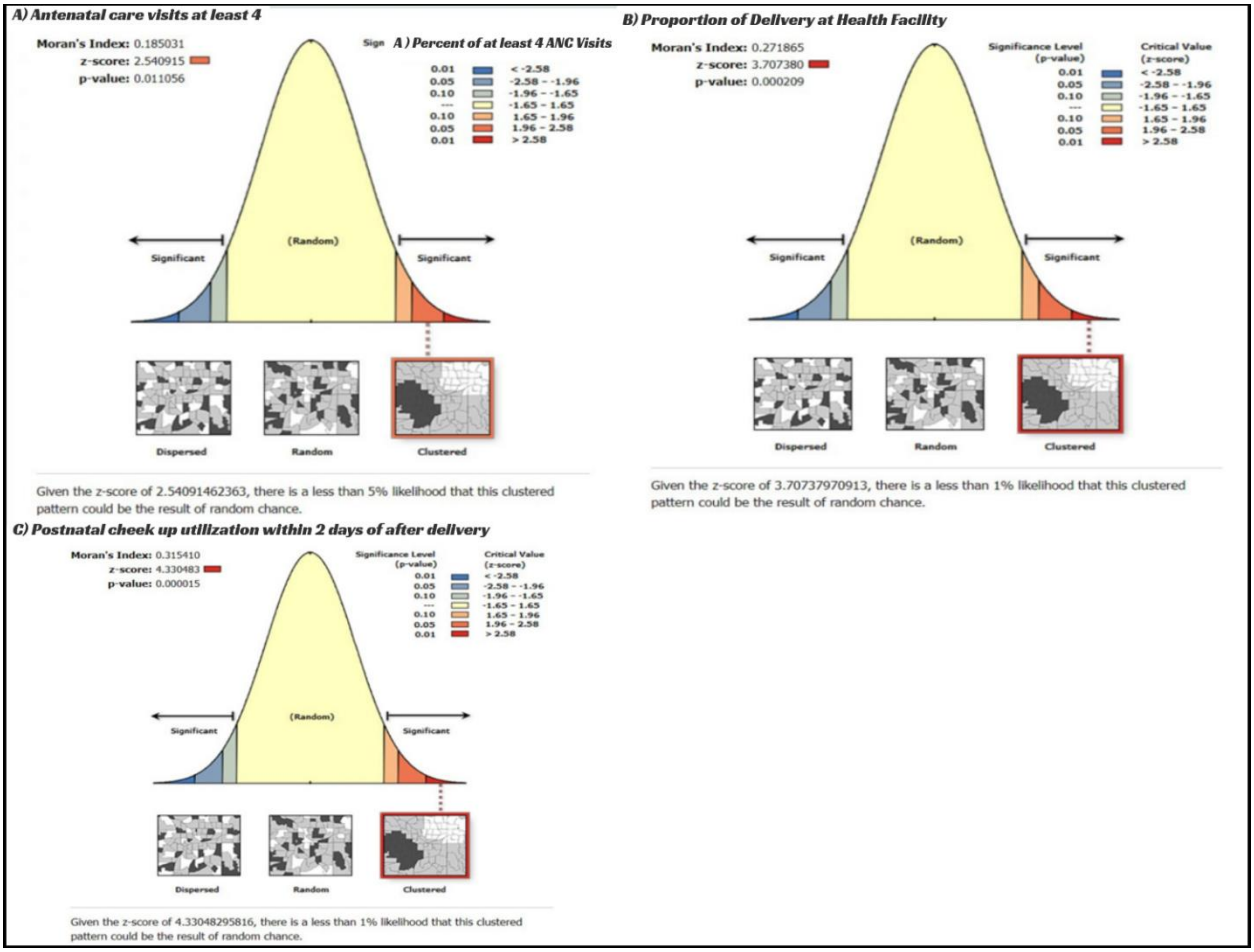


Figure 6: Spatial patterns of maternal health care utilization in 220 clusters in the four regions of Ethiopia. From the graphs show A) Antenatal care visits, B) Delivery at Health facility, and C) Postnatal cheek up visit

7.3.3. Bivariate logistic regression

The results in table 17 presented the bivariate logistic regression for the selected potential predictors. Based on the review of related literature, the study used a *p*-value < 0.2 as cut off value to consider the significant predictors as potential variables for further analysis in the multivariable logistic regression. Therefore, in ANC utilization for both urban and rural residences; except a variable called "autonomy health care utilization" the remaining variables considered in this bivariate logistic regression were taken for further analysis in multivariable regression analysis. In place of delivery, for urban residence except marital status all the remaining variables were considered in a multivariable regression analysis. But in rural settings; except women age and household size, all the remaining predictor variables in the bivariate logistic regression were taken for further analysis in a multivariable regression analysis. In PNC service utilization, for urban residence a predictor variables wealth index, husband education level, women working status, marital status, media exposure, ANC service utilization and place of delivery was considered for further analysis in the multivariable regression analysis. But for the rural setting; a predictor variables household wealth, husband education level, women working status, media exposure, ANC service utilization and place of deliveries were considered for further analysis in the multivariable regression analysis.

Table 17.Bivariate logistic regression for selected predictors of maternal health care utilization in urban and rural Ethiopia

	ANC								Place of delivery								PNC							
	Urban				Rural				Urban				Rural				Urban				Rural			
	COR	p Value	95% CI		COR	p Value	95% CI		COR	p value	95% CI		COR	p value	95% CI		COR	p value	95% CI		COR	p value	95% CI	
Women Age	0.87	**0.00**	0.80	0.94	0.95	**0.02**	0.90	0.99	0.90	**0.01**	0.83	0.98	0.97	0.30	0.93	1.02	0.97	0.62	0.87	1.09	1.03	0.54	0.94	1.12
Household size	0.71	**0.00**	0.61	0.84	0.69	**0.00**	0.61	0.77	0.83	**0.02**	0.70	0.97	0.97	0.56	0.86	1.09	0.92	0.49	0.74	1.15	1.00	0.97	0.82	1.23
Husband education level	1.19	**0.00**	1.06	1.33	1.39	**0.00**	1.29	1.48	1.44	**0.00**	1.25	1.66	1.41	**0.00**	1.31	1.52	1.14	**0.06**	1.00	1.31	1.13	**0.02**	1.02	1.25
Media Exposure	1.66	**0.00**	1.09	1.23	1.67	**0.00**	1.47	1.88	1.21	**0.00**	1.13	1.10	1.67	**0.00**	1.47	1.88	1.08	**0.03**	1.01	1.16	1.24	**0.02**	1.04	1.98
Autonomy health care utilization																								
No [RC]																								
Yes	0.80	0.35	0.51	1.26	0.74	0.18	0.48	1.15	2.43	**0.00**	1.45	4.07	1.10	**0.00**	1.46	3.03	1.39	0.34	0.71	2.75	1.38	0.31	0.75	2.54
wealth Index																								
poorest					[RC]								[RC]								[RC]			
Poorer	[RC]				1.63	**0.05**	1.00	2.64					1.78	**0.03**	1.05	3.03	[RC]				0.74	**0.47**	0.32	1.69
Middle					4.30	**0.00**	2.79	6.63					6.39	**0.00**	4.00	10.19					1.96	**0.05**	1.00	3.83
Richer	2.67	0.26	0.49	14.46	9.17	**0.00**	6.03	13.92	18.38	**0.00**	3.39	99.65	6.72	**0.00**	4.21	10.72	0.64	0.44	**0.20**	2.00	3.71	**0.00**	1.98	6.96
Richest	7.39	**0.01**	1.66	32.99	18.68	**0.00**	11.34	30.77	12.86	**0.00**	2.88	57.47	17.98	**0.00**	10.56	30.64	RC				6.06	**0.00**	2.86	12.82
women working status																								
not working [RC]																								
working	2.64	**0.00**	1.69	4.13	2.95	**0.00**	2.33	3.73	2.21	**0.00**	1.36	3.59	1.73	**0.00**	1.34	2.24	1.57	**0.19**	0.80	3.08	1.91	**0.00**	1.24	2.94
Marital status																								
Others [RC]																								
Married	2.64	**0.00**	1.69	4.13	2.95	**0.00**	2.33	3.73	0.98	0.96	0.51	1.88	0.69	**0.09**	0.46	1.05	0.55	**0.21**	0.21	1.40	0.84	0.69	0.35	2.00
ANC																								
No [RC]																								
yes									3.70	**0.00**	2.40	5.70	6.62	**0.00**	5.17	8.48	3.75	**0.00**	2.05	6.88	3.38	**0.00**	2.25	5.07
Place of delivery																								
No [RC]																								
yes																	56.20	**0.00**	7.62	414.	43.10	**0.00**	24.60	75.40

RC: reference category

7.3.4. Predictors of Maternal Health Care Service Utilization

The study result in table 18 revealed that odds of ANC service utilization increased by 1.09 times when the Media exposure increased (AOR = 1.09, 95% CI (1.02, 1.16)). In addition, in rural settings women living in households with middle wealth index (AOR = 3.36 95% CI (2.05–54.9)), richer (AOR = 6.07, 95% CI (3.73, 9.87)), and richest (AOR =8.90, 95% CI (4.80, 16.48)) were more likely to utilize ANC service compared to those poorest wealth quintiles.

The odd ratio of utilizing health facility delivery service were 3.19 times higher for women who had at least 4 Antenatal cares (ANC) in urban settings compared to those who have < 4 ANC during their pregnancy in similar settings (AOR =3.19, 95% CI (1.99–5.13)). The result in rural settings also showed a positive association i.e., the odds of utilizing health facility delivery were 4.56 times higher for women who had ANC during their pregnancy compared to those who did not have ANC (AOR = 4.56, 95% CI (3.48–5.98)). Further, the odds of health facility delivery also increased by 1.13 times when the media exposure increased (AOR = 1.13, 95% CI (1.04–1.22)) in urban settings and this increase also revealed in rural settings i.e., we have found a positive association that indicates an increase of health facility delivery utilization by 1.18 times when the husband years of education increased (AOR = 1.18, 95% CI (1.03–1.37)).

The odd ratio of utilizing a postnatal care (PNC) were 47.6 times for women who gave birth in health facilities compared to those who did not give birth in health facilities in urban settings (AOR=47.6, 95%CI (6.32-359.03)). But the result in the rural settings revealed a little bit increase i.e., the odd ratio of utilizing a PNC service were 49.87 times for women who gave birth in health facilities compared to those who did not give birth in health facilities in rural areas (AOR=49.87, 95%CI (26.54,92.72)). Additionally, the result in table-4 also indicates that the odds of utilizing a PNC service were 2.3 times for women who used ANC service during their pregnancy as compared to those who did not use ANC service in urban settings (AOR=2.3, 95%CI (1.15-4.60)). Regarding PNC service utilization, wealth index middle (AOR = 3.36 95% CI (2.05–54.9)), richer (AOR = 6.07, 95% CI (3.73, 9.87)), and richest (AOR =8.90, 95% CI (4.80, 16.48)) were more likely to utilize ANC service compared to those poorest wealth quintiles.

Table 18: multivariable logistic regression for selected predictors of maternal health care utilization in rural and urban Ethiopia

	ANC								**Place of delivery**								**PNC**							
	Urban				**Rural**				**Urban**				**Rural**				**Urban**				**Rural**			
	AOR	***p-value***	***95% CI***		***AOR***	***p-value***	***95% CI***		***AOR***	***p-value***	***95% CI***		***AOR***	***p-value***	***95% CI***		***AOR***	***p-value***	***95% CI***		***AOR***	***p-value***	***95% CI***	
Women Age	0.97	0.27	0.84	1.05	0.98	0.51	0.93	1.04	0.92	0.21	0.82	1.05												
Household size	0.97	0.77	0.76	1.22	0.85	**0.03**	0.74	0.98	1.16	0.26	0.90	1.49												
Husband education level	1.08	0.26	0.94	1.25	1.09	0.08	0.99	1.19	1.26	**0.00**	1.04	1.22	1.09	0.07	0.99	1.20	1.01	0.77	0.87	1.21	0.91	0.22	0.78	1.06
Media Exposure	1.09	**0.02**	1.02	1.16	1.21	**0.00**	1.06	1.38	1.13	**0.00**	1.04	1.22	1.18	**0.02**	1.03	1.37	1.01	0.91	0.92	0.22	0.92	0.48	0.73	1.16
autonomy health care utilization																								
No [RC]																								
Yes									2.80	**0.00**	1.52	5.16	1.67	**0.02**	1.07	2.61								
women working status																								
not working [RC]																								
working	1.65	0.07	0.97	2.82	1.18	0.47	0.75	1.86	1.32	0.39	0.70	2.48	0.79	0.14	0.59	1.08	0.76	0.51	0.34	1.71	1.50	0.22	0.78	2.88
wealth Index																								
poorest					[RC]								[RC]								[RC]			
poorer	[RC]				1.57	0.08	0.96	2.58	[RC]				1.53	0.13	0.89	2.64	[RC]				0.55	0.35	0.23	1.69
Middle					3.36	**0.00**	2.05	5.49					3.82	**0.00**	2.26	6.47					0.65	0.30	0.58	5.87
Richer	1.82	0.52	0.30	11.09	6.07	**0.00**	3.73	9.87	4.94	0.09	0.77	31.69	3.64	**0.00**	2.12	6.24	0.56	0.40	0.15	2.16	1.21	**0.03**	1.11	12.66
Richest	3.16	0.15	0.67	14.89	8.90	**0.00**	4.80	16.48	2.28	0.31	0.46	11.24	5.88	**0.00**	3.03	11.42	RC				1.22	**0.07**	0.91	11.24
Marital status																								
Others [RC]																								
Married	0.96	0.91	0.49	1.89	1.09	0.73	0.69	1.72					0.81	0.37	0.51	1.29	0.44	0.17	0.14	1.41				
ANC																								
No [RC]																								
yes									3.19	**0.00**	1.99	5.13	4.56	**0.00**	3.48	5.98	2.30	**0.02**	1.15	4.60	0.76	0.34	0.44	1.33
Place of delivery																								
No [RC]																								
yes																	47.6	**0.00**	6.32	359.03	49.87	**0.00**	26.54	93.72
	AIC	543	BIC	579	AIC	1862	BIC	1924	AIC	466	BIC	501	AIC	1629	BIC	1682	AIC	231	BIC	259	AIC	484	BIC	536

RC: Reference Category

7.3.5. Decomposition analysis result

The study used Blinder-Oaxaca decomposition for linear models to decompose utilization of maternal health services (ANC, place of delivery and PNC) difference between rural and urban areas. The results present in table 5 indicate the average predicted ANC service utilization among women as 48% for those living in urban residences and 20% for those residing in rural settings, the average predicted place of delivery for women is 63 % for those residing in urban settings and 17% for those in rural areas and the mean predicted PNC service utilization among women's is also situated as 28% for those living in urban areas and 9% for those residences in rural settings. The rural urban disparity in maternal health care service utilization was revealed as 28 % for ANC, 47 % for place of delivery, and 19 % for PNC. In general, for ANC about 142% (0.40/0.28) of the disparity was due to the different distributions of the predictors (endowments) of ANC, for place of delivery about 81% (0.038/0.47) of the disparity was due to the different distribution of the predictors of place of delivery and for PNC about 58% (0.11/0.19) of the disparity was due to the different distributions of the predictors of PNC. Among the predictor wealth index, it contributed 64% (0.18/0.28) for ANC, 32% (0.15/0.47) for place of delivery, and 63% (0.12/0.19) for PNC. The study also shows, the differences in the level of observed covariates (the explained component) accounted for about 104% (0.29/.28) of the total disparity for ANC, 74% (0.35/.47) of the total disparity for place of delivery, and 137% (0.26/.19) of the total disparity for PNC. This component is the combination of "endowments" and "interaction" parts of the three-fold decomposition given in table 19.

Table 19: Blinder-Oaxaca decomposition for selected risk factors of maternal health care utilization for rural urban four regions of Ethiopia

ANC							**Place of delivery**						**PNC**					
	Coef.	SE	Z	P-value	95% CI		Coef.	SE	Z	P>z	95% CI		Coef.	SE	Z	P-value	95% CI	
overall																		
Urban	0.48	0.03	19.29	0.00	0.43	0.53	0.63	0.02	26.28	0.00	0.59	0.68	0.28	0.03	9.40	0.00	0.22	0.34
Rural	0.20	0.01	22.96	0.00	0.18	0.21	0.17	0.01	20.74	0.00	0.15	0.18	0.09	0.01	10.93	0.00	0.07	0.10
difference	0.28	0.03	10.76	0.00	0.23	0.34	0.47	0.03	18.33	0.00	0.42	0.52	0.19	0.03	6.23	0.00	0.13	0.25
endowments	0.40	0.04	10.37	0.00	0.32	0.47	0.38	0.04	10.53	0.00	0.31	0.46	0.11	0.04	3.03	0.00	0.04	0.18
coefficients	0.00	0.09	0.00	1.00	-0.17	0.17	0.12	0.08	1.41	0.16	-0.05	0.27	-0.07	0.12	-0.58	0.56	-0.30	0.16
interaction	-0.11	0.09	-1.24	0.22	-0.30	0.07	-0.03	0.09	-0.39	0.70	-0.20	0.14	0.15	0.12	1.28	0.20	-0.08	0.39
endowments																		
Husband education	0.00	0.01	0.03	0.98	-0.03	0.03	-0.01	0.01	-0.53	0.60	-0.03	0.02	0.01	0.01	0.51	0.61	-0.01	0.03
Women autonomy for their health care	-0.02	0.01	-2.49	0.01	-0.03	0.00	0.01	0.01	1.14	0.25	-0.01	0.02	0.00	0.00	0.77	0.44	0.00	0.01
Women education	0.08	0.02	3.78	0.00	0.04	0.12	0.09	0.02	4.36	0.00	0.05	0.12	-0.01	0.02	-0.79	0.43	-0.05	0.02
Women working status	0.01	0.00	2.48	0.01	0.00	0.01	0.00	0.00	-0.55	0.59	0.00	0.00	0.00	0.00	0.19	0.85	0.00	0.00
Marital status	0.00	0.00	-0.89	0.37	0.00	0.00	0.00	0.00	0.83	0.41	0.00	0.00	0.00	0.00	0.22	0.83	0.00	0.00
Media exposure	0.13	0.04	3.28	0.00	0.05	0.21	0.18	0.04	4.43	0.00	0.10	0.25	0.00	0.04	0.00	1.00	-0.07	0.07
Total children ever born	0.03	0.01	2.42	0.02	0.01	0.06	-0.02	0.01	-1.67	0.10	-0.05	0.00	0.01	0.01	0.37	0.71	-0.02	0.03
Wealth index	0.18	0.02	8.67	0.00	0.14	0.23	0.15	0.02	7.23	0.00	0.11	0.19	0.12	0.02	5.80	0.00	0.08	0.16
Household size	0.00	0.00	1.26	0.21	0.00	0.01	-0.01	0.00	-1.79	0.07	-0.01	0.00	0.00	0.00	-0.56	0.57	-0.01	0.00
Women age	-0.01	0.01	-1.94	0.05	-0.02	0.00	0.01	0.00	1.42	0.16	0.00	0.01	0.00	0.00	-0.66	0.51	-0.01	0.01
Region	-0.01	0.00	-2.98	0.00	-0.02	0.00	0.00	0.00	-0.69	0.49	-0.01	0.00	-0.01	0.00	-1.87	0.06	-0.01	0.00
coefficients																		
Husband education	0.01	0.03	0.28	0.78	-0.06	0.08	0.05	0.03	1.52	0.13	-0.01	0.11	0.04	0.04	1.08	0.28	-0.03	0.11

Women autonomy for their health care	0.00	0.01	-0.02	0.98	-0.01	0.01	0.01	0.01	1.13	0.26	0.00	0.02	0.00	0.01	-0.55	0.58	-0.02	0.01
Women education	-0.03	0.02	-1.07	0.29	-0.07	0.02	0.00	0.02	-0.08	0.93	-0.04	0.04	0.01	0.02	0.50	0.62	-0.03	0.06
Women working status	0.00	0.01	-0.21	0.83	-0.03	0.03	0.00	0.01	-0.01	0.99	-0.03	0.03	0.00	0.02	0.10	0.92	-0.03	0.04
Marital status	-0.02	0.08	-0.27	0.79	-0.18	0.13	0.06	0.07	0.76	0.45	-0.09	0.20	-0.15	0.11	-1.37	0.17	-0.36	0.06
Media exposure	-0.01	0.01	-1.91	0.06	-0.02	0.00	-0.02	0.01	-3.21	0.00	-0.03	-0.01	0.00	0.01	0.63	0.53	-0.01	0.02
Total children ever born	-0.15	0.23	-0.67	0.50	-0.60	0.30	-0.78	0.21	-3.70	0.00	-1.20	-0.37	-0.26	0.27	-0.99	0.32	-0.78	0.26
Wealth index	-0.04	0.11	-0.37	0.72	-0.26	0.18	-0.08	0.10	-0.76	0.45	-0.28	0.12	0.04	0.14	0.26	0.80	-0.24	0.31
Household size	0.10	0.23	0.45	0.65	-0.34	0.54	0.41	0.21	1.99	0.05	0.01	0.82	0.28	0.30	0.94	0.35	-0.30	0.87
Women age	-0.09	0.54	-0.16	0.87	-1.14	0.97	0.91	0.50	1.83	0.07	-0.06	1.89	0.45	0.59	0.76	0.45	-0.71	1.61
Region	0.17	0.08	2.33	0.02	0.03	0.32	0.02	0.07	0.30	0.76	-0.12	0.16	0.03	0.10	0.27	0.79	-0.16	0.21
_cons	0.06	0.47	0.12	0.91	-0.86	0.98	-0.46	0.43	-1.07	0.29	-1.31	0.39	-0.51	0.57	-0.90	0.37	-1.62	0.60
Interaction																		
Husband education	0.01	0.03	0.28	0.78	-0.05	0.07	0.04	0.03	1.51	0.13	-0.01	0.10	0.03	0.03	1.07	0.28	-0.03	0.09
Women autonomy for their health care	0.00	0.01	-0.02	0.98	-0.02	0.02	0.01	0.01	1.13	0.26	-0.01	0.04	-0.01	0.01	-0.55	0.58	-0.02	0.01
Women education	-0.05	0.04	-1.07	0.29	-0.13	0.04	0.00	0.04	-0.08	0.93	-0.08	0.07	0.02	0.05	0.50	0.62	-0.07	0.11
Women working status	0.00	0.01	-0.21	0.83	-0.01	0.01	0.00	0.01	-0.01	0.99	-0.01	0.01	0.00	0.00	0.09	0.93	0.00	0.00
Marital status	0.00	0.00	0.27	0.79	-0.01	0.01	0.00	0.00	-0.72	0.47	-0.01	0.00	0.01	0.01	1.12	0.26	0.00	0.02
Media exposure	-0.10	0.05	-1.90	0.06	-0.20	0.00	-0.15	0.05	-3.19	0.00	-0.25	-0.06	0.03	0.05	0.63	0.53	-0.07	0.13
Total children ever born	0.03	0.05	0.67	0.50	-0.07	0.14	0.17	0.05	3.58	0.00	0.08	0.27	0.06	0.06	0.99	0.32	-0.05	0.16
Wealth index	-0.03	0.09	-0.37	0.72	-0.21	0.15	-0.06	0.08	-0.76	0.45	-0.23	0.10	0.03	0.12	0.26	0.80	-0.20	0.26
Household size	0.00	0.01	-0.45	0.66	-0.02	0.01	-0.02	0.01	-1.74	0.08	-0.04	0.00	-0.01	0.01	-0.89	0.38	-0.03	0.01
Women age	0.00	0.02	0.16	0.87	-0.03	0.03	-0.03	0.01	-1.75	0.08	-0.05	0.00	-0.01	0.02	-0.75	0.45	-0.04	0.02
Region	0.02	0.01	2.12	0.03	0.00	0.04	0.00	0.01	0.30	0.76	-0.01	0.02	0.00	0.01	0.27	0.79	-0.01	0.02

7.4. Discussion

This study has primarily aimed to assess the rural-urban inequality in maternal health care service utilization in four regions of Ethiopia. To the best knowledge of the authors, it is the first of its kind which provides comprehensive evidence on the three basic maternal health indicators in four regions of Ethiopia based on ecological and decomposition analysis. The Blinder Oaxaca decomposition results of the study indicated that there were unacceptably high rural-urban disparities in the utilization of maternal healthcare services in the study regions. This finding is consistent with a study done by Abosse et.al. (2011) which reported significant disparities in maternal healthcare utilization between urban and rural areas of Hadiya zone, Ethiopia (Abosse et al., 2011). The reason for the existence of the rural-urban disparity may be the poor set-up of medical facilities in most of the rural settings of Sub-Saharan Africa countries, that includes Ethiopia (Faruk et al., 2020).

Antenatal care (ANC) is one of the most crucial MCH services to ensure better maternal and infant health outcomes. The proportion of women who had at least four visit of ANC services for the last birth within five years period in these four regions were very low compared to the national average (62%) (Central Stastical Agency(CSA) & ICF, 2017). In addition, there are disparity of ANC service utilization in all regions of Ethiopia (Central Stastical Agency(CSA) & ICF, 2017). Like previous studies which shows the geographical disparity of the utilization of ANC service (Addisu et al., 2022; Shudura et al., 2020). This result may be due to the scarcity of resources that can be used to expand or maintain maternal health services. Further the existing health infrastructures that can be used for maternal and child health may weaken, due to the lower priority given by regions for such services, since they have overlapping other priorities in their health sector like prevention of communicable diseases (Ministry Of Health-Ethiopia (MOH-E), 2020).

Childbirth in a health facility is one of the essential MCH services which prevent stillbirths and improve the survival of newborns but the result for the utilization of health facility delivery in this study except Gambela in the remaining three regions show very low utilization below national average (Central Stastical Agency(CSA) & ICF, 2017). This study also revealed that there is a higher geographical clustering in the utilization of health facility delivery among the

study regions similar with other study in Ethiopia (Wilunda et al., 2015). This could be due to the mind-set of women's and their family which they believe home delivery has an important psychological advantages (Zielinski et al., 2015). Further, women suppose they will get ample support and care from their close relatives during and after birth if they made it in their homes. In addition, most women's and their families considered the health interventions provided in health facilities for childbirth is an extreme since, from their understanding and family customs, childbirth is a natural process that can be done with little assistance (Davis et al., 2011).

Postnatal care is also the other vital MCH service which is given to mothers and child after birth. Sometimes, mothers and their newborns encountered life-threatening complications in hours, days, or even weeks after delivery. Therefore, WHO recommended that all women should get their first PNC service in 48 to 72 hours after birth (World Health Organization (WHO), 2013) . But this study revealed the proportion of women who received postnatal checkup within 2 days after delivery is lower mainly in Afar and Somali below national average (Central Stastical Agency(CSA) & ICF, 2017). This may be due to low utilization of ANC and health facility delivery and not getting adequate advice from healthcare providers (Dona et al., 2022). Similar to the previous two maternal healthcare services, the PNC service utilization also shows geographical clustering among those four regions.

In addition, the study also identified different community and individual factors that affect the utilization of key maternal health services. Consistent with previous studies, this study also revealed wealth index is one of the factors that affect the utilization of maternal health care service utilization in rural areas (Bobo et al., 2017; Tesfaye et al., 2018; Tsegaye et al., 2021). Women from the higher wealth index are the higher maternal health care utilizers. Previous study also supported there is wealth related inequalities in the utilization of maternal health care services (Bobo et al., 2017; Federal Minstry of Ethiopia (FMoHE), 2016; Tesfaye et al., 2018; Tsegaye et al., 2021). This could be service readiness in the government health facilities is very low and also the government does not have capacity to avail all essential medicine for 24 hours in the health facility (Ethiopian Public Health Institute (EPHI), 2018). The non-availability or limited availability of the maternal healthcare services discourage women to visit the existing maternal healthcare service providing public health facilities. This will push women from

services utilization. In addition to this, it leads them for an additional costs that may include transportation and other travel related costs which may not be affordable by women from poor/poorest households since some of the health facilities may be far from their residences (Merga et al., 2019; Samuel et al., 2021).

The study also revealed that husband education status has a significant association with place of delivery in urban settings. This finding is consistent with the previous studies (Tsegaye et al., 2021). The association of education and place of delivery may be due to fathers with higher education usually has a better income and they are also socially respected; which provides them a chance to stabilize their wellbeing and to get healthcare (Garfield & Isacco, 2011; Geda et al., 2021). Further, fathers with a better education status can understand and calculate risks in pregnancy. They also share a responsibility i.e., they do not give pregnancy as the wives' supposed responsibility only (Ethiopian Public Health Institute (EPHI), 2018).

This study found ANC utilization is one of the predictors for place of delivery in both rural and urban settings in those four regions of Ethiopia. Even more, ANC also found as a predictor for a PNC service utilization in urban settings. This result of the study is consistent with various previous studies findings (Boah et al., 2018; Bobo et al., 2017; Pervin et al., 2012; Shudura et al., 2020; Tsegaye et al., 2021). This result could be due to an opportunity pregnant women will have during their antenatal care attendance to have adequate information on health facility delivery and PNC i.e., during ANC, health care providers give a comprehensive counseling that informs women on the risks and mitigation during pregnancy, childbirth and postnatal. And further they consult women about the benefits of facility delivery and attendance of PNC after birth (Boah et al., 2018; Pervin et al., 2012).

The study also reveals the place of delivery as a predictor for PNC utilization in both urban as well as rural settings. This result of the study is also consistent with previous studies done in Malawi and Zambia (Chungu et al., 2018; Sagawa et al., 2021). This result could be due to the exposure that the women will have during health facility delivery i.e., there are others who attend PNC service when they were in the health facility for delivery. Further, the health care providers also give those mothers health education during their attendance to delivery that promotes PNC

services and its benefits. Usually, the topics covered by the health providers include how to access, the timing (by when), the advantage of PNC utilization etc..(Chungu et al., 2018; Sagawa et al., 2021).

This study has several strengths. Among these, we used data from Ethiopian Demographic and Health Surveys (EDHS) which is a representative household survey that collected data nationally from all women in the reproductive age that includes the four study regions. The data collection instruments used to collect EDHS-2016 data were internationally validated and used in different countries. Moreover, data analysis was done based on group data (i.e., EA level) which can help to identify community level factors. The use of a decomposition analysis helps to better understand the observed and unobserved rural-urban disparity in service utilization among women. As a result, the findings of this study can add to the body of knowledge on inequalities of maternal health care service utilization in marginalized regions of Ethiopia and other similar settings contexts. This study can be used by policymakers and stockholders as a reference when they engaged in the development of relevant policy/strategy for the efficient promotion of maternal health care utilization for those disadvantaged regions of the country. It can also serve as an input for the baseline information for the maternal healthcare programs which are planned in those four regions of Ethiopia. Further, this study can be used as a reference by academicians and other scholars as a base. Regardless of its strengths, this study has some limitations that could be considered while interpreting its findings. The data analysis of this study is limited to included variables which are found in EDHS data set. Variables such as husband altitude, availability of service, and distance to the health facility were not included due to data limitations. As the data were generated using cross-sectional survey design, establishing temporality among the variables is difficult.

7.5. Conclusion

The utilization of maternal health care services in the four regions of Ethiopia has an urban-rural inequalities. Among the predictor variables of this study, household wealth index, education level of the husband and regions were pertinent predictors of ANC utilization. The household wealth index, husband education level, regions and ANC utilizations were significant predictors of place of delivery. In addition, household wealth index, women's working status, region, ANC

service utilization and place of delivery were predictors of PNC service utilization. In addition, there are significant rural-urban inequalities in the utilization of maternal health care services in the four regions of Ethiopia. Therefore, policymakers and all other concerned stakeholders need to develop a relevant policy/strategy that would help the efficient maternal healthcare utilization in the four regions of Ethiopia.

CHAPTER EIGHT

Impacts of Inequalities in Utilization of Key Maternal Health Service on Fertility Preference among High Parity Women in Four Selected Regions of Ethiopia

(Manuscript submitted and under review for publication @ BMC Women's Health and authors are Tigist Shumet and Nigatu Regassa)

8.1. Background

Maternal health is the health of women during pregnancy, childbirth, and in the post-partum period (World Health Organization, 2023). Maternal health has been becoming a global concern because the lives of millions of women in reproductive age can be saved through maternal health care services (World Health Organization (WHO), 2023; Yaya & Ghose, 2019). The key maternal health services include antenatal care (ANC), delivery care, postnatal care (PNC) and family planning (contraceptive) services. Recent studies indicated that nearly all pregnant women in developed countries who have low fertility, experience greater access to the key maternal health care services like ANC and delivery care. Contrary to this, women in low- and middle-income countries (LMICs) have high fertility and poor utilization of maternal health services (Department of Economic & Social Affairs, 2022; Shaw et al., 2016; Yaya & Ghose, 2019).

Antenatal care (ANC) is also used by health providers as an opportunity to promote the use of skilled attendance at birth, the exciting family planning options , healthy life style changes, benefit for optimal pregnancy spacing, and benefit of child limiting (Begum et al., 2015; World HEalth Organization(WHO), 2016) .Health facility delivery also another opportunity to provide information after delivery including the exciting family planning options and providing counseling about birth spacing. Countries with high rates of female contraceptive use typically have lower fertility rates(United Nations, 2020b). Further, the studies also show that contraceptive utilization has an impact on fertility behavior (Hasan et al., 2017).

Fertility is one of the three main components which determine the size, structure, and composition of a population. In three decades, the global fertility rate dropped from 3.2 live births per woman in 1990 to 2.3 in the year 2021. In similar manner, the Sub-Saharan Africa

Total Fertility Rate (TFR) dropped from 6.3 births per woman in 1990 to 4.6 in 2021 (Department of Economic and Social Affairs, 2022). Among all regions in the world, the Sub-Sharan Africa is well known for its highest fertility level (Department of Economic and Social Affairs, 2022). Fertility preferences are important measures for forecasting fertility, calculating levels of unwanted or mistimed birth, and assessing unmet need for contraceptives (Sennott & Yeatman, 2012).

Ethiopia is one of the Sub-Saharan Africa countries experiencing a fast population growth and the highest fertility rate (Department of Economic and Social Affairs, 2022; Misganaw et al., 2022b). The TFR of Ethiopia in 1990 was 6.9 birth per-women which declined to 4.3 children per woman in the year 2019 (Misganaw et al., 2022b). In Ethiopia, there is a huge spatial variation in TFR by place of residence (such as regional and rural-urban differentials). For instance, the total fertility rate (TFR) in Somali region was 6.4 children per woman, a region known for the highest TFR (Misganaw et al., 2022b).

Despite pro-poor health policies in Ethiopia, maternal, neonatal, and child health services utilization remains a challenge. The study done by Wuneh et al (2019) and colleagues assessed inequality in the utilization of various maternal and child health services. Findings revealed that maternal health services were low and unevenly distributed, favoring better-off women particularly skilled birth attendance. In contrast, preventive child health services were evenly distributed. Ethiopia aims for universal and equitable use of health services. The other studies done by Wuneh et al (2022) examined the association between household wealth, and maternal education with the utilization of maternal and child health services. The results indicated that higher household wealth was linked to an increased likelihood of skilled birth assistance during delivery and full child immunization. Furthermore, women's education demonstrated a positive association solely with skilled birth assistance during delivery. Educated women were more likely to receive skilled attendance during childbirth, particularly within more wealthy households. Wuneh et al (2022) also did a qualitative exploratory study which highlighted inequality in MCH service utilization. Education played a significant role and educated individuals were more likely to seek timely care. Addressing educational disparities is crucial for improving maternal and child health services. These studies emphasize the need for targeted interventions to bridge gaps in health service utilization, especially among vulnerable

populations in Ethiopia (Wuneh et al., 2019; Wuneh, Bezabih, Okwaraji, et al., 2022; Wuneh, Bezabih, Persson, et al., 2022).

According to the 2016 Ethiopian Demographic and Health Survey (EDHS) report, 36.7% of currently married women in Ethiopia either desire no more children or have undergone sterilization at the national level. In the study regions, we find that the proportions of mothers who wanted no more children were as follows: 12.4% in Afar, 7.9% in Somali, 35.1% in Benishangul-Gumuz, and 30.7% in Gambela (Central Stastical Agency(CSA) & ICF, 2017).

Several socio-demographic characteristics affect fertility preference such as age, marital status, income, household wealth, employment, educational level, parity, place of residence (urban-rural), region, religion, and number of children ever born, partners preference, sex preference for children (Ahinkorah et al., 2021; Rai et al., 2014; Sennott & Yeatman, 2012). Inequalities in the utilization of health services are among the most critical public health concerns in low-income economies. Despite modest progress in service utilization, significant inequality persists both within and between countries (WHO, 2010). Studies also indicated the existence of inequalities among various population groups (such as rural vs urban, educated vs less educated…etc.) in the utilization of maternal health services in Ethiopia (Chaka, 2017; Gebre et al., 2018).

The 2019 Ethiopian Mini Demographic and Health Survey, though conducted in relatively smaller sample size, indicates the key maternal health services utilization in Ethiopia was very low. i.e., the percentage of ANC utilization with the recommended 4^{+} visits was 43%, women's delivered in a health facility was 47.5%, women's who attended a postnatal checkup during the first 2 days after their birth were 33.8%, and 41.4% of women were found as users of any one method of contraceptive (Ethiopian public Health Instituite & ICF, 2019). Further, there is also a regional inequality in the utilization of the key maternal health services in Ethiopia. For those regions included in this study, the key maternal health services utilization was reported as; ANC service utilization (at least four times during pregnancy) was 28.3% in Afar, 23% in Somali, 31.8% in Gambela and 55.9% in Benishangul Gumuz. This indicates except Benishangul Gumuz all of the remining three regions had a lower utilization of ANC service in reference to the national average (43%) (Ethiopian public Health Instituite & ICF, 2019).

The percentage of the health facility delivery was 28.3 % in Afar, 23% in Somali, 63.7% in Benishangul Gumuz and 70.3% in Gambela, indicating that the health facility delivery in Afar

and Somali regions were lower than the national average. The prevalence of postnatal checkup during the first 2 days after birth was 23% in Afar, 10.3% in Somali, 45% in Benishangul Gumuz, and 55% in Gambela. This suggests that Gambela and Benishangul Gumuz had a higher utilization of the PNC service compared to the other study regions and with the national average (33.8%). However, the current contraceptive use ratees in all of the study regions were lower than the national average 41.4%) i.e., only 12.7% in Afar, 3.4% in Somali, 38.5% in Benishangul Gumuz and 33.8% in Gambela were using any one of the contraceptive methods (Ethiopian public Health Institiute & ICF, 2019).

Ethiopia needs to provide effective health interventions to reduce fertility level and achieve the Sustainable Development Goals by 2030. It is important to understand how inequalities in receiving maternal health services affect fertility preferences at the population level. However, little attention has been paid to the impact of inequalities in utilization maternal health service on fertility preference in the four study regions, where women have lower access to services and higher fertility levels. Previous studies on this topic have mainly focused on estimating prevalence, determinants, and geographical variation (Muluneh & Moyehodie, 2021; Tessema et al., 2020; Tessema & Tamirat, 2020; Tsegaye Negash, 2023) .

Therefore, our study fills the gap in the research on the population level attribution of maternal services to fertility preferences in four selected regions of Ethiopia. Moreover, the study has a methodological contribution/relevance as it employed Population Attributable Fractions (PAF) to measure inequalities or population level impacts of service utilization, which are rarely used in large scale data. In addition, understanding the fertility preferences among women with high parity contributes to improved reproductive health outcomes. By informing targeted interventions, promoting reproductive autonomy, and bridging the gap between expressed desires and contraceptive practices, we empower individual decision-making. Therefore, the study aims to assess the impacts of inequalities in the utilization of key maternal health services on fertility preference among high parity women in the study regions (Afar, Benishangul Gumuz, Gambela and Somali regions of Ethiopia). The study warrants answering the question; "*How much is the proportional reduction in fertility preference attributable to maternal health service utilization in the four regions of Ethiopia?*"

8.2. Methods

8.2.1 The study setting

Ethiopia is a federal democratic republic country composed of eleven national regional states and two chartered administrative cities. Among them, the four regional states of Ethiopia (Afar, Benishangul-Gumuz, Gambela and Somali) signify a considerable part of the country's most underdeveloped parts. According to the Ethiopian Statistics Service (ESS) projection, the size of the Ethiopian population by July 2022 was 123.4 million, of which, those residing in the four regions comprised 2.51 million in Somali, 2.03 million in Afar, 1.22 million in Benishangul-Gumuz and 508 thousands in Gambela (Ethiopian Central Statastics Agency, 2022).

The aforementioned-four regions of Ethiopia are known by relatively new administrations which needs further support to align their capacity to the standards required and practiced by those relatively developed regional states and chartered administrative cities of the country. Further, those four regions have a common characteristic that include relatively slow underlying pace of development in several sectors including the development of the basic infrastructures, long-standing disputes which are commonly shaped by several factors including their being peripheral in location, the existence of inequities in levels of development across all regions, the volatility and influx of refugees from bordering countries. All the above are situated in a areas where Ethiopia shares a country border with its neighboring countries; they are prone and commonly encounters unforeseen natural phenomena's like recurrent drought and flooding, having multiple ethnic groups, weak governance, and limited social services (Tsegaye Negash, 2023; Unicef, 2015; United Nations, 2013).

8.2.2. Data source and sampling

This study utilized a secondary data collected for 2016 Ethiopia Demographic and Health Surveys (EDHS). The EDHS is a nationally representative data that provides up-to-date estimates of key demographic and health indicators for Ethiopia. Among other things, the EDHS data also includes information on maternal health services, fertility, knowledge, and utilization of contraception etc. The EDHS employed a two-stage stratified sampling technique i.e., a total of 645 Enumeration Areas (EAs) were selected in the first stage and a fixed 28 households per EA were selected in the second stage. The main criteria of selecting the respondent were *"All women in the age group 15 to 49 years who- permanently lived or visitors and who stayed the night*

before the survey and were available during the survey". Further, five different DHS Program's standard questionnaires were adopted and used during EDHS. Therefore, the current study included only married women with at least five births during the five years prior to the survey. It was determined that 977 women (aged 15 to 49) in total (104 from urban and 873 from rural) met the eligible criteria for the analysis. Figure 7 shows the detail of the selection processes of the respondents for this study.

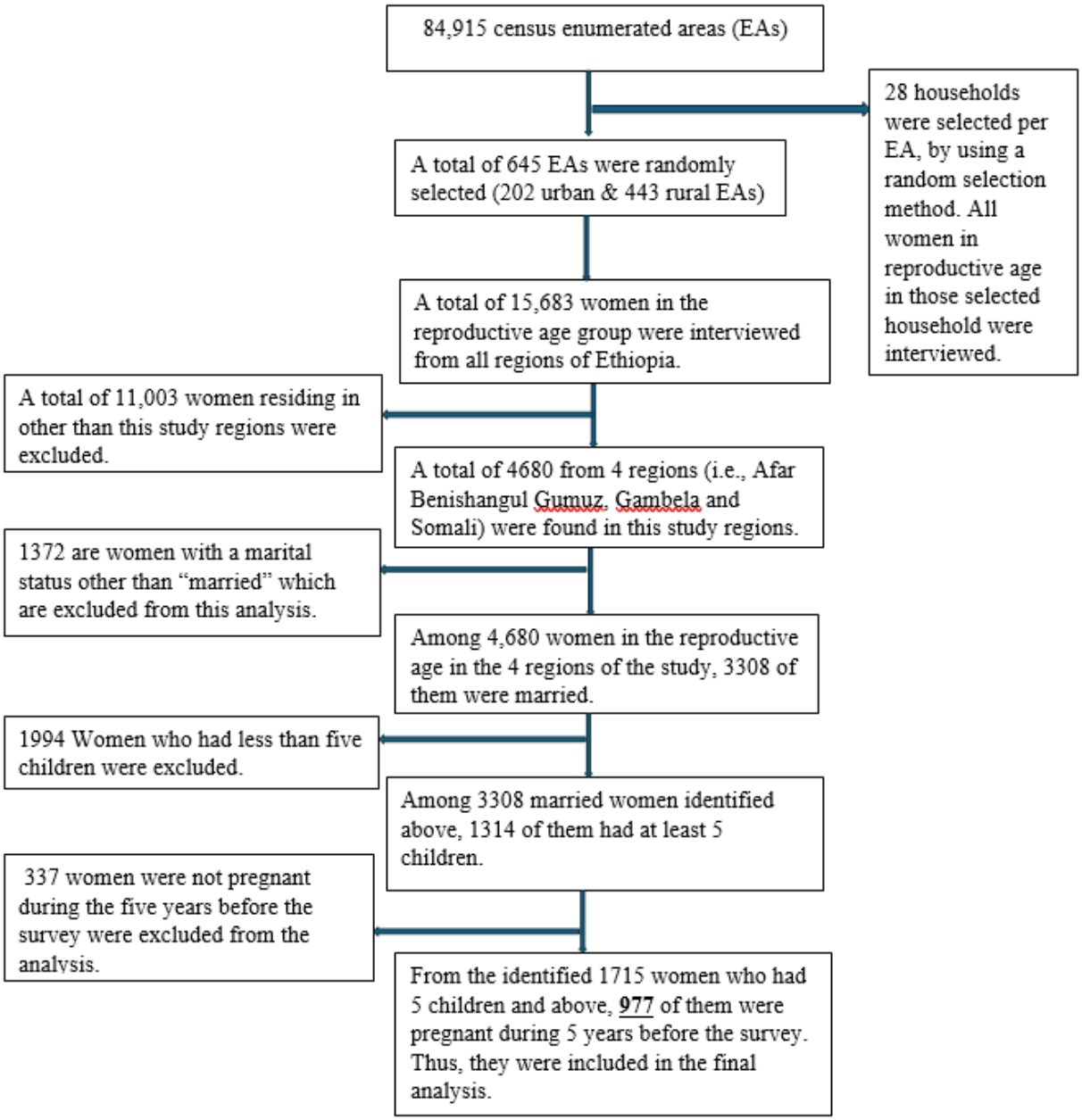


Figure 7: Schematic presentation of the sampling procedure.

8.2.3. Outcome variables

The outcome variable of the study is fertility preference. The information on fertility preference was collected in the Demographic and Health Surveys by asking married women whether they want more children or not. The responses included “have another”, “undecided”, “no-more”, and “sterilized (respondent or partner), “declared fecund” and “never had sex”. For the purposes of this study, we re-classified responses into a dichotomous response as 0 = no which includes responses of those married women’s that includes “no-more”, “sterilized (respondent or partner)”, “declared fecund” and “never had sex”; and 1 = yes (have preference) which includes “have another” and “undecided” (Bankole et al., 2011; Feyisetan & Casterline, 2000). Ethiopia has a very high total fertility rate (4.3 births per woman) (Misganaw et al., 2022b). High fertility is defined as having five or more children by a women over her reproductive period (World Bank, 2010). In addition, the study also denoted high fertility in reference to the national average. Therefore, this study included women with high fertility, who reported having five and more children during the survey period.

Exposure and control variables

The main exposure variables we wanted to measure the impacts on the outcome variable were the key maternal health service utilization variables (ANC, place of delivery, PNC, and contraception utilization). Socio demographic variables were used as control variables, i.e they were used as confounding variables in the analysis so that examining the net effects of the MHS variables is possible. Table 20 summarizes the list and description of exposure and control variables included in the study.

Table 20: Description of exposure and control variables

Exposure variables

Name of variables	Variable Description	Coding
ANC	Health care during pregnancy 5 years before the survey.	1. < 4 2. > = 4
Place of delivery	Births by place of delivery 5 years before the survey.	1. Out of Health facility 2. Health facility
PNC	Care given to the women after delivery 5 years before the survey.	1. No 2. Yes
Current use of contraceptive	Use of any medicines, devices, or surgery to prevent pregnancy.	1. Not Using 2. Using

Control variables

Name of variables	Variable Description	Coding
Women's age	Age in completed years.	1. 15-19 2. 20-34 3. 35-49.
Husband/partner education level /women educational level	Women or men aged 15-49 by highest level of schooling attended or completed.	1.No education 2.Primary education, 3. Secondary & above
Residence	Place of residence is the type of place where the respondent resides.	1.Urban 2. Rural
Household size	The number of persons in a household.	1.<=5, 2.>6
Work status	Women/husband employed in the 12 months before the survey.	1.Not working 2. Working
Women autonomy on their own-health care	Women's ability and freedom to make independent decisions about their medical care.	1. No(women with her husband / her husband/ others) 2- Yes (by her own)
Wealth Index	Composite measure of a household's cumulative living standard measured by ownership of key assets.	1.Poorest 2. Poorer 3.Midle 4.Richer 5.Richest
Religion	Religion could be based on self-identification, affiliation, beliefs, practices, or other indicators of religious involvement of the respondent.	1. Muslim 2. orthodox, 3. protestant 4. Other
Husband desire for more children	Husband wants to have more kids.	1. want more 2. others

8.2.4. Statistical analysis

For data cleaning and analysis, a statistical software called Stata v-17 (StataCorp, 2021) and SPSS v-25 (IBM Corp, 2017b) were used. The analysis of this study followed four steps: univariate (descriptive), bivariate and multivariable logistic regression, and computation of Population Attributable Fractions (PAFs) analysis. Bivariate logistic regression was used to select the potential variables by using a cut off p-values< 0.2 and then the multivariable logistic regression analyses were performed to assess the association between the main exposure

variables and the outcome variable (i.e., fertility preference), controlling for the possible effects of the confounding variables.

To check possible multicollinearity among the independent variables, the study used Variable Inflation Factor (VIF) and those which showed a VIF values >2.5 were excluded from further analysis. In this regard, the preliminary analysis result indicated that there was significant multicollinearity among region, religion, husband's age and women's age variables. Therefore, the study excluded two potential predictors (women age and region) from the logistic regression analysis. For multivariable logistic regression analysis, a p-value < 0.05 with 95% confidence interval were used to declare statistical-significant associations. To select the best fitting model, we used the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC). Further, we applied regression-based Population Attributable Fractions (PAFs) which is considered as a reliable method in measuring population level impacts of interventions or risk factors (Rückinger et al., 2009).

PAF works under four major assumptions. It primarily assumes causality, which is a causal relationship between a specific exposure (such as a risk factor) and a disease or adverse condition. It implies that the exposure contributes to the occurrence of the desired outcome. Second, PAF assumes that other risk factors are unaffected when estimating the fraction of cases attributable to a specific exposure. Multiple risk factors often interact, and their effects may not be independent. Ignoring shared causal responsibility or multicausality can lead to misinterpretations of PAFs. The third assumption is realistic intervention which indicates PAF provides insights into the potential impact of reducing exposure to a risk factor. It assumes that interventions are feasible and can realistically reduce exposure. In summary, PAF informs research priorities and guides public policies by quantifying the proportion of disease burden attributable to specific risk factors (Khosravi et al., 2021).

Greenland and Drescher (1993) introduced the methods of obtaining Attributable Fractions directly from logistic regression analysis. In this study, we adopted the steps identified by Simon Ruckinger et.al (2009) to calculate the PAF of the risk factor of interest (Rückinger et al., 2009).

Step I. The risk factor must be coded dichotomously. It is 'removed' from the population by classifying all individuals as unexposed, irrespective of their real status.

Step II. The predicted probabilities for each-individual estimated by using this modified dataset with the below formula:

$$pp_i = \frac{1}{1+exp(-(\alpha+\beta' x_i)}$$

Where α is the estimate for the intercept of the logistic regression model, β represents the parameter vector for the covariates included in the model, and x_i representing the observations of the covariates for everyone; however, with the 'removed' covariate set to zero for all individuals.

Step III. The sum of all predicted probabilities is the adjusted number of cases of fertility preference that would be expected if the risk factor was absent in the population.

Step IV. The PAF is finally calculated by subtracting these expected cases from the observed cases and dividing them by the observed cases.

Further, employing a combination of Population Attributable Fractions (PAFs) and multivariable logistic regression to measure inequality in maternal health services (MHS) utilization is believed to add up to the robustness of the findings. PAFs quantify the proportion of health outcomes attributable to specific risk factors, indirectly revealing inequality across different population groups. Meanwhile, multivariable logistic regression models consider multiple risk factors simultaneously, adjusting for confounders and showing how these factors impact distinct subgroups. By estimating PAFs directly from logistic regression results, we gain context-specific insights into risk factor impacts within specific populations, informing targeted interventions and addressing health inequalities.

8.3. Results

8.3.2. Background characteristics of Respondents

Table 21 summarizes the characteristics of the 977-respondent drawn from the four regions (Afar, Benishangul Gumuz, Gambela and Somali). Most respondents were residing in the rural areas (89.4 %) while the remaining 10.6% of them resided in urban areas. Most of the respondents of the study (47.6%) were in the age group 24–34 years. Majority (88.4%) of

women had no education. Most of the women were living in poorest households (70%). About 75% of the respondents were Muslim and 74% were not working during the survey period.

Table 21: Background characteristics of women with high parity in four regions of Ethiopia

Characteristics	Number	Percent
Region		
Afar	236	24.2
Somali	388	39.7
Benishangul Gumuz	225	23.0
Gambela	128	13.1
Type of place of residence		
Rural	873	89.4
Urban	104	10.6
Women age		
<=24	106	10.8
25-34	465	47.6
>34	406	41.6
Education level		
No education	864	88.4
Primary	93	9.5
Secondary and above	20	2.0
Household wealth status		
Poorest	684	70.0
Poorer	103	10.5
Middle	56	5.7
Richer	66	6.8
Richest	68	7.0
Religion		
Muslim	737	75.4
Orthodox	66	6.8
Protestant	138	14.1
Others	36	3.7
Work status		
No	723	74.0
Yes	254	26.0
Total	977	100

8.3.3. Bivariate relationship between Socio demographic variables and fertility Preference

Table 22 presents the results of the chi-square analysis and the percentage distribution of fertility preferences of married women in the four regions of Ethiopia by the selected characteristics and

key maternal health service variables. The results revealed that women who resided in all of the age groups had a higher proportion of fertility preference, and also a gradual decline in fertility preference also observed when we go from the early to late reproductive age groups, i.e., 92.9% of those women who were- in the age of 24 years and less, 81.3% from the main childbearing ages (24–34), and 67.2% of women whose age is greater than and equal to 34 years had fertility preference. The proportion of fertility preference was higher among those in no education category compared to women with primary, secondary, and above education status, respectively. Larger proportion (82%) of women from Muslim religion had higher fertility preference.

Further, the result in Table 3 also showed women's fertility preferences based on the key maternal health services (ANC, place of delivery, PNC, and current contraceptive use). About 78% of women who attended ANC services below the recommended 4 visits, 77.3% of women who delivered out of health facilities, and 78.4% of women who did not use any contraceptives had a higher proportion of fertility preference.

Table 22: Result of bivariate relationship between socioeconomic variables, key maternal health service and fertility preference (N=977).

Characteristics	**Fertility preference**		**χ^2(P value)**
	No Number and %	**Yes Number and %**	
Women age			
<=24	1(7.1)	13(92.9)	
24-34	92(18.7)	401(81.3)	**<0.001**
>=34	154(32.8)	316(67.2)	
Women Education Level			
No education	200(23.1)	664(76.9)	
Primary	39(41.9)	54(58.1)	**<0.001**
Secondary and above	8 (40.0)	12(60.0)	
Religion			
Muslim	131(17.8)	606(82.2)	
Orthodox	42(63.6)	24(36.4)	**<0.001**
Protestant	59(42.8)	79(57.2)	
Others	15(41.7)	21(58.3)	
Region			
Afar	33(14.0)	203(86.0)	
Somali	44(11.3)	344(88.7)	**<0.001**
Benishangul Gumuz	120(53.3)	10546.7)	
Gambela	50(39.1)	78(60.9)	
Type of place of residence			

Rural	220(25.2)	653(74.8)	0.47
Urban	27(26.0)	77(74.0)	
Work status			
No	159(22.0)	564(78.0)	**<0.001**
Yes	88(34.6)	166(65.4)	
Women autonomy on their health care			
No	186(24.3)	581(75.7)	**0.09**
Yes (by hear own)	61(29.0)	149(71.0)	
Husband age			
<=34	20(18.9)	86(81.1)	**0.02**
35-44	106(22.8)	359(77.2)	
>45	121(29.9)	285(70.2)	
Husband education			
No education	151(21.3)	559(78.7)	**<0.001**
Primary	60(35.5)	108(64.3)	
Secondary and above	36(36.4)	63(63.6)	
Wealth index			
Poorest	129(18.9)	555(81.1)	
Poorer	34(33.0)	69(67.7)	
Middle	26(46.45)	30(53.6)	**<0.001**
Richer	34(51.5)	32(48.5)	
Richest	24(35.3)	64.7)	
Household size			
<=5	20(20.4)	78(79.6)	0.24
>=6	227(25.8)	652(74.2)	
Husband desire for more children			
want more children	85(23.4)	278(76.6)	0.32
Others	161(26.3)	452(73.7)	
ANC			
<4	182(22.3)	633(77.7)	**<0.001**
>=4	65(40.1)	97(59.9)	
Place of delivery			
Out of health facility	186(22.7)	633(77.3)	**<0.001**
At health Facility	61(38.6)	97(61.4)	
PNC			
No	214(24.4)	662(75.6)	0.07
Yes	21.9)	68(67.3)	
Current contraceptive use			
Not using	197(21.6)	714(78.4)	**<0.001**
Using	50(75.8)	16(24.2)	
Total	**247**	**730**	

8.3.4. Multivariable logistic regression model for investigating the impact of key maternal health service on fertility preference

Table 23 shows that religions, household wealth status, place of delivery and current contraceptive use have a significant association with fertility preference in the four study regions. The results reveal that women who delivered at health facilities had 41% lower odds of fertility preference (AOR: 0.59; 95% CI: 0.04 to 0.36; P <0.05) than women who delivered out of health facilities. Moreover, the results in Table 23 show that women who are currently using contraceptives had 71% lower odds of fertility preference (AOR: 0.19; 95% CI: 0.00 to 0.10; P < 0.05) than women who are not using contraceptives.

Table 23: Multivariable binary logistic regression analysis for examining the effects of key maternal health services on fertility preference in four regions of Ethiopia (N= 977)

Variables	**Model1 (Control variables only)**				**Model 2 (Control and exposure variables)**			
	AOR	**P value**	**95%CI**		**AOR**	**P value**	**95%CI**	
Women education level								
Not educated [RC]								
Primary	0.73	0.23	0.44	1.22	0.75	0.28	0.44	1.28
Secondary and above	1.03	0.95	0.36	2.96	0.96	0.94	0.33	2.84
Religion								
Muslim [RC]								
Orthodox	0.16	**0.00**	0.09	0.28	0.19	**0.00**	0.11	0.36
Protestant	0.33	**0.00**	0.22	0.52	0.34	**0.00**	0.21	0.53
Others	0.28	**0.00**	0.14	0.56	0.31	**0.00**	0.15	0.64
Women autonomy on their own health care								
No [RC]								
Yes	0.75	0.13	0.52	1.08	0.72	0.09	0.49	1.05
Working status								
No [RC]								
Yes	0.88	0.47	0.62	1.25	0.92	0.66	0.64	1.33
Husband education level								
Not educated [RC]								
Primary	0.93	0.73	0.61	1.42	1.06	0.79	0.68	1.66
Secondary and above	0.89	0.68	0.51	1.55	0.99	0.96	0.55	1.75
Wealth index combined								
Poorest [RC]								
Poorer	0.49	**0.00**	0.30	0.80	0.68	0.14	0.40	1.14
Middle	0.31	**0.00**	0.17	0.56	0.44	**0.01**	0.23	0.85

Richer	0.33	**0.00**	0.18	0.58	0.50	**0.03**	0.27	0.95
Richest	0.49	**0.02**	0.27	0.89	0.76	0.42	0.39	1.48
ANC								
<4 RC								
>=4					0.76	0.23	0.48	1.19
Place of delivery								
Out of health facility RC								
At health Facility					0.59	**0.04**	0.36	0.98
PNC								
No								
Yes					1.20	0.55	0.66	2.17
Current contraceptive use								
Not using RC								
Using					0.19	**0.00**	0.10	0.35
AIC	997.85				969.03			
BIC	1066.23				1056.95			

RC=Reference category

8.3.5. Population Attributable Fraction (PAFs) for selected risk factor of fertility preference

The results displayed in Table 24 show the Population-Attributed Fractions (PAFs), which are impact measurements of an individual risk factor at the population level. Due to the small proportion of non-fertility preferences among women residing in those four regions of the study, the PAFs were computed only for women who had fertility preferences. The estimated adjusted PAFs indicate that current contraceptive use contributed the biggest proportion (80%) of impacts. This is interpreted as the proportion of fertility preference among women residing in the four regions that could have been reduced at the population level if the exposure (the non-use of contraceptives) had been removed. Similarly, 38% of the fertility preferences of women in the four regions of Ethiopia can be reduced if in the women residing in the poor households were removed. Further, 37% of the fertility preferences of women can also be reduced if the exposure to non-health facility delivery was removed. Moreover, the other socio-demographic factors, including religion and type of place of residence, were also important risk factors whose combined impact at the population level is close to 64%. The combined population-level impacts of all the significant risk factors amounted to 219%.

Table 24: Population Attributable Fraction (PAFs) for selected risk factor of fertility preference in four regions of Ethiopia (N=977).

Risk factor	AOR	P value	(95%CI)		PAF %
Women age (<=24 years age)	0.98	0.39	-1.25	3.22	1
Women education (no education)	0.25	0.31	-0.24	0.74	20
Religion (Muslim)	1.23	**0.00**	0.86	1.60	59
Type of place of residence (Rural)	-0.70	**0.02**	-1.28	-0.12	5
Women currently working (not working)	0.02	0.93	-0.36	0.39	1
Women autonomy on their own health care (decision made by her husband/ others)	0.32	0.11	-0.07	0.72	22
Husband age (<=34 years age)	0.31	0.32	-0.30	0.91	3
Husband education (no education)	-0.03	0.90	-0.42	0.37	-2
Wealth index (poorest)	0.68	**0.00**	0.29	1.08	38
Family size (<=5)	0.13	0.63	-0.40	0.67	1
Husband desire for more children (want more)	-0.06	0.72	-0.40	0.28	-2
ANC (<4)	0.32	0.15	-0.12	0.77	24
Place of delivery (out of health facility)	0.56	**0.02**	0.08	1.04	37
PNC (no)	-0.21	0.49	-0.81	0.39	-21
Current contraceptive use (not using)	1.72	**0.00**	1.08	2.36	80
Total for only significant variables					**219**
Total for all variables					**266**

8.4. Discussion

This study has primarily aimed to determine the impacts of the inequalities in utilization of key maternal health services on fertility preference among high-parity women in four regions of Ethiopia (Afar, Benishangul Gumuz, Gambela, and Somali regions). The study employed both the conventional regression analysis and PAF analysis to understand the role of the exposure variables on women's fertility preference. The first level of analysis showed the existence of a significant association between a range of predictors (both exposure and control variables) and the dependent variable (fertility preference). The second level of analysis using PAF documented the impacts of the inequalities in the key exposure variables on the outcome variable.

Among the background characteristics used in this study, religion and wealth index were found to have significant associations with fertility preference. i.e., non-Muslim women- had a lower desire to have more children compared to Muslim women. This finding is consistent with the results of previous studies conducted among two Muslim communities in Kenya and in Ghana, both of which reported that Muslim women prefer red to have more children compared to

Christians. The reason reported was that the respondents strongly believed that children are blessing of God (Abdi et al., 2020; Ahinkorah et al., 2021).

This study also found that women who had better wealth status had lower fertility preferences compared to those living in the poorest (lowest) wealth category. This finding is in line with the results of some previous studies which indicated that higher socioeconomic status is associated with lower fertility preferences (Ahinkorah et al., 2020, 2021; Matthew AKPA, 2012; Teshale et al., 2022). The possible explanations for this finding may correspond to the fact that women in the lowest wealth quintile have a greater desire to have more children as most of them believe in the utility of children as old age security i.e., it is a customary practice/expectation that most children will support their family when they grow older. In addition, in most developing countries like Ethiopia, women from the poorest families may not get the opportunity to go to school or they are poorly educated which may, by itself, hinder them from having good knowledge of family planning or reproductive (Atake & Gnakou Ali, 2019; Teshale et al., 2022).

The contraceptive use and place of delivery had significant associations with fertility preferences. This finding is consistent with other previous studies which indicated that women who use contraception have a lower preference to have more children than those who are not using a contraceptive (Matthew AKPA, 2012; Teshale et al., 2022). Tessema et.al (2020) and Tessema and Tamirat, (2020) reported place of delivery as a key determinant of fertility preference of women in Ethiopia. The possible reason for such association could be skilled health professionals usually provide counseling service on FP choices and birth interval or spacing between births (Tessema et al., 2020; Tessema & Tamirat, 2020). Furthermore, those women may have a more negative subjective birth experience and an emergency operative mode of delivery (instrumental vaginal delivery or emergency cesarean delivery) which may also be related to a change in fertility intentions in their postpartum period i.e., desiring fewer children and/or increasing desired inter-pregnancy interval (Preis et al., 2020).

Further, the study also analyzed the risk factors or population level impacts using the PAFs analysis. The findings confirmed that the three socioeconomic variables (religion, type of place of residence and wealth index) and the two key maternal health service (place of delivery and current contraceptive use) posed significant impacts on women's fertility preference. The PAF result in this study exceeded 100%, suggesting that some of the women had multiple risk factors

that affected their fertility preference. These risk factors with fertility preference could be prevented by different methods, and the prevention cases of these women could be counted more than once (Rowe et al., 2004) .

The combined PAFs of the two main maternal health services (place of delivery and current contraceptive use) in this study were 117%. This means that more than half of the women's fertility preferences in this study could have been prevented by removing the risk factors (i.e., ensuring access to those nonusers of the services). The other half could also be prevented by addressing the risk factors identified from the socioeconomic variables. As previous studies indicated, the PAF results for a specific population may not be fitting or consistent to the PAF results done in other populations, since there might be a varying prevalence of risk factors (Rückinger et al., 2009). This makes comparison of PAF results across different populations.

This study has several strengths, such as the use of a nationally representative dataset that helps to make sound generalizations of the findings. It also has a methodological contribution/ relevance as it addressed population-level impacts of service utilization using Population Attributable Fractions (PAF), which is rarely reported by previous studies. Thus, the findings of the study can serve as one of the few references for similar studies in the future. However, this study also has some limitations. First, the study used a cross-sectional design that limits the inference of causality. Second, some of the responses might have been affected by recall bias, as the respondents might have difficulty remembering events that occurred in the last five years before the survey. Moreover, EDHS did not collect information related to some key socio-cultural variables which play an important role in fertility preference. For this reason, the analysis did not account for some variables (such as norms and values, social influences or other family members' perspectives, especially the husband's,) which may have a significant impact on reproductive decisions. The measurement of fertility preferences is based on what currently married women reported which can be changed over time.

8.5. Conclusion and implications

This study investigated the factors influencing fertility preferences among high-parity women in four regions of Ethiopia. The finding reveals that maternal health service utilization (such as place of delivery and contraceptive use) and socioeconomic conditions (such as religion, type of residence, and wealth index) significantly impacted fertility preferences. Interestingly,

inadequate utilization of essential maternal health services (nonuse of institutional delivery and contraception) accounted for half of the conventional risk factors for fertility preferences.

To address these disparities, we recommend enhancing access to maternal health services through proactive measures, strengthening existing fertility control programs, and engaging religious leaders. Collaborating with religious institutions can promote safe deliveries, adoption of family planning, and overall well-being of women and their children. Additionally, localizing maternal services through implementing mobile clinics, community health workers, and outreach programs is essential. Empowering local leaders to champion maternal health will bridge gaps and ensure equitable access for women in remote areas.

CHAPTER NINE

Population Level Impacts of Inequalities in MCH Service Utilization on Child Survival in Four Regions of Ethiopia

(Manuscript submitted for publication @ BMC Pediatrics and is under review. The manuscript is authored by Tigist Shumet and Nigatu Regassa)

9.1. Background

Under-five mortality is the chance of a child dying before turning five years old. In 2020, five million children died worldwide, with most deaths due to infectious diseases, preterm birth, and delivery complications. Despite a 61% decrease in global child mortality rates between 1990 and 2020, improving child survival remains a pressing issue, particularly in Sub-Saharan Africa, where one in every 13 children dies before turning five (Sharrow et al., 2022; United Nations Inter-agency Group for Child Mortality Estimation (UN & IGME), 2021).

Ethiopia has seen a significant decrease in under-five mortality, with a decrease from 123 deaths per 1000 live births in 2005 to 55 deaths in 2019. This improvement is attributed to increased coverage of maternal health services like antenatal care, delivery care, and postnatal care. However, these services are not equally accessible to all regions and socio-economic groups, highlighting a significant gap in maternal health care utilization(CSA & ORC Macro, 2006; EPHI & ICF, 2021; Ethiopia Central Statstics Agency(CSA)[Ethiopia] & ICF, 2017; FMOH, 2015). For example, the percentage of pregnant mothers who attended antenatal care (ANC) four or more times was only 11% in Somali region, compared to 43% at the national level. Similarly, the percentage of facility-based deliveries was only 23% in Somali region, compared to 48% at the national level (EPHI & ICF, 2021). These figures show that there is a large gap in maternal health care utilization between different regions and groups in Ethiopia.

A low Maternal and Child Health (MCH) service utilization can contribute to maternal and child health problems and increase mortality. Proper maternal and child health interventions play a significant role in reducing both under-five mortality and morbidities among the most marginalized community members, including children and women. On the contrary, inadequate

use of maternal healthcare services significantly impacts child health outcomes. Antenatal Care (ANC) offers risk recognition, prevention, control of pregnancy-related diseases, and health education for mothers and children. Contact with health workers during ANC visits allows early detection and treatment of health complications and pregnancy-related infections for pregnant women (Kiross et al., 2021; Tegegne et al., 2019).

The World Health Organization (WHO) recommends four postnatal checkups to assess various health aspects to ensuring early identification of potential concerns a woman and newborn including discussing future visits and immunization schedules. Early postnatal visits (with in the first 24 hours) are crucial for mother and baby's well-being, enabling breastfeeding establishment and addressing attachment and positioning issues. Further, additional three postnatal checkup for the baby, along with the mother's recommended (World Health Organization(WHO) & Jhpiego, 2015).

Health facility delivery significantly reduces infant mortality rates by providing immediate care for complication that might occur during delivery (Tura et al., 2013). However, a case-control study in India found that facility delivery without postnatal check-up increased neonatal death (Doctor et al., 2018). No study was reported in Ethiopia gauging how much this factor contributes to the reduction of mortality.

Anemia, a global public health issue, affects two billion people, particularly pregnant women (41.8%), preschool-age children (47.4%), and 30.2% of non-pregnant women affected globally (World Health Organization(WHO), 2023a). In Ethiopia, according to EDHs 2016 the prevalence of anemia was 57 % in children less than 5 year and 24% in women in reproductive age (Central Stastical Agency(CSA) & ICF, 2017). Iron Deficiency (ID) is responsible for half of the burden of anemia, which has multifaceted causes. Maternal anemia has been associated with various adverse outcomes, including an increased risk of maternal death, low birth weight, and preterm birth (Gebremedhin et al., 2014). According to the national guideline and control and prevention of micronutrient deficiencies in Ethiopia, pregnant women should take oral iron supplements of 60 mg elemental iron and folic acid supplements of 400 μg every day for at least six months during pregnancy and three months after giving birth, following the WHO recommendations (Ethiopian Federal Ministry of Health (EFMOH), 2016) (World Health

Organization(WHO), 2012). However, the Ethiopia Mini Demographic Health Survey shows only 60% of women have taken the supplement in recent pregnancy and 11% for 90+ days (EPHI & ICF, 2021).

Among health interventions, immunization is one of the most effective and affordable ways to prevent and control various infectious diseases. It is important to receive vaccines at different stages of life, especially during childhood. Childhood immunization can reduce the risk of serious illnesses and death among children (Awoh & Plugge, 2015) (World Health Organization(WHO), 2021a). According to the World Health Organization (2021), immunization prevents about 1.5 million deaths every year in all age groups (World Health Organization(WHO), 2021a). In Ethiopia, 44% of children aged 12-23 months received all basic vaccines and 73 % received Bacillus Calmette –Guerin (BCG) vaccine in 2019 (EPHI & ICF, 2021), but we have little information on how much such intervention contributes to the reduction of under-five mortality in the country.

The health and well-being of mothers and children are crucial for reducing the burden of mortality and morbidity among the most vulnerable groups. However, there are other factors that can influence child survival, such as socio-economic status. Thus, several studies have investigated the factors affecting child mortality in Ethiopia using various data sources and methods. According to those studies, some of the common factors that increased the risk of child mortality were rural residence, low maternal education, multiple births, lack of antenatal or postnatal care, lack of breastfeeding, cultural norms, financial constraints, low female empowerment, seasonal migration, and poor health service delivery (Alamirew et al., 2022; Argawu & Mekebo, 2022; Ayele et al., 2017; Ebrahim & Atteraya, 2023; Gebresilassie et al., 2021; Liben et al., 2019; Tibebu et al., 2022; Zewudie et al., 2020). Further, the risk of mortality for children under five years old was also higher for those children who had multiple siblings, were male, were the firstborn, belonged to a large family, had poor personal illness control, inadequate child feeding and newborn care, low immunization status, no Vitamin A supplementation, short birth intervals, and dead older (Ebrahim & Atteraya, 2023; Shifa et al., 2019; Zewudie et al., 2020). On the other hand, some of the factors that decreased the risk of child mortality were living in cities like Addis Ababa, having higher maternal autonomy, giving

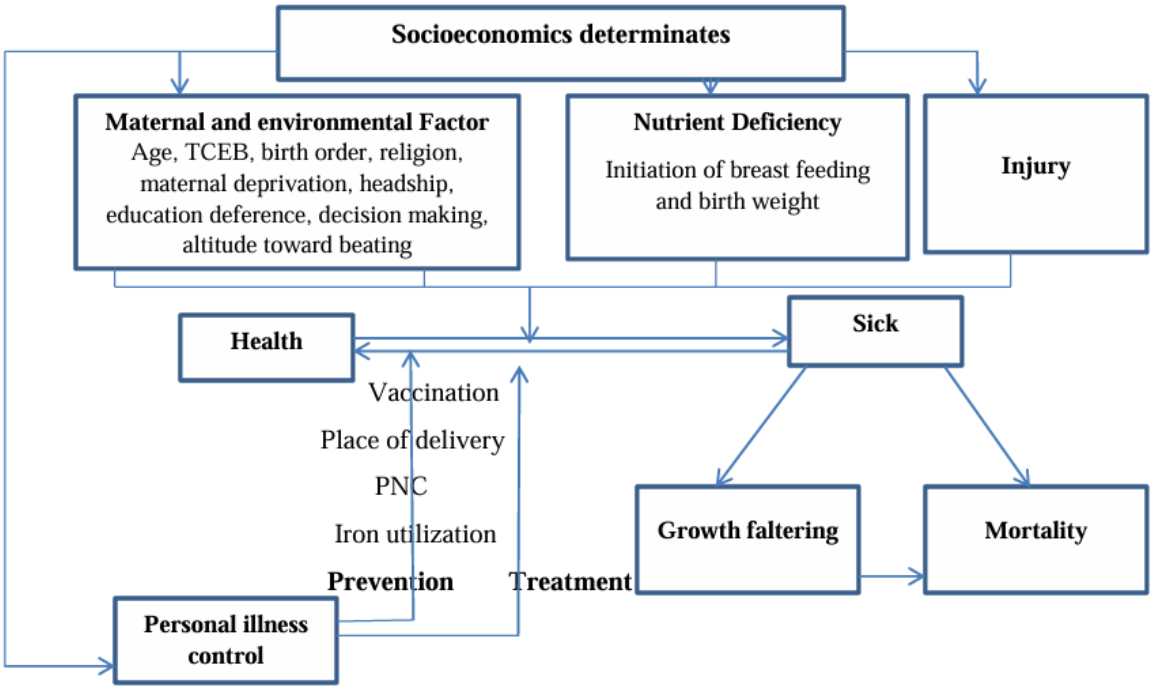
birth in health facilities, and having timely antenatal care visits (Ayele et al., 2017; Mitiku, 2021) Some of those studies also reported some differences in child mortality by residence type, household wealth, and birth weight (Ayele et al., 2017; Ebrahim & Atteraya, 2023; Fenta & Fenta, 2020; Gebresilassie et al., 2021; Oduse et al., 2021).

However, these previous studies have not fully explored the role of empowerment and maternal and child health (MCH) service utilization in child survival in four regions of Ethiopia: Afar, Somali, Benishangul Gumuz and Gambela. These regions have high levels of poverty and under-five mortality compared to other regions in the country. Therefore, this study aims to fill this gap by assessing the population level impacts of inequalities in MCH service utilization on child survival in these regions. The study answers the following questions: "*What are the main factors that have significant association with child survival in those four regions?"* and "*How much is the proportional reduction in under-five mortality if MCH service utilization improved in the four regions of Ethiopia".*

9.2. Theoretical framework

This study was guided by adapting a conceptual framework from Mosley and Chen's framework. Mosley and Chen (1984) identified socioeconomic and biomedical factors as the determinants of child survival. Socioeconomic factors indirectly affect child survival through proximate factors, while proximate factors directly affect child mortality. These factors include maternal factors, environmental hygiene, nutrient deficiency, injury, and personal illness control. In addition, dependent variable (mortality and morbidity) can be measured using a single variable with a combination of health (nutrition status) and death. The framework used "weight-for-age" as a measure of health status of children. Before classifying the health status, the study will compare the actual weight for age with the expected weight for age based on the standard growth rate. From this, the study will find children's weight in terms of percentage of the standard weight for age. To classify the health status, the study used five classifications: healthy (90% or higher of standard weight-for-age); Grade I (75–89% of standard); Grade II (60– 74% of standard); Grade III (below 60% of standard); and Grade IV-dead (Mosley & Chen, 1984).

This study examines how child survival (outcome variable) is influenced by various factors. The framework of this study is based on the models of Mosley and Chen (1984) which assume that the proximate determinants and socioeconomic variables have effects on the outcome variable (child survival). The framework identifies three types of proximate determinants: maternal and environmental factors, nutrient deficiency, and personal illness control. Maternal and environmental factors include age, total children ever born, birth order, religion, maternal deprivation, headship, education difference, decision making, attitude toward beating, etc. Nutrient deficiency includes initiation of breastfeeding and birth weight. Personal illness control includes antenatal care, place of delivery, postnatal care to the baby, iron utilization during pregnancy, and vaccination status. The framework also includes injury as a proximate determinant, but this variable is not considered in this study due to lack of data. The framework shows how these proximate determinants and personal illness control directly affect child survival (**Figure8**).



Source: Adapted from Mosley and Chain,(1984)(Mosley & Chen, 1984).

Figure 8: Conceptual framework for the study of population level impacts of MCH service utilization on child survival in selected four regions of Ethiopia.

9.3. Methods

9.3.1. Study design and source of data

The study utilized secondary data from the 2016 Ethiopian Demographic and Health Survey (EDHS) which was conducted between January 18, 2016, and June 27, 2016 (Central Stastical Agency(CSA) & ICF, 2017). For this study, we used data collected from four- selected regions of Ethiopia, namely Afar, Benishangul Gumuz, Gambela, and Somali regions.

9.3.2. Study setting

The study regions are Afar, Benishangul Gumuz, Gambela, and Somali regions of Ethiopia. Those regional states are listed as the least developed regions in the country. They are characterized by low land with semi-arid climate conditions, poor infrastructure, low administrative capacity, a high level of poverty, and poor development indicators. The arid environment in the Afar and Somali regions and the small and scattered nomadic populations make it more challenging to provide essential services. Many parts of these four regions are inaccessible with poor or no roads (UNHCR, 2019). Further, these regions are known for hosting refugees. Most refugees in Ethiopia are located-in these four emerging regions and in Tigray region (UNHCR, 2019).

9.3.3. Sampling

The 2016 Ethiopian Demographic and Health Survey (EDHS) collected demographic and health indicators for the country, using a stratified two-stage cluster sampling design. The sample was selected independently in each stratum in two stages, using a probability proportional to size selection. The 2007 Population and Housing Census provided the sampling frame, and a household listing operation was conducted from September to December 2015. A total of 10,641 mothers of under-five children were interviewed about their children (Central Stastical Agency(CSA) & ICF, 2017). This study involved 2183 children who were born from married women in those four regions.

9.3.4. Variables of the study

Outcome measures

The outcome variable of the study is child survival. It was generated by using Mosley and Chen’s (1984) framework. The framework used "weight-for-age" as an indicator of children's

health. The study compared the actual weight for age with the expected to weight for age based on the standard growth rate. The study calculated children's weight as a percentage of the average weight for their age. Child survival was measured by a scale from 1 (Healthy) to 5 (Dead), with lower scores indicating better health outcomes: healthy (90% or higher of standard weight-for-age); Grade I (75–89% of standard); Grade II (60– 74% of standard); Grade III (below 60% of standard); and Grade IV-dead. Further to assess the population level impact we categorized the outcome variables as a binary variable (Alive, death).

Exposure variables and control variables

Utilization of maternal and child health (MCH) service is the exposure variable whose effect we want to analyse on the outcome variables (child survival)(ANC (<4,>=4), PNC to the baby (yes, no), place of delivery (health facility , out of health facility), maternal use of Iron supplement during pregnancy (yes , no), BCG vaccination (yes, no).

Control variables included in the study were; child sex (male , female given at birth),birth weight (<2.5, >=2.5), breast feeding initiation (immediate, delayed), birth order (first, second and above), total children ever Born (<=3,>3), mother age(<=24,24-34,>=34), mother religion (Muslim, orthodox, protestant, others), headship (other, head), household size (<=5,>5), education difference were computed from difference between women, and husband education and coded as (yes/ no). The remaining variables generated a composite variable. Initially we categorize all variables dichotomously and then we use PCA to generate the variables. The highest eigenvalue was used as a multiplier.

Attitude towards wife beating was computed from 5 variables (beating justified if wife goes out without telling husband, beating justified if wife neglects the children, beating justified if wife argues with husband, beating justified if wife refuses to have sex with husband, and beating justified if wife burns the food). The highest eigenvalue was 3.47, mean 2.34 and SD 7.16. The final variable was labeled as attitude toward wife beating and coded as; 0 = women has negative attitude and 1 having positive attitude. Maternal deprivation was computed from 13 variables (wealth index, women education, women employment, reading magazine, listing to radio, watching TV, use of internet, women have own mobile, women covered by health insurance,

household electricity, flush toilet, improved water, location /rural-urban) (Adekanmbi et al., 2017). The highest eigenvalue was 0.54, mean 2.2 and SD 18.2. The final variable was labeled as maternal deprivation and coded as; 0=women deprived and 1= not deprived. Decision making was computed from four variables (person who usually decides on respondent's health care, person who usually decides on large household purchases, person who usually decides on visits to family or relatives, person who usually decides what to do with money husband earns). The highest eigenvalue was 2.68, mean 1.27 and SD 6.86. The final variable was labeled as decision making and coded as; 0 = women has poor decision making capacity and 1 having better decision making capacity.

9.3.5. Statistical analysis

Stata Version 18 (StataCorp, 2023) and SPSS version 25 (IBM Corp, 2017a), statistical programmes, were used for data cleaning and analysis. Due to the categorical nature of the outcome variable, we used ordered regression to examine the key determinants of child survival. We checked the basic assumption of ordered regression before the analysis. We used a likelihood ratio test to assess the proportional odds assumption and the p-value of the model was 0.13, which indicates that the model is appropriate (Liu et al., 2023). The study used the Variable Inflation Factor (VIF) to test for multicollinearity among the independent variables, and those that showed a VIF value >2.5 were removed from further analysis. As a result, the ordered regression analysis did not include region. Bivariate ordered regression was used to select the potential variables by using a cut off $p< 0.2$. Multivariable ordered regression analyses were carried out to assess the association between the selected explanatory variables (i.e., control and exposure variables) and child survival. A p-value of 0.05 with a 95% confidence interval was used to declare statistically significant relationships in multivariable ordered regression analysis. For ordered regression, we used continuous variables as it is and for the population attributable fraction, we categorized the continuous variables based on their mean (below and above their mean value) as binary variables. The Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) were also utilized to choose the best-fitting model.

We used regression-based Population Attributable Fractions (PAFs) to measure the population level impacts of the risk factor of interest. The method is reliable for assessing the effects of

interventions or risk factors (Rückinger et al., 2009). We followed the method identified by Greenland and Drescher and the steps proposed by Ruckinger et al. to calculate the PAFs from logistic regression analysis (Greenland & Drescher, 1993; Rückinger et al., 2009). The steps are as follows:

I. Coded the risk factor as a binary variable. We assumed that all individuals were not exposed to the risk factor, regardless of their actual status.

II. Used the following formula to estimate the predicted probabilities for each-individual using the modified dataset:

$$pp_i = \frac{1}{1+exp(-(\alpha+\beta' x_i)}$$

where α is the intercept, β is the vector of coefficients for the covariates, and x_i is the vector of observations for the covariates, with the risk factor set to zero for all individuals.

III. Summed up all the predicted probabilities to get the adjusted number of cases of child survival that would occur if the risk factor was absent in the population.

IV. Subtracted the expected cases from the observed cases and divided by the observed cases to get the PAF.

9.4. Result

9.4.1. Socio-demographic characteristics of the respondents

Table 25 presents the background characteristics of 2183 women respondents from the four regions of Ethiopia, namely Afar, Benishangul Gumuz, Gambela, and Somali. The majority (84%) of the study participants were from urban areas, while the remaining 16% were from rural areas of those four study regions. The age group with the highest representation is 24-34 years, which accounts for 48.7% of the study participants. Of the women who participated in this study, 53.9% had three or more children**.**

Table 25: Background characteristics of women with under five children in four regions of Ethiopia (n=2183)

Characteristics	Number	Percent
Child Sex		
Male	1161	53.4
Female	1022	46.6
Total children ever born		

<=3	1006	46.1
>3	1177	53.9
Birth order		
First	373	17.1
second and above	1810	82.9
Birth weight		
< 2.5Kg	47	2.2
>=2.5Kg	2136	97.8
Breast feeding initiation		
Immediate	626	28.7
Delayed	1557	71.3
Maternal age		
<=24	642	29.4
24-34	1063	48.7
>=34	478	21.9
Religion		
Muslim	1465	67.1
Orthodox	212	9.7
Protestant	444	20.3
Others	62	2.9
Region		
Afar	554	25.4
Somali	661	30.3
Benishangul Gumuz	512	23.5
Gambela	456	20.9
Type of place of residence		
Rural	349	16
Urban	1834	84
Household size		
<=5	1033	47.3
>=6	1150	52.7
	Median	**IQR**
Altitude toward wife beating	-0.5	11.4
Decision making	-2.4	3.3
Maternal deprivation	-5	18.1
Total	**2183**	**100**

9.4.2. Bivariate and multivariable ordered regression

This study investigated the contribution of each risk factor (exposure and socioeconomic/control variables) to child survival in Ethiopia. For this purpose, the study began the analysis with

assessing the association between the explanatory variables of interest and the outcome variable using ordered logistic regression. The bivariate analysis in Table 26 showed the relationship between each predictor variable and child survival. The multivariable ordered regression model only included the predictor variables that had a p-value below 0.2 in the bivariate analysis. The likelihood ratio test showed that the ordinal regression model was appropriate for the data, as the proportional odds assumption was not violated ($p = 0.13$). The model also had a significant overall effect on the outcome variable ($p < 0.05$).

In the multivariable ordered regression model result, the study found that the exposure variables ANC and place of delivery had a significant association with child survival. Specifically, children of women who had four or more ANC visits (AOR = 0.69, 95% CI: 0.54-0.88, $p<0.05$) during their pregnancy had a higher level of survival than children of women who had less than four ANC visits. This means that children whose mothers had four or more ANC visits during their pregnancy were more likely to survive than children whose mothers had less than four ANC visits. The reported adjusted odds ratio (AOR) of 0.69 for four or more ANC visits indicates that the odds of child survival were 31% lower for mothers who had four or more ANC visits compared to those with less than four visits, after controlling for other factors in the model. In other words, having four or more ANC visits increases the chances of child survival. Similarly, the result showed that children who were born in a health facility (AOR=0.65, 95% CI: 0.51-0.83, $p<0.05$) had a higher level of survival than children who were born outside of health facilities. The reported AOR of 0.65 for health facility delivery indicates that the odds of child survival were 35% lower for mothers who deliver in health facilities compared to those who did not delivered in health facilities, after controlling for other factors.

Furthermore, the study also found some of socioeconomic determinants included in the conceptual framework showed a significant association with child survival. Particularly, birth weight, breast feeding initiation, birth order, and religion were found to be statistically significant ($P < 0.05$) predictors of child survival. Specifically, children with a birth weight of 2.5kg and above (AOR = 0.28, 95% CI: 0.15-0.52, $p<0.05$) had higher level of survival than those with a birth weight of less than 2.5kg. Newborns who had immediate breast-feeding initiation (AOR = 0.67, 95% CI: 0.55-0.82, $p<0.05$) had higher levels of survival than those with delayed breast-feeding initiation. Children who were in the second and above birth order (AOR =

0.62, 95% CI: 0.46-0.84, p<0.05) had higher levels of survival than those who were first born. Children born from mothers with other religions (AOR = 2.81, 95% CI: 1.42-5.55, p<0.05) had higher levels of survival than the reference religion (Muslim). The AOR of 2.81 for mothers with other religion indicates that the odds of a child surviving are 2.81 times higher for children who belong to those mothers with other religions than for children who belong to those mothers who have the reference religion, assuming that the other predictor variables in the model are held constant.

Table 26: Result of bivariate and Multivariable relationship between socioeconomic variables, key maternal child health service and child survival *(N=2183)*

Characteristics	**Bivariate Regression**	**Ordered**	**Multivariable ordered Regression**			
			Model 1		**Model 2**	
			(Background characteristics)		**(Background characteristics and Key maternal health care service)**	
	COR(95% CI)	**P value**	**AOR(95% CI)**	**P value**	**AOR(95% CI)**	**P value**
Sex of the index child						
Male [RC]						
Female	0.93(0.79-1.09)	0.370				
Birth weight						
< 2.5kg[RC]						
>=2.5kg	0.54(0.3-0.95)	**0.030**	0.34(0.19-0.62)	**<0.001**	0.28(0.15-0.52)	**<0.001**
Breast feeding initiation						
Delayed [RC]						
Immediate	0.63(0.52-0.76)	**<0.001**	0.65(0.53-0.79)	**<0.001**	0.67(0.55-0.82)	**<0.001**
Total children ever born						
<=3[RC]						
>3	1.19(1.01-1.40)	**0.040**	1.18(0.93-1.49)	0.180	1.15(0.9-1.46)	0.260
Birth order						
First [RC]						
Second and above	0.83(0.66-1.04)	**0.110**	0.65(0.48-0.88)	**0.010**	0.62(0.46-0.84)	**<0.001**
Maternal age						
<=24[RC]						
25-34	0.98(0.81-1.18)	0.830	1.08(0.84-1.40)	0.540	1.11(0.86-1.44)	0.440
>=34	1.36(1.09-1.71)	**0.010**	1.31(0.95-1.81)	0.100	1.35(0.98-1.87)	0.070
Headship						
Others [RC]						
Head	1.09(0.91-1.3)	0.360				

Education difference between husband and wife	1.00(0.99-1.01)	0.830				
Altitude towards beating	1.01(1.00-1.02	0.290				
Decision-making	1.01(1.00-1.02)	**0.110**	1.01(1.00-1.02)	0.240	1.01(0.99-1.02)	0.330
Maternal deprivation	0.99(0.99-1.00)	**<0.001**	0.99(0.98-0.99)	**0.000**	1(0.99-1.00)	0.310
Religion						
Muslim [RC]						
Orthodox	0.72(0.51-1.00	**0.050**	0.82(0.57-1.18)	0.280	0.84(0.59-1.22)	0.360
Protestant	0.94(0.7-1.27)	0.700	1.09(0.79-1.5)	0.610	1.08(0.78-1.5)	0.630
Others	2.55(1.37-4.77)	**<0.001**	2.85(1.45-5.64)	**<0.001**	2.81(1.42-5.55)	**<0.001**
Household size						
<=5[RC]						
>=6	1.08(0.92-1.27)	0.360				
Antenatal care(ANC)						
<4[RC]						
>=4	0.58(0.48-0.71)	**<0.001**			0.69(0.54-0.88)	**<0.001**
Place of delivery						
Out of health facility [RC]						
Health facility	0.59(0.49-0.72)	**<0.001**			0.65(0.51-0.83)	**<0.001**
Post-natal care (PNC)						
No [RC]						
Yes	0.75(0.54-1.03)	**0.080**			1(0.7-1.42)	0.998
Maternal use of Iron supplement during Pregnancy						
No [RC]						
Yes	0.86(0.73-1.02)	**0.080**			1.03(0.85-1.25)	0.750
BCG						
No [RC]						
Yes	1.06(0.88-1.27)	0.560				
AIC			4374		4357	
BIC			4458		4463	

RC: Reference category

**COR= p value <0.2 , AOR=p value <0.05*

9.4.3. Results of population attributable fraction

Table 27 presents the Population-Attributed Fractions (PAFs), which are measure of the impact of an individual risk factor at the population level. The adjusted PAFs estimated that place of delivery (out of health facility), ANC (<4), and birth weight (<2.5kg) were significant risk

factors, whose combined impact at the population level is 50%. However, the combined population-level impacts of all factors amount to 131%.

Table 27: Population attributable fraction (PAFs) for selected risk factor of child survival in Four regions of Ethiopia, N=2183

Characteristics	Adjusted OR	P value	95% CI		Adjusted PAF
Child Sex(Male)	1.11	0.27	0.93	1.33	7
Birth weight(<2.5kg)	2.01	**0.02**	1.11	4.15	1
Breast feeding initiation(delayed)	1.09	0.45	0.88	1.35	3
Total children ever born(>3)	1.03	0.83	0.78	1.36	4
Birth order (first)	1.03	0.12	0.94	1.70	0
maternal age (>=24)	1.19	0.19	0.92	1.55	1
Headship (others)	1.10	0.53	0.86	1.33	4
Education difference (yes)	1.10	0.62	0.77	1.16	4
Altitude toward wife beating (poor attitude)	1.06	0.54	0.88	1.27	4
Maternal deprived (yes)	1.20	0.11	0.96	1.50	13
Decision making (low)	1.11	0.36	0.89	1.38	4
Maternal Religion (Muslim)	1.06	0.65	0.85	1.29	3
Household size (<5)	1.06	0.64	0.84	1.34	7
ANC (<4)	1.36	**0.01**	1.07	1.73	23
Place of delivery (out of health facility)	1.49	**0.00**	1.16	1.91	26
PNC to the baby (No)	1.20	0.32	0.84	1.72	13
maternal use of Iron supplement during pregnancy (No)	0.91	0.35	0.74	1.11	0
BCG (No)	0.09	0.34	0.91	1.32	14
Total					**131**
Total only significant variable					**50**

9.5. Discussion

Using the 2016 Ethiopian Demographic Health Survey (EDHS) data, this study determined the population level impacts of inequalities in MCH service utilization/ risk factors on child survival in four regions of Ethiopia (Afar, Somali, Benishangul Gumuz and Gambela). The results of the multivariate regression analysis confirmed the exposure variables ANC and place of delivery had a significant association with child survival which is consistent with previous studies (Getachew & Bekele, 2016; Kiross et al., 2021; Kuhnt & Vollmer, 2017; Mwebesa et al., 2022; Rückinger et al., 2009; Tesema et al., 2022; Tura et al., 2013; Worku et al., 2021).

Specifically, we found that having four or more ANC visits increased the chances of child survival. This may be because the health provider and the expecting mother had more frequent communication, which allowed them to monitor the health status of both the mother and the fetus. This also helped them to detect any danger signs that could lead to serious complications (Jain et al., 2016; World Health Organization (WHO), 2013). Moreover, having four or more ANC visits also enabled the expecting mother to get enough information, such as her nutrition, birth preparation, benefit of breast feeding, utilization of iron and folic acid supplementation, which are essential for reducing the risk of maternal and neonatal mortality and morbidities (Jain et al., 2016; World Health Organization (WHO), 2013). Similarly, another possible reason for the positive association between delivering at a health facility and child survival is that the mothers who deliver in health facilities may have access to skilled birth attendants. They also benefit from essential medicines, equipment and hygiene facilities that can prevent and treat common causes of death among children under 5 years of age (Micah & Hotchkiss, 2020).

The result of the association between birth weight and child survival is consistent with the findings of previous studies including the one conducted in India by *Jana et al. (2023)*, in Ethiopia by Taddese et al. (2016) and in Jordan by Mazharul et al. (2020) all of which indicate that low birth weight (< 2.5 kg) for infants during birth poses a high risk of infant and child death (Islam et al., 2020; Jana et al., 2023; Srivastava et al., 2021). Low birth weight (LBW) increases the risks of various complications which include Infections, Hypothermia, Hypoglycemia, respiratory distress syndrome, bleeding in the brain, Necrotizing enterocolitis (Jana et al., 2023). Further, LBW is often associated with preterm birth, which is when a baby is born before 37 weeks of gestation. Preterm birth is also a major cause of infant mortality (Jana et al., 2023).

Birth order of second or higher is significantly associated with child survival. Previous studies conducted on such subject reached similar conclusion (Tesema et al., 2022). This association could be attributed to the fact that mothers with no prior experience in childcare. However the other study which is done in Ethiopia within a former Southern Nations Nationalities and Peoples Region (SNNPR) also reported that higher-order births had higher odds of under-five mortality than lower-order births (Gobebo, 2021). This is due to study population difference.

Our findings on the association between having other religion and child survival is consistent

with results of a study done by Diddy (2008) in Nigeria, which reported that mothers who followed a traditional or other religion were more likely to fully immunize their children, resulting in children being protected from diseases that can be prevented by vaccines and this helps their survival (Antai, 2009).

Moreover, the study finding that newborns who had immediate breast-feeding initiation had higher levels of survival than those with delayed breast-feeding initiation is also consistent with what is mentioned in a joint statement by UNICEF and WHO (UNICEF & WHO, 2018). Early initiation of breastfeeding within the first hour of birth can prevent 22% of all deaths among babies under one month in low- and middle-income countries. The statement explains that early breastfeeding has several benefits for the newborn, such as stimulating breathing, keeping the baby warm, transferring antibodies and other immune factors from the mother, and promoting the colonization of the baby's gut by beneficial bacteria. Early breastfeeding also helps the mother by reducing the risk of postpartum bleeding and supporting child spacing (UNICEF & WHO, 2018).

As the major aim of the study was estimating the population level impacts of the risk factors described above, we used the regression-based Population Attributable Fractions (PAFs) model as presented in Table 3 above. We found that place of delivery (out of health facility), ANC (<4), and birth weight (<2.5kg) were significant risk factors that together accounted for nearly 50% of the child mortality in the study population. However, the total PAF of all the variables in the study was 131%, which exceeded 100%. This suggested that some children in the four regions of Ethiopia faced multiple risk factors that affected their survival. These risk factors could be prevented by different interventions, but some children could benefit from more than one intervention (UNICEF & WHO, 2018). The PAF of the two maternal and child health services (place of delivery (out of health facility) and ANC (<4)) in this study was 49%. This implied that almost half of the under-five mortality in this study could be avoided by addressing these health service interventions. However, the remaining mortality could also be reduced by addressing the risk factors related to the socioeconomic variables. Previous studies indicated that the PAF results for a specific population may not be applicable or consistent with the PAF results for other populations, because the prevalence of risk factors may vary (Rückinger et al., 2009).

Finally, it is important to discuss the strengths and limitations of the study. One of the strengths

worth mentioning is that the study used reliable and validated national-level data with large sample size in order to represent the study population. This makes the findings of the study more relevant for planning, monitoring and evaluation of health programs in the respective regions. This study is not without limitation. Due to the cross-sectional nature of the study, where data were collected at a specific point in time in the life of respondents, it is difficult to establish temporal relationship between the risk factors and the outcome of interest. Recall bias might have an impact on the results of this study since some women might have difficulty recalling incidents that happened in the five years prior to the survey. Furthermore, this study used a secondary data source, which seems to have missed some variables that may have some effects on child survival.

9.6. Conclusion and policy implications

Based on the analysis of the 2183 women with children under five drawn from four regions of Ethiopia, the study found that ANC and place of delivery accounted for 49% of the conventional risk factors for child survival in the study areas. The implication of the finding is twofold: first, given the poor quality and quantity of MCH services in the four regions, we strongly suggest that the government should prioritize to improving service access and to utilization by providing more budget and incentives to the respective regions. Second, continuous efforts should be made to improve knowledge and attitude of the women and men through various Social and Behavioral Communications (SBCC).

CHAPTER TEN

Major findings, conclusion, policy implications and future work

10.1. Major findings

The main objective of the study was to examine the levels of inequality in key maternal and child health (MCH) service utilization and health-related quality of life (HRQoL) in the four emerging regions of Ethiopia (Afar, Somali, Benishangul-Gumuz, and Gambela) and assess their implications for fertility and child survival. To address the specific objectives, the study used a range of data sources: the 2016 Ethiopian Demographic Health Survey (EDHS) data, scoping review and qualitative primary data collected from the Afar and Somali Regions of Ethiopia.

The study has focused on several interdependent components, including Health-Related Quality of Life (HRQoL), demand and unmet need for contraception, barriers to contraception utilization, maternal health care service utilization, fertility preferences, and child survival. These intermediate core variables were thoroughly explored across Chapters 4 to 9 and are considered the ultimate outcomes of the study. Notably, the presentations in these chapters revealed that these intermediate core variables are influenced by a diverse set of exposures or independent variables. These include Husband/partner education level, women's educational level, women's age, residence, wealth index, religion, sex of the household head, age of the household head, total number of children ever born, household size, child age, child sex, headship, marital status, work status, child's birth order, intimate partner violence, and women's autonomy regarding their own health care. The results presented throughout the entire thesis contribute collectively to the development of policies and inform healthcare professionals. This ultimately improves the overall health-related quality of life and reduces inequalities, providing valuable insights into the complex dynamics that shape maternal and child health outcomes for those four emerging regions of Ethiopia.

Chapter four examined the health-related quality of life (HRQoL) of urban and rural women of reproductive age in four emerging regions of Ethiopia. The study revealed significant disparities in the quality of life between women residing in rural and urban areas within these regions. This disparity aligns with findings from various global studies (Ali & Chauhan, 2020; Nabolsi et al.,

2020; Samuel et al., 2021). Notably, two socioeconomic factors—wealth index and educational attainment—accounted for a substantial portion of this inequality. This is consistent with a study done by Abosse et al. (2011), who identified pronounced urban-rural disparities in maternal healthcare utilization across selected Sub-Saharan African countries, including Ethiopia (Abosse et al., 2011). Furthermore, this study corroborates with other studies emphasizing the need for addressing wealth imbalances and enhance education levels among mothers to improve maternal health service usage in Sub-Saharan African countries (Yaya et al., 2016). Additionally, previous studies have established education as a crucial determinant of an individual's quality of life. Those with limited education may struggle to secure quality employment, leading to fewer economic opportunities, increased risk of social exclusion, poverty, and diminished political participation (European commission, 2020; Ezat et al., 2019).

Chapter five explored the disparities in demand and unmet need for contraception among married/in-union and sexually active women in four emerging regions of Ethiopia. The study indicated a vast inequality in both the demand and unmet need for contraception among women aged 15 to 49 years in these regions. Key predictors of contraception demand and family planning needs included the educational levels of women and their husbands, household wealth index, husband's age, employment status, region, and residence. These findings are in line with previous research conducted in Saudi Arabia (Khalil et al., 2018),Nigeria (Fagbamigbe et al., 2018), Uganda (Tetui et al., 2021), and various districts of Ethiopia (Asmamaw & Negash, 2023; G/Meskel et al., 2021; Girma Garo et al., 2021; Kebede et al., 2019; Mekonnen & Worku, 2011).

The study concludes that education, wealth, employment, and family size significantly influence contraception demand and unmet need. Educated women, possessing greater autonomy and knowledge, are more likely to use contraception, a trend supported by research from multiple countries (Baldwin et al., 2008; G/Meskel et al., 2021; Girma Garo et al., 2021; Janet Núñez Gough, 2007; Mekonnen & Worku, 2011). Households with higher wealth have better access to family planning services, whereas the poorest encounter obstacles such as cost and distance to health facilities, consistent with studies in Sub-Saharan Africa and Ethiopia (Asmamaw & Negash, 2023; Ekholuenetale et al., 2022; Mutua, et al., 2021; Samuel et al., 2021; Tsehay, 2022)

Working women exhibit a higher demand for contraception, while employed husbands demonstrate a lower unmet need, underscoring the influence of parental employment status on contraception disparities (De Jong et al., 2016; Grown et al., 2005; Mwaikambo et al., 2011). Moreover, women with larger families show an increased demand for contraception, as observed in Ethiopia and Nigeria (Azanaw et al., 2022; Solanke et al., 2022).

In addition to the above, paternal education also significantly influences contraception use. Husbands with higher education levels tend to offer greater support and autonomy to their wives, which positively impacts the utilization of family planning services. This observation is consistent with research from Ethiopia, which underscores the role of educated husbands in promoting birth spacing and fostering open communication about contraception within households (Abate & Belachew, 2017; Allen & Daly, 2007; Ashmad et al., 2012; Mekonnen & Worku, 2011).

Chapter six explores the barriers to contraceptive use among women of reproductive age in two regions of Ethiopia, namely the Afar and Somali regions, based on qualitative data. These regions are currently experiencing the highest fertility rate in Ethiopia. The analysis has revealed a complex array of barriers to contraceptive use. Characterized by high fertility rates and low contraceptive prevalence, the identified barriers fall into four themes: personal beliefs and attitudes, interpersonal factors, service availability and accessibility, and health workers' factors. These findings are also consistent with prior research in Ethiopia and other developing countries (Aychew et al., 2022; Bekele et al., 2021; Endriyas et al., 2018; Gonie et al., 2018; Jalu et al., 2019; Ouma et al., 2021; Seyife et al., 2019; Teshoma et al., 2023a; Utaile et al., 2020).

Personal beliefs and attitudes barriers include religious or cultural objections, myths, misconceptions, and a general lack of knowledge, which are often accompanied by negative attitudes towards contraceptives (Aychew et al., 2022; Bekele et al., 2021; Endriyas et al., 2018; Gonie et al., 2018; Jalu et al., 2019; Ouma et al., 2021; Seyife et al., 2019; Teshoma et al., 2023a; Utaile et al., 2020). Interpersonal barriers encompass partner opposition, socio-cultural influences, fear of judgment or stigma, and inadequate spousal communication and support (Kapadia-Kundu et al., 2022). Service-related barriers arise from the limited availability and accessibility of contraceptives, exacerbated by poor information dissemination by health workers and the media. These challenges are intensified by socio-cultural norms favoring large families,

male dominance in reproductive decisions, the distance and costs associated with accessing health facilities, and a lack of privacy in family planning services (Bekele et al., 2021; Gonie et al., 2018; Jalu et al., 2019; Seyife et al., 2019). Additionally, the health system faces issues such as stock-outs, a shortage of trained health workers, and substandard quality of care, which diminish women's trust and satisfaction, thereby hindering their use of contraceptive services. Privacy concerns, financial constraints, distrust or fear of health workers, and the absence of skilled personnel further impede women's access to and use of contraceptive services, underscoring the multifaceted challenges faced in these regions of Ethiopia methods (Jalu et al., 2019; Ouma et al., 2021; Seyife et al., 2019).

Chapter seven of this study assessed the rural-urban disparities in maternal healthcare service utilization across four regions of Ethiopia, employing ecological and decomposition analysis. The finding revealed significant disparities in the use of maternal health services such as antenatal care (ANC), place of delivery, and postnatal care (PNC) between urban and rural settings in these regions. The findings highlight pronounced rural-urban gaps in maternal healthcare, with rural areas facing challenges due to inadequate medical infrastructure (Abosse et al., 2011a; Faruk et al., 2020). The ANC visits were substantially lower than the national average, indicative of regional disparities and constrained resources (Central Statistical Agency (CSA) & ICF, 2017; Addisu et al., 2022; Shudura et al., 2020). The rates of health facility deliveries showed geographical variation, shaped by cultural preferences for home births (Davis et al., 2011; Wilunda et al., 2015; Zielinski et al., 2015). The PNC checkups within 48 to 72 hours post-delivery were suboptimal, especially in the Afar and Somali regions, attributable to the low rates of ANC and health facility deliveries, coupled with insufficient healthcare guidance (World Health Organization (WHO), 2013; Central Statistical Agency (CSA) & ICF, 2017; Dona et al., 2022). These insights underscore the urgent need to enhance maternal health services and infrastructure, particularly in the rural areas studied in those four regions.

Moreover, the chapter identified key predictors of maternal healthcare service utilization. Household wealth index, the husband's education level, and geographic region emerged as significant determinants of ANC utilization. Similarly, these factors, along with ANC attendance, were influential in determining the place of delivery. The household wealth index, women's employment status, region, ANC attendance, and place of delivery were predictive of

PNC utilization. Wealth and education, especially of husbands, markedly affect the use of maternal health services in rural settings. Women from wealthier households were more likely to utilize these services, while educated husbands were inclined to support deliveries in health facilities, recognizing the associated risks and benefits (Bobo et al., 2017; Ethiopian Public Health Institute (EPHI), 2018; Garfield & Isacco, 2011; Geda et al., 2021; Merga et al., 2019; Samuel et al., 2021; Tesfaye et al., 2018; Tsegaye et al., 2021). The ANC is a pivotal factor for both place of delivery and PNC utilization, as it equips women with essential information and counseling on maternal health services (Boah et al., 2018; Bobo et al., 2017; Chungu et al., 2018; Pervin et al., 2012; Sagawa et al., 2021; Shudura et al., 2020; Tsegaye et al., 2021). Further, this study's findings emphasize the critical role of improving service availability and addressing socioeconomic factors to bolster maternal healthcare access.

Chapter eight investigated how inequalities in maternal health service use affect fertility preferences among high-parity women in four Ethiopian regions. The study revealed that essential maternal health services such as the place of delivery and current contraceptive use alongside socioeconomic factors like religion, residence type, and wealth index, shaped the fertility preferences among women residing in those regions. The study also indicated that current contraceptive use and place of delivery accounted for 117% of the conventional risk factors for fertility preference in the study regions. Religion and economic status emerged as significant determinants; muslim women and those from less affluent backgrounds expressed a stronger desire for larger families, viewing children as blessings and future support providers for the family (Abdi et al., 2020; Ahinkorah et al., 2021; Atake & Gnakou Ali, 2019; Matthew AKPA, 2012; Teshale et al., 2022). In contrast, women with greater wealth and those who utilized contraception or opted for health facility deliveries tended to prefer smaller families. This might be a decision influenced by the family planning education received during healthcare interactions (Matthew AKPA, 2012; Tessema et al., 2020; Tessema & Tamirat, 2020; Preis et al., 2020). These findings underscore the profound impact of socioeconomic and healthcare factors on fertility choices.

Chapter nine assessed the impact of disparities in maternal and child health (MCH) service utilization on child survival at the population level in four regions of Ethiopia. The study found that antenatal care (ANC) and place of delivery were significant, accounting for 49% of the

conventional risk factors affecting child survival in these regions. Additionally, socioeconomic factors and MCH services, such as place of delivery and contraceptive use, were linked to fertility preferences and child survival. The population's attributable fraction (PAF) exceeded 100%, indicating the presence of multiple overlapping risk factors (Rowe et al., 2004; Rückinger et al., 2009). Regular ANC visits and deliveries in health facilities were associated with improved child survival, offering critical care and information (Jain et al., 2016; Micah & Hotchkiss, 2020; World Health Organization (WHO), 2013). Low birth weight was also identified as a risk factor, associated with complications and preterm births (Islam et al., 2020; Jana et al., 2023; Srivastava, S. et al., 2021). The findings suggest that addressing these risk factors could significantly enhance child survival rates. Given the substandard quality and availability of MCH services in the four regions, the government should prioritize improving service access and utilization by allocating more budget and incentives to the respective regions.

The study further revealed that birth order and the initiation of immediate breastfeeding are critical for child survival. A higher birth order was linked to increased survival, potentially due to mother's accumulated childcare experience, though this varies across populations (Tesema et al., 2022). Immediate breastfeeding, strongly advocated by UNICEF and WHO, is essential for newborn survival, conferring numerous health benefits (UNICEF & WHO, 2018). The study's Population Attributable Fractions (PAFs) analysis suggested that enhancing health facility delivery, antenatal care, and addressing low birth weight could prevent nearly half of child mortality cases. Socioeconomic interventions could address the remaining issues (Rückinger et al., 2009; UNICEF & WHO, 2018). These findings underscore the need for a comprehensive approach to improve child survival in Ethiopia.

10.2. Conclusion

Overall, the findings of the study found significant urban-rural and socioeconomic inequalities in the health-related quality of life, demand and unmet need for contraception, maternal health care services utilization, fertility preference, and child survival in the four regions. The key factors that influenced these inequalities and outcomes were wealth index, education level, region, residence, religion, husband's working status, age of husband, ANC utilization, place of delivery, and current contraceptive use. The study also identified key maternal health services, such as

place of delivery and current contraceptive use, that accounted for half of the conventional risk factors that raised women's fertility preferences and ANC and place of delivery reduced child survival in the study population.

10.3. Overall policy implications

The unacceptably low rates of most MCH explained substantial disparities in child survival and fertility preferences in the study regions. If Ethiopia is to meet the SGD goal 3 (improving maternal and child health), the country needs to narrow down the geographic and socioeconomic disparities by addressing the main challenges related to poor service utilization. Based on the chapters discussed above, the study outlined four implications where policy interventions can drive positive change in those four emerging regions of Ethiopia:

I. *Addressing inequality in maternal health care utilization and quality of life:* Policymakers should prioritize educational initiatives and economic policies aimed at reducing wealth disparities, particularly in rural areas of the four emerging regions of Ethiopia. Further, investment in women's education and economic empowerment programs can serve as critical strategies to enhance the overall maternal health care utilization and quality of life.

II. *Reducing Unmet Need for contraception:* A concerted effort is required to implement multidimensional and multisectoral strategies that address socioeconomic disparities affecting contraception. Policies should focus on enhancing access to contraception**,** with targeted efforts aimed at subgroups facing the greatest barriers.

III. *Overcoming Barriers to Contraceptive Use:* Effective interventions should encompass comprehensive information and counseling services to raise awareness about contraceptive options, community engagement to challenge socio-cultural norms hindering adoption, and improvements in the quality and availability of reproductive health services. Additionally, policies must empower women to make informed choices regarding their fertility.

IV. *Improving Maternal and child Health (MCH) Services and its utilization:* Policies should prioritize expanding access to maternal and child health services, particularly in remote

areas. This involves implementing initiatives like mobile clinics, engaging community health workers and allocating additional resources and incentives to enhance the quality and accessibility of MCH services in those emerging regions of Ethiopia. Additionally, involving religious leaders and institutions can promote safe deliveries and contraception. Further, Strategies should address predictors of maternal and child health care service utilization, including household wealth (which impacts access), education levels (influencing health-seeking behavior), and regional disparities (ensuring equitable access across urban and rural areas). Additionally, policies should aim to educate both women and men about maternal and child health through effective Social and Behavioral Communication (SBCC) strategies.

10.4. Future work

To advance the field of reproductive health, future research endeavors should adopt a multifaceted approach. Longitudinal studies are essential to monitor the long-term effects of policy shifts on quality of life and health outcomes. A deeper understanding of the diverse needs of women's subgroups is crucial, necessitating subgroup analysis to customize interventions. The efficacy of current policies and programs must be scrutinized through impact evaluation to ensure they effectively diminish disparities and enhance health metrics. Additionally, there is a compelling need to explore the nexus between service utilization and fertility preferences, particularly the role of religious leaders and community-based health services in shaping these dynamics. Lastly, the continuous assessment of Maternal and Child Health (MCH) services evaluating the influence of increased investments and incentives, alongside the impact of Social and Behavior Change Communication (SBCC) programs on health behaviors and attitudes remains a pivotal area of research. Collectively, these efforts will provide valuable insights and guide effective policymaking for improved reproductive health outcomes.

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Appendix

Annex I: Information sheet, verbal consent, and interview guide for qualitative part in English language.

Assessment of barriers to modern contraceptive utilization in very high fertility regions of Ethiopia,

Introduction:

Hello, my name is _____ and we are the principal investigators. This information sheet and consent form is prepared by the principal investigators. This study is designed to explore barriers to modern contraceptive utilization in very high fertility regions of Ethiopia. The investigators are PhD candidates at Addis Ababa University.

Purpose of the study:

The aim of this study is to explore barriers to modern contraceptive utilization in very high fertility regions of Ethiopia. The finding of this study will contribute to-improve the use barriers to modern contraceptive utilization.

Procedure of the study:

In order to proceed to the assessment, we politely request you to allow us to interview regarding contraceptive utilization. After we sought your permission, we make an interview you with each question until the end unless want to withdraw at any step from the study or bypass question that you do not want to answer.

Risks/discomfort:

We assure the confidentiality of the information, and we make it anonymous/not report by the name of the individual; and the information we take will contribute to improve the barriers to modern contraceptive utilization which will contribute for better decision making.

You may feel discomfort for wasting your time for about 45 minutes however your support is important for us and we kindly ask you to sacrifice your precious time.

Benefits and Incentives:

For your support for this study, you may not get direct benefit, but your participation is likely to help us in assessing assessment of barriers to modern contraceptive utilization and, it's

contributing factors in high fertility regions of Ethiopia. Therefore, this study finding can be used by policymakers and other stockholders as a reference during engaging the development of relevant new policy/strategies that will have an efficient promotion of modern contraceptive utilization. Further, by participating in this study, there is no incentive provided but this study finding will be presented in the selected enumeration area, open presentation in Addis Ababa university and in different workshop, it will be published in scientific journal, and anyone who will have an interested to know about this study result will access the findings.

Confidentiality:

The information that we will collect from this research project will be kept confidential (strictly secrete). The facilities identities are kept confidential, and we will report the finding in simply "one of the participants". Hence you are kindly requested to support honestly.

Persons to contact:

If you have any question, you can contact any of the facilitators and you may ask at any time you want on mobile number +2519 11900725 Of principal investigator Tigist Shumet

Verbal consent form

Title of Project: barriers to modern contraceptive utilization in very high fertility regions of Ethiopia

Name of Principal Investigator: Tigist shumet _ Tel. No (s): +251911900725

The contents of the respondent information sheet (RIS) dated……. that was provided have been read carefully by me / explained in detail to me in a language that I comprehend, and I have fully understood the contents. I confirm that I have had the opportunity to ask questions. The nature and purpose of the study and its potential risks /benefits and expected duration of the study, and other relevant details of the study have been explained to me in detail. I understand that my participation is voluntary and that I am free to withdraw at any time or decline to answer any question, without giving any reason. I am informed that the information collected about me from my participation in this research must be confidential and my anonymity should be maintained.

I agree to take part in the above study. Yes ____ No ____

Name of data collector _____ signature_____ Date_____

In-depth Interview Guide for Qualitative Data Collection in English

Section I	**Background characteristics**	Response	Skip
1	Age of the respondent		
2	What is the highest grade you have completed?		
3	Respondent employment status		
4	What is your religion		
5	How old was your (husband/partner)		
6	What is the highest grade your husband education		
7	Husband employment status		
8	Are you currently married or living together with a man as if married		
9	Have you ever given birth?		If No skip to13
10	Total number of children ever born		
	probe how many son and daughters		
11	All children still alive probe		
12	Are you Pregnant now		

Section II- Family planning use/experiences

2.1 Have you ever used contraceptive

Probe: If yes, which methods have you ever used

a. Are you currently using a method of family planning

Probe: If yes, which methods have you currently used, how did you first decide to use, where did you go to get it done most recently, what has the provider discussed with you

b. For how long have you been using the family planning method? (Please write time in month)

c. What is the best experience about the family planning method that you are using

d. What is the worst experience about the family planning method that you are using?

2.2 Do you discuss about family planning use with your spouse/partner If yes, what was his reaction towards using contraceptive? Is he supportive of using it? If No, why?

2.3 Where do you get the family planning services that you are currently using from?

2.4 Did your provider tell you when to come back for follow up? When is that?

2.5 How did you learn about the family planning method that you are using? Why did you decide to use the family planning method?

Section III - FERTILITY PREFERENCES, PREGNANCY RISK

3.1 How happy or unhappy would you be if you became pregnant in the next few months?

3.2 What about your husband/partner? How happy or unhappy do you think he would be if you became pregnant in the next few months?

3.3 How likely do you think it is that you could become pregnant in the next few months? Probe Why is that, meaning of what is mentioned, abstinence, infecundity, how effective the method?

Section IV: FAMILY PLANNING BARRIERS

4.1 What is the distance from your house to the family planning service center? Please tell us any of your experience if the distance from your home to the health facility affected your family planning use?

4.2 How much do you spend on family planning every month? Is that expensive?

4.3 Did anyone explain to you the advantages and disadvantages of the method of family planning that you are currently using? Probe If no, what was the reason?

4.4 Have you noticed any side effects as a result of using the family planning method? Probes If yes, please mention them?

4.5 Have you consulted a health worker about these side effects?

4.6 Will these side effects affect your use of contraception in the future? If yes, how?

4.7 Do you know of a place where you could access family planning services?

4.8 Who in your family usually has the final say on decisions of family planning and number of children?

4.9 Are there any cultural or religious beliefs that affect the use of modern family planning

methods in your society?

Probe If yes, please mention them

4.1 In your opinion, what problems hinder the use of contraception in your community? Please explain in detail

4.11 In general what are your thoughts of family planning?

4.12 according to you, what do you think should be done to improve family planning services

4.13 Are there any issues, questions, comments that you would like to raise or points to you wanted to add?

key informant interview guide with the Health extension worker / Health center Contraception provider

Section I	**Background characteristics**	**Response**
1	Region, zone , woreda , and kebele	
2	Respondent ID	
3	Age of the respondent	
4	Gender	
5	Education background	
6	Position	
7	Years of experience as a family planning focal person or in their role	

1. Ask the interviewee about their main responsibilities and tasks as a family planning focal person or on their role, such as planning, budgeting, monitoring, reporting, training, supervising, or coordinating family planning services and activities in their respective health offices.
2. Ask the interviewee about their level of knowledge and skills on family planning methods, guidelines, policies, and best practices.

2. **Barriers in Contraception Utilization**

2.1. Would you please describe availability and provision of modern contraception methods in your region /zone/woreda?

2.2. How do you see the quality of modern contraception services provision?

2.3. Would you mention the barriers of providing modern contraception services and factors influencing modern contraception methods utilization?

Probe: for different types of barriers, such as supply, demand, service delivery, policy, or management.

2.4. Ask the interviewee to provide examples or data that illustrate the barriers they mentioned.

2.5. Ask the interviewee to rate the importance or severity of each barrier on a scale of 1 to 5, where 1 is not important at all and 5 is very important.

2.6. Ask the interviewee to suggest possible solutions or strategies to overcome or reduce each barrier.

2.7. How do you see women's current choice and utilization of family planning methods?

2.8. Common complaints raised by women who were/are using modern methods? And reasons for discontinuation?

3. Training, evidence and best practices on FP services and training need

3.1. Is there any training given regarding FP services provision?

3.2. Are there evidence/researches done on FP service provision and utilization and existing evidence indicating the problem areas that need to be addressed and best practices to be expanded?

3.3. What do you say and suggest improving family planning service provision and to increase family planning service utilization/coverage?

Annex II: Information sheet, verbal consent and interview guide for qualitative part in Amharic Language

Barriers to modern contraceptive utilization in very high fertility regions of Ethiopia,

መግቢያ

ሰላም፣ ስሜ _____ እባላለሁ ። ይህ የመረጃ ወረቀት እና የስምምነት ቅጽ የተዘጋጀው በዋና ተመራማሪዎቹ ነው። ይህ ጥናት በኢትዮጵያ ሶማሌ እና አፋር ክልሎች የዘመናዊ ወሊድ መከላከያ አጠቃቀምን እንቅፋት ለመዳሰስ የተዘጋጀ ነው። ተመራማሪዎ በአዲስ አበባ ዩኒቨርሲቲ የዶክትሬት (ፒ.ኤች.ዲ) እጩ ናቸው።

የጥናቱ ዓላማ፡-

የዚህ ጥናት ዓላማ በኢትዮጵያ ሶማሌ እና አፋር ክልሎች ዘመናዊ የእርግዝና መከላከያ አጠቃቀምን እንቅፋቶችን ማሰስ ነው። የዚህ ጥናት ግኝት ለዘመናዊ የእርግዝና መከላከያ አጠቃቀም ላይ ያሉ ተግዳሮቶችን ለማሻሻል አስተዋፅኦ ያደርጋል

የጥናቱ ሂደት፡-

ወደ ግምገማው ለመቀጠል የወሊድ መከላከያ አጠቃቀምን በተመለከተ ቃለ መጠይቅ እንድንሰጥ እንድትፈቅድልን በትህትና እንጠይቃለን።ፈቃድዎን ከጠየቅን በኋላ እያንዳንዱን ጥያቄ እስከ መጨረሻው ድረስ ቃለ መጠይቅ እናደርጋለ እርስዎ ከጥናቱ በማንኛውም ደረጃ ለማቆም እስካልፈለጉ ወይም ሊመልሱት የማይፈልጉትን ጥያቄ በማለፍ::

አደጋዎች / ምቾት ማጣት;

የመረጃውን ምስጢራዊነት እናረጋግጣለን እንዲሁም ሪፖርቱ በሚዘጋጅበት ጊዜ የግለሰብ ስም አይጠቀስም. እንዲሁም የምንወስደው መረጃ ዘመናዊ የእርግዝና መከላከያ አጠቃቀም ላይ ያሉ መሰናክሎችን ለማሻሻል አስተዋፅኦ ያደርጋል በተጨማሪም ለተሻለ ውሳኔ አሰጣጥ አስተዋጽኦ ያደርጋል

ለ45 ደቂቃ ያህል ጊዜዎን በማጥፋትዎ ምቾት ላይሰማዎት ይችላል ፣ነገር ግን የእርስዎ ድጋፍ ለእኛ አስፈላጊ ነው እናም ውድ ጊዜዎን እንዲሰጡን በአክብሮት እንጠይቃለን።

ጥቅሞች እና ማበረታቻዎች

ለዚህ ጥናት ለሚያደርጉት ድጋፍ ቀጥተኛ ጥቅም ላያገኙ ይችላሉ፣ነገር ግን የእርስዎ ተሳትፎ ለአፋር እና ሶማሌ ክልል፣ኢትዮጵያ ለዘመናዊ የወሊድ መከላከያ አጠቃቀም እንቅፋቶችን ለመገምገም ሊረዳን ይችላል፣በመጨረሻም የወሊድ መከላከያ አጠቃቀምን ማጠናከርን የመሳሰሉ ችግሮችን ይለዩ።ስለዚህ ይህ የጥናት ግኝት የወሊድ መከላከያ አጠቃቀምን በብቃት የሚያስተዋውቅ አዲስ ፖሊሲ/ስትራቴጂዎችን በሚያዘጋጅበት ወቅት ፖሊሲ አውጪዎች እና ሌሎች ባለድርሻ አካላት እንደ ዋቢ ሊጠቀሙበት ይችላሉ። በተጨማሪ, በዚህ ጥናት ውስጥ በመሳተፍ; የተሰጠ ማበረታቻ ባይኖርም ይህ የጥናት ግኝት በተመረጠው የመቁጠሪያ ቦታ ፣በአዲስ አበባ ዩኒቨርሲቲ ፣ በተለያዩ አውደ ጥናቶች የሚቀርብበ ፣ በሳይንሳዊ ጆርናል ታትሞ የሚወጣ ሲሆን እና ስለዚህ የጥናት ውጤት የማወቅ ፍላጎት ያለው ሰው ግኝቱን ያገኛል።

ሚስጥራዊነት

ከዚህ የምርምር ፕሮጀክት የምንሰበስበው መረጃ በሚስጥር (በድብቅ ሚስጥራዊ) ይጠበቃል። የመገልገያዎቹ ማንነቶች ሚስጥራዊ ናቸው እና ግኝቱን በቀላሉ "ከተሳታፊው በአንዱ" ውስጥ እናሳውቃለን. ስለሆነም በታማኝነት እንድትደግፉ በአክብሮት እንጠይቃለን።

ስለጥናቱ የሚያገኟቸው ሰዎች፡-

ማንኛውም አይነት ጥያቄ ካሎት ማናቸውንም አስተባባሪዎች ማነጋገር ይችላሉ እና በፈለጋችሁት ጊዜ በሞባይል ቁጥር _____የዋና ተመራማሪ ትግስት ሹመት መጠየቅ ትችላላችሁ::

Verbal consent form in Amharic Languge

የቃል ስምምነት ቅጽ

የዋና ተመራማሪ ስም፡ ትግስት ሹመት ሞባይል ቁጥርዋ _____:: የ ምላሽ ሰጪ መረጃ ወረቀት ቀኑ ..... ሲሆን: እኔ ምላሽ ሰጪ በጥንቃቄ ይህን የቃል ስምምነት አንብቤያለሁ እንዲሁም መረጃ ሰብሳቢው በምረዳው ቋንቋ በዝርዝር ገልጾልኛል፣ እና ይዘቱን ሙሉ በሙሉ ተረድቻለሁ:: ጥያቄዎችን የመጠየቅ እድል እንዳገኘሁም አረጋግጣለሁ። የጥናቱ ዓይነት እና አላማ እንዲሁም ሊኖሩ የሚችሉ አደጋዎች/ጥቅሞቹ እና የሚጠበቀው የጥናቱ ቆይታ እና ሌሎች ተዛማጅ የጥናቱ ዝርዝሮች በዝርዝር ተብራርተውልኛል። የእኔ ተሳትፎ በፈቃደኝነት እንደሆነ እና በማንኛውም ጊዜ ከጥናቱ መውጣትም ሆነ

ማንኛውንም ጥያቄ ለመመለስ ፈቃደኛ ካልሆንኩ ምንም ምክንያት ሳልገልጽ አለመመለስ እንደምችል ተረድቻለሁ::. በዚህ ጥናት ውስጥ በመሳተፍ ስለ እኔ የሚሰበሰበው መረጃ ሚስጥራዊ መሆን እንዳለበት እና ማንነቴ እንዳማይገለጽ ተረድቻለሁ::

ከላይ ባለው ጥናት ውስጥ ለመሳተፍ ተስማምቻለሁ. አዎ _____ አይ ____

የመረጃ ሰብሳቢው ስም:…… **ፊርማ**_____ **ቀን**_____

Annex III. Interview Guide for Qualitative Data Collection

ክፍል- I	***BACKGROUND CHARACTERISTICS***	***ምላሽ***	***ዝለል***
1	ምላሽ ሰጪው ዕድሜ		
2	ያጠናቀቁት ከፍተኛው የትምህርት ደረጃ?		
3	ምላሽ ሰጪ የሥራ ሁኔታ		
4	ሃይማኖትሽ ምንድን ነው		
5	የትዳር አጋርዎ ዕድሜ		
6	የትዳር አጋርዎ ያጠናቀቁት ከፍተኛው የትምህርት ደረጃ?		
7	የትዳር አጋርዎ የሥራ ሁኔታ		
8	በአሁኑ ጊዜ ህግአዊ ትዳር አልዎት ወይም ከአንድ ወንድ ጋር እንደተጋባ ሰው አብረው እየኖሩ ነው።		
9	ወልደሽ ታውቃለሽ?		ካልሆነ ወደ 13 ዝለል
10	እስካሁን የወለድሻቸው ልጆች ጠቅላላ ቁጥር		
	ስንት ወንድና ሴት ልጆች አሉሽ		
11	ሁሉም ልጆች አሁንም በሕይወት አሉ		
12	አሁን ነፍሰ ጡር ነሽ?		

ክፍል II FAMILY PLANNING USE/EXPERIENCES

1.1. የወሊድ መከላከያ ተጠቅመሽ ታውቂያለሽ

አዎ ከሆነ፣ የትኞቹን ዘዴዎች ተጠቅመሽ ታውቃለሽ

a. በአሁኑ ጊዜ የቤተሰብ ምጣኔ ዘዴን እየተጠቀምሽ ነው።

አዎ ከሆነ፣ በአሁኑ ጊዜ የትኞቹን ዘዴዎች ትጠቀሚያለሽ፣ እንዴት ለመጠቀም ወስነሽ፣ በቅርብ ጊዜ የት ሄደሽ ነው የቤተሰብ ምጣኔ ዘዴን አገልግሎት ያገኛሽው? የቤተሰብ ምጣኔ ዘዴን አቅራቢው ካንች ጋር ምን ተወያይቷል?

b. የቤተሰብ ምጣኔ ዘዴን ለምን ያህል ጊዜ እየተጠቀሙ ኖረዋል? (እባክዎ በወራት ይጥቀሱልን)

c. እየተጠቀሙበት ስላለው የቤተሰብ ምጣኔ ዘዴ የተሻለው ተሞክሮ ምንድነው?

d. እየተጠቀሙበት ባለው የቤተሰብ ምጣኔ ዘዴ በጣም መጥፎው ተሞክሮ ምንድነው?

1.2. ስለቤተሰብ ምጣኔ አጠቃቀም ከትዳር ጓደኛዎ ጋር ይወያያሉ?

አዎ ከሆነ፣ የወሊድ መከላከያ ሲጠቀሙ የሰጠው ምላሽ ምን ነበር? እሱን ለመጠቀም ይደግፋል?

አይ ከሆነ ለምን?

1.3. አሁን እየተጠቀሙበት ያለውን የቤተሰብ ምጣኔ አገልግሎት ከየት ነው የሚያገኙት?

1.4. አገልግሎት ሰጪዎ ለክትትል መቼ እንደሚመለሱ ነግሮዎታል? መቼ ነው?

1.5. እየተጠቀምሽበት ስላለው የቤተሰብ ምጣኔ ዘዴ እንዴት ተማርሽ? ለምን የቤተሰብ ምጣኔ ዘዴን ለመጠቀም ወሰንሽ?

ክፍልIII FERTILITY PREFERENCES, PREGNANCY RISK

3.1. በሚቀጥሉት ጥቂት ወራት ውስጥ ነፍሰ ጡር ብትሆኝ ምን ያህል ደስተኛ ትሆኛለሽ ወይም አትሆኝም?

3.2.የትዳር አጋርሽ በሚቀጥሉት ጥቂት ወራት ውስጥ ነፍሰ ጡር ብትሆኝ ምን ያህል ደስተኛ ይሆናል ወይም አይሆንም?

3.3. በሚቀጥሉት ጥቂት ወራት ውስጥ ማርገዝ የምትችይበት ዕድል ምን ያህል ይመስልሻል?

ለምንድነው, የተጠቀሰው ትርጉም, መታቀብ, በፅንስ ውስጥ, ዘዴው ምን ያህል ውጤታማ ነው?

ክፍል IV: FAMILY PLANNING BARRIERS

4.1. የቤተሰብ ምጣኔ አገልግሎት ማእከል ያለው ርቀት ምን ያህል ነው? ከቤትዎ እስከ ጤና ተቋማቱ ያለው ርቀት የቤተሰብ ምጣኔ አጠቃቀምዎ ላይ የፈጠረው ተጽኖ ካለ እባክዎን ማንኛውንም ልምድዎን ይንገሩን?

4.2. በየወሩ ለቤተሰብ ምጣኔ ምን ያህል ገንዘብ ያወጣሉ? ለእርስዋ ውድ ነው?

4.3. በአሁኑ ጊዜ እየተጠቀሙበት ያለውን የቤተሰብ ምጣኔ ዘዴ ጥቅሙ እና ጉዳቱን የገለፀልዎት አለ? አይ ከሆነ ምክንያቱ ምን ነበር?

4.4. የቤተሰብ ምጣኔ ዘዴን በመጠቀም የጎንዮሽ ጉዳቶችን አስተውለው ያውቃሉ? አዎ ከሆነ፣ እባክዎን ይጠቅሷቸው?

4.5. ስለነዚህ የጎንዮሽ ጉዳቶች የጤና ባለሙያ አማክረሃል?

4.6. እነዚህ የጎንዮሽ ጉዳቶች ለወደፊቱ የእርግዝና መከላከያ አጠቃቀምዎ ላይ ተጽእኖ ያሳድራሉ? አዎ ከሆነ እንዴት?

4.7. የቤተሰብ ምጣኔ አገልግሎት ማግኘት የምትችይበት ቦታ ታውቂያለሽ?

4.8. በቤተሰባችሁ ውስጥ አብዛኛውን ጊዜ ስለቤተሰብ ምጣኔ ውሳኔ እና ስለልጆች ብዛት የመጨረሻ አስተያየት/ ውሳኔ ያለው ማነው?

4.9. በእርስዎ ማህበረሰብ ውስጥ ዘመናዊ የቤተሰብ ምጣኔ ዘዴዎችን የሚነኩ ባህላዊ ወይም ሃይማኖታዊ እምነቶች አሉ? አዎ ከሆነ፣ እባክዎን ይጠቀሷቸው

4.10. በእርስዎ አስተያየት፣ በእርስዎ ማህበረሰብ ውስጥ የወሊድ መከላከያ መጠቀምን የሚከለክሉት የትኞቹ ችግሮች ናቸው? እባክዎን በዝርዝር ያብራሩ

4.11. በአጠቃላይ ስለቤተሰብ ምጣኔ ሀሳብዎ ምን ይመስላል?

4.12. እንደ እርስዎ፣ የቤተሰብ ምጣኔ አገልግሎትን ለማሻሻል ምን መደረግ አለበት ብለው ያስባሉ

4.13. ለማንሳት የምትፈልጋቸው ጉዳዮች፣ ጥያቄዎች፣ አስተያየቶች ወይም ልትጠቆም የምትፈልጋቸው ነገሮች አሉ?

Annex III: Information sheet, verbal consent, and interview guide for qualitative part in Afar language.

Annex I: Qualitative exxah oyti cibta

Qafar kee soomaliyah rakaakayal Qusbah tan Buxa marih taxxerah ayfaafayih gere kalotu.

Culma:

Macaasini/Nagayasseni, Yi Migaaq _____ diiqistah nanu akah nanim eqembo kusaq abeyniti. Ama iddini kee kusaqat gabayasgalenimih cibta massoosem nacarsin kusaq abeyna. Ama kusaq akh massossenim Afar kee somaliyah rakaakayal qusbah tan buxah marih taxxerah ayfaafayal yanih yang exe kalot ceedonuh massooysenim kinni. A kusaaq abtah tanim Addis Ababah jaamiqat doktriit bartteynit kinni.

Kusaqa leh yan Hadafa:

A kusaqa hadafah leem Ittopiyyah rakaakayak Afar kee Somaliyah rakaakayih addal Qusbah tan buxa marih taxxera ayfaafayal gexe kalotu tanih tan caagida ceedonu kinni. A kusaqak geytimah yan xalot qusubah tan buxa marih taxxera Ayfaafayat yantifiqimeh yan mara yaffeh yan taqabih calli gorisonuh cato aleele.

Kusaqak Gexso:

Kusaaqa fannah tatirnamak nacaaral buxa maxxih taddera ayfaafay wagsiisak essero kok abnuh masaakaxxa luk koo eserna. Atu gacisam farewaytah tan essero tellek aw essero soolisamih fayxi allewwaytek Atu neh taceeh tan iddinik sara inkih tan esserora ila ellecabo fan koo essereno.

Bohuyu/Ruftosinna

Atu neh taceeh tan oytak sirri dacaarisnam kooh warisnam kee koo akak yarigenih yanin migaqal manayyaqa, kalah kadduk atu neh taceeh tan oyta tayseh tan margaqa abonuh cato leh tan qusbah tan buxa marih taxxerah ayfaafay yaaysiisonuh kaxxa cato neh aleele.

Nee lih tatrusah tan 45 daggigatah ruffto allewaytam bicitah, lakiin atu abtah tan gabat agle neh mangoh yan tudiiq leem ariguk faxximah yan uddur nee lih tatrusam kulsa luk koo essernah.

Tuxiiqi/Aytikumusiyya:

Atu a kusaqat abtah tan gabatagleh sannih geytah tan manfaaqat alleewaytam bicitah, lakiin atu abtah tan gabatagle Qusbah tan buxa marih taxxerah ayfaafayal tanih tan gexekalotitte naariguh kaxxa cato neh yalu duddah, amah Ittopiyyak afar kee somaliyah rakaakayal yanih yan taqabi nariguh kaxxa cato neeh allele. Ellecabol abinal takkeh tan taamomi diga lek waytam yasmitenimi. A kusaqat gaba yasgalenim akkewaytek edde geyanah yannin manfaaqat mayyana.

Cummi Dacaayri:

A kusaqih projektik kobxisnah nan oytak cummi (Siirih daggisanama) dacaarsimele. ayfaafay tacee tan taamah arocah migaaqittek sirrih dacaarisnam kee geynah nan oyta uxxuk "gabatagle leh yan marak" inki sehadaytih lee katuk siin aysixxigeno. Amacaak ugut abak qadik tan gabatagle caysitanam siin esserna.

Angaaraw Edde Haysitan Sehada:

Fexe qaynatih essero tellek inkih tan koobaahiseynit yaabisamih dudda litom kee atu edde faxxah tan saqatal ---------- Nacarsin kusaq abeynah tan Tigist Shumiyek a tilifoonih ragmil essero dayosamih dudda littoh

Afal aban iddini cibta

Cugaaysoh Ammunta: Ittopiyyak Afar kee somaliyah rakaakayal Qusbah tan buxa marih taxxerah ayfaafay gexe kalotu.

Nacaarsin kusaq abeynah migaqa: Tigis Shumet_ T No _____ Oyta yacuwee oytih cibti addat leh yannimi (RIS) Ayro_____Yooh dayyoysenih yanin oyta anu nagay ikkriyeh/ anu argeh an afal adda^fakkot yoh abenimik ugutak inkih yan dimmoma iffimeh. Essero esseramih dudda liyyom yoh warisenih. Kusaq kinnane kee kusaq hadaf kee yaffuwah yan taaqabi/tu^xiiq kee kusaqat sugnuwaynah gidde kee kalah tan kusaqat araawah tan caagidak adda^fakkot naggay yoh abenih. Anu liyyoh an gabat agle yii fayxil dibbuk takkem kee anu gacsa akak farewa essero gacsewamih dudda kee anu innih elle farinanih saqatal essero soolisamih dudda liyyom nagay yoh warisenih. Akusaqat abah an gebat agleh yook geyanah yannin oyta siirriih dagisanam kee yoo akak yarigenih yanni oyta a kusaqih addat cullusewanam yooh qadoysenih.

Irrok yanih yan kusaqih addat angelemih fayxi Liyoh.

Yeey ____ Maleey ____

Oytakobriseh Migaqa_____ Feera^wara_____ Ayro_____

Annex IV: Information sheet, verbal consent , and interview guide for qualitative data collection in Somali language

Qualitative Esseroh Oyta Kobrisiyyih Maayfaakana

Information sheet for qualitative part Somali language

Barriers to modern contraceptive utilization in very high fertility regions of Ethiopia,

Hordhac:

Hello, magacaygu waa _____ waxaana nahay baarayaasha maamulaha. Warqadan macluumaadka iyo foomka ogolaanshaha waxaa diyaariyay baarayaasha maamulaha. Daraasaddan waxaa loogu talagalay in lagu sahmiyo caqabadaha hortaagan isticmaalka casriga ah ee ka hortagga uurka ee Gobollada Soomaalida iyo Canfarta, Itoobiya. Baarayaasha ayaa ah musharaxa PhD ee Jaamacadda Addis Ababa.

Ujeedada daraasadda:

Ujeedada daraasaddan ayaa ah in la sahmiyo caqabadaha hortaagan isticmaalka casriga ah ee ka hortagga uurka ee Gobollada Soomaalida iyo Canfarta ee Itoobiya. Xogta daraasaddan lagahelo ayaa gacan ka geysan doonta hagaajinta caqabadaha isticmaalka ka hortagga uurka ee casriga ah.

Habka daraasadda:

Si aan u sii wadno qiimaynta waxa aanu si xushmad leh kaaga codsanaynaa in aad noo ogolaato in aanu waraysi kula yeelano kaas oo ah ka faa'iidaysiga ka hortagga uurka. Ka dib markii aanu waydiisanay ogolaanshahaaga waxaanu ku siin doonaa waraysi su'aal kasta ilaa dhamaadka ilaa aad rabto in aad sawirto tallaabo kasta oo ka mid ah daraasadda ama su'aal kagudub ah oo aadan rabin inaad ka jawaabto.

khatarta/raaxo darro:

Waxaan xaqiijinaa sirta macluumaadka waxaanan ka dhignaa qarsoodi/aanan lagu sheegin magaca qofka; iyo macluumaadka aan qaadanno waxay gacan ka geysan doontaa hagaajinta caqabadaha ka hor-tagga uur-qaadidda casriga ah taas oo gacan ka geysan doonta go'aan qaadashada wanaagsan.

Waxaa laga yaabaa inaad dareento raaxo la'aan inaad waqtigaaga lumiso ilaa 45 daqiiqo si kastaba ha ahaatee taageeradaadu waa noo muhiim, si naxariis leh waxaan kaa codsaneynaa inaad waqtigeeda qaaliga ah ka dhigto.

Faa'iidooyinka iyo Dhiirigelinta:

Taageeradaada daraasaddan, waxaa laga yaabaa inaadan si toos ah u helin faa'iido, laakiin ka qaybqaadashadaadu waxay u badan tahay inay naga caawiso qiimaynta caqabadaha hortaagan isticmaalka casriga ah ee ka hortagga uurka iyo, waxay qayb ka qaadanaysaa arrimaha Canfarta iyo deegaanka Soomaalida, Itoobiya. Ugu dambeyntii cadee in faragelintu ay ka mid yihiin xoojinta isticmaalka ka hortagga uurka iyo in kale. Laguma siin doono wax dhiirigelin ah marka laga reebo inaad ka qayb qaadato daraasaddan.

Sirta Qarsoon:

Xogta aan ka ururin doono mashruucan cilmi-baadhista waxa lagu hayn doonaa sir (si adag). Aqoonsiga tas-hiilaadka waa sir, waxaanan si fudud ugu soo sheegi doonaa natiijada "mid ka mid ah ka qaybgalayaasha". Markaa si naxariis leh ayaa lagaa codsanayaa inaad si daacad ah u taageerto.

Dadka halka lagala xiriirayo:

Haddii aad hayso wax su'aal ah waxaad la xiriiri kartaa mid ka mid ah fududeeyayaasha oo waxaad ku weydiin kartaa wakhti kasta oo aad rabto lambarka mobaylka _____Baaraha maamulaha Tigist Shumet.

Annex II: Foomka ogolaanshaha afka ah

Magaca Mashruuca: Caqabadaha hortaagan isticmaalka casriga ah ee ka hortagga uurka ee Canfarta iyo deegaanka Soomaalida Itoobiya.

Name of Principal Investigator: Tigist shumet _ Tel. No (s): _____ Nuxurka xaashida macluumaadka jawaab bixiyaasha (RIS) ee taariikhaysan…….ee la bixiyay si taxadar leh ayaan u akhriyay/si faahfaahsan iigu sharaxay luuqad aan fahmay, si buuxdana waan u fahmay waxa ku jira. Waxaan xaqiijinayaa inaan fursad u helay inaan su'aalo ku weydiiyo. Dabeecadda iyo ujeedada daraasadda iyo khatarta / faa'iidooyinka ka iman kara iyo muddada la filayo ee daraasadda, iyo tafaasiisha kale ee khuseeya daraasadda ayaa si faahfaahsan ii sharraxay.

Waxaan fahamsanahay in ka-qaybgalkaygu uu yahay mid ikhtiyaari ah oo aan xor u ahay inaan ka noqdo wakhti kasta ama diido inaan ka jawaabo su'aal kasta, anigoon bixin wax sabab ah. Waxaa la igu wargaliyay in macluumaadka la iga soo aruuriyay ka qeybgalka cilmi baaristan ay tahay mid sir ah oo qarsoodigayga la ilaaliyo.

Waxaan aqbalay inaan ka qaybqaato daraasaddan kor ku xusan. Haa____ Maya ____

Magaca xog ururiyaha _____saxeexa_____ Taariikhda_____

Qualitative Esseroh Oyta Kobrisiyyih Maayfaakana

I Footima	**Darifaa Calatitte**	Raddi/Gacsa	Taturu
1	Oyta Yacuwee Karma		
2	Gabba akak kaleh yan kaxxa caddoh baritto maggidey?		
3	Oyta Yacuwee Taamah Caddo		
4	Atu Litoh tan dinni macaay		
6	Ku (Baqali/Wakkliti) karmak maggidet yanni		
7	Ku baqalak kaxxa caddoh baritto maggidey		
8	Ku baqali taamak leeh yanim		
9	Atu Awakih udduru kalih taqisheh tan waklitu aw baqala maay litoo?		
10	Atu daylo dalteh maay tarige?		Maleey tekkek,13 fannah tatur
11	Atu Ahak dumma dalteh tan dayloh qaxaad maggidey?		
	Labim aw sayim takkeh gidde esser		
12	Inkih yan uxxi roocil yanik waytam esser		
13	Atu awak idiqiso maay litto		

IIFootima **Buxa Marih Taxxera Antiffiqiyya/Abak raga**

2.1. Buxa Marih Taxxera tintifiqimeh maay tarige

Eyyeqsiis: Yeey tekkek, ani cogdak sugte atu edde tintifiqimeem

a. Atu Awak edde tantifiqimeh tan Buxa Marih Taxxera maay litto

Eyyeqsiis: Yeey tekkek, Atu awak edde tatntifiqimem aninah yan buxa marih cogday , amahat tantifiqimuh margaqa aninal abtu dudde, ama ayfaafay geytu kot dayih yan aracay elle gedem ankek sugte, Ayfaafay yacuwee koo lih abeh yan walaal macaak sugte?

b. Atu Buxa Marih Taxxera makkina udduuruh antafaqimuk edde sugte? (Kumaganak udduur alsal cullus)

c. Atu awak edde tantifiqimeh tan Buxa Marih Taxxera wagsiisak atu litoh tan maqe abak raag macaay?

d. Atu awak edde tantifiqimeh tan Buxa Marih Taxxera wagsiisak atu litoh tan ummah yan abak raag macaay?

2.2. Buxa marih taxxera wagsiisak ku baqala /waklita lih walal edde maay gexsiisa Yeey tekkek, Buxa marih taxxerat tintiffiqimeh tan wak ussuk luk sugeh yan mabla macaa ceelak sugte? Usuk koo elle catak maay suge/

Maleey tekkek, Macaay?

2.3 Atu awak edde tamtifiqimeh tan buxa marih taaxxera akak geytam ankey?

2.4 Atu kataata edde taddureh tan udduur ayfaafay yacuwee koh wariseh maay suge? Wooh masaakuk sugte?

2.5 Atu Awak edde tantiffiqimeh tan Buxa marih taxxera ixxiga aninnal geyte? Atu Buxa marih taxxera ayfaafayat tantifiqimuh maragqa akah abtem macaay?

III-

Footima **DALANAAMIH DOORIT, IDIQISO BOHUYU**

3.1 Yaamatuwah yan dagoh tan alsiteh addat tadiqim duddek litoh tan fayxi kee ferewayti macaa ceelta?

3.2 Ku baqali/ wakaliti macaa yasaalem kot ceelta? Yaamatuwah yan dagoh tan alsiteh addat tadiqim duddek ku baqalak fayxi kee ferewayti macaa ceelta?

3.3 Yaamatuwah yan dagoh alsiteh addat edde tadiqem duddah tan sami maddulu lem kot ceelta? Amah akah tekkem esser, Doorenih yanin buxa marih taaxxerak maqana, sinni wassanama, infecundity, Cogda luk sugteh tan manafaqata?

IVFootima **BUXA MARIH TAAXERAH GEXE KAALOTU**

4.1 Ku buxak buxa marih ayfaafay elle yaceenih yanin fanteyna makkina dedar leeh?
Ku buxak illa qafiyat fanteyna fannat yannih yan yannih yan deedar buxa marih taxxera ayfaafayal kataysah yan taqabi yeelek ku maganah atu litooh tan abak raag teellek?

4.2 Kulli ayroh buxa marih taxxerah ayfaafayah maggide mekkltah? Mangoh yaan malu maay litoo?

4.3 Atu Awak edde tantifiqimeh yan buxa marih taxeera wagsiisak tu^xiiq kee Tukalot kooh warise sugeh sehadayti maay suggeh? Maleey tekkek eyqesiis, Sabab kak macaak sugte?

4.4 Buxa marih taxxerat tintifiqimemik ugut abak koo yoffeh yan taqabi maay suge? Yeey tekkek, Ku maganah ken essehs?

4.5 Koo Yoofeh yan taqabih qafiyat tutaregoh fayyu goriseh maay sugte?

4.6 Amma taaqabitte foca fannah atu buxa marih taxxerah ayfaafayal taqabi kol katayselem kot maay ceelta? Yeey tekkek, Anninal?

4.7 Buxa marih taxxera elle geytah tan arah maay tarige?

4.8 Atu daylok daltah gidde kee buxa marih taaxxerat tantifiqimem wagsiisak ellecaboh margaqa akak qambalimtam iyyay?

4.9 Atu edde taqisheh tan ayyuntih addat qusubah tan buxa marih taxxerat yantifiqimenim wassah tan dini kee qadaat arawaah tan caagida maay tani?
Yeey tekkek, Ku maganah ken essehs

4.1 Atu litoh tan mablal, atu edde tanih tan ayyuntiha addat buxa marih taxxera antifiqime kalah yan taqabi maay yanni?
Kumaganah adda^fakot abam kaa esser

4.11 Buxa marih taaxxera wagsiisak Atu litoh tan mabla macaa ceelta?

4.12 Atu litoh tan mabla wagsiisak, Buxa marih taxxerah ayfaafay yaysiisonuh macaa abanam faxxinta intamih mabla litto?

4.13 Atu uggusam faxxa caagida, essero, mabla aw atu tascaasem faxxa caagida maay litoo?

1. **key informant interview guide with the Health extension worker / Health centre Contraception provider in Somali languge**

2.1.Weydii qofka la wareystay mas'uuliyadahooda iyo hawlahooda ugu muhiimsan sida xubinta qorsheynta qoyska ama doorkooda, sida qorsheynta, miisaaniyad-sameynta, la socodka, warbixinta, tababarka, kormeerka, ama isku-dubbaridka adeegyada qorsheynta qoyska iyo hawlaha xafiisyadooda caafimaadka.

2.2. Weydii qofka la wareystay heerka aqoontooda iyo xirfadahooda hababka qorsheynta qoyska, tilmaamaha, siyaasadaha, iyo hababka ugu wanaagsan

Caqabadaha Isticmaalka Ka Hortagga Uurka

2.3.Fadlan ma sharaxi kartaa helitaanka iyo bixinta hababka ka hortagga uurka ee casriga ah ee gobolkaaga/aagga/degmada?

2.4.Sideed u aragtaa tayada bixinta adeegyada ka hortagga uurka ee casriga ah?

2.5.Ma sheegi lahayd caqabadaha keenaya bixinta adeegyada ka hortagga uurka ee casriga ah iyo arrimaha saamaynta ku leh ka faa'iidaysiga hababka casriga ah ee ka hortagga uurka?

Probe: noocyada caqabadaha kala duwan, sida saadka, baahida, adeeg bixinta, siyaasadda, ama maamulka.

2.6.Weydii qofka la wareystay inuu bixiyo tusaalooyin ama xog muujinaya caqabadaha ay sheegeen

2.7.Weydii qofka la waraysanayo inuu ku qiimeeyo muhiimada ama darnaanta caqabad kasta oo lagu qiyaaso 1 ilaa 5, halkaas oo 1 aanu haba yaraatee muhiim ahayn 5-na ay aad muhiim u tahay.

2.8.Weydii qofka la waraysanayo inuu soo jeediyo xalal ama xeelado si looga gudbo ama loo yareeyo caqabad kasta

2.9. Sidee u aragtaa doorashada haweenka ee hadda iyo ka faa'iidaysiga hababka qorshaynta qoyska?

2.10. Cabashooyinka caadiga ah ee ay soo jeediyaan haweenka isticmaalaya hababka casriga ah? Iyo sababaha joojinta?

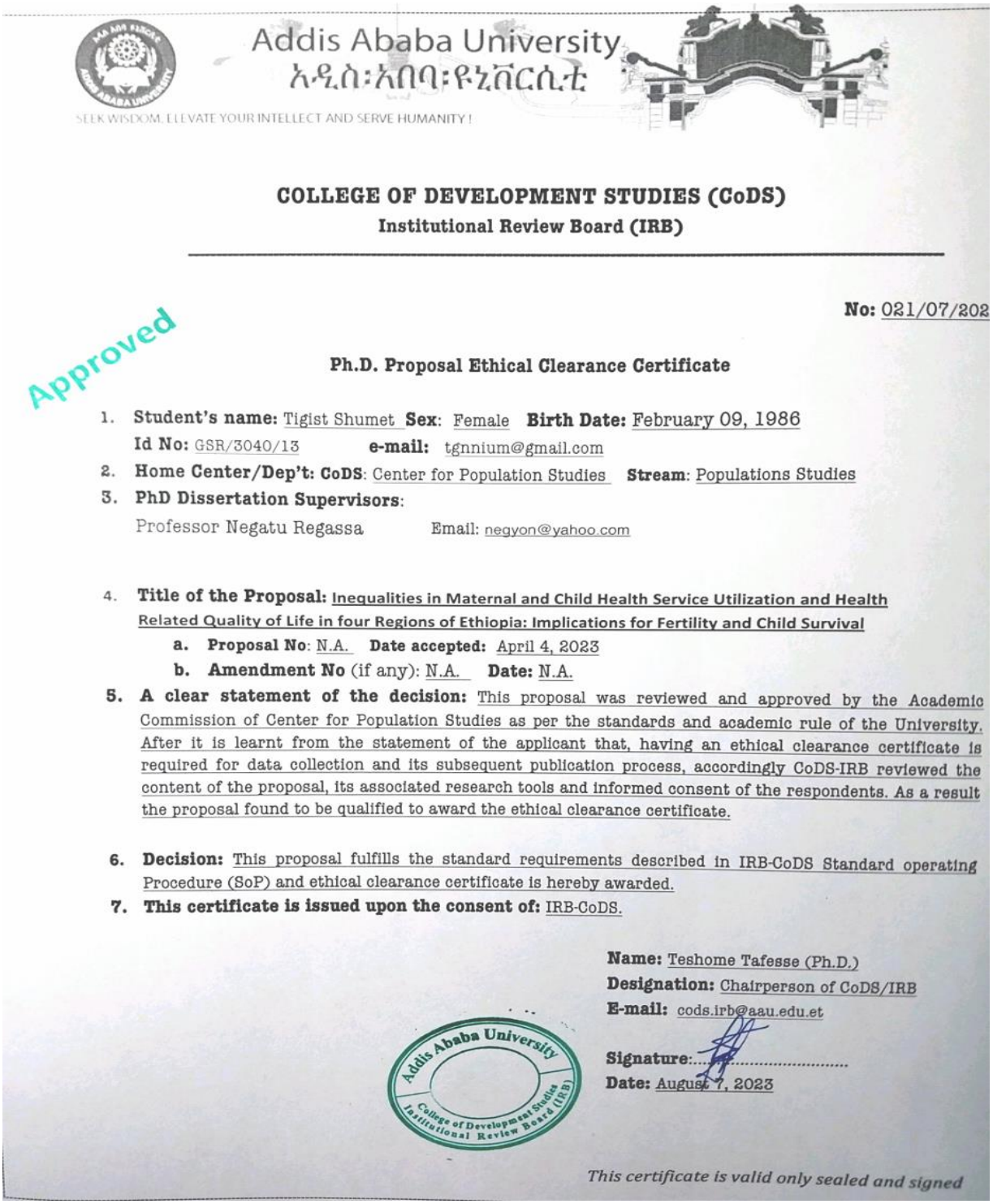
3. Tababarka, cadaymaha iyo hababka ugu wanaagsan ee adeegyada FP iyo baahida tababarka

3.1. Ma jiraa wax tababar ah oo la bixiyay oo ku saabsan bixinta adeegyada FP?

3.2. Ma jiraan cadaymo/baaritaanno lagu sameeyay bixinta adeega FP iyo ka faa'iidaysiga iyo cadaymaha jira ee tilmaamaya meelaha dhibaatadu ka jirto ee u baahan in wax laga qabto iyo hababka ugu wanagsan ee la balaadhiyo?

3.3. Maxaad leedahay oo aad soo jeedisaa si loo horumariyo bixinta adeegga qorshaynta qoyska iyo in la kordhiyo ka faa'iidaysiga/daboolanka adeegga qorshaynta qoyska?

Annex V: Ethical clearance



Addis Ababa University
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COLLEGE OF DEVELOPMENT STUDIES (CoDS)

Institutional Review Board (IRB)

No: 021/07/202

Approved

Ph.D. Proposal Ethical Clearance Certificate

1. **Student's name:** Tigist Shumet **Sex:** Female **Birth Date:** February 09, 1986
   Id No: GSR/3040/13 **e-mail:** tgnnium@gmail.com
2. **Home Center/Dep't: CoDS:** Center for Population Studies **Stream:** Populations Studies
3. **PhD Dissertation Supervisors:**
   Professor Negatu Regassa Email: negyon@yahoo.com

4. **Title of the Proposal:** Inequalities in Maternal and Child Health Service Utilization and Health Related Quality of Life in four Regions of Ethiopia: Implications for Fertility and Child Survival
   a. **Proposal No:** N.A. **Date accepted:** April 4, 2023
   b. **Amendment No** (if any): N.A. **Date:** N.A.
5. **A clear statement of the decision:** This proposal was reviewed and approved by the Academic Commission of Center for Population Studies as per the standards and academic rule of the University. After it is learnt from the statement of the applicant that, having an ethical clearance certificate is required for data collection and its subsequent publication process, accordingly CoDS-IRB reviewed the content of the proposal, its associated research tools and informed consent of the respondents. As a result the proposal found to be qualified to award the ethical clearance certificate.

6. **Decision:** This proposal fulfills the standard requirements described in IRB-CoDS Standard operating Procedure (SoP) and ethical clearance certificate is hereby awarded.
7. **This certificate is issued upon the consent of:** IRB-CoDS.

Name: Teshome Tafesse (Ph.D.)
Designation: Chairperson of CoDS/IRB
E-mail: cods.irb@aau.edu.et

Signature:.....
Date: August 7, 2023

Addis Ababa University
College of Development Studies
Institutional Review Board (IRB)

This certificate is valid only sealed and signed

Annex VI: DHS data utilization permission

Nov 04, 2022

Tigist shumet
Ethiopian public health Institiute
Ethiopia
Request Date: 11/04/2022

Dear Tigist shumet:

This is to confirm that you are approved to use the following Survey Datasets for your registered research paper titled: "Inequalities in Health-related quality of life among women of reproductive age in urban and rural peripheral region Ethiopia: A Decomposition analysis ":

Ethiopia

To access the datasets, please login at: https://www.dhsprogram.com/data/dataset_admin/login_main.cfm. The user name is the registered email address, and the password is the one selected during registration.

The IRB-approved procedures for DHS public-use datasets do not in any way allow respondents, households, or sample communities to be identified. There are no names of individuals or household addresses in the data files. The geographic identifiers only go down to the regional level (where regions are typically very large geographical areas encompassing several states/provinces). Each enumeration area (Primary Sampling Unit) has a PSU number in the data file, but the PSU numbers do not have any labels to indicate their names or locations. In surveys that collect GIS coordinates in the field, the coordinates are only for the enumeration area (EA) as a whole, and not for individual households, and the measured coordinates are randomly displaced within a large geographic area so that specific enumeration areas cannot be identified.

The DHS Data may be used only for the purpose of statistical reporting and analysis, and only for your registered research. To use the data for another purpose, a new research project must be registered. All DHS data should be treated as confidential, and no effort should be made to identify any household or individual respondent interviewed in the survey. Also, be aware that re-distribution of any DHS micro-level data, either directly or within any tool/dashboard, is not permitted. Please reference the complete terms of use at: https://dhsprogram.com/Data/terms-of-use.cfm.

The data must not be passed on to other researchers without the written consent of DHS. However, if you have coresearchers registered in your account for this research paper, you are authorized to share the data with them. All data users are required to submit an electronic copy (pdf) of any reports/publications resulting from using the DHS data files to: references@dhsprogram.com.

Sincerely,

Bridgette Wellington

Bridgette Wellington
Data Archivist
The Demographic and Health Surveys (DHS) Program

530 Gaither Road, Suite 500, Rockville, MD 20850 USA +1.301.407.6500 +1.301.407.6501 fax icf.com

Feb 01, 2023

Tigist shumet
Ethiopian public health Institiute
Ethiopia
Request Date: 02/01/2023

Dear Tigist shumet:

This is to confirm that you are approved to use the following Survey Datasets for your registered research paper titled: "Inequalities in demand and unmet need for contraception among women in the four regions of Ethiopia":

Ethiopia

To access the datasets, please login at: https://www.dhsprogram.com/data/dataset_admin/login_main.cfm. The user name is the registered email address, and the password is the one selected during registration.

The IRB-approved procedures for DHS public-use datasets do not in any way allow respondents, households, or sample communities to be identified. There are no names of individuals or household addresses in the data files. The geographic identifiers only go down to the regional level (where regions are typically very large geographical areas encompassing several states/provinces). Each enumeration area (Primary Sampling Unit) has a PSU number in the data file, but the PSU numbers do not have any labels to indicate their names or locations. In surveys that collect GIS coordinates in the field, the coordinates are only for the enumeration area (EA) as a whole, and not for individual households, and the measured coordinates are randomly displaced within a large geographic area so that specific enumeration areas cannot be identified.

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Sincerely,

Bridgette Wellington

Bridgette Wellington
Data Archivist
The Demographic and Health Surveys (DHS) Program

530 Gaither Road, Suite 500, Rockville, MD 20850 USA +1.301.407.6500 +1.301.407.6501 fax icf.com

Feb 01, 2023

Tigist shumet
Ethiopian public health Institiute
Ethiopia
Request Date: 02/01/2023

Dear Tigist shumet:

This is to confirm that you are approved to use the following Survey Datasets for your registered research paper titled: "Maternal health care utilization in four regions of Ethiopia: Ecological analysis":

Ethiopia

To access the datasets, please login at: https://www.dhsprogram.com/data/dataset_admin/login_main.cfm. The user name is the registered email address, and the password is the one selected during registration.

The IRB-approved procedures for DHS public-use datasets do not in any way allow respondents, households, or sample communities to be identified. There are no names of individuals or household addresses in the data files. The geographic identifiers only go down to the regional level (where regions are typically very large geographical areas encompassing several states/provinces). Each enumeration area (Primary Sampling Unit) has a PSU number in the data file, but the PSU numbers do not have any labels to indicate their names or locations. In surveys that collect GIS coordinates in the field, the coordinates are only for the enumeration area (EA) as a whole, and not for individual households, and the measured coordinates are randomly displaced within a large geographic area so that specific enumeration areas cannot be identified.

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Sincerely,

Bridgette Wellington

Bridgette Wellington
Data Archivist
The Demographic and Health Surveys (DHS) Program

Mar 24, 2023

Tigist shumet
Ethiopian public health Institiute
Ethiopia
Request Date: 03/24/2023

Dear Tigist shumet:

This is to confirm that you are approved to use the following Survey Datasets for your registered research paper titled: "Population level impacts of inequalities in MCH service utilization on child survival in four regions of Ethiopia":

Ethiopia

To access the datasets, please login at: https://www.dhsprogram.com/data/dataset_admin/login_main.cfm. The user name is the registered email address, and the password is the one selected during registration.

The IRB-approved procedures for DHS public-use datasets do not in any way allow respondents, households, or sample communities to be identified. There are no names of individuals or household addresses in the data files. The geographic identifiers only go down to the regional level (where regions are typically very large geographical areas encompassing several states/provinces). Each enumeration area (Primary Sampling Unit) has a PSU number in the data file, but the PSU numbers do not have any labels to indicate their names or locations. In surveys that collect GIS coordinates in the field, the coordinates are only for the enumeration area (EA) as a whole, and not for individual households, and the measured coordinates are randomly displaced within a large geographic area so that specific enumeration areas cannot be identified.

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Sincerely,

Bridgette Wellington

Bridgette Wellington
Data Archivist
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Mar 24, 2023

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Sincerely,

Bridgette Wellington

Bridgette Wellington
Data Archivist
The Demographic and Health Surveys (DHS) Program

Annex VII: Published and status of unpublished papers

Shumet and Geda *BMC Women's Health* (2023) 23:317
https://doi.org/10.1186/s12905-023-02465-2

BMC Women's Health

RESEARCH Open Access

Residential inequalities in health-related quality of life among women of reproductive age in four regions of Ethiopia: a decomposition analysis

Tigist Shumet[1,2*] and Nigatu Regassa Geda[1,3]

Abstract

Background Ethiopian rural-urban disparities in key domains of health-related quality of life among women in reproductive age have been huge. However, sources of such inequalities were not studied well. Therefore, this study aimed to assess inequalities in health-related quality of life among women residing in urban and rural areas in four regions of Ethiopia.

Methods This study used data extracted from the 2016 Ethiopian Demographic and Health Survey; collected at national level from January 18, 2016, to June 27, 2016. Stratified two stage cluster sampling method were used. The data collected from 2385 women in the age group 15–49 years who were living in four regions (Afar, Benishangul-Gumuz, Gambela, and Somali regions) of Ethiopia were used for this study. The outcome variable, Health-Related Quality of Life (HRQoL), was generated by Principal Component Analysis. Further, Multivariable Ordinary Least Square and Oaxaca decomposition threefold (interaction) were used in the analysis with a *p*-value less than 0.05 and 95% confidence interval to declare statistical significances.

Results Women education, region, religion, wealth index, and husband/partner education were identified as predictors of Health-Related Quality of Life. Women residing in rural areas had far lower health-related quality of life than those living in urban areas. The wealth index and educational level of women were the largest contributor of the inequality in health-related quality of life.

Conclusion A substantial inequality in quality of life exist between women who reside in rural and urban areas in those four regions of Ethiopia. The socioeconomic factors more importantly wealth index and educational attainment explained the significant portion of the reported rural-urban disparities. Therefore, Policymakers and local administrators should pay more attention on interventions that promote education and narrowing gap in wealth in rural and urban settings.

Keywords Inequalities, Health related quality of life, Decomposition, Ethiopia

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Tigist Shumet
tgnnium@gmail.com
Full list of author information is available at the end of the article

ISSN: 2573-9506

Research article

International Journal of Women's Health Care

Rural-Urban Disparity in Maternal Health Care Service Utilization in Four Regions of Ethiopia: Ecological and Decomposition Analysis

Tigist Shumet[1,2*] and Nigatu Regassa Geda[1,3]

[1]*Center for Population Studies, College of Development Studies, Addis Ababa University, Ethiopia*

[2]*Health System and Reproductive Health Research Directorate, Ethiopian Public Health Institute, Ethiopia*

[3]*College Pharmacy and Nutrition, University of Saskatchewan, Canada*

***Corresponding Author**
Tigist Shumet, Center for Population Studies, College of Development Studies, Addis Ababa University and Health System and Reproductive Health Research Directorate, Ethiopian Public Health Institute, Ethiopia.

Submitted: 2023, Dec 14; **Accepted:** 2024, Apr 05; **Published:** 2024, Apr 11

Citation: Shumet, T., Geda, N. R. (2024). Rural-Urban Disparity in Maternal Health Care Service Utilization in Four Regions of Ethiopia: Ecological and Decomposition Analysis. *Int J Women's Health Care, 9*(1), 01-15.

Abstract

Background: *Maternal healthcare services utilization is very low in Ethiopia with a disparity among regions. Therefore, this study aimed to assess rural-urban disparity in maternal healthcare service utilization in four regions of Ethiopia.*

Method: *This study used 2016 Ethiopian Demographic and Health Survey data. 2563 and 1555 women who delivered in 5-years and in 2-years prior to the survey from 220 clusters respectively included as respondents of the study. Partial ecological approach used a mixture of individual level and ecological variables (group level). Multivariable logistic regression, Blinder Oaxaca decomposition and Moran's index were used during data analysis.*

Result: *This study found; Media exposure in rural-urban, and wealth-index in rural areas as predictors of antenatal-care utilization. Wealth-index in rural, husband education level in urban, women autonomy for own healthcare and antenatal-care utilizations in rural and urban areas as predictors of place of delivery. Wealth-index in rural, antenatal-care utilization in urban; and place of delivery in both urban and rural areas predict postnatal-care utilization. Moreover; geographic clustering observed in the utilization of ANC (Moran's I = 0.185031, p = 0.011056), health-facility delivery (Moran's I = 0.271865, p = 0.000209), and PNC (Moran's I = 0.315410, p = 0.000015). The study also revealed huge rural-urban disparities in utilization of maternal healthcare services in those four regions.*

Conclusion: *Significant rural-urban inequalities in utilization of maternal healthcare services found in four regions of Ethiopia. Therefore, policymakers and concerned stakeholders needs to develop relevant strategies that will enhance maternal healthcare utilization in those marginalized regions.*

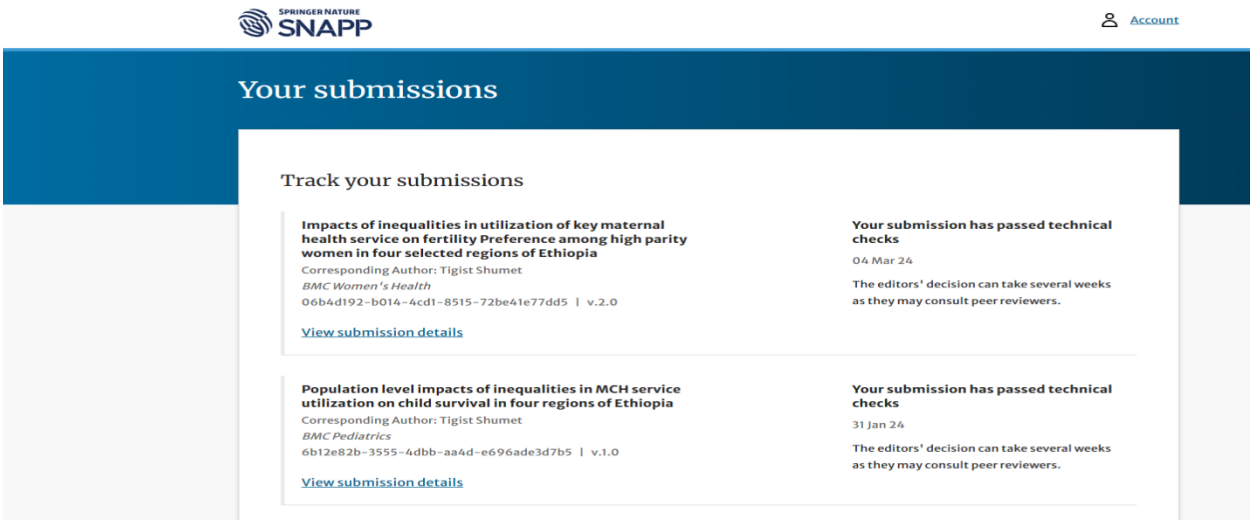
Keywords: ANC, Decomposition, Ethiopia, Inequality, Place of Delivery, PNC

Abbreviations

AIC: Akaike information criterion
ANC: Antenatal Care
AOR: Adjusted Odd Ratio
BIC: Bayesian information criterion
CI: Confidence Interval
COR: Crude Odd Ratio
CSA: Central Statistics Agency
EA: Enumeration Area
EDHS: Ethiopian Demographic and Health Survey
MCH: Maternal and Child Health Service
PCA: Principal Component Analysis
PNC: Post-Natal Care
SD: Standard deviation
VIF: Variance inflation Factor
WHO: World Health Organization

1. Background

Maternal health refers to the health of women during pregnancy, childbirth, and the postpartum period. Maternal health is an important indicator of wellbeing of women, and has significant implications for the survival of the neonates and children [1]. The most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Population level impacts of inequalities in MCH service utilization on child survival in four regions of Ethiopia
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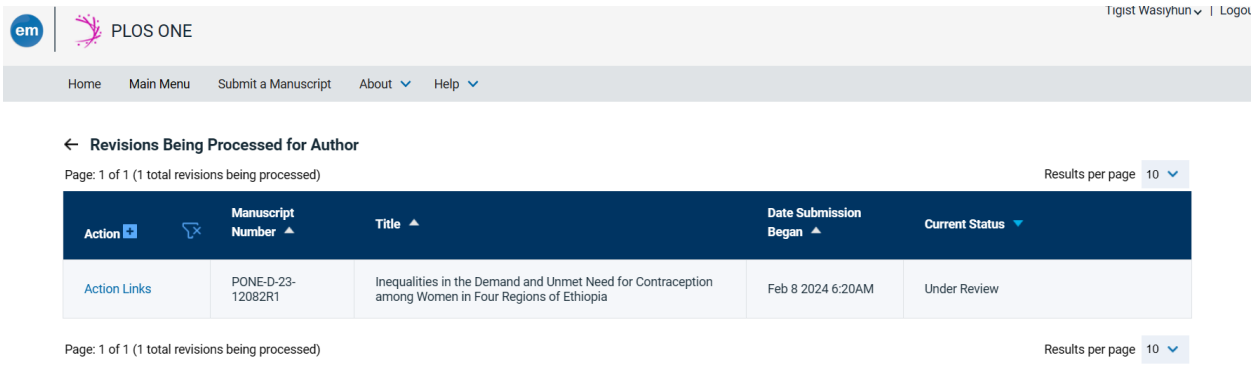
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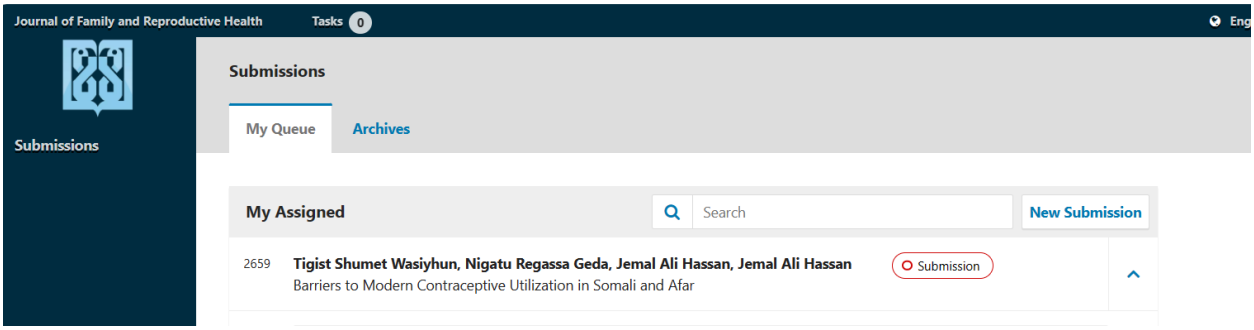
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Submission
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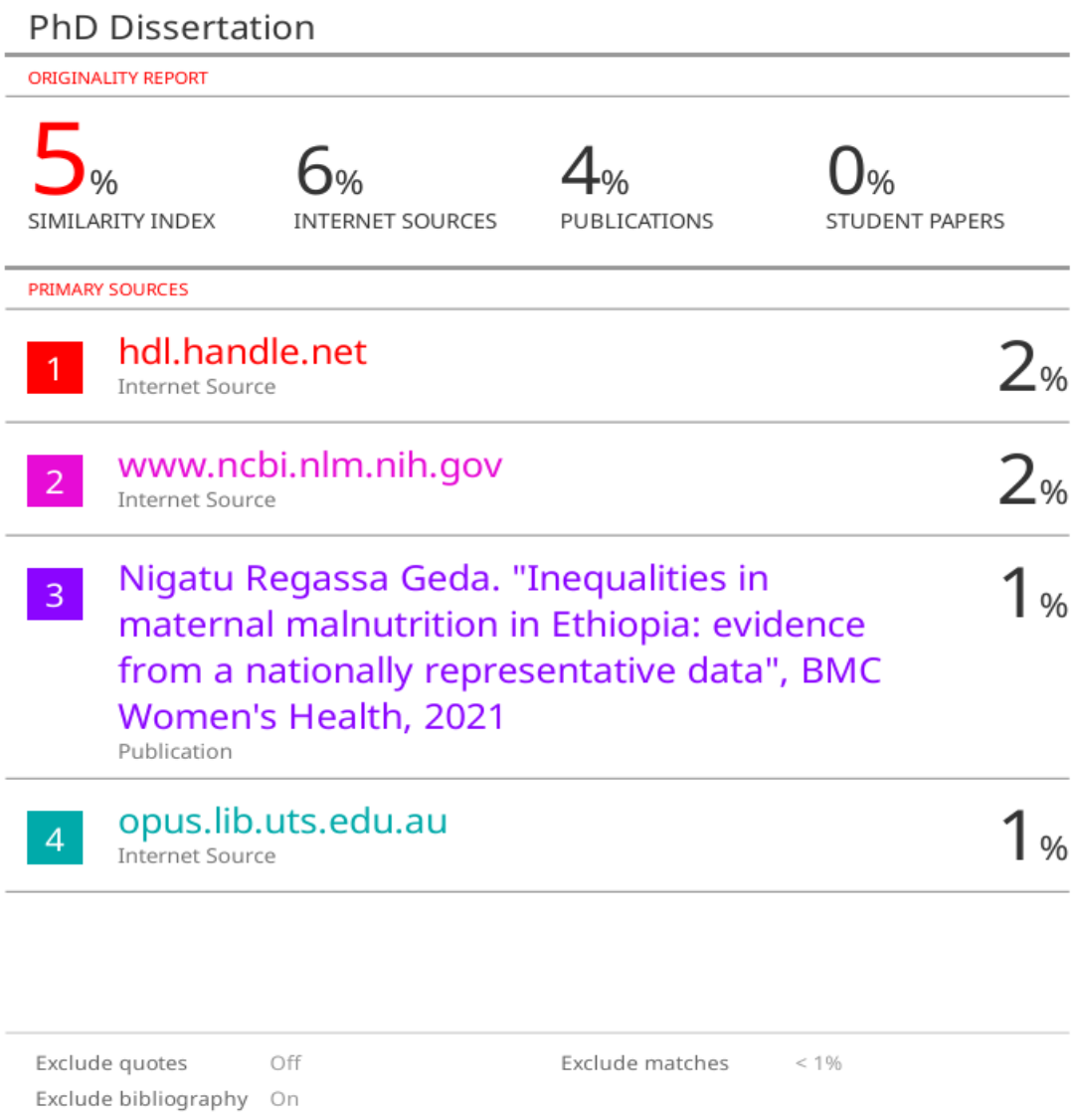
Annex VIII: Plagiarism report



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