DETERMINANTS OF FERTILITY IN SUB-SAHARAN AFRICA: IMPACTS OF EDUCATION ON FERTILITY FOR AGES 15-24

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Declaration

I certify that this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any university and that, to the best of my knowledge and belief, it does not contain material previously published or written by another person except where due reference is made in the text.

Caroline Kisato

30th December 2020

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Abstract

Fertility decline in sub-Saharan Africa (SSA) has been exceptional as compared to other regions globally. The speed of fertility decline has been slower in most African countries with an average total fertility rate (TFR) of 4.7 children per woman in 2015-2020 (United Nations, 2019). This figure is more than double the average rate of other world regions (Asia, Caribbean, Europe and Latin America) whose fertility levels have declined to 2.2 children per woman or less. The high fertility rates in SSA are contributing to an increase in population growth with projections expecting the number to double by 2050. This "*African exception*" is raising concern for researchers and policy makers.

This study uses secondary data from the most recent Demographic and Health Survey (DHS) of Ethiopia (2000, 2005, 2011, 2016), Kenya (2003, 2008-09, 2014), Malawi (2000, 2004, 2010, 2015-16) and Mali (2001, 2006, 2012-12, 2018) to conduct analysis of fertility rates among ages 15-24. There are approximately 880 million young women aged 15-24 years globally (UNAIDS, 2014). Sub-Saharan Africa comprises of an adolescent population of more than 250 million (20% globally) aged 10-19 and expected to increase to 24% by 2030 (United Nations, 2019). Whereas adolescent youth are projected to decline in Asia from "715 million in 2015 to 711 in 2030 and 619 million in 2060", Africa is experiencing a rapid growth with projections of 42% increase by 2030 (UN population, 2015). Adolescents and young women aged 15-24 in SSA face myriad challenges such as child marriage, adolescent childbearing, low use of modern contraceptives, unwanted pregnancies, unsafe abortion practices and low levels of education attainment. The Bongaarts framework of proximate determinants of fertility is used to interpret the data.

This study revealed that there is a relationship between education attainment of women ages 15-24 and the proximate determinants of fertility (age at first birth, index of contraception use and breastfeeding). A higher percentage of women of childbearing age with higher education levels were using modern contraceptives as compared to those women with no formal education. In contrast, the median duration of postpartum is higher among women with no formal education in contrast to women with higher education. More women in all education categories are using some sort of modern contraceptive as compared with traditional or folk methods of contraception. However, fewer women with secondary or higher education are breastfeeding which has repercussions on the wellbeing of mother and child.

This study confirms that the education attainment of women ages 15-24 slows down fertility rates in the selected four countries as the women delay age at first marriage and utilise modern contraceptives.

Table of Contents

Declaration 2
Acknowledgements 3
Abstract 4
List of abbreviations and acronyms 10
CHAPTER 1: INTRODUCTION TO THE STUDY 11
1.1 Background to the study 11
1.2 Statement of the problem 13
1.3 Research question 15
1.4 Research objectives 16
1.5 Basic theoretical framework 16
1.6 Summary 17
1.7 Structure 17
1.8 Operational meaning of terms (Bongaarts, 1978; Stover, 1998) 18
CHAPTER 2: CRITICAL REVIEW OF LITERATURE 19
2.1 Background 19
2.1.1 Demographic Transition Theory (DTT) 19
2.2 Method 20
2.3 Relationship between women's education and proximate determinants of fertility in Ethiopia, Kenya, Malawi and Mali 21
2.3.1 Contraception use and women's education 21
2.3.2 Age at first marriage and women's education 22
2.3.3 Breastfeeding and women's education. 24
2.3.4 Abortion and women's education 25
2.4 Conclusion 26
CHAPTER 3: Country context 27
3.1.1 Ethiopia 27
3.1.2 Kenya 29
3.1.3 Malawi 30
3.1.4 Mali 31
3.2 Fertility trends of four countries 33
3.3 Conclusion 33
CHAPTER 4: METHODOLOGY, DATA ANALYSIS & DISCUSSION 35
4.1 Methodology 35
4.2 Conceptual framework: The Proximate determinants of fertility model 35

Summary of Bongaarts model 35
a) Index at marriage (Cm) 37
b) Index of contraception (Cc) 37
c) Index of breastfeeding (Ci) 38
d) Index of induced abortion (Ca) 38
4.3 Data Analysis 39
4.3.1 Introduction 39
4.4 Ethiopia 41
4.4.1 Total Fertility Rates by different education levels 41
4.4.2 Age at first marriage by education level 42
4.4.3 Contraception use by education level 43
4.4.4 Breastfeeding by education level 44
4.5 Kenya 45
4.5.1 Total Fertility Rate (TFR) by different education levels 45
4.5.2 Age at first marriage for ages 15-24 by education level 46
4.5.3 Contraceptive use by education level 47
4.5.4 Breastfeeding by education level 48
4.6 Malawi 49
4.6.1 Total fertility rate by education level 49
4.6.2 Age at first marriage by education level 50
4.6.3 Contraception use by education level 51
4.6.4 Breastfeeding by education level 52
4.7 Mali 54
4.7.1 Total Fertility Rate by education level 54
4.7.2 Age at first marriage by education level 54
4.7.3 Contraception use by education level 55
4.7.4 Breastfeeding by education level 56
4.8 Summary 57
4.9 DISCUSSION 58
4.9.1 Introduction 58
4.9.2 Proximate determinants of fertility by education 58
4.9.3 Strengths and limitations 60
4.9.4 Summary 60
CHAPTER 5: CONCLUSION AND POLICY IMPLICATIONS 62
5.1 Conclusion 62
5.2 Policy recommendations 63

6.0 Reference List 66

FIGURES AND TABLES

FIGURES

Figure 1: Map of Africa.....12
Figure 2: Population by region: estimates, 1950-2020, medium variant projections, 2020-2100, with 80- and 85- percent prediction intervals......13
Figure 3: Projected size of the world's population, medium variant and momentum scenario, 2010-2100.....14
Figure 4: Bongaarts framework for analysing proximate determinants of fertility......36
Figure 5: Total Fertility Rate in Ethiopia, 1955-2020.....28
Figure 6: Total Fertility Rate in Kenya, 1955-2020......30
Figure 7: Total Fertility Rate in Malawi, 1955-2020.....31
Figure 8: Total Fertility Rate in Mali, 1955-2020.....32
Figure 9: Fertility rate, (total births per woman) Mali, Ethiopia, Kenya and Malawi.....33
Figure 10: Percentage of women with secondary or higher education aged 15-24 in Ethiopia, Kenya, Mali and Malawi.....60

TABLES

Table 1: "The year primary school tuition fees were eliminated, the expected age of primary school enrolment, and the earliest birth cohort exposed in each country".....24
Table 2:Trends in fertility.....28
Table 3: Demographic and Health Survey countries and years of survey between 2000-2018...35
Table 4: 2019 demographic profile of ages 15-24.....40
Table 5: Total Fertility Rate by education level for Ethiopia.....41
Table 6: Median age at first marriage for ages 15-24 in Ethiopia.....42
Table 7: Married women currently using any modern method of contraception in Ethiopia....43
Table 8: Married women currently using traditional or folk method of contraception in Ethiopia.....44
Table 9: Proximate determinants of fertility of women in Ethiopia (2016, 2011, 2005, 2000)....45
Table 10: Total Fertility Rate 15-49 for Kenya.....46
Table 11: Median age at first marriage for women ages 15-24 in Kenya.....47
Table 12: Married women currently using any modern method of contraception in Kenya.....48
Table 13: Married women currently using any traditional or folk method of contraception in Kenya.....48
Table 14: Proximate determinants of fertility of women in Kenya (2014, 2008-09, 2003).....49
Table 15: Total Fertility Rate (TFR) 15-49 by education in Malawi.....50
Table 16: Median age at first marriage for women ages 15-24 by education level.....50
Table 17: Married women currently using any modern method of contraception in Malawi....51
Table 18: Married women currently using any traditional or folk method of contraception in Malawi.....52
Table 19: Proximate determinants of fertility of women in Malawi (2015-16, 2010, 2004, 2000)53
Table 20: Total Fertility Rate by education level in Mali.....54
Table 21: Median age at first marriage for women ages 15-24 in Mali.....55
Table 22: Married women currently using any modern method of contraception in Mali.....56
Table 23: Married women currently using any traditional or folk method of contraception in Mali.....56
Table 24: Proximate determinants of fertility in Mali (2018, 2012-13, 2006, 2001).....57

List of abbreviations and acronyms

AAS	Australia Awards Scholarship
ASFR	Age specific fertility rates
Ca	Index of induced abortion
Cc	Index of contraceptive
Ci	Index of fecundability
Cm	Index of marriage
CPR	Contraceptive prevalence rate
DHS	Demographic and Health Survey
DFAT	Department of Foreign Affairs & Trade
EDHS	Ethiopia Demographic and Health Survey
EDSM	Enquête Démographique et de Santé
KDHS	Kenya Demographic and Health Survey
MDHS	Malawi Demographic and Health Survey
SAPS	Structural Adjustment Programmes
SSA	Sub-Saharan Africa
TFR	Total fertility rate
UN	United Nations
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNICEF	United Nations Children's Fund
UNFPA	United Nations Population Fund
WHO	World Health Organisation
WPP	World Population Prospects

CHAPTER 1: INTRODUCTION TO THE STUDY

1.1 Background to the study

Fertility rates have been declining at a slower pace in the sub-Saharan African (SSA) countries and even stagnated in mid-transition as compared to Asia, Latin America, the Caribbean and Europe (Bongaarts, 2017, p. 39, Schoumaker, 2019, p. 257). Several authors have referred to the fertility trends in SSA as the "African exception". Guengant (2017, p. 15) argues that population increase in SSA has been due to "late adoption of population policies and family programs, a lukewarm support from governments to these programs, and the poor implementation of these programs in societies that remain largely pronatalist". The area covered by SSA is shown in Figure 1 and consists of 48 of Africa's 54 countries as listed by the World Bank. The United Nations Development Program (UNDP) excludes Algeria, Djibouti, Egypt, Libya, Morocco, Somalia, Sudan and Tunisia listing 46 countries.

The United Nations estimates transitions in fertility rates in SSA were evident in the 1970s and 1980s when they reached their maximum and fertility declines began in the 1980s and 1990s. Guengant (2017, p. 18) identifies five types of fertility transitions in SSA using the United Nations 2015 estimates. They are as follows with the countries in bold as the case studies:

1. *"Fertility transition completed or close to completion"*, where the total fertility rate (TFR) is estimated at less than three children per woman on average in 2010-2015. Countries under this category include: "Mauritius, Seychelles, Cape Verde, South Africa and Botswana" (see Figure 1). They have higher Gross Domestic Product (GDP) per capita within the region and better living standards.

2. *"Fertility transition underway"* where the TFR is estimated between three and less than four children per woman in 2010-2015. Countries under this category are "Lesotho, Djibouti, Swaziland and Namibia" (Figure 1) with close economic and cultural relationships with South Africa.

3. *"Fertility transition initiated"*, where TFR is estimated between four and less than five children per woman in 2010-2015. Countries under this category are: "Gabon, Zimbabwe, Rwanda, Ghana, Eritrea, Central African Republic (C.A.R), **Kenya**, Madagascar, **Ethiopia**, Comoros, Sao Tome Principe, Togo, Mauritania, Sierra Leone, Cameroon, Liberia, Benin, Congo, Guinea-Bissau, and Equatorial Guinea" (Figure 1). Most of these countries have a coastal area with high urbanisation rates.

4. *"Slow and irregular transition"*, where the TFR is estimated between five and less than six children per woman. Countries under this category include: "Cote d'Ivoire, Guinea, South Sudan, Senegal, Tanzania, **Malawi**, Mozambique, Zambia, Burkina Faso, Nigeria, Gambia and Uganda" (Figure 1). They have a weak political commitment to lower fertility.

5. *"Very slow and/or incipient fertility transition"* where TFR is estimated at six or more children per woman. Countries in this category include: "Burundi, the Democratic Republic of the Congo, Angola, Chad, **Mali**, Somalia, and Niger" (Figure 1).

The demographic trends in the world indicate that fertility rates have decreased in several countries globally. However, the selected countries for this study fall between the third, fourth and fifth stage of the demographic transition (Guengant, 2017). The number of children per woman in these groups are above four. Most of these countries are characterised by a high proportion of the population in the age bracket of 15-24 years.

Figure 1: Map of Africa

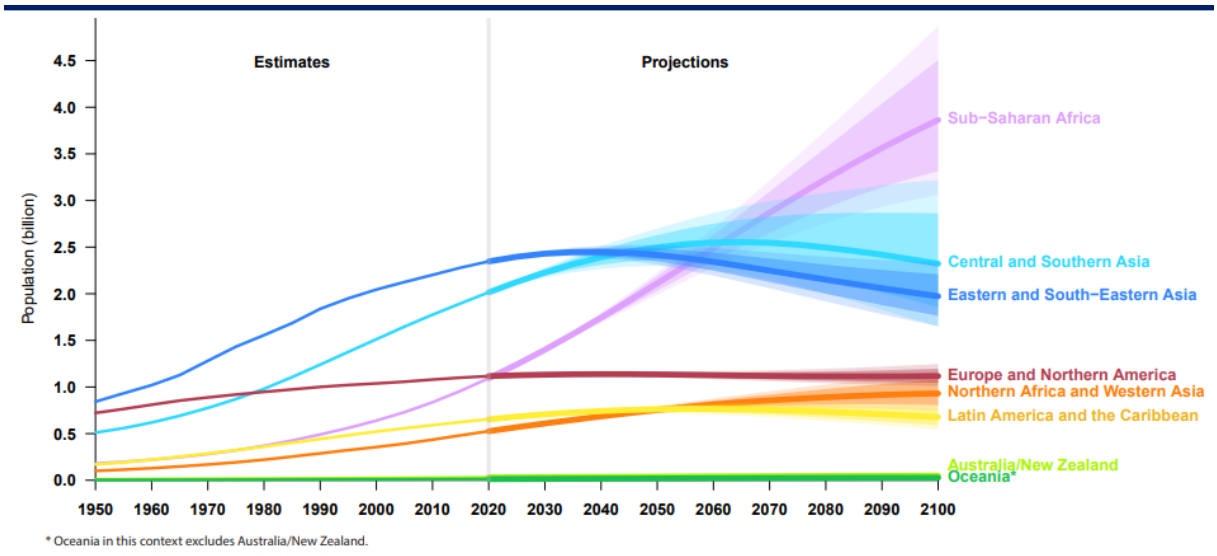
Source: The World Bank 2015

1.2 Statement of the problem

Fertility transition in sub-Saharan African countries occurred later in time and has been slower as compared to other regions: Asia, Europe, Caribbean and Latin America, despite exposure to contraceptive use and education. According to multiple studies, many SSA countries that began a decline in fertility rates have stalled mid-way. Kenya, Ethiopia, Malawi and Mali share similarities in fertility trends of women ages 15-24 which has led to significant risks for both mother and child and limited education and livelihood opportunities for these women. An increase in fertility rates in the region will most likely contribute to rapid population growth exerting pressure on various aspects. Although several policies have been put in place by governments, they do not seem to be addressing fertility trends among ages 15-24.

Globally, there are approximately 7.7 billion people which are projected to reach approximately "8.5 billion in 2030, 9.7 billion in 2050, and 12.7 billion in 2100" (*World Population Prospects*, 2019, p. 5). Of this population, sub-Saharan African (SSA) countries will account for more than 50% of the global population between 2019 and 2050. The *World Population Prospects* 2019 indicates that the world's population is increasing but at a slower rate due to reduced levels of fertility. Although SSA will account for most of the growth of the world's population in coming years, other regions will decline in population (see Figure 2).

Figure 2: Population by region: estimates, 1950-2020, medium variant projections, 2020-2100, with 80- and 85- percent prediction intervals.



Source: World Population Prospects 2019 Data Booklet

Hertrich (2017, p. 112) argues that whereas the overall fertility increased in SSA in the 1980s, by the 1990s, multiple sub-Saharan African countries showed declining fertility rates. The Demographic and Health Surveys (DHS) calculate fertility rates based on data for three years prior to each survey. The datasets have indicated varying trends in fertility for various sub-Saharan African countries.

However, the World Bank (2014) has projected that sub-Saharan Africa will have 1.4 billion people living in the region by 2030 with an average age of 20 years. UNFPA (2014) report indicates that 15 countries in SSA consist of 50% of the population under age 18. In contrast, Asia, Latin America and the Caribbean are projected to start undergoing a decline in population after reaching their peak before 2030. The World Bank (2014) argues that much of the projected population growth will be driven by the youthful population age structures (see Figure 3) who will have reached their maturity in the next few decades.

Figure 3: Projected size of the world's population, medium variant and momentum scenario, 2010-2100

Image removed due to copyright restriction.

Source: United Nations, Department of Economic and Social Affairs, Population Division (2019). World Population Prospects 2019.

The United Nations (2011 cited in Bongaarts & Casterline, 2013, p. 153) suggest that the high fertility and declining mortality rates are among the major contributors to rapid population growth in sub-Saharan Africa. The United Nation states that "fertility in sub-Saharan Africa

(SSA) stood at 5.1 births per woman in 2010-15 in comparison to 2.2 in Latin America and Asia, which is more than double the replacement level" (Hertrich, 2017, p. 112). Following from this growth rate, the United Nations projects an increase in the population of sub-Saharan Africa from "0.86 billion in 2010 to 1.96 billion in 2050 and 3.36 billion in 2100" (Bongaarts & Casterline, 2013, p. 153).

According to the workshop held by the Committee on Population (2016 citing Bongaarts & Casterline, 2013), the TFR of SSA was estimated at 5.1 births per woman, whereas the WPP2019 shows sub-Saharan Africa's total fertility has declined from 6.3 births per woman in 1990 to 4.6 births in 2019. However, the most recent report estimates SSA total fertility rate (TFR) at 4.7 births per woman in 2015-2020 (United Nations, 2019) which is a decline of 0.4 births. Rossier and Corker (2017. p. 192) using studies conducted on "the relationship between induced abortion and contraception" (see Bongaarts & Westoff, 2000; Marston & Cleland, 2003; WHO, 2011) point out that the decline in Latin America, Asia and North Africa resulted from an increase in abortion rates and use of contraception. The authors further state that evidence indicates similar trends are occurring in modern sub-Saharan Africa. Finlay et al. (2017, p. 1) argue that over the past century, countries have observed a decline in their total fertility rates nationally where lifetime fertility is below 2.1 live births per woman. These authors point out that the decline has differed across countries indicating variations within a country's total fertility rate (TFR).

This thesis assesses the impact of education of youth aged 15-24 on the determinants of fertility rates (age at marriage, access to contraception, and breastfeeding) within four sub-Saharan African (SSA) countries using data from Demographic and Health Surveys (DHS) of the selected countries. Youth aged 15-24 in the selected countries face multiple challenges when they become mothers at an early age. They also have a longer period for childbearing increasing fertility rates in the country. I have excluded abortion in the proximate determinants of fertility because it is considered illegal in several sub-Saharan African countries and it is not easy to find reliable data. I will use Bongaarts and Stover's proximate determinants of fertility model for the four countries as the conceptual framework to the study.

1.3 Research question

- Why is fertility so persistently high in the age group 15-24 years in the selected SSA countries?

- What is the relationship between female education and fertility in Ethiopia, Kenya, Malawi and Mali?

1.4 Research objectives

The goal of this study is to investigate the impact of education among women aged 15-24 and the dynamics associated with fertility levels in Ethiopia, Kenya, Malawi and Mali using Bongaarts proximate determinants of fertility.

Specifically, the study seeks to achieve the following objectives:

- Examine the total fertility rates of Ethiopia, Kenya, Malawi and Mali using Demographic and Health Survey data collected between 2000-2018.
- Assess the effects of education on the Bongaarts proximate determinants of the age-specific fertility rates of ages 15-24 years in each of the four countries of SSA.

1.5 Basic theoretical framework

The study will use the Bongaarts model for a conceptual framework. Bongaarts (1982) model examines the relative contribution of each of the four proximate determinants to the inhibition of fertility from its theoretical maximum. Bongaarts framework for analysing the proximate determinants of fertility has evolved over time to include more determinants. The original model focused on marriage, postpartum infecundability, abortion and contraception and in 1984, he added pathological sterility. In the Bongaarts framework, "the relative importance of each of the proximate determinants of fertility is expressed with an index that can vary from 0 to 1, where 1 indicates no reduction of fertility by the determinant, and values closer to 0 indicate more reduction" (Johnson et al., 2011, p. 5). The Bongaarts model estimates the total fertility rate as a function of the biological maximum total fertility known as Total Fecundity (TF), and lower than this rate due to delayed sexual activity (Cm), contraceptive use (Cc), abortion (Ca) and postpartum infecundability (Ci).

$$TFRe = Cm \times Cc \times Ci \times Ca \times TF$$

Bongaarts, Frank and Lesthaeghe (1984, p. 515) argue that to comprehensively analyse factors influencing fertility, it is important to distinguish between (a) proximate variables and (b) socioeconomic and environmental variables (see Figure 4)

The authors further claim that proximate determinants influence fertility directly while "socioeconomic variables affect fertility indirectly by modifying the proximate determinants". Stover (1998, p. 255) modified Bongaarts framework to include new data that is available from diverse sources. Stover (1998) pointed out that women who are also sexually active outside marriage are more likely to use contraception and seek induced abortions.

Bongaarts, Frank and Lesthaeghe (1984, p. 516) argue that a socioeconomic variable can affect fertility in diverse ways depending on the contribution of the proximate determinants. The effect can be positive or negative or insignificant. The authors demonstrate how a "socioeconomic variable can have negative fertility effects through one set of proximate variables (such as education's effect on use of contraception) and positive effects through another set (such as education's effect on length of breastfeeding)". In this research, women's educational level is used as a socio-economic variable to examine its influence on various proximate determinants of fertility.

1.6 Summary

Sub-Saharan African countries' fertility trends have been unique in comparison to other regions in the world. The decline in fertility rates started later than other regions and has been relatively slower. Whereas Latin America and Asia reached below or close to replacement level of 2.1 in 2010, African women were found to have an average of 5.5 children (United Nations 2015, cited in Schoumaker, 2017, p. 197). Some studies indicate that the higher-level education attainment of women has been a driver for decline of fertility rates.

The future fertility trends in SSA are very unpredictable because some countries have not shown any decline while others have stagnated. This is illustrated by the United Nations report that the selected countries either have fertility transition initiated (Kenya and Ethiopia) or are undergoing slow and irregular transition (Malawi) or very slow and/or incipient fertility transition (Mali). The proximate determinants of fertility (contraception use, age at marriage and breastfeeding) are not similar in these countries or sufficient data are unavailable.

1.7 Structure

This thesis consists of five chapters with Chapter one introducing the background to the study and statement of the problem. It highlights the research question, objectives, scope of study

and conceptual framework. Chapter two is a critical literature review of the conceptual framework using Bongaarts model, and impact of education on three variables, namely: age at marriage, contraception and breastfeeding. Chapter three highlights the country context of Ethiopia, Kenya, Malawi and Mali. Chapter four presents the methodology, data analysis and findings of the study of four sub-Saharan African countries with three or more demographic and health surveys between 2000-2018. Chapter five concludes the study and provides policy measures and recommendations based on the findings of the study.

1.8 Operational meaning of terms (Bongaarts, 1978; Stover, 1998)

Contraception: "Any practice undertaken deliberately to reduce the risk of conception".

Contraceptive prevalence (CPR): "The percentage of women ages 15-49 practicing, or whose sexual partners are practicing any form of contraception".

Fertility rate: "the average number of births per woman during her reproductive years".

Induced abortion: This includes any practice that intentionally interrupts the normal course of gestation.

Lactational amenorrhoea: After a pregnancy, a woman remains less likely to conceive until normal pattern of ovulation and menstruation is restored (postpartum amenorrhoea).

Postpartum abstinence: Prolonged abstinence from sexual relations while a newborn is breastfeeding.

Sub-Saharan Africa: The term refers to more than 40 African countries situated south of the Sahara Desert excluding countries in North Africa (Figure 1).

Stall: "implies that an ongoing fertility transition is interrupted by a period of no significant change in fertility before the country reaches the end of the transition" (Schoumaker, 2019).

Total fertility rate per woman (TFR): TFR is the average number of live births a woman would have by the end of her reproductive life (15- 49 years) if she were subject, throughout her life, to the age-specific fertility rates observed in a given year.

CHAPTER 2: CRITICAL REVIEW OF LITERATURE

2.1 Background

Fertility declines have been uneven in most sub-Saharan African countries in comparison to other developing regions whose total fertility has reduced from "five lives births per woman in 1950-1955 to 2.5 births per woman in 2010-2015" (UN World Fertility Report, 2015, p. 15). More so in the late 1990s and early 2000s, some SSA countries stabilised in their fertility decline while others stalled. Several studies link this unique trend to particular periodic factors such as the delay in socioeconomic development, the low priority allocated by governments to family planning programs, the effects of HIV/AIDS among other factors. Goujon et al. (2015) argue that this African stall could be linked to slow progress in women's education due to the Structural Adjustment Programs (SAPs) enforced in the late 1980s by the Bretton Woods Institutions. Kebede et al. (2019) suggest that further research is required to provide statistical data to show how the SAPS impacted education budgets and school enrolment rates in different countries.

Sub- Saharan Africa (SSA) continues to show high fertility levels of 5.1 births per woman in 2010-2015 in comparison to Asia, Latin America and the Caribbean with fertility levels of 2.2 births per woman in the same period. A recent United Nations report estimates a slight decline in fertility rates in sub-Saharan Africa from 5.1 in 2010-2015 to 4.7 in 2015-2020 (United Nations, 2019). East Timor (formerly Timor-Leste) and Afghanistan are two other countries with women having five children or more. Europe and North America's total fertility is below 2.1 births per woman which is below replacement level and continues to decline. Some of the key reasons for this decline include empowerment of women where access to education and labour market participation has increased; declining child mortality; contraception; coercive policy interventions; and a rising cost of raising children. The United Nations (UN, 2001) projections show that the majority of countries will complete their fertility transitions before 2050.

2.1.1 Demographic Transition Theory (DTT)

A great number of studies use the demographic transition theory to describe the fertility transition that occurred in the West during the late nineteenth century (Bongaarts, 2017, p. 40 citing Davis, 1945; Notestein, 1945, 1953). The theory suggests that "fertility transitions are driven by social and economic development" where modernisation and industrialisation of

societies affects various aspects leading to lower mortality and increase in fertility decline (Bongaarts, 2020, p. 40). The theory claims that the rising cost of raising children reduces the demand of having big families causing people to opt to use birth control. Caldwell and his collaborators (1987, 1988, 1992 cited in Bongaarts, 2017, p. 40) argue that Africa's situation is different because of the pronatalist nature of the society hence cannot be explained using the demographic transition theory. Teller and Hailemariam (2011, p. 4) support Caldwell et al.'s argument and point out that in several countries in sub-Saharan Africa, the "historical context is framed by poverty, food insecurity, disease, climate change and political instability". Hence Teller and Hailemariam (2011) suggest that demographers need to take these complexities into consideration as they apply the "global population theories and models" in different countries in SSA.

The limitations of the demographic transition theory first enunciated by Everett Rogers in 1962 that was used to explain fertility transition in Africa led to adoption of the diffusion of innovations theory. Rogers (2003 cited in Bongaarts 2017, p.41) defines diffusion as "the process by which new ideas, behaviours, and attitudes spread within a population through a variety of mechanisms (e.g. social networks, opinion leaders, and media)". The author points out that this process does not depend on social and economic changes but progresses quickly in homogeneous societies.

Guengant (2017, p. 21) argues that it is important to differentiate between intermediate and proximate determinants of fertility when explaining the high fertility levels in SSA. The author states that "*intermediate determinants* of fertility are socioeconomic and influence fertility indirectly" whereas "*proximate determinants* of fertility are biological and /or behavioural in nature". The scope of this thesis will be limited to proximate determinants of fertility on Ethiopia, Kenya, Malawi and Mali using Bongaarts framework and analyse its correlation to education.

2.2 Method

I searched the online Flinders library, google scholar, JSTOR and PubMed to identify published journals and books that analysed proximate determinants of fertility in sub-Saharan Africa and their correlation with education. The keyword search terms included *determinants of fertility and education in sub-Saharan Africa; adolescent fertility AND education in sub-Saharan Africa; contraceptive use in SSA; age at first marriage in SSA; breastfeeding in SSA; Bongaarts and fertility* and *DHS*. I conducted a systematic or scoping review through searching cited references (pearling) of selective articles relevant to my study and found 6,268 publications in

the initial search. I excluded publications that did not involve analysis of determinants of fertility of women aged 15-24 and impacts on education in sub-Saharan Africa, specifically Ethiopia, Kenya, Malawi and Mali. The study also used the DHS datasets as shown in Table 3.

Of the 6,268 publications, 150 were considered for further review after removing duplicates and articles that did not meet the eligibility criteria. The countries under analysis do not have the same number of DHS surveys. The study will examine the impacts of education on the total fertility rate using the revised Bongaarts (1978, 1982; Stover, 1998) fertility framework of proximate determinants of fertility, that explain the fertility levels and trends of a country.

2.3 Relationship between women's education and proximate determinants of fertility in Ethiopia, Kenya, Malawi and Mali

This study uses datasets from demographic and health surveys conducted between 2000-2018 for Ethiopia, Kenya, Malawi and Mali to assess how the level of education of women ages 15-24 affects the fertility trends. Women ages 15-24 have a longer childbearing period affecting multiple dimensions of life either positively or negatively. Prior to the late 1970s, demographic literature held the view that women's education was inversely associated with fertility, but this was disapproved with empirical evidence. In the 1980s, the World Fertility Survey (WFS) provided data for several developing countries increasing empirical evidence. The studies using WFS data ascertained that education negatively influences fertility. The limitations of these studies led to employing the proximate determinants of fertility (Bongaarts, 1978) which addresses both direct and indirect factors through which education influences the rate of childbearing in a population.

2.3.1 Contraception use and women's education

According to the United Nations Population Fund (UNFPA, 2014), sub-Saharan Africa has one of the highest numbers of unintended or unwanted pregnancies among adolescents and lowest use of contraceptives and family planning services (Radovich et al., 2018, p. 274). The low use of modern methods of contraception by many SSA women is a result of multiple reasons such as traditions, norms, cultures or lack of awareness on choices they can make. It is critical to address unplanned pregnancy among adolescents and young women in sub-Saharan Africa to curtail the fertility rates, however, there are various barriers that young people experience when trying to access quality healthcare. These barriers include age restrictions or stigmatisation, privacy concerns and the cost of modern contraceptives. This study's scope is based on modern

contraceptive and traditional contraceptive use of ages 15-24 years using DHS data for Ethiopia, Kenya, Malawi and Mali.

Rossier and Corker (2017, p. 192) argue that induced abortion, abstinence and use of traditional methods of contraception, mainly withdrawal, contributed immensely to fertility decline in Western countries before the uptake of modern contraception. In sub-Saharan Africa, women were expected to abstain from premarital sex while married women with infants observed long durations of postpartum abstinence (UN, 2013). The practice seems to be declining as more women use modern contraceptives as shown in the DHS datasets. However, Rossier and Corker (2017 citing Okpani & Okpani, 2000; Kabonga et al., 2010; Adanu et al., 2012) claim that other studies focused on family planning in SSA report greater use of traditional methods of contraception.

According to an analysis of modern contraceptive prevalence rate (CPR) in sub-Saharan Africa, Ethiopia, Rwanda and Malawi were found to have increased their CPR (USAID/Africa Bureau, 2011). Several findings show that the higher the level of education of a woman of reproductive age, the greater the likelihood she will use modern contraceptives, delay marriage and childbearing leading to lower fertility in comparison to less educated women. Several authors correlate women's education attainment with higher contraceptive use and lower fertility (Larsson & Stanfors, 2014, p. 23 citing Caldwell, 1980; Cleland & Rodriguez, 1983; Cochrane, 1983; Jejeebhoy, 1995; Martin, 1995). However, other factors such as culture, level of development of the region amongst others may influence the effect of women's education on contraceptive use. Societies that are pronatalist and patriarchal, which is common in sub-Saharan Africa, may have different outcomes.

Larsson and Stanfors claim that most of the time the relationship between women's education and fertility is negative, albeit the positive aspects still require further research. Hence, this study will use Bongaarts model to determine the effect of women's education ages 15-24 on the proximate determinants of fertility based on nationally representative data of Ethiopia, Kenya, Malawi and Mali.

2.3.2 Age at first marriage and women's education

In several societies, age at first marriage is considered the time when childbearing is socially acceptable. Studies have found that early marriage hinders development of young girls and women in multiple areas including health, socioeconomic outcomes and overall wellbeing. The

United Nations Children's Fund (UNICEF) report of 2014 stipulated that globally, over 700 million women currently living were married under age 18 with a higher percentage in developing countries. Poverty and gender inequality have been found to perpetuate this harmful practice of child marriage globally. Although minimal focus has been placed on understanding the prevalence rate of child marriage in sub-Saharan African countries, it is still common with more than a third of girls marrying in their teenagerhood (Koski et al., 2018, p. 2).

Findings from a study conducted in Kenya, Senegal, Uganda and Zambia by the International Centre for Research on Women (ICRW) revealed that "child marriage is rooted in traditions and gender discriminatory norms that prioritize women's roles as wives, mothers, and household caretakers, resulting in inadequate investments by families in girls' education" (Petroni et al., 2017). In contrast, age at first marriage has risen in countries such as Botswana, Namibia and South Africa from below 18 years to a median exceeding 25 years but with a rise in premarital fertility (Garenne, 2004 cited in Clark et al., 2017, p. 1).

However, Koski, Clark and Nandi (2017) argue that the median age of first marriage is under the age of 18 in Niger, Mali, Malawi, Guinea and Burkina Faso. Various scholars are suggesting this increase in the median age of marriage is among the reasons why premarital fertility is increasing in the region though the correlation is not certain. Since premarital fertility is higher among adolescents, it has affected the women's health, well-being, disrupted their education and occupational ambitions. Clark et al. (2017, p. 3) citing Lloyd and Mensch (2008) argue that some studies disagree with the claim that adolescent pregnancy lead to high school dropouts.

Subsequently, multiple DHS data and other literature indicate that increased education attainment of girls has a positive correlation with delay in age at marriage. A good example is initiatives that provide cash transfers and reduced education costs for girls in low-income countries such as Malawi, Zimbabwe and Kenya. These initiatives have demonstrated positive results (Hallfors et al., 2015 cited in Koski et al., 2018, p. 2). There has been an increase in retention of girls in school, yet a percentage of the young women are still getting married before the age of 18 years. Koski et al. (2018, p. 3) cautions against generalisation of the findings of benefits of cash transfers and reduced education costs in school because of the limited scope under which the study was implemented and unknown possibility for scale up.

Ethiopia, Kenya, and Malawi, amongst other sub-Saharan African countries adopted policies to provide free primary school education (Table 1). Omoeva and Moussa (2018) argue that the

outcome of the adoption of Universal Primary Education (UPE) policies in Ethiopia, Malawi and Uganda increased school enrolment and mean years of schooling for girls by "1.2 and 1.8 years" and reduced early sexual activity by "6.6 to 7.6 percentage points". Kenya eliminated primary school tuition fee later in 2003 as compared to Malawi and Ethiopia that implemented UPE early in 1994 and 1995, respectively (see Table 1). The UPE increased school enrolment and delayed early marriages of girls. This study will analyse data on educational attainment and age at first marriage from DHS datasets of the selected countries conducted between 2000 and 2018 to determine whether there is a relationship among the variables.

Table 1: "The year primary school tuition fees were eliminated, the expected age of primary school enrolment, and the earliest birth cohort exposed in each country"

Country	Year Tuition fees eliminated	Expected age at enrolment	Earliest birth cohort exposed
Ethiopia	1995	7	1988
Kenya	2003	6	1997
Malawi	1994	6	1998

Source: UNESCO International Bureau of Education and World Bank reports 2009

2.3.3 Breastfeeding and women's education.

The length and intensity of breast feeding influences the duration of menstruation or post-partum amenorrhoea offering limited protection from conception. World Health Organisation (WHO) and other global initiatives recommend exclusive breastfeeding (EBF) for infants up to age of six months, but the practice remains low in several sub-Saharan African countries (Lori et al., 2018). Some of the reasons include poor understanding of EBF and cultural perceptions of exclusive breastfeeding. WHO (2020) reports that out of the 1.9 billion women of reproductive age globally, 272 million, mainly from middle and low-income countries have a low uptake of postpartum family planning and other modern methods.

Studies reveal that "Lactational Amenorrhea Method (LAM) is 98% effective" for family planning if used correctly (Labbok, 2020). Women who optimally breastfeed their babies are less likely to experience early ovulation and menstruation in contrast to women who partially or do not breastfeed their babies. This natural method of family planning is cost friendly and has no side effects as compared to modern contraceptives. Education of both older and younger women will play a significant role to raise awareness on the importance of adopting EBF in sub-Saharan Africa.

2.3.4 Abortion and women's education

Unplanned or unintended pregnancies occur globally and are "associated with multiple risk factors such as malnutrition, mental illness, unsafe abortion, maternal mortality, and horizontal transmission of HIV to children" (Ahinkorah, 2020, p. 1). This is evidenced primarily among adolescent girls and young women rather than mature women. However, most studies conducted on unwanted pregnancies in the sub-Saharan Africa region tend to focus on all women of reproductive ages 15-49. It is estimated that more than 77% of abortions in SSA are done by untrained persons or use of non-recommended method or both leading to death (Guttmacher Institute, 2020 citing Bankole et al). The results reveal that unwanted pregnancies among women occurs due to lack of considerable information or education on contraceptive use, contraceptive failure, sexual violence, cultural expectations, lower socioeconomic status, and lack of access to contraceptives. Both formal and informal education provides knowledge on how to address these challenges.

Moreover, studies conducted in Latin America, Asia and North Africa found abortion was prevalent during the early stages of fertility decline but decreased with rise in use of modern contraceptives (Bongaarts & Westoff, 2000; Marston & Cleland, 2003; WHO, 2011). A similar trend of women choosing abortion is observed in urban women in sub-Saharan Africa (Rossier & Corker, 2017, p. 196). A percentage of girls who conceive while in school resort to abortion to avoid detection and expulsion. Some countries such as Tanzania have strict regulations concerning schoolgirls who become pregnant; they are expelled from school. Other countries such as Kenya, Malawi and Gabon have accommodating policies that allow pregnant women to resume their studies after giving birth (Human Rights Watch, 2018). Unfortunately, Demographic Health Survey does not provide data on the re-enrolment of women aged 15-24 after giving birth. The World Health Organisation (WHO 2011) argues that the number of unsafe abortions is likely to increase if proper structures are not put in place such as women's access to safe abortion and contraception. Educating the younger women on how to avoid unwanted pregnancy will address most of these challenges.

The World Health Organisation (WHO, 2012) estimates that globally, three million teenage girls undergo unsafe abortions annually. Abortion is legally practiced in many countries worldwide in contrast to the majority of sub-Saharan African countries where it is considered illegal. As much as the rate of induced abortion in SSA is among the highest globally performed under unsafe and illegal circumstances, obtaining reliable data is difficult. It is estimated that Africa's rate of unsafe abortion is 28 per 1000 women aged 15-44 in comparison to 1 per 1000

in developed countries (Guttmacher Institute cited in Sedgh et al., 2012). This has resulted in high maternal death and health complications due to failed abortions.

Africa's Adolescent Birth Rate (ABR) is at 98 births per 1000 compared to Latin America and the Caribbean with an ABR of 67 births per 1000 women. Adolescent girls and young women experience high unmet need for contraceptives due to several barriers leading to high rates of unintended pregnancies. A proportion of the young women choose to undergo unsafe abortion leading to maternal death and multiple health problems which curtails opportunities for socioeconomic development and interruption of their education.

2.4 Conclusion

Bongaarts model is a tool that describes the relationship between fertility and the four proximate determinants: marriage; contraception; breastfeeding (postpartum infecundability); and induced abortion. These factors inhibit fertility by reducing the theoretical biological maximum by slowing down natural fertility. The inhibiting effect is measured by four indices: Total Fecundity (TF); Total Natural Fertility (TN); Total Marital Fertility Rate (TMFR); and Total Fertility Rate (TFR) which each range in value from 1 indicating no fertility inhibiting effect, to 0 indicating total fertility-inhibiting effect.

The Total Fecundity Rate (TF) of most populations is estimated to fall between 13-17 births per woman, with an average of 15 in Bongaarts aggregate model. The model has its limitations thus does not provide accurate total fertility rates (TFR). In Bongaarts model, TFR excludes children born outside marriage or sexual union. Due to the unreliability of marriage as an indicator of entry to sexual activity in several countries, Stover (1998) modified the indicator of marriage to proportion of women sexually active either unmarried or married.

Studies show that fertility of a given community is affected by age at first marriage, women's education level and contraceptive use which will be discussed in chapter four. Most women of reproductive age that marry early have a longer reproductive age duration and are less likely to be educated. This study assesses how the socio-demographic characteristic of education literacy affects fertility and its relationship with the proximate determinants of fertility. The contexts of the four selected countries will be discussed in chapter 3.

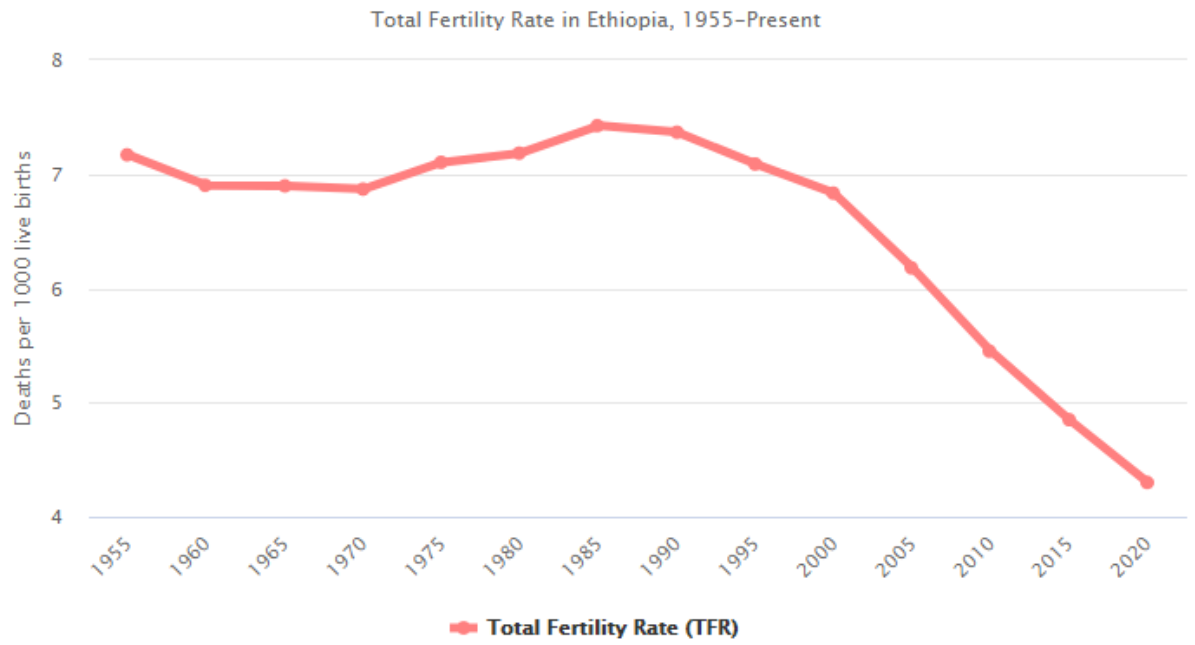
CHAPTER 3: Country context

This study will focus on four sub-Saharan countries, namely, Ethiopia, Kenya, Malawi and Mali with total fertility rates above 4.5. These countries are also characterised by a youthful population, child marriages and prevalence of adolescent pregnancy.

3.1.1 Ethiopia

The Federal Democratic Republic of Ethiopia is a landlocked country located in the volatile region of the Horn of Africa with a population of 114,963,588 (Worldometer, 2020; United Nations data) with a total fertility rate of 4.3 births per woman in 2020. Ethiopia is ranked as the second most populous country in sub-Saharan Africa despite a declining TFR. The country borders Eritrea and Djibouti to the North, Kenya to the South, Somalia to the East and Sudan and South Sudan to the West (Figure 1). The TFR declined from 7.2 to 6.9 births per woman between 1955-1970 and slightly increased from 7.1 to 7.4 children per woman between 1975-1990. Then between 1995-2020, the TFR declined from 7.1 to 4.3 children per woman (Figure 5). The TFR in Ethiopia indicated a faster decline rate in comparison to other countries in sub-Saharan African because between 1995-2000 Ethiopia's TFR was similar to the SSA average but declined between 2000-2014 (Hailemariam, 2017, p. 57).

Figure 4: Total Fertility Rate in Ethiopia, 1955-2020



Source: Worldometer 2020

Childbearing starts early in Ethiopia with a high percentage of women having had their first birth in their teens. The population of Ethiopia is comprised of one third young people with 45% of the total births occurring among the young cohort aged 15-24. The age-specific fertility rate (ASFR) among the 15-19 age group is 80 births per 1000 women and increases in the age group 25-29 at 214 births per 1000 women (EDHS, 2016, p. 77). This early start to childbearing increases levels of fertility and inversely affects the educational attainment of adolescent girls and young women. It also reduces employment opportunities for the young mothers. The EDHS 2000 report reveals that age-specific fertility rates in Ethiopia are lower in urban areas in comparison to rural areas (Table 2).

Table 2:Trends in fertility

Age-Specific fertility rates (per 1000 women) and total fertility rates				
Age	**1990 NFFS1[1]**	**2000 Ethiopia DHS[2]**		**Total**
		Urban	**Rural**	
15-19	95	60	123	110
20-24	275	149	266	244
25-29	289	156	289	264

Age-Specific fertility rates (per 1000 women) and total fertility rates				
Age	**1990 NFFS1[1]**	**2000 Ethiopia DHS[2]**		**Total**
		Urban	**Rural**	
30-34	257	160	264	248
35-39	199	97	199	183
40-44	105	33	109	100
45-49	56	4	27	24
Total fertility	6.4	3.3	6.4	5.9

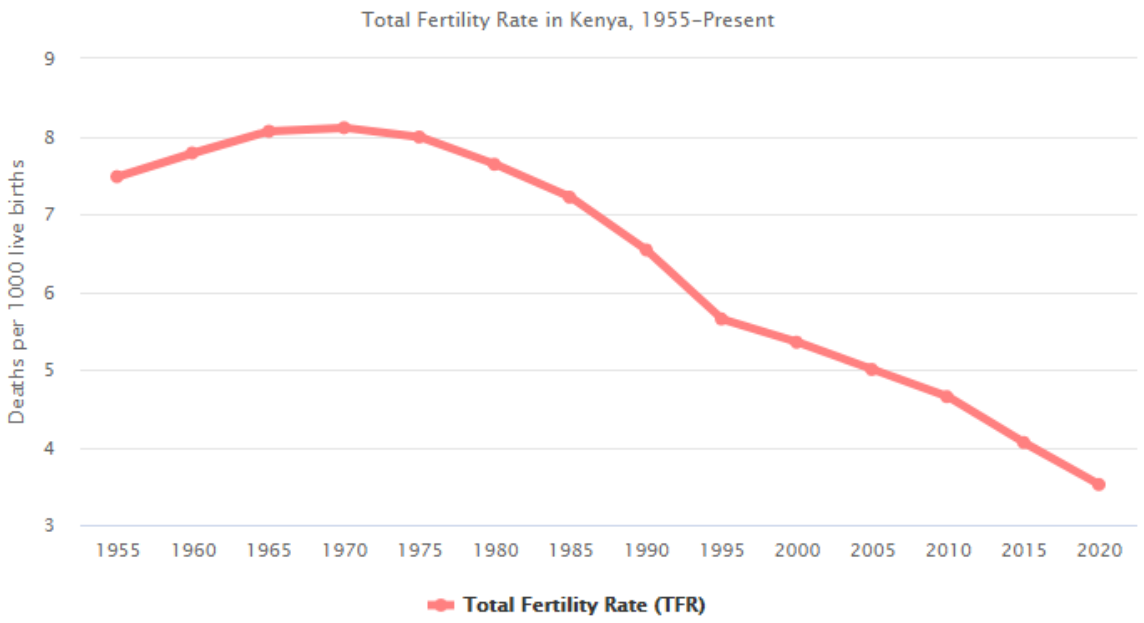
Source: CSA, 1993
CSA and ORC Marco, 2001

EDHS 2011 found that wealthy Ethiopians are more educated than the poor populace. Ashford (2012 cited in Madhavan, 2014, p.9) argues that Ethiopia reformed the law to allow abortion in cases of rape or incest to protect the women and minors from mental distress. Unintended pregnancies are highly reported in Addis Ababa especially among the wealthy in comparison to other regions.

3.1.2 Kenya

Kenya's population is estimated at 53,771,296 (Worldometer, 2020, UN data) with a Total Fertility Rate (TFR) of 3.5 births per woman. The 1917 World Fertility Survey (WFS) indicated that Kenya had a TFR of over eight children per woman (Askew, Maggwa & Obare 2017, p. 290) which was ranked amongst the highest globally but has decreased over the years. Between 1955-1970, Kenya's TFR increased from 7.5 to 8.1 children per woman, then from 1975-1990, the TFR declined from 8.0 to 6.5. The decline continued from 1995-2020 with a TFR of 5.7 to 3.5 births per woman (Figure 6).

Figure 5: Total Fertility Rate in Kenya, 1955-2020.



Source: Worldometer 2020

Fertility is higher among women in rural areas (5.4 children per woman) in comparison to urban areas (3.3 children per woman) as provided in 2000 KDHS. This figure slightly decreased as indicated in 2014 KDHS with TFR of 4.5 among rural women and 3.1 among urban women. Fertility peaks at age 20-24 in both rural and urban areas although the rate is slower in urban areas due to various favourable factors such as better education, better access to family planning information and services and later marriage as claimed in the DHS reports.

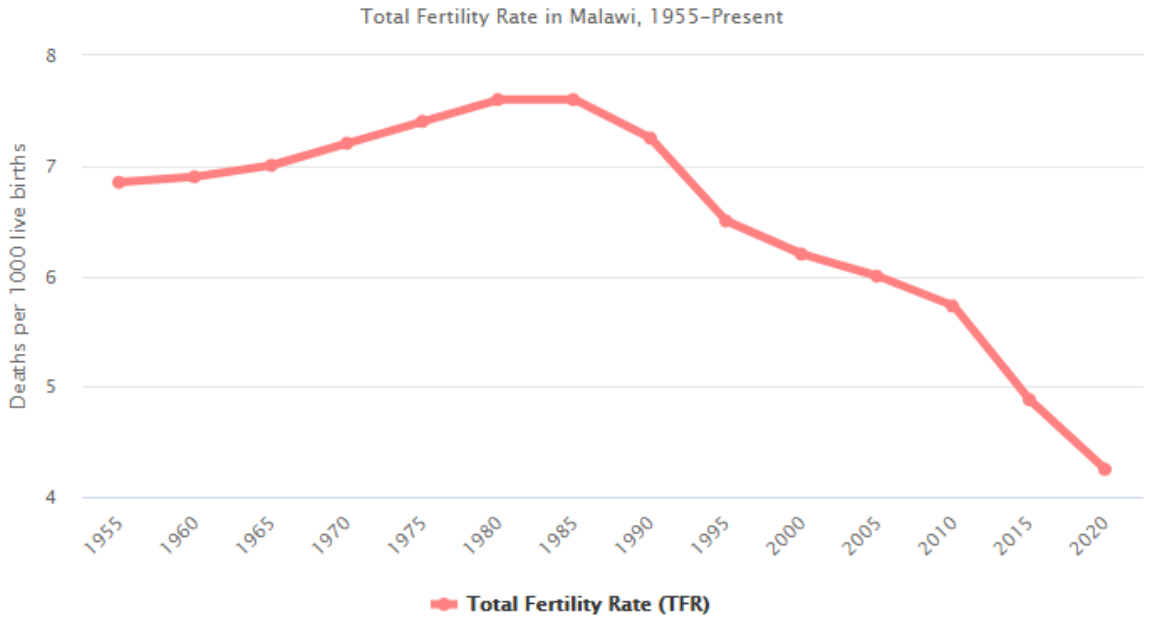
Teenage fertility of women aged 15-19 has increased with teens who have begun childbearing increasing from 21% in 1998 to 23% in 2003 (KDHS, 2014). Statistics reveal that 46% of uneducated teenagers have begun childbearing in comparison to 10% with secondary and higher education. The wealth status of the family of the teenager also determines the rate at which they begin childbearing with 29% in poorer households compared to 21% in wealthier households.

3.1.3 Malawi

Malawi's population is 19,129,952 (Worldometer, 2020) with a total fertility rate of 4.3 live births per woman in 2020. The TFR increased from 1955-1985 with 6.9 to 7.6 births per woman. The fertility rate declined gradually from 1990-2005 with TFR of 7.3 to 6.0 births per

woman then from 2010-2010, the TFR progressively declined from 5.7 to 4.3 births per woman (Figure 7).

Figure 6: Total Fertility Rate in Malawi, 1955-2020



Source: Worldometer 2020

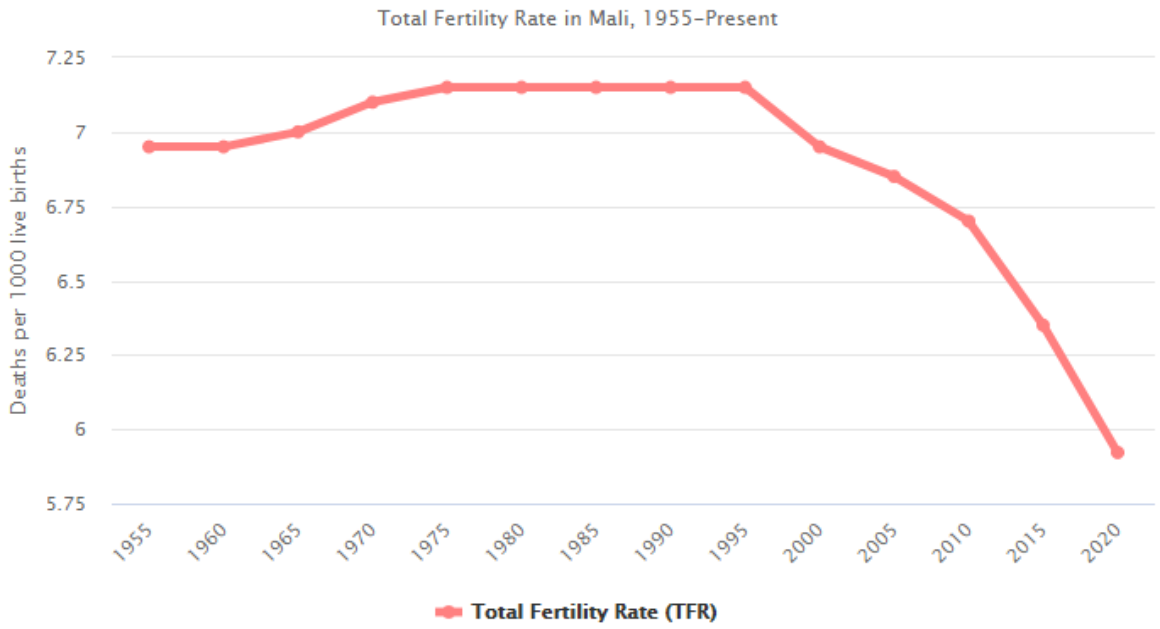
One third of adolescents have begun childbearing; a quarter of teenagers have a child and 9% are expectant as indicated in the 2004 MDHS. The results show that 25% of teenagers in urban areas have begun childbearing compared to 36% in rural areas. The findings further indicate that 63% of teenagers with no education have begun childbearing and the percentage decreases with the more education one has. Fertility rates are higher among the age cohort 20-24 (MDHS 2010, p.44) with more childbearing among women with no education.

3.1.4 Mali

The Republic of Mali is a landlocked country in the West Africa region (Figure 1) with a population of approximately 20,250,833 (Worldometer 2020; UN data). Mali is bordered by Burkina Faso, Mauritania, Guinea, Niger, Côte d' Ivoire, and Senegal with a population growth rate of 3% per year (United Nations, 2019). Despite this population growth rate, the country has been experiencing inter-ethnic clashes over land since 2012 leading to instability and insecurity. The World Bank report (2020) stipulates that the population of Mali increased from

15 million in 2010 to 19 million in 2020. Mali has a fertility rate of 6.3 births per woman (INSTAT and ICF, 2019b; World Bank, 2020) with a high percentage of young people under age 25 representing 67% of the population (USAID/Mali 2015). The fertility rate decreased from 7.1 children per woman in the 1980s to 6.3 in 2018 (Figure 8) due to various socio-economic factors including education, wealth and location.

Figure 7: Total Fertility Rate in Mali, 1955-2020



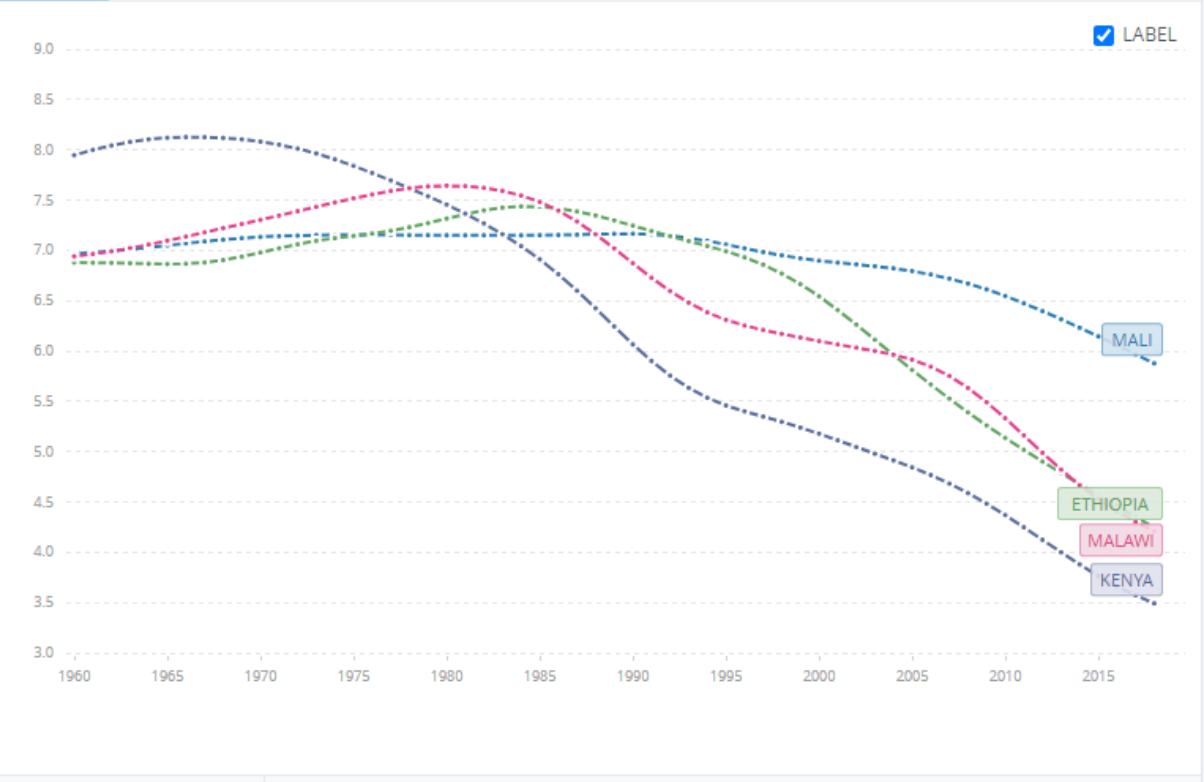
Source: Worldometer 2020

Mali has adopted various policies to address family planning ranging from the French law of July 31, 1920; national family planning policy known as the Malian Association for the Promotion of Family Planning (AMPPF) in 1972; and a community-based program promoting contraceptive use in 1990 (MacQuarrie et al., 2020, p. 1). Mali's age-specific fertility rate (ASFR) per 1000 women for ages 15-19 of 172 is among the highest in Africa (MacQuarrie, Mallick, & Allen, 2017; Power & Madsen, 2019). Furthermore, MacQuerrie and Allen (2017 cited in MacQuarrie et al., 2020, p. 2) argue that "Mali has very early fertility, with the world's highest ASFR of 17 births per 1,000 women age 10-14". The Mali 2018 DHS found that women with secondary or higher education had an average of 4.5 children compared to 6.8 children for women with no education.

3.2 Fertility trends of four countries

The fertility trends of Ethiopia, Kenya, Malawi and Mali have been decreasing over the years between 1960 and 2015 at varying levels. It is evident that these countries have not reached fertility rates that are below replacement level (Figure 9). The fertility rates also vary considerably with women's education as indicated in the DHS datasets and other reports.

Figure 8: Fertility rate, (total births per woman) Mali, Ethiopia, Kenya and Malawi



Source: data.worldbank.org

Several studies have shown that women of reproductive age with secondary school education in the capital city of Ethiopia have below replacement fertility whereas the national TFR is 4.3 children per woman (Canning et al., 2015, p.2). There are other factors that have influenced fertility decline in these countries, such as rural-urban residence and wealth quintile, as illustrated in the DHS data. The different proximate determinants of fertility have played varying roles in fertility trends in these countries.

3.3 Conclusion

Fertility transitions in sub-Saharan Africa indicate progressive decline despite the slow pace as compared to other regions such as Latin America, Carribbean and Asia that have reached

replacement level of 2.2 and below. The literature revealed that the TFR of Ethiopia, Kenya, Malawi and Mali declined between 1950-2020. A large number of authors suggest that the decline is as a result of increase in contraceptive prevalence rate (CPR) among women of reproductive ages in SSA. Other studies claim that higher education of women slows down fertility and helps in changing some of the social norms. A good case study is the Kerala population in India. Amartya Sen (1999) argued that the high level of literacy among Kerala population lowered fertility rate to 1.7 children per woman. This study will discuss the relationship between education attainment and fertility rates in Ethiopia, Kenya, Malawi and Mali in Chapter three.

CHAPTER 4: METHODOLOGY, DATA ANALYSIS & DISCUSSION

4.1 Methodology

The analysis of this study is based on three to four most recent Demographic and Health Surveys (DHS) of four sub-Saharan African (SSA) countries where surveys have been conducted between 2000 and 2018. The DHS samples are nationally representative, cross-sectional household surveys that collect data on a wide range of sociodemographic and health variables (Radovich et al., 2018, p.274; Clark, Koski & Smith-Greenaway, 2017, p. 7). The DHS data for all countries was collected using two-stage cluster sampling methods. I obtained data from dhsprogram.com on completed standard DHS between 2000 and 2018 (Table 3).

Table 3: Demographic and Health Survey countries and years of survey between 2000-2018

Country	Years of Standard DHS
Ethiopia	2000, 2005, 2011, 2016
Kenya	2003, 2008-09, 2014
Malawi	2000, 2004, 2010, 2015-16
Mali	2001, 2006, 2012-13, 2018

4.2 Conceptual framework: The Proximate determinants of fertility model

Summary of Bongaarts model

Bongaarts (1978, 1982) modified Davis and Blake (1956) framework which used 11 'intermediate variables' to analyse fertility and fertility change. Davis and Blake's framework did not include breastfeeding which Bongaarts added and attempted to quantify the intermediate variables that he renamed proximate determinants. Bongaarts summed them up into eight quantifiable factors, namely: "proportion of women married by age, contraceptive use and effectiveness, induced abortion, lactational infecundability, frequency of intercourse, permanent sterility, spontaneous intrauterine mortality and duration of the fertile period" (Bongaarts, 1978, p. 106). The first four factors vary over time and affect fertility immensely whereas the latter four have a lesser impact on fertility levels. Despite criticisms of Bongaarts' simplified model, it has been used by several researchers to analyse the factors affecting fertility. Stover (1998, p. 255) argues that apart from Bongaarts framework, there were other individual-level approaches developed (Hobcraft & Little, 1984; Wood, 1994).

Bongaarts model uses four proximate determinants of fertility to show levels and trends in the total fertility. Each index takes on a value between 0 and 1 to quantify the fertility inhibition. Following from Bongaarts framework, Finley, Mejia-Guevara and Akachi (2017, p. 4) argue that "delayed exposure to sexual activity (Cm), contraceptive use (Cc), abortion (Ca), postpartum infecundability (Ci), and the residual reduce the fertility rate from the biological maximum of 15.3 to the observed rate of 2.1". The four proximate determinants of delayed marriage or delayed sexual activity, contraceptive use, abortion and breastfeeding will reduce the risk of a woman falling pregnant.

Bongaarts (2016 cited in Guengant 2017, p. 21) suggests that Africa's slow demographic transition is a result of low levels of development of multiple SSA countries leading to low contraceptive prevalence rates (CPR), the pronatalist nature of African societies, and low demand for family planning programs. Laelago, Habtu and Yohannes (2019, p. 2) argue that fertility decline in SSA is a result of more unmarried women rather than contraceptive use supporting Bongaarts argument. However, from studies done in Ghana, it was found that contraceptive use, marriage status and postpartum infecundability influenced fertility rates. This indicates that fertility transition in SSA is unique for each country.

Figure 9: Bongaarts framework for analysing proximate determinants of fertility.

Image removed due to copyright restriction.

Source: Bongaarts 1978

a) Index at marriage (Cm)

The index at marriage is intended to demonstrate the reduction in conception due to lack of sexual intercourse during a woman's reproductive period. Substitution of marriage was used during Bongaarts earlier time because data on sexual activity was limited. Stover (1998, p. 256) states that "the index is calculated as the sum of age-specific proportions married, *m(a)*, times age-specific marital fertility rates, *g(a)*, divided by the sum of the age-specific marital fertility rates:"

"C*m* = {S *m(a)* * *g(a)*} / Sg(a)".

Stover (1998, p. 256) further states that use of sexual activity will provide new data on women who are not married but active sexually unlike Bongaarts original model that focused mainly on married women. To avoid confusion due to the variations of time when it comes to sexual activity, Stover suggests "adoption of active in the last month as the best indicator for the proximate determinant model".

b) Index of contraception (Cc)

The main purpose of contraception use is to avoid pregnancy. Bongaarts (cited in Stover, 1998, p. 260; Johnson et al., 2011, p. 6) calculates the index of contraception use as:

"Cc = 1- 1.08 **u* * *e*,

where *u* is total number of married women using contraception; *e* is the average effectiveness of contraception; 1.08 is a sterility correction factor."

Bongaarts (2017, p. 130) argues that the total fertility rate (TFR) ranges between six to seven births per woman in countries with no contraceptive use, whereas countries with approximately 75% contraceptive prevalence rate (CPR) have two births per woman. Hence globally, "contraceptive prevalence increased from 55% in 1990 to 63% in 2010 while unmet need for family planning decreased from 15% in 1990 to 12% in 2010" (DHS, 2014 citing Alkema et al., 2013).

However, Westoff and Bankole (2001, cited in Bongaarts, 2017, p. 130), in analysing DHS data of specific sub-Saharan countries from the 1990s found the cross-sectional fertility-inhibiting effect of CPR deviating from Bongaarts framework. Malawi's 2010 DHS is a good example, where "CPR was 46.1% and the corresponding TFR 5.7 births per woman" (Jain et al., 2014 cited in Bongaarts, 2017, p. 130). Following from the observation of several other

African countries, the authors suggest that contraceptive use is of lesser effect on fertility in SSA in comparison to Asia, Latin America and the Caribbean.

Bongaarts (2017, p. 131) conducted a study to re-examine whether the findings of Westoff and Bankole (2010) depicting a weak link between the TFR and CPR in SSA in comparison to other developing regions sufficed. Errors were found in the DHS survey fertility estimates of multiple countries (Schoumaker, 2014 cited in Bongaarts, 2017, pp. 131-132) due to misreporting of recent birth dates. To address this gap, Bongaarts uses United Nations World Population Prospects TFR estimates "which adjusts when errors are evident and relies on multiple sources of data on fertility" (Gerland, 2014, p. 275).

c) Index of breastfeeding (Ci)

The index of breastfeeding or postpartum infecundability also known as lactation amenorrhea indicates the effects of breastfeeding or abstinence on fertility. "The index is calculated as the average birth interval in the absence of breastfeeding, divided by the average length of the interval when breastfeeding takes place: Ci = 20/ [18.5 + *i*]" (Stover, 1998, p. 257)

where i = average duration of postpartum infecundability.

Bongaarts (1982, cited in Stover, 1998) merged the effects of lactation and postpartum abstinence. Stover points out that "DHS reports on the duration of postpartum abstinence as well as the combined effects of both postpartum abstinence and lactational amenorrhea known as postpartum insusceptibility" (1998, p. 257).

d) Index of induced abortion (Ca)

"The abortion index estimates the number of births averted by an abortion" (Bongaarts, 2015, p. 540). The author's earlier model "estimates that an abortion averts on average $b = 0.4(1 + u)$ births or between 0.4 when no contraception is practiced and 0.8 when all women who have an abortion use contraception". Where u is the proportion of women of reproductive age currently using contraception. The formula for measuring index of abortion is as follows:

$$Ca = \frac{TFR}{TFR + 0.4(1 + u)\,TA}$$

Stover (1998) and Westoff (2008) critiqued this model due to its limitations and improved it. Bongaarts (2015) updated the proximate determinants of fertility model which computes the abortion index as:

$$Ca = \frac{TFR}{(TFR + b * ab(a))}$$

$$TAR = ab(a)$$

$$b = \frac{14}{18.5 + i(a)}$$

where TFR represents the total fertility rate, *b* is the number of births averted by induced abortion, *ab(a)* is the age specific abortion rate, TAR is the total abortion rate, *i* is the average duration of lactational infecundability (months).

"The value of 14 is the mean reproductive duration expected following abortion, 18.5 + *i(a)* is the average reproductive duration expected following live births, and *i*(*a*) represents the mean postpartum infecundity interval" (Bongaarts, 1978, p. 122).

Induced abortion occurs in several sub-Saharan African countries although reliable statistics on the prevalence of induced abortion is often lacking and unreliable (Tariku et al., 2019). I excluded the index of abortion in this study because there is insufficient data in the multiple DHS datasets and the selected countries consider abortion practices illegal.

4.3 Data Analysis

4.3.1 Introduction

This study uses Demographic and Health Survey (DHS) data from four sub-Saharan African countries with recent surveys between 2000-2018 to examine change in fertility for those females aged 15-24 and implication of education on their fertility. The World Health Organisation (WHO, 2018) reported that some countries such as Mali and Niger had over 20% of women giving birth before the age of 16 years. According to Bongaarts, women who begin childbearing at early age are likely to reach the maximum fecundity rate of 15.3. In addition, premarital sex has increased among young people leading to unintended pregnancies, health risks for mother and infant, school dropout and limited livelihood opportunities.

The countries' DHS are as follows: Ethiopia, 2000, 2005, 2011, 2016; Kenya, 2003, 2008-09, 2014; Malawi, 2000, 2004, 2010, 2015-2016; Mali, 2001, 2006, 2012-13, 2018. All DHS data are nationally representative household surveys and use a stratified multistage cluster design.

The study examines the impacts of education on the proximate determinants of fertility of young women of reproductive age as provided in the DHS datasets. According to the 2019 demographic profile, sub-Saharan African population is increasing fast with a youthful population ranging between 19% and 22% and total fertility of 3.42-6.82 (Table 4).

Table 4: 2019 demographic profile of ages 15-24

2019 demographic profile			
Country/variables	**Total population (millions)**	**Percentage of population aged 15-24**	**Total fertility (live births per woman)**
Ethiopia	112.1	21.6	4.15
Kenya	52.6	20.8	3.42
Malawi	18.6	20.9	4.13
Mali	19.7	19.7	5.78
Niger	23.3	19.4	6.82
Nigeria	201.0	19.3	5.32
Tanzania	58.0	19.5	4.83

This study uses the Bongaarts indices of proximate determinants (age at first marriage, index of contraception use and index of breastfeeding) of women aged 15-24 in Ethiopia, Kenya, Malawi and Mali and examines the relationship between fertility and the level of education of women in the reproductive age group, especially for the younger cohort aged 15-24. The level of education is defined according to the number of years completed. It includes: (a) no education, (b) completed primary education (c) completed secondary education, (d) completed higher education.

Bongaarts model of age at first marriage presumes that all fertility takes place within a union or marriage which is not the reality in many countries in sub-Saharan Africa. The median age at marriage for ages 15-19 and 20-24 varies across the four countries. The education level and fertility of these young women is also determined by other factors such as place of residence (urban or rural), wealth quintile of the household the woman comes from, culture and religion which will not be assessed in this paper. The assumption is that women raised or growing up in urban areas are more likely to be more educated than women growing up in a rural area. This is because there are more and better amenities and opportunities in urban areas as compared to rural areas. This study limited its scope to specific variables or indicators.

Total Fertility Rates by different education levels

The metric demographers use to measure the number of children per woman is known as the Total Fertility Rate (TFR). TFR is defined as "the average number of children that would be born to a woman over her lifetime if the woman were to experience the exact current age-specific fertility rates (ASFRs) through her reproductive years" (Roser, 2014, p. 2).

TFR is calculated by totalling the average number of births per woman across five-year age groups of ASFRs. The formula is as follows:

$$TFR = 5 \times \sum(ASFR) = 5 \times \left(\frac{number\ of\ births\ to\ women\ aged\ 15-19}{number\ of\ women\ aged\ 15-19} + \cdots + \frac{number\ of\ births\ to\ women\ aged\ 45-49}{number\ of\ women\ aged\ 45-49}\right)$$

The total fertility rate is a major contributing factor to population growth rate in any country. This study will provide the TFR by different education level in each of the selected countries using the DHS program Statcompiler.

4.4 Ethiopia

4.4.1 Total Fertility Rates by different education levels

Table 5 presents the total fertility rates for women aged 15-49 by education level for four most recent surveys in Ethiopia. The data shows that there is an inverse relationship between TFR and education attainment. TFR declined in all surveys with increase in education levels of the women. The TFR was lowest in 2011 among women with higher education and highest in 2005 among women with no formal education (Table 5).

Table 5: Total Fertility Rate by education level for Ethiopia

Level of education	DHS (2000)	DHS (2005)	DHS (2011)	DHS (2016)
No education	5.9	6.1	5.8	5.7
Primary	4.7	5.1	4.6	4.2
Secondary	3.3	2.0	1.9	2.2
More than Secondary	1.9	1.4	1.3	1.9

Source: The DHS Program Statcompiler

4.4.2 Age at first marriage by education level

The Demographic and Health Survey datasets define "age at first marriage as the age at which the respondent began living with her first spouse/partner". EDHS 2016 indicates that 40% of girls are married under 18 years and 14% before 15 years.

The median age at first marriage for women ages 20-24 is 18.1 years in 2000 and 2005. Data for women with secondary or higher education is omitted because of the small number of married respondents interviewed (Table 6). Women aged 20-24 with primary education were observed to marry at a median age of 20.0 years as compared to 16.5 years for women with no formal education, whereas in EDHS 2000 the median age was 17.4 for women with no formal education and 18.9 for women with primary education. The median age at first marriage increases from 18.9 years in EDHS 2000 to 20.0 in EDHS 2005 among women with primary education. The median age decreases with women with no education from 17.4 years (EDHS 2000) to 16.5 (EDHS 2005). In EDHS 2011 and 2016, median age at first marriage is 16.6 among women aged 20-24. The median age at first marriage of women aged 20-24 with primary education decreases to 18.5 years (EDHS 2016) compared to the other datasets. Education of girls plays a significant role in delaying early marriage. Lack of data for 15-19 years makes it difficult to assess the exact changes in the different EDHS datasets.

Table 6: Median age at first marriage for ages 15-24 in Ethiopia

ETHIOPIA	EDUCATION LEVEL	AGE AT FIRST MARRIAGE Median age at first marriage	
SURVEY		15-19	20-24
2016	**No education**	a	16.6
	Primary	a	18.5
	Secondary	a	a
	More than secondary	a	a
2011	**No education**	a	16.6
	Primary complete	a	19.4
	Secondary	a	a
	More than secondary	a	a
2005	**No education**	a	16.5
	Primary	a	20.0
	Secondary and higher	a	a

ETHIOPIA	EDUCATION LEVEL	AGE AT FIRST MARRIAGE Median age at first marriage	
SURVEY		15-19	20-24
2000	No education	a	17.4
	Primary	a	18.9
	Secondary and higher	a	a

Note: a=Omitted when less than 50 percent of respondents began living with her first spouse/partner
Source: DHS reports

4.4.3 Contraception use by education level

According to EDHS 2016, the contraceptive prevalence rate (CPR) in Ethiopia is 36% for married women of reproductive age 15-49. There are more women using modern methods (33%) which has increased over the past 16 years compared to traditional methods (1%). Table 9 illustrates a substantial variation according to education level in the use of contraception among married women ages 15-49. Contraceptive use increases with level of education as presented in Tables 7, 8 and 9. Sixty-eight percent of women aged 15-49 with secondary or higher education use any method of contraception compared to 22% with no education (EDHS 2011). Similarly, EDHS 2000, 2005 and 2016 show the same pattern. Among adolescents aged 15-24, 57% of married women with higher education in 2011 use modern methods of contraception as compared to 22% with no education (Table 7). Almost 20% of married women aged 15-24 with higher education used traditional methods in 2000 as compared to 1% with no formal education (Table 8). There has been a decline in use of traditional methods of contraception between 2000 and 2016.

Table 7: Married women currently using any modern method of contraception in Ethiopia

Ethiopia		Age (5-year groups)		Education			
Survey	TOTAL	15-19	20-24	No education	Primary	Secondary	Higher
2016 DHS	35.3	31.8	38.5	30.9	39.0	50.6	50.7
2011 DHS	27.3	23.0	33.4	21.8	33.7	53.4	57.2
2005 DHS	13.9	8.6	15.4	9.8	21.9	46.5	42.6
2000 DHS	6.3	3.0	5.4	3.7	13.2	31.4	47.0

Source: The DHS Program STATcompiler

Table 8: Married women currently using traditional or folk method of contraception in Ethiopia

Ethiopia							
Survey	***TOTAL***	***15-19***	***20-24***	***No education***	***Primary***	***Secondary***	***Higher***
2016 DHS	0.6	0.1	0.3	0.3	0.6	1.8	4.3
2011 DHS	1.3	0.8	1.4	0.4	2.0	4.1	10.6
2005 DHS	0.8	0.3	1.3	0.2	1.5	5.8	12.2
2000 DHS	1.7	0.8	2.0	0.9	3.2	10.9	18.9

Source: The DHS Program STAT compiler

4.4.4 Breastfeeding by education level

Postpartum amenorrhea is the period between childbirth and return of menstruation and is influenced by the length and intensity of breastfeeding. Women who are not exposed to the risk of pregnancy after birth are considered insusceptible. Table 9 shows that women aged 15-49 with no education have a longer duration of amenorrhea in 2000 (20 months) as compared to 2005 and 2011 (16 months). According to EDHS 2000, women under the age of 30 years are insusceptible for a shorter period (19 months) as compared to women above 30 years (21 months). This is due to a shorter duration of amenorrhoea. The survey also shows that women with primary, secondary and higher education have a lower duration of amenorrhoea in contrast to women with no formal education.

Table 9: Proximate determinants of fertility of women in Ethiopia (2016, 2011, 2005, 2000)

COUNTRY/DHS YEAR/VARIABLES	CONTRACEPTION USE Percentage distribution of currently married women age 15-49 by contraceptive method and education level			BREASTFEEDING Median duration of postpartum by months	
	Any method	Modern method	Traditional method	Amenorrhoea	Insusceptibility
ETHIOPIA					
2016					
No education	31.2	30.9	0.3	16.0	16.8
Primary	39.6	39.0	0.6	12.9	14.6
Secondary	52.4	50.6	1.8	6.4	7.2
More than secondary	55.0	50.7	4.3	(4.9)	(6.3)
2011					
No education	22.2	21.8	0.4	17.2	17.6
Primary	35.7	33.7	2.0	12.0	12.8
Secondary	57.6	53.4	4.1	3.8	5.3
More than secondary	67.8	57.2	10.6		8.3
2005					
No education	10.0	9.8	0.2	16.2	18.1
Primary	23.4	21.9	1.5	14.2	15.3
Secondary and higher	52.6	45.9	6.7	10.3	10.4
2000					
No education	4.6	3.7	0.9	19.9	20.4
Primary	16.4	13.2	3.2	15.5	16.1
Secondary and higher	44.8	33.0	11.7	8.4	12.2

Source: DHS reports

4.5 Kenya

4.5.1 Total Fertility Rate (TFR) by different education levels

Table 10 presents the TFR for the three years preceding the survey for age group 15-49 in Kenya using DHS Program Statcompiler. The TFR has been relatively similar in the three

4atasets among women with higher education, secondary education and no formal education. The TFR is lower in 2014 (4.4) as compared to 2008-09 (5.2) and 2003 (5.5) among women with primary education. The difference in TFR between women with higher education and women with no education is more than double suggesting that education plays a significant role in reducing TFR.

Table 10: Total Fertility Rate 15-49 for Kenya

Level of education	DHS (2003) TFR (Total Fertility Rate)	DHS (2008-09) TFR (Total Fertility Rate)	DHS (2014) TFR (Total Fertility Rate
No education	6.7	6.7	6.5
Primary	5.5	5.2	4.4
Secondary	3.4	3.3	3.1
Higher	2.4	2.5	2.4

Source: The DHS Program Statcompiler

4.5.2 Age at first marriage for ages 15-24 by education level

Most African communities' associate marriage with childbearing and is considered socially acceptable. Studies have shown that women who marry early are exposed to a lengthy period of pregnancy over their childbearing years with more children born in their reproductive years. Women who have their first child earlier and give birth to more children contribute more to fertility rates. KDHS 2014 shows that 23% of girls are married under 18 years and 4% before 15 years.

Table 11 presents median age at first marriage for women aged 15-24 taken from three data surveys in Kenya. DHS data for ages 15-19 is omitted because the percentage of women married for the first time at this age is below 50%. The median age at first marriage of women aged 20-24 with primary school education declines progressively from 19.6 years (KDHS 2000) to 19.0 years (KDHS 2014). The median age at first marriage of women with no formal education is lowest in KDHS 2008-09 at 16.4 years as compared to 17.5 (KDHS 2003) and 17.0 (KDHS 2014). However, the limited data from the published DHS reports especially for women aged 15-19 will not provide substantive conclusion of the role of education on age at first marriage. This requires further research into other credible documents to understand the fertility trends among adolescents.

Table 11: Median age at first marriage for women ages 15-24 in Kenya

KENYA	EDUCATION LEVEL	AGE AT FIRST MARRIAGE Median age at first marriage	
SURVEY		15-19	20-24
2014	No education	a	17.0
	Primary	a	19.0
	Secondary	a	a
2008-09	No education	a	16.4
	Primary complete	a	19.2
	Secondary	a	a
2003	No education	a	17.5
	Primary	a	19.6
	Secondary	a	a

Note: a = Omitted because less than 50 percent of the women married for the first time before reaching the beginning of the age group

4.5.3 Contraceptive use by education level

According to KDHS 2014, the use of any contraceptive method is higher among sexually active single women (65%) compared to 58% of married women. The CPR for Kenya is 39% in 2003 and increased in 2008-09. The KDHS 2014 presented in Table 14 data shows that more women with secondary or higher education (65%) aged 15-49 use any method of contraception as compared to women with no education (18%). Six percent of women with secondary education use any traditional method as compared to 2% with no education. The percentage of women with secondary or higher education using traditional methods of contraception has been decreasing steadily as shown in KDHS 2003 (10%) to 6% in KDHS 2014.

Among ages 15-24, use of any modern contraception is lowest with married women having no formal education (8%) in contrast to women with higher education (62%) [Table 12]. According to KDHS 2014, there were more women with secondary education (60%) using modern contraception as compared to KDHS 2003 (49%). Table 13 shows that there are more women with higher education (15%) using traditional or folk method of contraception in contrast to women with no formal education (4%). I would suggest that categorizing these methods as 'traditional' is problematic because it refers to a method used in earlier years and likely to be discarded and replaced with modern contraceptives and may include withdrawal for example. This is not the case as revealed in a study conducted in southern Cameroon where periodic abstinence accounted for 55% of contraceptive use among both educated and less

educated because the women perceived it as 'modern' as compared to modern contraceptives which they saw as 'less-than modern' (Johnson-Hanks, 2004, p. 230).

Table 12: Married women currently using any modern method of contraception in Kenya

Kenya		Age (5-year groups)		Education			
Survey	**TOTAL**	**15-19**	**20-24**	**No education**	**Primary**	**Secondary**	**Higher**
2014 DHS	53.2	36.8	49.8	15.3	55.7	60.2	55.9
2008-09 DHS	39.4	19.6	30.4	12.0	38.3	51.5	54.3
2003 DHS	31.5	12.7	22.4	8.0	28.8	48.8	62.4

Source: STATcompiler The DHS Program

Table 13: Married women currently using any traditional or folk method of contraception in Kenya

Kenya		Age (5-year group)		Education			
Survey	***TOTAL***	***15-19***	***20-24***	***No education***	***Primary***	***Secondary***	***Higher***
2014 DHS	4.8	3.4	3.7	2.4	4.1	5.7	8.1
2008-09 DHS	6.0	2.9	5.2	2.1	5.9	7.5	8.5
2003 DHS	7.8	3.7	5.4	4.0	7.7	8.9	14.7

Source: STATcompiler The DHS Program

4.5.4 Breastfeeding by education level

The length and intensity of breastfeeding offers protection from conception. Table 14 shows that women with no formal education breastfeed longer in contrast to women with primary or secondary education. The median duration of amenorrhoea and insusceptibility decreases as education levels increase throughout the three surveys.

Table 14: Proximate determinants of fertility of women in Kenya (2014, 2008-09, 2003)

COUNTRY/DHS YEAR/VARIABLES	CONTRACEPTION USE Percentage distribution of currently married women age 15-49 by contraceptive method and education level			BREASTFEEDING Median duration of postpartum by months	
	Any method	Modern method	Traditional method	Amenorrhoea	Insusceptibility
KENYA					
2014					
No education	17.7	15.3	2.4	10.7	12.0
Primary incomplete	54.6	51.1	3.4	9.6	11.1
Primary complete	64.3	59.6	4.7	5.5	6.9
Secondary+	65.3	59.0	6.3	4.3	5.4
2008-09					
No education	14.1	12.0	2.1	12.1	12.9
Primary incomplete	40.3	34.8	5.4	10.3	11.5
Primary complete	48.2	41.8	6.4	9.3	10.2
Secondary+	59.8	52.1	7.7	6.3	8.8
2003					
No education	12.0	8.0	4.0	14.9	16.6
Primary incomplete	30.2	23.1	7.1	10.2	12.8
Primary complete	44.2	35.7	8.5	8.5	10.2
Secondary+	61.8	51.7	10.1	7.9	9.1

Source: DHS datasets

4.6 Malawi

4.6.1 Total fertility rate by education level

The total fertility rate (TFR) for the three years preceding the survey for age group 15-49 expressed per woman is highest among women with no formal education in published MDHS 2000 (7.3) as presented in Table 15. TFR decreases to an average of 2.1 among women with

higher education in published MDHS 2004, 2010 and 2015-16. Women with primary education have a relatively high fertility rate as compared to women with secondary education.

Table 15: Total Fertility Rate (TFR) 15-49 by education in Malawi

Level of education	DHS (2000) TFR (Total Fertility Rate)	DHS (2004) TFR (Total Fertility Rate)	DHS (2010) TFR (Total Fertility Rate	DHS (2015-16) TFR (Total Fertility Rate
No education	7.3	6.8	6.9	5.5
Primary	6.4	6.2	5.9	4.8
Secondary	3.1	3.9	3.8	3.3
Higher	-	2.0	2.1	2.3

Source: The DHS program Statcompiler

4.6.2 Age at first marriage by education level

According to MDHS 2015-16, 42% of girls are married before 18 years and approximately a tenth is married under 15 years. This practice of early marriage influences fertility and population growth rates in the country. The median age at first marriage for women aged 20-24 has remained constant at 18 years for the four DHS datasets. Table 16 presents a relatively similar median age at first marriage for women with no education, and primary education whereas women with secondary and higher education in 2000 had a median age of 20. Primary education does not play a significant role in the median age at first marriage of women aged 20-24 as compared to secondary and higher education.

Table 16: Median age at first marriage for women ages 15-24 by education level

MALAWI	EDUCATION LEVEL	AGE AT FIRST MARRIAGE Median age at first marriage	
SURVEY		15-19	20-24
2015-16	**No education**	a	17.1
	Primary	a	17.6
	Secondary	a	a
	More than secondary	a	a
2010	**No education**	a	16.9
	Primary	a	17.4
	Secondary	a	a
	More than secondary	a	a
2004	**No education**	a	16.6

MALAWI	EDUCATION LEVEL	AGE AT FIRST MARRIAGE Median age at first marriage	
SURVEY		15-19	20-24
	Primary 1-4	a	17.2
	Primary 5-8	a	17.7
	Secondary and higher	a	A
2000	No education	a	17.0
	Primary 1-4	a	17.6
	Primary 5-8	a	18.2
	Secondary and higher	a	20+a

a Less than 50 percent of respondents have been married by age 20. Median is at least 20 years.
a = Omitted because less than 50 percent of respondents married for the first time before reaching the beginning of the age group

4.6.3 Contraception use by education level

The MDHS report states that modern contraceptive use by married women of reproductive age 15-49 has increased from 7% in 1992 to 58% in 2015-16. The CPR among currently married women aged 15-49 as of 2015-16 is 59%. The current use of contraception by women with no formal education is 55% as compared to 59% with more than secondary education. A higher percentage of women with more than secondary education are using any traditional method of contraception (8%) (including withdrawal) as compared to women with no formal education (3%) as shown in Table 19. This data shows that level of education does not affect fertility that much.

Married women ages 15-24 using any method of contraception is relatively similar in 2015-16 among all education levels including those with no formal education (Table 17). The percentage of women using a traditional or folk method of contraception increased significantly among women with higher education in 2018 (8 percent) but declined in 2015-16 (3.2 percent) as presented in Table 18. How do you explain these data?

Table 17: Married women currently using any modern method of contraception in Malawi

Malawi				Education			
Survey	TOTAL	15-19	20-24	No education	Primary	Secondary	Higher
2015-16 DHS	58.1	37.5	54.8	53.7	59.0	58.7	55.3
2010 DHS	42.2	26.4	38.0	37.1	42.1	48.4	49.0

Malawi				Education			
Survey	**TOTAL**	**15-19**	**20-24**	**No education**	**Primary**	**Secondary**	**Higher**
2004 DHS	28.1	16.6	25.4	22.9	28.0	40.7	49.2
2000 DHS	26.1	12.9	22.7	21.7	26.5	41.6	-

Source: STATcompiler The DHS Program

Table 18: Married women currently using any traditional or folk method of contraception in Malawi

Malawi		Age (5-year group)		Education			
Survey	***TOTAL***	***15-19***	***20-24***	**No education**	**Primary**	**Secondary**	**Higher**
2015-16 DHS	1.1	0.6	0.8	1.0	1.0	1.2	3.2
2010 DHS	3.9	2.4	3.8	3.1	3.9	4.4	8.2
2004 DHS	4.3	2.3	3.7	4.0	4.7	3.1	3.4
2000 DHS	4.5	2.3	3.6	4.2	4.8	3.5	-

Source: STATcompiler The DHS Program

4.6.4 Breastfeeding by education level

The median duration of amenorrhoea and insusceptibility has been declining over the years. The four surveys (Table 19) show relatively similar trends of higher duration of postpartum amenorrhoea and insusceptibility from 2000 (14.4 and 16.7 months respectively) to 2015-16 (13.3 and 14.7 months respectively) of women with no formal education as compared to those with more than secondary education (9.1 and 13.1 months). The median duration of postpartum amenorrhoea and insusceptibility is 10.7 and 12. 7 months for those with primary education in 2004 and 2015-16 respectively. These findings show that a woman's education level affects breastfeeding. For instance, in 2010, women with more than secondary education (5.1 months)

had a shorter postpartum amenorrhoea as compared to women with no formal education (12.3 months).

Table 19: Proximate determinants of fertility of women in Malawi (2015-16, 2010, 2004, 2000)

COUNTRY/DHS YEAR/VARIABLES	CONTRACEPTION USE Percentage distribution of currently married women age 15-49 by contraceptive method and education level			BREASTFEEDING Median duration of postpartum by months	
	Any method	Modern method	Traditional method	Amenorrhoea	Insusceptibility
MALAWI					
2015-16					
No education	54.6	53.7	1.0	13.3	14.7
Primary	60.1	59.0	1.0	10.7	12.7
Secondary	59.9	58.7	1.2	6.1	9.6
More than secondary	58.6	55.3	3.2	*	(4.8)
2010					
No education	40.3	37.1	3.1	12.3	13.7
Primary	46.0	42.1	3.9	10.7	12.8
Secondary	52.8	48.4	4.4	8.4	9.8
More than secondary	57.3	49.0	8.2	5.1	6.1
2004					
No education	27.0	23.1	2.2	14.0	15.2
Primary 1-4	29.4	25.5	1.4	12.2	12.8
Primary 5-8	35.4	30.0	1.9	11.3	12.4
Secondary & higher	44.2	41.0	0.7	8.3	9.7
2000					
No education	26.0	21.7	4.2	14.4	16.7
Primary 1-4	28.1	23.6	4.5	12.7	14.4
Primary 5-8	34.7	29.5	5.2	11.5	13.9
Secondary and higher	45.1	41.6	3.5	9.1	13.1

Note: An asterisk indicates that a figure is based on fewer than 25 unweighted cases and has been suppressed.

4.7 Mali

4.7.1 Total Fertility Rate by education level

According to the EDSM 2018 report, 54% of girls under 18 years and 16% below 15 years are married increasing Mali's prevalence rate of child marriage. Statistics reveal that fertility rate per woman is higher in low-income countries where children are expected to work at earlier ages and contribute to the family needs as compared to high income countries (Statista Research Department, 2015). Mali's TFR is highest among women with no education ranging between 6.5 and 7.1 in the four data surveys. The TFR is lowest in 2006 (2.9) among women wit7 higher education and relatively similar in all datasets among women with secondary and primary education respectively (Table 20).

Table 20: Total Fertility Rate by education level in Mali

Level of education	DHS (2001) TFR (Total Fertility Rate)	DHS (2006) TFR (Total Fertility Rate)	DHS (2012-13) TFR (Total Fertility Rate	DHS (2018) TFR (Total Fertility Rate
No education	7.1	7.0	6.5	6.8
Primary	6.6	6.3	5.9	5.9
Secondary	4.3	4.0	4.0	4.7
Higher	3.2	2.9	3.7	3.6

Source: The DHS Program Statcompiler

4.7.2 Age at first marriage by education level

The median age at first marriage is 16.7 years (EDSM 2001 & 2006) for ages 20-24 for women with primary education whereas for women with no formal education it is 16.2 years (Table 21). The median age at first marriage for women with primary education increases to 17.3 years (EDSM 2012-13, 2018). It also increases for women with no formal education to 16.5 and 17.0 respectively. There is an increase in median age for women with secondary education to 18.9 years (EDSM 2006) indicating an inverse relationship between education and age at first marriage.

There is no data provided for women aged 15-19 because of the small number of respondents interviewed. Early marriage is associated with early childbearing and multiple health risks to mother and child.

Table 21: Median age at first marriage for women ages 15-24 in Mali

MALI	EDUCATION LEVEL	AGE AT FIRST MARRIAGE Median age at first marriage	
SURVEY		15-19	20-24
2018	No education	a	17.0
	Primary	a	17.3
	Secondary and higher	a	19.7
2012-13	No education	a	16.5
	Primary	a	17.3
	Secondary and higher	a	a
2006	No education	a	16.2
	Primary	a	16.7
	Secondary and higher	a	18.9
2001	No education	a	16.3
	Primary	a	16.7
	Secondary and higher	a	a

a = Omitted because less than 50 percent of respondents married for the first time before reaching the beginning of the age group
Source: DHS datasets

4.7.3 Contraception use by education level

According to the most recent survey in Mali (EDSM 2018), 30% of women with secondary and higher education use any method of contraception as compared to 14% with no education (Table 24). Similarly, a higher percentage of women with secondary and higher education use traditional methods of contraception (including withdrawal). The contraceptive prevalence rate is very low in Mali as compared to Ethiopia, Kenya and Malawi. Modern contraceptive use among women with secondary or higher education in EDSM 2001 is 33% and slightly decreases in EDSM 2006 (26%) and picks up again in EDSM 2012-13 (27%) and EDSM 2018 (29%). The DHS report does not explain the findings of why there is little change in the indicators for consecutive years.

The percentage of married women ages 15-24 using any modern contraceptive ranges between 32% and 36% among women with higher education for the four surveys (Table 22). Women with no formal education using any modern contraceptive is lower than all the other levels of education. According to MDHS 2006, 13% of women with higher education were using traditional or folk method of contraception as compared to 1% with no formal education (Table 23). This confirms that contraceptive use increases with level of education.

Table 22: Married women currently using any modern method of contraception in Mali

Mali		Age (5 year-group)		Education			
Survey	**TOTAL**	**15-19**	**20-24**	**No education**	**Primary**	**Secondary**	**Higher**
2018 DHS	16.4	9.2	16.7	13.6	17.7	27.9	35.7
2012-13 DHS	9.9	6.5	10.0	7.8	12.9	25.6	36.1
2006 DHS	6.9	5.8	7.4	4.8	11.8	22.2	31.5
2001 DHS	5.7	3.6	5.2	4.0	10.1	24.4	36.4

Source: STATcompiler The DHS Program

Table 23: Married women currently using any traditional or folk method of contraception in Mali

Mali		Age (5 year-group)		Education			
Survey	**TOTAL**	**15-19**	**20-24**	**No education**	**Primary**	**Secondary**	**Higher**
2018 DHS	0.8	1.0	0.8	0.8	0.7	0.9	3.2
2012-13 DHS	0.4	0.2	0.2	0.4	0.5	0.3	2.1
2006 DHS	1.4	1.9	1.7	0.8	2.3	5.5	13.0
2001 DHS	2.3	1.3	1.9	1.9	3.0	7.9	4.1

Source: STATcompiler The DHS Program

4.7.4 Breastfeeding by education level

Table 24 presents the median duration of postpartum amenorrhoea as shorter among women with secondary or higher education in 2001 (4.4 months). It increases slightly in 2006 (6.8 months) but declines steadily in 2012-12 (5.8 months) and 2018 (5.0 months). The length of

postpartum amenorrhoea and insusceptibility declines with increase in the level of education of a woman. Postpartum insusceptibility is lowest in 2018 (6.7 months) among women with secondary or higher education. Hence, it is evident that higher female education affects traditional practices such as breastfeeding and abstinence.

Table 24: Proximate determinants of fertility in Mali (2018, 2012-13, 2006, 2001)

COUNTRY/DHS YEAR/VARIABLES	CONTRACEPTION USE Percentage distribution of currently married women age 15-49 by contraceptive method and education level			BREASTFEEDING Median duration of postpartum by months	
	Any method	Modern method	Traditional method	Amenorrhoea	Insusceptibility
MALI					
2018					
No education	14.4	13.6	0.8	10.3	11.3
Primary	18.4	17.7	0.7	10.5	11.0
Secondary & higher	29.8	28.7	1.2	5.0	6.7
2012-13					
No education	8.1	7.8	0.4	11.6	12.0
Primary	13.4	12.9	0.5	9.6	10.4
Secondary & higher	27.5	26.5	1.0	5.8	6.9
2006					
No education	5.6	4.8	0.8	11.1	12.0
Primary	14.1	11.8	2.3	9.5	9.8
Secondary & higher	29.0	22.9	6.1	6.8	9.3
2001					
No education	5.9	4.0	1.9	12.0	13.1
Primary	13.1	10.1	3.0	11.9	12.7
Secondary & higher	33.1	25.6	7.5	4.4	9.0

4.8 Summary

The United Nations points out that traditional methods of contraception are commonly used among married women of reproductive age in Middle Africa (57%), Western Africa (29%) and Western Asia (33%) despite their low levels of effectiveness. There is minimal research in this

area probably due to low levels of effectiveness as compared to use of modern contraceptives. Moreover, fertility declines in most Western countries prior to modern contraception uptake was attributed to induced abortion, abstinence and use of traditional methods of contraception. Sub-Saharan Africa is no exception to this pattern though in the recent years, there has been an increase in modern contraceptive use among women of different education levels.

The findings indicate that a higher percentage of women of secondary and higher levels of education use both modern and traditional methods of contraception as compared to women with no formal education. However, there is a decline in breastfeeding among women of higher levels of education in contrast to women with no formal education in Ethiopia, Kenya, Malawi and Mali.

4.9 DISCUSSION

4.9.1 Introduction

The purpose of this study is to investigate the impact of education on proximate determinants of fertility for women aged 15-24 in four sub-Saharan African countries using DHS reports between 2000 and 2018. The study uses the Bongaarts model as the conceptual framework for analysis which assisted in understanding fertility trends in the four countries. Using published country-level data from 15 DHS reports in four countries in SSA, the Bongaarts proximate determinants of fertility showed how the different indices (age at first marriage, index of contraception use and index of breastfeeding) are impacted by education attainment in the four countries. I excluded the index of abortion in this study due to lack of adequate data in the selected countries. The analysis also examined the association of TFR of the selected countries by education level. Among all the selected countries TFR decreases with longer average education for females supporting previous studies (Bongaarts, Mensch & Blanc, 2016; Lloyd & Mensch, 2008).

4.9.2 Proximate determinants of fertility by education

A large number of studies show that sub-Saharan Africa median age at first marriage of women globally is 21.1 years as compared to Asia (22.6 years) and Latin America (26.4 years). Hertrich (2016, p. 26) points out that the pronatalist nature of the society is a factor behind early marriage of girls leading to nuptiality (marriage) patterns that are the lowest globally. Culture plays a significant role in encouraging early marriage of young girls in Ethiopia, Kenya, Malawi and Mali disrupting female education attainment. Several studies have shown that education of women delays the onset of childbearing and lowers fertility outcomes. Lutz

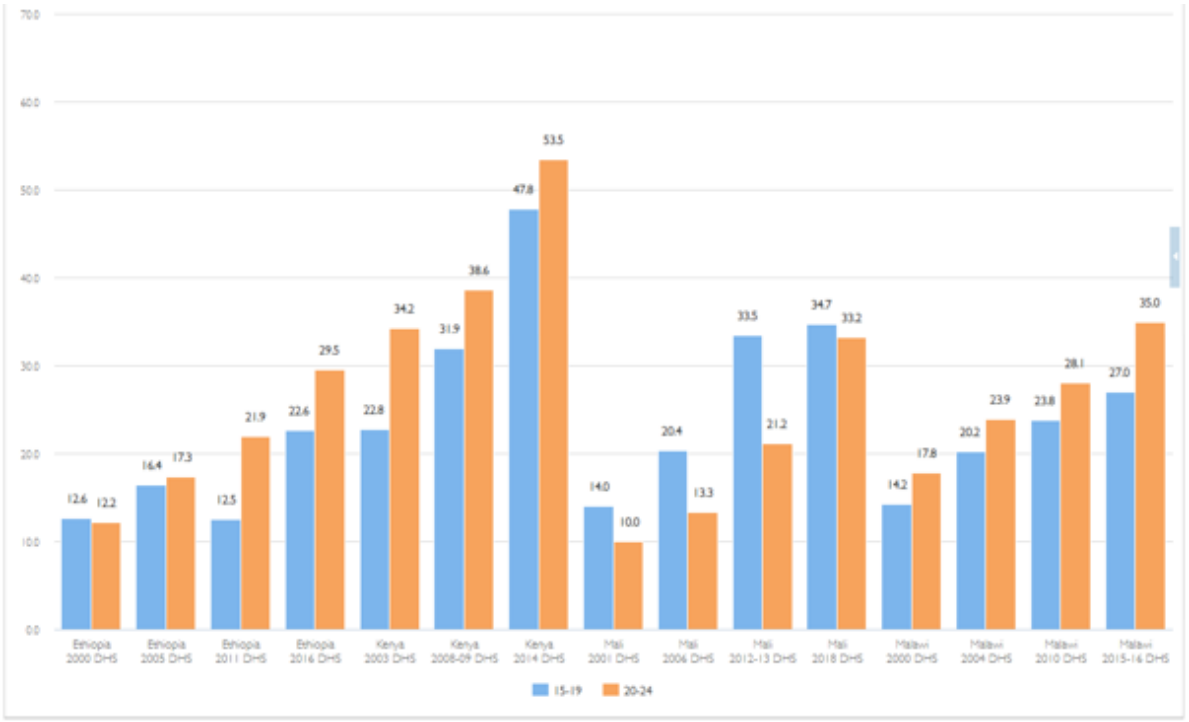
and Skirbekk (2014, p. 15) point out that "educational attainment is the single most important source of empirically observable heterogeneity next to age and sex". These studies do not take into consideration other variables such as abilities, motivation and preferences that may affect the number of children a woman decides to have. These factors need to be considered concurrently with each countries social, economic and cultural context as they will impact the proximate determinants.

Comparing fertility trends across the selected countries using DHS datasets shows that there is a correlation between education attainment and fertility levels. Findings from the study, indicate that the median age at first marriage of women with more than eight or more years of education in the selected countries increased as compared to women with no formal education. As mentioned earlier, child brides are present in these four countries and unwanted pregnancies are higher among teenagers and less educated women. Programmatic interventions to address this challenge should be a priority to help reduce fertility levels among young women and encourage them to complete their education.

The findings revealed a decline in duration of breastfeeding among the women aged 15-24 years with secondary and higher education. Studies have shown that optimal breastfeeding slows down fertility levels in women of reproductive age (Labbok, 2008; Rogers & Stephenson, 2018). Several African societies practiced exclusive breastfeeding before modern contraceptives were introduced to them. The different countries (Ethiopia, Kenya, Malawi and Mali) need to consider designing programmes that educate and support exclusive breastfeeding among women of reproductive age ages 15-24 years to reduce fertility levels.

Murtin (2013 cited in Bongaarts, 2019) concludes that the "average years of primary schooling among the adult population, rather than income standards, child mortality, or total mortality rates, drive fertility down by about 40% to 80% when those years grow from zero (no illiteracy) to 6 years (full literacy)". In the four sub-Saharan African countries in this study, universal primary education has played a significant role in school enrolment. Transition of girls from primary to secondary school reduces due to multiple factors such as pregnancy, poverty, religious and cultural beliefs. Figure 10 presents the percentage of women aged 15-24 years with secondary or higher education in Ethiopia, Kenya, Malawi and Mali. There is a variation across the countries DHS datasets with Mali having a higher proportion of females aged 15-19 educated in contrast to those aged 20-24.

Figure 10: Percentage of women with secondary or higher education aged 15-24 in Ethiopia, Kenya, Mali and Malawi



Source: DHS Program Statcompiler

4.9.3 Strengths and limitations

This study utilised DHS datasets that are based on a nationally representative sample survey of women of reproductive age (15-49) and men age 15-59 or 15-54. The surveys are conducted 3 years prior to the survey which may not represent the current population in that specific region. The main focus of this study is women of reproductive age 15-24 in four countries in sub-Saharan Africa. The study did not address sexually active women outside marriage or union who also impact fertility rates in the selected countries.

Fabic, Choi and Bird (2015) state that the DHS Program collects objective and self-reported data files that follow a standardised format that are comparable across countries. This approach was very useful for analysing the four countries. This study relied on recall data from survey respondents which some studies found to have unexpected biases or adolescents providing inaccurate information about their age (Neal & Hosegood, 2015). Availability of inadequate data in the DHS datasets for women aged 15-19 affected the study in specific areas.

4.9.4 Summary

This research showed that women with lower social status and fewer opportunities for education are more likely to experience higher fertility as it influences the age at marriage and use of modern contraception. From the findings of the four countries, TFR was higher among

women with limited formal education levels than those with secondary education. It is also notable that education can have varying effects on fertility in different countries. Hence it is important to understand how the impact of education on fertility can vary in differential socio-economic or cultural set up and also what other factors influence fertility rates of young people in each country.

CHAPTER 5: CONCLUSION AND POLICY IMPLICATIONS

5.1 Conclusion

This study examined the relationship between the proximate determinants of fertility of women aged 15-24 and the role of education. According to the United Nations (2004 cited in Kravdal, 2012, p. 646), multiple studies have indicated "an inverse relationship between a woman's education and her fertility". Hence, the higher the educational attainment of a woman, the fewer children she is likely to bear. However, there are multiple other factors that contribute towards fertility reduction which are not discussed in this study.

The analysis suggests that proximate determinants of fertility (age at first marriage, contraceptive use and breastfeeding) have a relationship with education attainment although this varies across the selected countries. Examining the fertility trends of women aged 15-24 is crucial because early childbearing lengthens the reproductive period and affects socioeconomic variables such as educational attainment and career aspirations. This further exacerbates the health of both mother and child. Ethiopia, Kenya, Malawi and Mali have shown steady decline in fertility rates but experience a rapid increase in population growth.

The study shows the median age at first marriage of women of childbearing age 20-24 increases incrementally among women with no education, primary education, secondary and higher education in Ethiopia, Mali, Malawi and Kenya. Most data for ages 15-19 was omitted because of the small number of married respondents interviewed, however, several studies have indicated high cases of child marriages in many sub-Saharan African countries.

The index of contraception (Cc) increases with level of education of women ages 15-24 in Ethiopia, Kenya and Mali. More emphasis is placed on modern contraception with minimal reporting on traditional or folk methods of contraception. However, Malawi has almost similar percentages of women in all categories indicating that education plays a minimal role in modern contraceptive uptake.

Postpartum infecundability (Ci) or breastfeeding declines with education level in the selected countries. The mean duration of breastfeeding is lower among women with secondary or higher education as compared to women with no formal education in the four countries.

5.2 Policy recommendations

The United Nations estimates sub-Saharan Africa's total fertility rate as 4.7 children per woman in 2015-2020 with a lower rate of contraceptive use than globally. The region has a young age structure and the population is projected to reach 2.1 billion by 2050 (UN population). Multiple policies and programs to reduce fertility are available in the selected countries although implementation has been a challenge to achieve desired results. Based on the analysis provided in this thesis, I recommend the following policy measures to address some of these gaps:

Provide access to quality education

Several countries in SSA provide free primary education. However, there is a considerable proportion of children who remain out of school and lack quality education. The World Health Organisation (WHO, 2018) reported that some countries such as Mali and Niger, had over 20% of women giving birth before the age of 16 years. Fertility rates are higher where women have limited access to quality education as shown in the selected countries. Programs and policies should encourage parents and guardians to push for quality education for their children and discourage early marriages. Continuous improvement of access to affordable and quality education for girls and young women aged 15-24 is important to enable them to enrol more in secondary and higher levels of education.

Invest in sexual and reproductive health.

Unwanted pregnancies among young women are high among adolescents in SSA. Family planning programs targeting ages 15-24 in some of the selected countries are weak or non-existent, discouraging contraceptive use. The various stakeholders need to review the existing policies and programs on contraceptive use and design youth friendly programs to reach this target group. More emphasis should be put on women with little or no formal education.

Address the prevalence of unwanted pregnancies among women aged 15-24

Young people in SSA experience barriers to accessing quality health care such as accessibility, cost, method failure, discontinuation, confidentiality concerns and lack of knowledge. Unintended pregnancies are higher in SSA culminating to mental illness, unsafe abortions and mortality (Abajobir et al. 2016). Each country needs to invest in high quality family planning care for young women and work in collaboration with relevant stakeholders.

Adopt policies to increase breastfeeding

The decline in breastfeeding among educated women as shown in the four countries raises challenges for the newborn child. The World Health Organisation (WHO) recommends exclusive breastfeeding among childbearing women for at least six months. Young mothers need to be encouraged to breastfeed their children in the formative months. This is beneficial for the child and mother's health and also acts as a natural method of family planning reducing fertility levels if used according to the guidelines (Rogers & Stephenson, 2018). The government and healthcare services need to educate young mothers on the importance of breastfeeding and organise follow-up meetings to understand the challenges the women face.

Strengthen partnerships with donors

The majority of family planning activities are donor funded. As much as I did not discuss the role of donors in this study, they play an important role in supporting family planning programmes of adolescents and young people. Lack of trust by some governments of Western organisations that advocate for family planning stalls these programs. Open discussions and collaboration between donors, government and the community is important for the success of the initiatives.

Summary

The slow pace of fertility decline in sub-Saharan Africa has aroused interest amongst researchers and policymakers. As much as several studies have been conducted, there are still questions to be answered such as why is the situation in Africa exceptional compared to other regions of the world? How do we address the youth bulge and unwanted pregnancies? How do we provide quality education that addresses fertility and other important aspects of life? This study was not able to answer all the questions, but it confirmed the positive effects of education of women aged 15-24 in reducing fertility rates in Ethiopia, Kenya, Malawi and Mali although the effect of education at different levels on modern contraception use was insignificant in Malawi. In case of Malawi the difference in level of education of women aged 15-24 did not appear to have differential impact on use of modern contraception. This does not necessarily mean that the level of education may not make any considerable impact on expected direction. It is important to have a set of policies which will not treat women's education in isolation as an enabling factor for fertility reduction, but as a factor integrated to other socio-economic goals such as enhancing women's employment as well as improving women and child health.

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