EFFECTS OF CONTRACEPTIVE USE, PRENATAL VISITS, AND FACILITY DELIVERY ON MATERNAL MORTALITY IN KENYA, UGANDA AND TANZANIA

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DECLARATION

This research project is my original work and has not been presented for a degree in any other university or any other award.

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DEDICATION

This research project is dedicated to Mercy Maina, my dear wife, and Mr. and Mrs. Gachuru, my parents, for their untiring support and relentless encouragement.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS AND ACRONYMS

ANC	Antenatal Care Attendance
CDoHs	County Departments of Health
DFE	Dynamic Fixed Effect
DH	Delivery at health facility
EAC	East African Community
FANC	Focused Antenatal Coverage
GDP	Gross Domestic Product
GNP	Gross National Product
MDGs	Millennium Development Goals
MG	Mean group
MHC	Maternal and Child Health
NHIF	National Health Insurance Fund
PBF	Performance Based Financing
PMG	Pooled Mean Group
SDGs	Sustainable Development Goals
TDHS	Tanzania Demographic and Demographic Survey
TFR	Total Fertility Rate

UBOS	Uganda Bureau of Statistics
UNICEF	United Nations International Children's Emergency Fund
WHO	World Health Organisation

OPERATIONAL DEFINITION OF KEY TERMS

Contraceptive Prevalence Rate	The proportion of women between the age of 15-49 using at least one contraceptive method.
Unmet Need for Contraception	The percentage of women of reproductive of age who desire to delay child bearing and cannot access contraception or using undesired contraception method.
Prenatal Care/ Antenatal Care Attendance (ANC)	The sum of pregnant women making at least two health visits to a health facility before delivery.
Prenatal visit	Routine visit to access medical care during pregnancy
Total Fertility Rate	The total number of children born by a woman who has gone through the entire reproductive age.
Health facility delivery/ Skilled birth attendance	The number of deliveries handled in a health facility by a trained medical staff. Measured as a proportion of the total expected births.
Skilled Health Personnel	A Trained and competent health professional regulated to national and international

	standards offering qualified maternal and newborn services.
Maternal Health Services Accessibility	The utilization of quality health services on a timely basis.
Postpartum	The period after child delivery lasting for eight weeks and terminates after full recovery of the mother.
Maternal Mortality Rate	Total sum of deaths of pregnant women directly associated to the pregnancy or happening inside 6 weeks after the termination of the pregnancy given 100,000 live births.
Maternal mortality	Women who die during pregnancy or after forty two days since the conclusion of a pregnancy.

ABSTRACT

Globally maternal mortality rate has continued to be on a high level compared to the World Health Organisation (WHO) standards. This is despite several initiatives to tackle the high maternal mortality. These initiatives include but are not limited to the Alma-Ata Declaration of 1978, the millennium development goals (MDGs) which had a goal dedicated to maternal mortality, sustainable development goals (SDGs) to accelerate the gains in MDGs. However, despite the various initiatives by governments to lower maternal deaths, the global mortality rate remains higher than the WHO goal of 70 deaths per 100,000 births as at 1990. As of 2020, the global mortality rate was 223 deaths per 100,000 births. The East African Community (EAC) countries had maternal mortality rates higher than the global average with Kenya recording the highest deaths of 530, Uganda 284 and Tanzania recorded the least mortality rate of 238 per 100,000 births. This is despite developing robust frameworks to improve health outcomes. Although maternal mortality has been on a downward trend in Kenya, Uganda and Tanzania since 1990, none of the East African Community countries attained the global maternal mortality rate average and subsequently missed the WHO target of 70 deaths. To reduce the high maternal deaths, the nations have been encouraging the utilization of contraceptives, prenatal care services and facility delivery services. The utilization of services varied in the three countries and so is the rate of reduction of maternal mortality. This study, therefore, sought to analyze how the utilization of these three variables (contraceptive use, prenatal care and delivery at health facility) affects maternal mortality. The study objectives were: to explore the effects of contraceptive prevalence rate on maternal mortality, establish the effect of prenatal visits on maternal mortality and determine the effect of health facility delivery on maternal mortality in Kenya, Uganda and Tanzania. Data was obtained from World Health Organization reports, World Bank reports, and Demographic and Household surveys (Kenya, Uganda and Tanzania). The panel data obtained between 2000 and 2016 from the three East African countries, was analyzed using Panel Auto-Regressive Distributed lag model. It was established that in the long run prenatal care use and delivery at health facility are important determinants of maternal mortality while contraceptive use did not have an effect on maternal mortality in Kenya, Uganda and Tanzania. Hence for the EAC countries to reduce maternal mortality the governments should build more health infrastructure to enhance timely access. They should further establish comprehensive health programs by incorporating specific programs to tackle maternal mortality and strengthen community outreach services through empowering community health workers.

CHAPTER ONE

INTRODUCTION

1.1 Background

Health systems worldwide continue to experience a major setback occasioned by the high maternal mortality. Of the global deaths associated to maternal mortality in 2020, the low and lower middle-income countries accounted for 95 percent. This is despite global maternal deaths declining by 34 percent between 2000- 2020. Sub-Saharan Africa and Southern Asia accounted for 70 percent (202,000) and 16 percent (47,000) respectively of the deaths (World Health Organization (WHO, 2023). Some Sub- Saharan countries continued to register over 900 maternal deaths per 100,000 live births. South Sudan registering the highest maternal deaths of 1,223. This contrasted with that of middle-income and developed regions, such as Australia and the European Union, which had 3 and 13 deaths in 100,000 live deliveries respectively. According to WHO, most of the deaths recorded in the low-income countries could be avoided (WHO, 2023).

The high number of deaths attracted global initiatives aimed at curbing the high maternal mortality rates. For Example; the Alma-Ata Declaration of 1978 (WHO, 1978) required all nations to urgently implement primary health care and direct more technical and financial resources with an aim of making health care available to all. The Alma-Ata declaration advocated for equity and described health as a human right. Mwalali and Ngui (2009), pointed out that the Alma-Ata declaration contributed to the reduction in maternal and child mortality by integrating programs and resources, increasing community involvement in sub-Saharan Africa.

To respond to the increased recognition that primary health care in the developing nations was not dedicated to the reduction of maternal deaths the Safe Motherhood Initiative was

implemented. Given this background, the initiative called upon all governments to decrease by one-half the maternal mortality level in 1990 by 2000, and by an additional half by 2015 (Starrs, 1987). To achieve this objective, countries focused on family planning, antenatal, newborn and postnatal care and HIV/AIDS control. The initiative identified maternal sepsis, severe bleeding and hypertension in pregnancy as the lead causes of maternal deaths. Inequality in access to primary health care has not been achieved with governments neglecting the provision of health care to its citizens and economic inequalities have worsened (Shaikh, 2018).

In efforts to improve health outcomes, countries in 1990, committed themselves to implementation of the Millennium Development Goals (MDGs) by the year 2015. The United Nations through the MDGs targeted poverty reduction, health improvement, education attainment, gender equality and environmental sustainability. Three out of the eight goals are focused on health, with the fifth solely targeting maternal mortality. The goal focused on the enhancement of maternal health by universal access to reproductive health care. To reduce maternal deaths, MDGs, pointed out quality health services, contraceptive use, antenatal care and skilled delivery as crucial interventions to reduce maternal deaths.

The MDGs envisioned lowering the maternal mortality rate by three quarters from 1990 to 2015. Global deaths associated with pregnancy declined by 45% between 1990 and 2015 but this was still lower than the target set by the MDGs (WHO, 2015). While significant progress was made in Kenya, Uganda and Tanzania, they fell short of achieving the intended target. The impact of the MDGs was affected by inadequate healthcare infrastructure, cultural and social barriers, lack of skilled health personnel and

poverty in Kenya, Uganda and Tanzania. Besides the general challenges experienced in Kenya, Uganda and Tanzania, Uganda, experienced a large number of maternal deaths caused by home deliveries and lack of antenatal care (Edwards, 2018). Tanzania experienced a lack of political prioritization and inadequate health financing as barriers to the implementation of the MDGs (Afnan et al., 2015)

The United Nations (UN) in 2015 set to accelerate and sustain the gains of the MDGs by unveiling the Sustainable Development Goals (SDGs). The 2030 agenda targeted 17 goals that are to be achieved and targeted to address the shortcomings of the MDGs. While the MDGs focused on eradicating poverty, the SDGs emphasize the need for an inclusive, long-term and sustainable development process (UN, 2016). The goals are integrated and indivisible where the attainment of one goal leads to tackling problems related to another goal. SDG 3 focuses entirely on health and well-being by expanding the focus beyond core diseases. Integrated under SDG 3, is the lowering and sustaining the global maternal deaths below 70 given 100,000 live deliveries by the year 2030 from 219 deaths reported in 2015. In 2020, the global maternal deaths was 223 per 100,000 live births which was still below the global target (WHO, 2024). SDGs called for heightened efforts to address inequalities in access to quality care, comprehensive coverage of universal health, accountability and strengthening of health systems since most of these deaths occurred in less developed nations and could have been avoided (WHO, 2024).

During the MDG implementation period (1990-2015), there was a general reduction of 44 percent of maternal mortality rate translating to an annualized reduction rate of 2.3 percent between 1990 and 2015 (WHO, 2015). To achieve the 2030 SDG target, the global maternal death reduction ratio needs to be sustained below 7.3 percent (WHO, 2016). To

achieve this target, SDG 3 seeks to increase coverage of skilled birth attendance since 40 percent of births in Africa and South-East Asia were delivered outside a health facility and without a skilled health staff hence reducing the risks of maternal mortality (WHO, 2023). In Kenya, Uganda and Tanzania, the implementation of the initiatives to support the attainment of the MDGs and SDGs targets led to the creation of national policies that has helped in lowering maternal deaths. Kenya introduced free maternal health services in 2013 which led to an increase in skilled and facility deliveries (Government of Kenya, 2016). Similarly, Uganda implemented the 'Village Health Teams' to increase awareness about maternal health services which led to an increase in access to health services (UBOS, 2022). In general, the three countries experienced improved access to various maternal and health services due to the targeted approach in dealing with maternal mortality advocated by the MDGs and SDGS (United Nations, 2024)

Major disruptions caused by global factors like war and pandemics are known to cause an increase in maternal mortality. In 2020, the world experienced the Covid-19 pandemic which led to the disruption of global health systems resulting in the general death of populations. According to WHO (2024), it was not clear how the pandemic directly affected maternal mortality rates. Though data showed a stagnation in maternal mortality reduction during the height of the pandemic, it was inconclusive how many deaths were directly caused by Covid-19. The maternal deaths experienced during the pandemic may have been caused by the disruptions of health systems and the different containment measures in different countries leading to a delay in the timely access of emergency health and antenatal care.

1.1.1 Global contraceptive use, prenatal visit, delivery at health facility and maternal mortality.

The consumption and utilization of contraceptives and prenatal care have significant effects on maternal mortality according to Carroli, Rooney, and Villa, (2001). Stout (1997) regarded prenatal care as an efficient approach to warrant expectant mother's wellness and the fetus during pregnancy and at birth. The WHO through the Safe Motherhood Initiative recommended four prenatal visits for expectant mothers to detect and ensure safe delivery at a health facility. In the global sphere, there exist disparities between developed and developing countries regarding access to health services.

On Contraceptive Use, the uptake of modern contraceptive methods has been on an upward trend, however, this has not matched the increased demand resulting from higher population growth. Global statistics suggest that Africa continues to report low contraceptive use and the highest unmet needs of contraceptive use compared to global figures (UN, 2021). The WHO projected that in 2021, 164 million women who desired to avoid pregnancy were not utilizing the recommended contraceptive use (WHO, 2024). There exist disparities in the utilization of modern contraceptives in different regions as shown in figure 1.1.

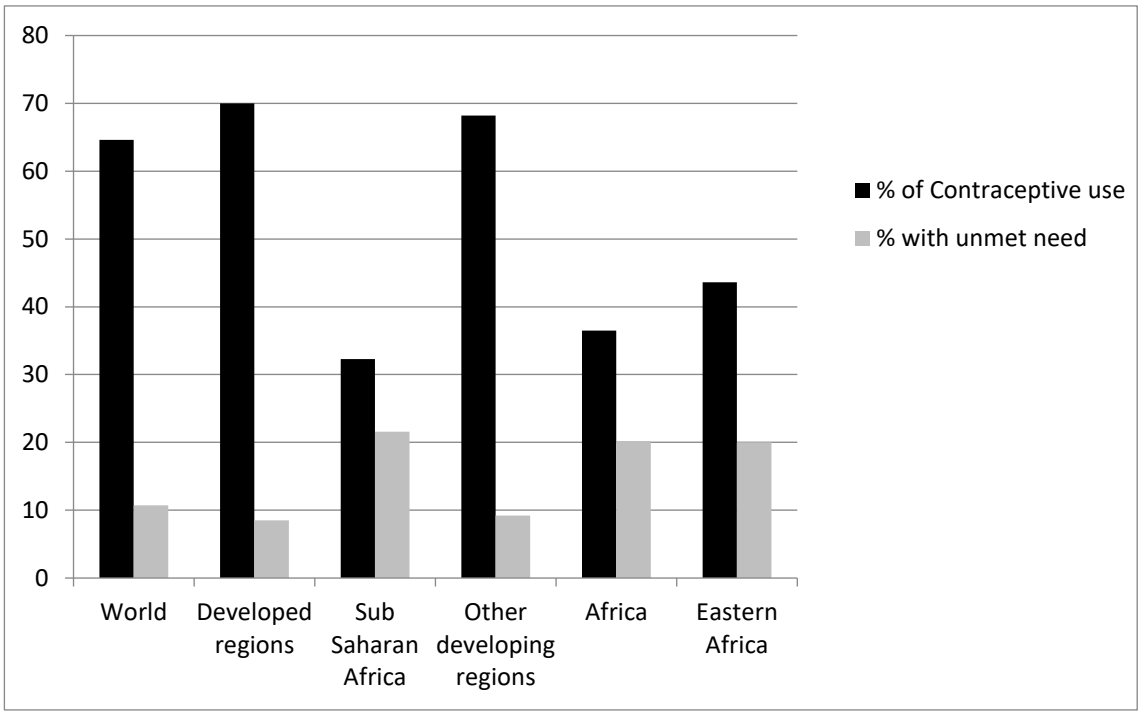

Figure 1. 1: Global Contraceptive use and unmet needs

Source: UN (2021)

Based on Figure 1.1, contraceptive use was not impressive for Africa and Eastern Africa compared to other regions. Developed regions have the highest use of contraceptive use at 70% and the least proportion of unmet needs (9%). Despite the numerous initiatives geared towards the improvement of contraceptive use, sub-Saharan Africa, Africa and Eastern Africa continue to have the highest unmet needs of 21%, 20% and 20% respectively, hence the lowest uptake of contraceptives.

Prenatal Care is an essential health care service that pregnant women receive throughout pregnancy. The United Nations Children's Fund reported in 2016 that globally 86 percent of pregnant women were accessing at least one skilled health prenatal care visit while 46 percent received at least four visits. In Sub-Saharan Africa, 52 percent of expectant mothers accessed at least four visits while South Asia was lower at 46 percent. Prenatal care coverage of one visit is over 95 percent in Eastern Europe, Central Asia and Pacific

countries. This does not compare to the coverage in Sub-Saharan Africa and South Asia with a gap of over 20 percentage points. This is despite a rise in the consumption of prenatal services in low-income nations since the introduction of the Focused Antenatal (FANC) Model in 2002 (WHO, 2016). The FANC model sought to improve the quality of care and recommended at least four visits in the course of pregnancy. The low-income countries had 39 percent of expectant women make the recommended four visits compared with 82 percent in high-income countries.

The WHO introduced a new prenatal model in 2016 that emphasizes that the initial prenatal visit takes place between the first and twelfth week of pregnancy (WHO, 2016). A study by Moller, Petzold, Chou and Say (2017), analyzed the timing of the initial visit and health outcomes and concluded that a larger proportion of maternal deaths and morbidities are related to complications from pre-existing conditions. Early screening and detection provide the opportunity to treat and address these complications before the birth date. The study highlighted the level of education as the main barrier to early access to prenatal visits. The study pointed out that, a significant statistical correlation exists between early visits and maternal deaths. The Sub-Saharan Africa and Oceania countries had the least early visits and registered the highest maternal mortality rates in 2015.

Despite the increase in prenatal visits, the number of maternal and newborn deaths during delivery remains high, emphasizing the advantage of births being administered by a trained health practitioner (Singh, Darroch and Ashford, 2014). While prenatal visits are important, women require skilled attendance for complications and emergencies during delivery. According to WHO, women accessing skilled care deliveries stand a higher chance of survival than those who do not, when complications occur. Global statistics

shows great inequalities in the different world regions of the percentage of women delivering at health facilities and accessing more than four antenatal visits as illustrated in Figure 1.2.

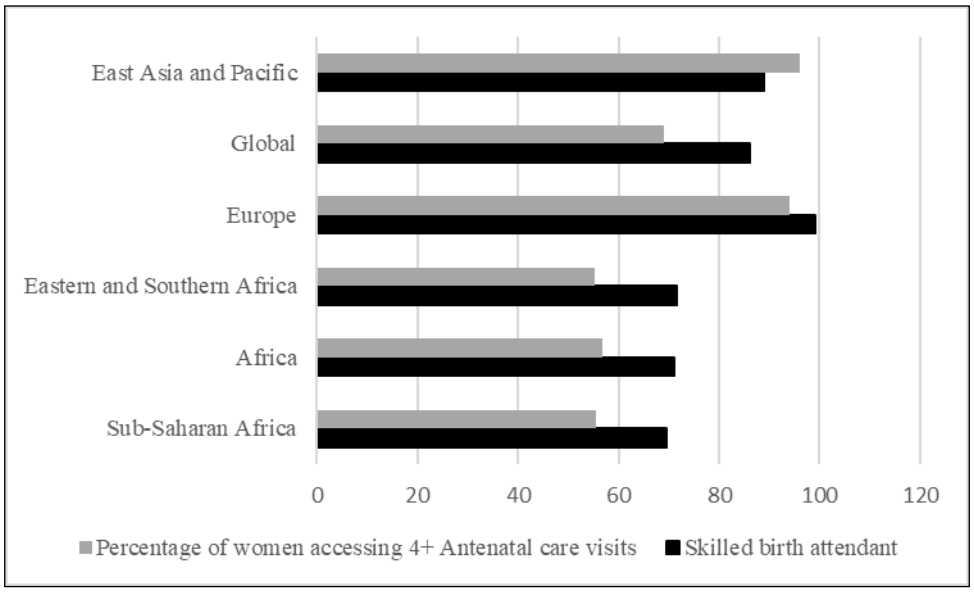

Figure 1. 2: Percentage of women accessing Maternal Care, 2022.

Source: WHO (2024), UNICEF (2024)

Figure 1.2 shows the summary of the percentage of women accessing maternal care. The East Asia and Pacific region registered 89 percent facility deliveries; Sub-Saharan Africa and Africa had lows of 69.5 percent and 71 percent respectively while Europe recorded highs of 99 percent. Whereas, the WHO recommends more than four antenatal visits for optimum maternal care, Sub-Saharan Africa and Africa registered the least percentages of 55 and 57 respectively. East Asia and the Pacific region registered the highest percent of 96 followed by Europe at 94 percent (WHO, 2024).

Global Trends in Maternal Mortality Rate

Maternal mortality rate denotes the total sum of newborns dying at birth given 100,000 live births. WHO among other health institutions have found a strong link between prenatal visits, contraceptive use and delivery at the health facility with maternal mortality rates. Figure 1.2 shows the trend of global maternal mortality rate between the period 1990 and 2020.

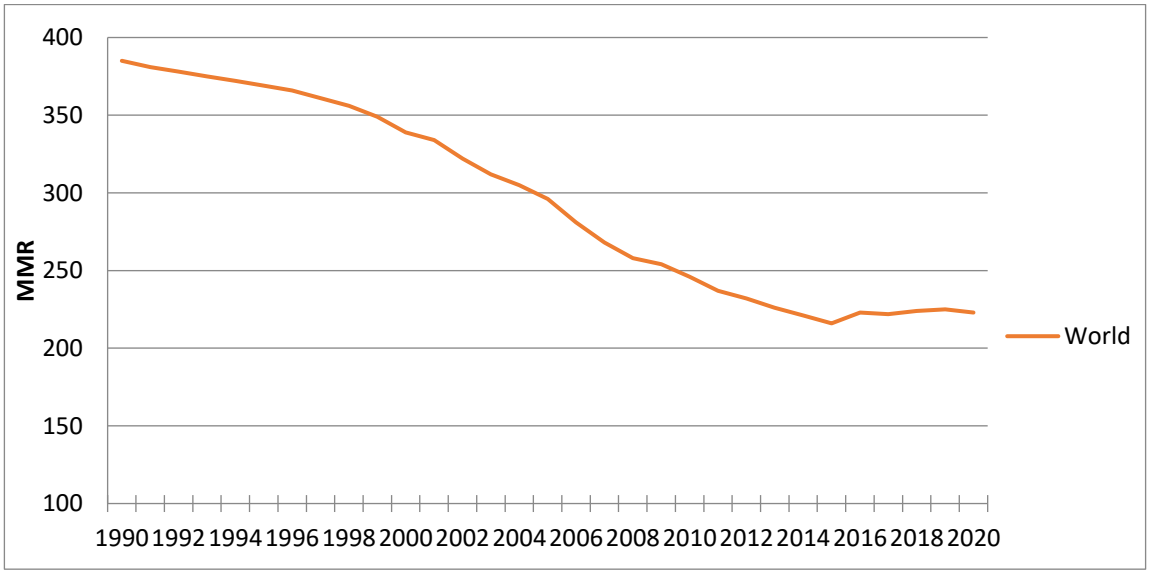

Figure 1. 3: Global maternal mortality trend.

Source: World Health Organization (2024)

Figure 1.2 shows a gradual decline in maternal mortality from a rate of 385 in 1990 as compared to 223 in 2020, a 42 percent decline, which can be explained by the success of various initiatives implemented by the WHO, UN, NGO's and governments. Example; the launching of several initiatives to help reduce the maternal mortality ratio, most notably the Global Strategy for Women's and Children's Health in 2010 by the United Nations (UN); to help speed up the achievement of MDG 5 by 2015 (Ki-Moon, 2010). However, the global maternal deaths have remained higher than the MDG target

throughout the period beginning 1990 to 2020. In 2010 the WHO and UN set targets of 96 and 70 deaths given 100,000 live births in 2015 and 2030 respectively.

Despite such initiatives, the reduction in maternal mortality has been low with Sub-Saharan Africa accounting for the least reduction. The rate of maternal deaths differs between countries and regions; Sub-Saharan Africa and Southern Asia continued to record very high maternal deaths accounting for 70 percent (202,000) and 16 percent (47,000) respectively, of deaths registered globally (WHO, 2022).

1.1.2 Contraceptive use, prenatal visit, delivery at health facility and maternal mortality in Kenya, Uganda and Tanzania.

The three EAC countries continues to record variations in utilization of contraceptive use, prenatal care, and facility delivery. Over the years various countries have implemented policies in line with the global strategies to lessen maternal deaths. In 2013, the government of Kenya implemented free maternal care geared towards eliminating economic barriers to access to maternal health. In 2016, Kenya further expanded the maternal care program dubbed ‘Linda Mama’, aimed at extending free maternity services to over 700 mission hospitals managed under the National Health Insurance Fund (NHIF). There was a 35% increase in deliveries at a public health facility in the first year of the policy implementation (Government of Kenya, 2016).

USAID launched the Saving Mothers, Giving Life Initiative in 2012 in Uganda and Zambia which was focused on the reduction of maternal and newborn deaths. It was anchored on reducing delays in seeking appropriate care promptly and also eliminating inconsistencies in the quality of care provided at different facilities (Isabirye et al. 2017)

Prenatal care in Kenya, Uganda and Tanzania continues to be low compared to the four visits recommended by WHO. The number of women receiving prenatal care in the three East African states for the period 1990 to 2014 is shown in Figure 1.3.

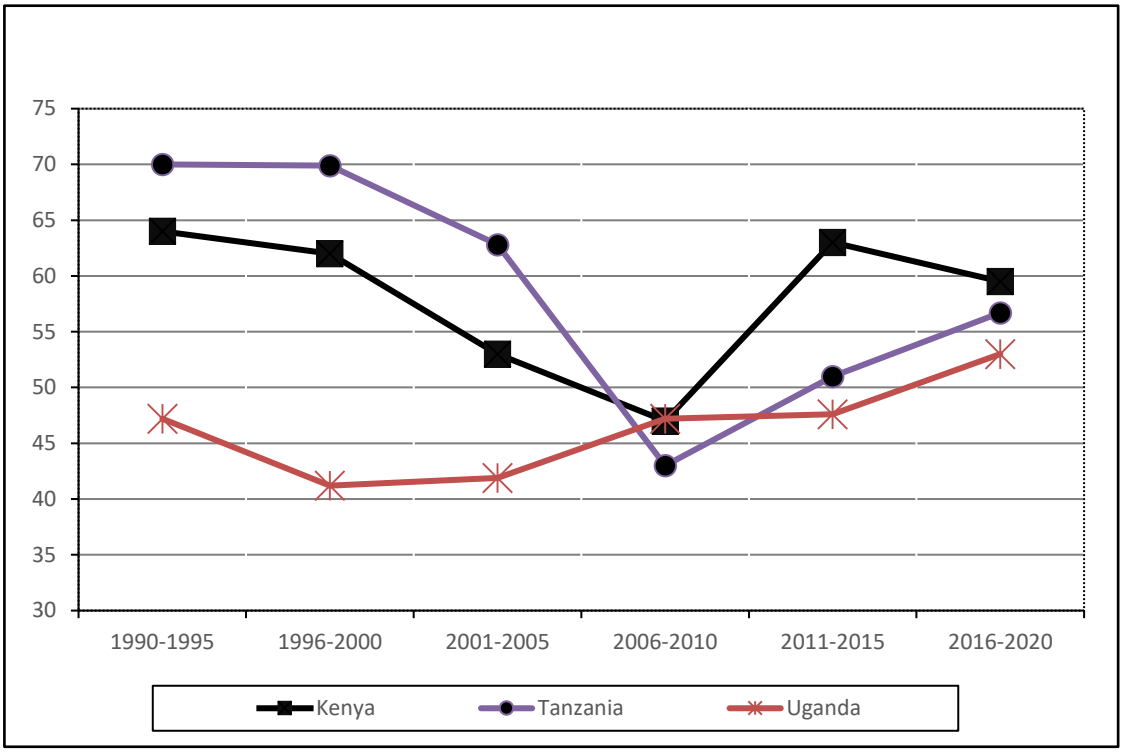

Figure 1. 4: Percentage of pregnant women receiving at least four prenatal care visits.

Source: World Health Organization (2024)

Figure 1.3 shows that the percentage of pregnant women receiving at least four prenatal visits. Tanzania recorded 70 percent, which was the highest percentage in the 1990-1995 period before declining to the lowest percentage of 43 between 2006 and 2010. For the period 2016-2020, Kenya registered the highest uptake of 60 percent followed by Tanzania and Uganda at 56 percent and 53 percent respectively. Initially, Tanzania experienced a sharp decline between the periods 2001-2005 and 2006-2010 before increasing in the 2011-2015 and 2016-2020 periods. In Kenya, the increase is attributed

to the introduction of free maternal care and increased expenditure on health (Government of Kenya,2016).

According to WHO 2012, there exists a link between the high maternal mortality rate and the high fertility rates in all the EAC states. The lowest fertility of five children per woman was recorded in Kenya and Tanzania. The high fertility rates were occasioned by low consumption of contraceptives which resulted in high unmet needs (Figure 1.4).

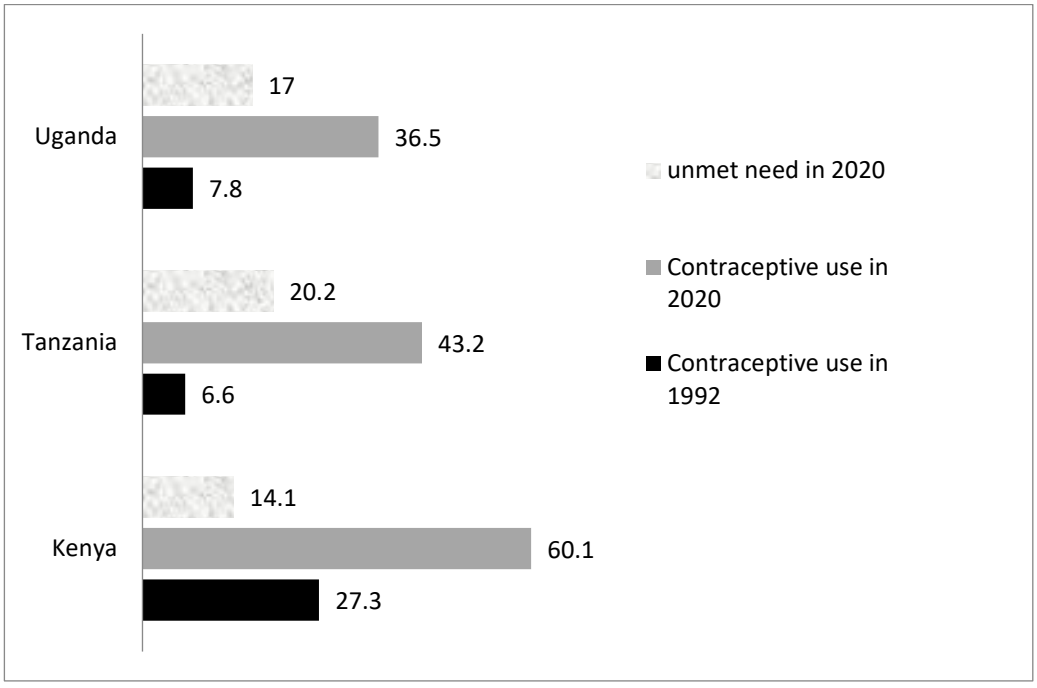

Figure 1. 5: Contraceptive Prevalence rates and unmet needs 1992- 2020.

Source: UN (2022)

Figure 1.4 shows the comparison between 1992 and 2020 contraceptive use in the three East African Community states. The utilization of contraceptives in all the states increased between the period under review with Kenya exhibiting the highest rate at 60.1 percent and Uganda the lowest rate at 36.5 percent, an increase from 27.3 percent and 7.8 percent respectively. Despite the increase in contraceptive use in all the countries as of 2020

compared with 1992, Uganda and Tanzania registered high unmet needs in 2020. This did not compare to the world average of 12 percent as of 2020 (WHO, 2022).

The three East African Community countries continue to register varied levels of pregnant women delivering at health facilities. The Kenya Demographic and Health Survey (KDHS), (2015) reported an increase in facility deliveries from 43 percent in the 2005-2009 period to 61 percent in 2014. The rate increased with the rise in prenatal visits. The percentage varied between urban and rural areas with 82 and 50 percent respectively. Uganda recorded 74 percent of women delivered at a health facility in 2012-2016 and 57 percent in the 2007-2011 periods (Uganda Demographic and Health Survey (UDHS), 2017) and 63 percent in Tanzania for the five years before 2016 (Tanzania Demographic and Demographic Survey, 2016).

Maternal mortality remains very high in the East African Community states. In 2016, the maternal mortality rate in all the East African Community nations was above the worldwide maternal mortality rate of 214 maternal deaths given 100,000 live births (WHO, 2016) as exhibited in Figure 1.5.

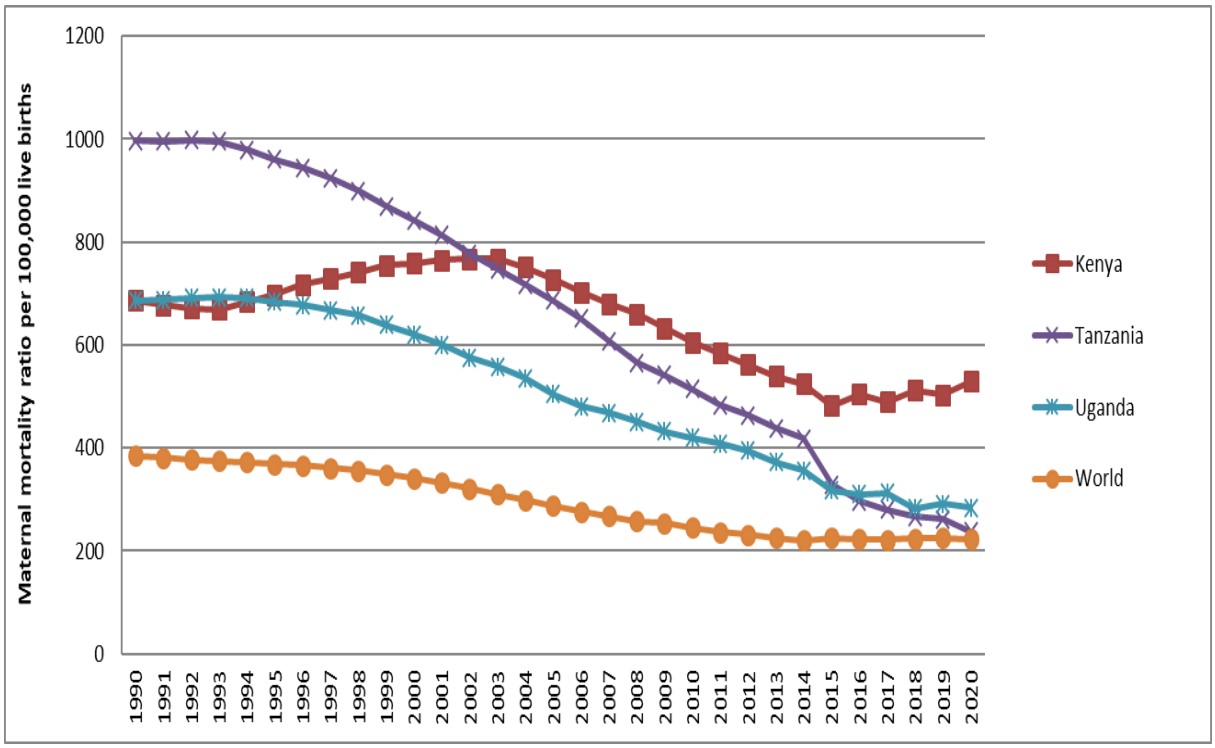

Figure 1. 6: Maternal mortality trend in the East African Community.

Source: World Health Organization (2016)

Figure 1.5 shows that maternal mortality has been on a downward trend since 1990 for all countries and the world except in Kenya where the ratio increased from 669 to 755 deaths in 1993 and 1995 respectively, before gradually reducing to 530 by 2020. Uganda and Tanzania showed a moderate decline in MMR from 687 and 997 deaths in 1990 to 284 and 238 in 2020 respectively. Globally the ratio has been on a downward trend; 223 deaths were registered in 2020 translating to a 42 percent reduction from the rate in 1990. Despite the downward trend in all the countries, from 1990 to 2020, all the EAC nations had a mortality ratio higher than the world average.

Countries have been registering a substantial reduction of preventable maternal mortality as WHO has been strengthening the availability of maternal health services, prenatal services and qualified care during and after childbirth. Studies have shown that utilizers

of contraceptives have a high tendency to access prenatal care services, delivery care by a skilled attendant and institutional health amenities, and immunization. There is empirical evidence that the consumption of one health service influences the use of other health care interventions (Warren et al.1987).

The Safe Motherhood Initiative regarded contraceptive use and prenatal care among the four key pillars targeting the reduction and prevention of maternal deaths in developing countries. Modern use of family planning reduces maternal mortality risks associated with pregnancy by lowering the occurrence of pregnancy. It lowers the risks associated with pregnancy, unsafe abortions, and lowers the total fertility rate hence a reduction in maternal mortality (Stover and Ross, 2010). The WHO estimates that 1,016 million women are using contraceptives and approximately 27 maternal deaths are averted by every 100,000 women using contraceptives during a year.

The foregone shows that maternal mortality varies among the countries. This seems to be explained by the variation in the use of contraceptives, utilization of prenatal services, delivery at health facilities and or delivery by skilled attendants.

1.2 Statement of the Problem

The soundness of any health system can be measured by maternal mortality. Many countries have been experiencing great challenges in the recent past, especially in developing countries which accounted for 99 percent (301,500) of maternal deaths registered globally in 2015. This is despite maternal deaths declining by 44 percent between 1990- 2015 (WHO, 2016). This led to numerous global drives targeted at curbing the high maternal mortality rate like the Alma-Ata Declaration of 1978 and the Safe Motherhood Initiative (Starrs, 1987). Furthermore, governments committed to lowering

by one-half of maternal deaths by 2000 given the 1990 rates and subsequently by a further half by 2015 when the United Nations launched the Millennium Development Goals in 1990. However, despite the various initiatives by governments and non-governmental organizations the global 214 deaths registered in 2016 was higher than the WHO goal of 70 deaths given 100,000 births.

Kenya, Uganda and Tanzania have also not been spared as they still experience high maternal mortality despite developing robust frameworks to improve health outcomes. Although maternal mortality has been decreasing in the East African Community since 1990, none of the East African Community countries has been able to attain the global average maternal rate of 214 deaths per 100.000 births. As of 2016, Tanzania recorded the highest deaths per 100,000 live births of 539, followed by Uganda (381) and Kenya at 346. The high mortality deaths was despite various interventions being promoted to focus on prevention and care by increasing public health expenditure, increasing skillful birth attendants at birth, prenatal care and contraceptive services availability.

Numerous researches focused on the effects of these variables on maternal mortality in different regions have been carried out (Cook 2002; Stover and Ross, 2010). Of the reviewed literature a handful were inconclusive while others did not concentrate on the Sub-Saharan Africa region. The findings in the studies could not be used to generalize the case for Kenya, Uganda and Tanzania due to cross-region differences in social, economic and cultural beliefs. The effects of these variables on maternal mortality may vary among countries. For instance, there are variations in the utilization of these services among the three countries, additionally, maternal mortality also varies among these countries. This variation in maternal mortality could be occasioned to the differential in the consumption

of the services in these countries. This study, therefore, sought to explore if the three variables (contraceptive use, prenatal care and delivery at health facility) have an effect on maternal mortality rate in Kenya, Uganda and Tanzania.

1.3 Research Questions

The research questions for this study were:

i. What is the effect of contraceptive prevalence rate on maternal mortality in Kenya, Uganda and Tanzania?

ii. What is the effect of prenatal visits on maternal mortality in Kenya, Uganda and Tanzania?

iii. What is the effect of delivery at a health facility on maternal mortality in Kenya, Uganda and Tanzania?

1.4 Objectives of the Study

The general objective of this study was to examine the effects of contraceptive use, prenatal visits and health facility delivery on maternal mortality in the East African Community. The specific objectives were to:

i. Determine the effect of contraceptive prevalence rate on maternal mortality in Kenya, Uganda and Tanzania.

ii. Establish the effect of prenatal visits on maternal mortality in Kenya, Uganda and Tanzania.

iii. Examine the effect of delivery at a health facility on maternal mortality in Kenya, Uganda and Tanzania.

1.5 Significance of the study

Response to the high maternal mortality is guided by a planned strategy that aims at harmonizing and targeting the different initiatives by the different stakeholders. These responses desire to achieve high productivity of human capital by reducing the mortality rate hence impacting health expenditure and health programs. This study will deliver auxiliary and necessary information to developers of policy and decision-makers to help in the planning and implementation of future maternal mortality policies.

Health human capital is a key input in economic models as it determines the level of labour available in the market. Despite this, few empirical studies on maternal mortality exist in the sub-Saharan and East African Community region. Most of the empirical and theoretical information available is focused on clinical factors, ignoring the economic, political and social macro-structural factors. This study will, therefore, add knowledge and help in policy implementation to governments, non-governmental organizations and other implementing units while stimulating interest in further research.

1.6 Scope of the Study

This study used data on contraceptive use, prenatal visits, delivery at health facility and maternal mortality in Kenya, Uganda and Tanzania for the period 2000 to 2016. The study concentrated on the period due to the heightened initiatives to improve maternal care like MDGs and SGDs which was launched in 1990 and 2015 respectively. Furthermore, data on maternal mortality and the independent variables is only available in the period under review. The study focused on the three East African Community countries.

1.7 Organization of the Study

This study is structured in five chapters; Chapter One captures the Introduction, Chapter Two the literature review, Chapter Three the research methodology, Chapter Four the empirical findings and Chapter Five the study summary and conclusions.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter is divided into sections consisting of theoretical literature review, empirical literature review and overview of the literature review.

2.2 Theoretical Literature

2.2.1 The Consumer Theory

The theory of the consumer explains the fundamental problem facing households as they make choices to consume certain goods and services. The theory studies the household's expenditure behavior given their preferences and budget constraints. The theory assumes households are rational and seek to maximize value from the utilization of a bundle of goods and services. The consumer endeavors to apportion his scarce resources given a choice of goods and services in order to maximize utility (Kreps, 1990). Assuming the household consumes two goods X and Y whose prices are P*x* and P*y* respectively and has a fixed income M, the utility is represented by U (X, Y).

The consumer problem is represented as follows:

$$Max\ U(X, Y) \text{ subject to a budget constraint } P_xX + P_yY = M \qquad (2.1)$$

Using the Langrage Multiplier method

$$\text{Max } L(X, Y, \lambda) = U(X, Y) + \lambda (M - P_xX - P_yY) \qquad (2.2)$$

Differentiating the langrage function with respect to each of the argument, yields

the optimal quantities X*, Y* and U* the consumer chooses to consume given their respective prices and income.

The general significance of the theory in this study is that it defines the household's behavior while making choices in regards to the goods and services they consume given their limited resources. This theory shows that the demand for health services depends on income and prices of the health services. Kenya, Uganda and Tanzania have applied the principles of consumer theory in the the health sector by using price sensitivity and consumer behavior to influence maternal healthcare utilization. In order to reduce the price barrier to accessing health services, Kenya introduced free maternal health care program termed 'linda mama'. This led to a significant increase in facility delivery and antenatal care across fourteen counties after two years of the implementation of the policy (Gitobu, Gichangi and Mwanda, 2013). Uganda through the Uganda's National Health Insurance scheme aimed at reducing the cost of healthcare for the most vulnerable population in the lower-income bracket therefore increase the demand (Orem et al 2011). The study concluded that cost of care is a hindrance to health service utilization.

2.2.2 The Rosenzweig and Schultz health production

The health production function developed by Rosenzweig and Schultz embodies an analysis of inputs and outputs, where consumers derive utility from the consumption of health. Health is produced by the utilization of inputs, some of which are influenced by the individual. The individuals' choice of health inputs will probably depend on unobserved health behaviours and capability in putting the input goods into use. Therefore, the consumption of these inputs is influenced by the individual's unobserved and observed characteristics. The model employs a utility maximization model to develop interpretations

of estimated effects of the utilization of health observable inputs and the unobservable individual characteristic health outcomes (Mityakov and Mroz, 2013).

The model assumes that humans maximize an inter-temporal lifetime utility function comprised of multiple periods in each of which choices are made regarding consumption, leisure and savings. All the inputs into the utility maximization function are chosen optimally subject to a budget constraint (Mwabu, 2007).

$U = U$ (N, R, H) …… (2.3)

Where,

N - Health neutral good, a utility, *U*, yielding good or service but does not have direct effect on the well-being of the household but is desired for their own sake.

R - Health-associated good or behavior producing satisfaction, and directly and indirectly affects health condition e.g. exercise, smoking, precautionary undertakings.

H – Reproductive health status

And the health of a household is produced by the following individual member's health production function:

H=H (R, W, μ) …… (2.4)

, where

W – Market inputs that are purchased and directly affects individual's wellbeing e.g. medical services.

μ- Random variables unique to individual's health, caused by either genetic or environmental conditions.

The household ultimate objective is to maximize utility while producing health but they

are limited to a budget constrain given as;

$$I = PnN + PrR + PwW \quad \text{.....} \quad (2.5)$$

Where,

I represent an individual's exogenous income and Pn, Pr, Pw prices of health-good N, R and W respectively.

W. W is procured for the improvement of health and therefore enters the utility function of the individual only through the production function (Equation 2.4).

Maximizing equation (2.3) given equation (2.4) and subject to (2.5) yields the following input demand functions;

$$N = Dn\,(P_n, P_r, P_w, I, \mu) \quad \text{.....} \quad (2.6)$$

$$R = Dr\,(P_n, P_r, P_w, I, \mu) \quad \text{.....} \quad (2.7)$$

$$W = D_w\,(P_n, P_r, P_w, I, \mu) \quad \text{.....} \quad (2.8)$$

Equations 2.6 to 2.8 derives the effects changes in the individual prices have on health given changes in the consumption of the respective goods. Differentiating the health production function (equation 2.4), given changes in health inputs yields equation 2.9 below

$$\partial H = Fr.\,\partial R + Fw.\,\partial W + F\mu.\,\partial \mu \quad \text{.....} \quad (2.9)$$

Where, ∂H is change in Health status while, $F\mu$, Fr, Fw, represent health inputs' marginal products.

Relating changes in Health status to the respective input's price changes;

$$\partial H/\partial Pn = Fr\,\partial R/\partial Pn + Fw\,\partial W/\partial Pn + F\mu\,\partial \mu/\partial Pn \quad \text{.....} \quad (2.10)$$

$$\partial H/\partial Pr = Fr\,\partial R/\partial Pr + Fw\,\partial W/\partial Pr + F\mu\,\partial \mu/\partial Pr \quad \text{.....} \quad (2.11)$$

$$\partial H/\partial Pw = Fr\,\partial R/\partial Pw + Fw\,\partial W/\partial Pw + F\mu\,\partial \mu/\partial Pw \quad \text{.....} \quad (2.12)$$

And $F\mu\ \partial\mu/\partial Pn$, $F\mu\ \partial\mu/\partial Pr$, $F\mu\ \partial\mu/\partial Pw = 0$ μ- represent random variables not associated with prices.

According to the Rosenzweig and Schultz Model, R, health-related good, is a function of input prices, income and unobserved characteristics (μ). This model shows that health production (health status such as maternal mortality) is a function of utilization of health services (R, W)

where $H = H(R, W, \mu) = H(Dr(Pn, Pr, Pw, I, \mu), Dw(Pn, Pr, Pw, I, \mu), \mu)$

The model takes into consideration all the marginal impacts of the unmeasured and measured inputs optimally chosen as the household's utility maximization choices (Mityakov and Mroz, 2013). The theory considers health care as a consumer good (equation 2.3) which yields utility to the individual and a health production input (equation 2.4) that improves health. These characteristics make this model the most applicable in estimating the effects of contraceptive use, prenatal care and facility delivery on maternal mortality in this study since it takes into consideration both the observed and unobserved variables in health. Further, Thorton (2002) pointed out the importance of approximating an aggregate health production function, as it approximates the general effect on the population's health stock given the investment in health through utilization of health care. The model links reproductive health services demand and household's health production which is the main characteristic of the model. Individuals would be willing to consume a commodity despite its negative effect on health as long as it yields utility (e.g., smoking). Similarly, individuals will be willing to invest in health through purchase of medical care yielding disutility but estimated to improve health. This can be obtained directly from

Rosenzweig and Schultz's production function, where the utility maximization function is presumed (Ajakaiye and Mwabu, 2007).

2.2.3 The Grossman Theoretical Model

The health production theory developed by Grossman views health as capital stock and its utilization produces an output of healthy time. Economic, social and environmental factors are treated as inputs into the production system and assumes individuals are endowed with an initial stock. The initial endowment of stock depreciates as age increases and can only be enhanced through Investment. Health is treated as both a consumption and investment good. Individuals feel better after the consumption of health increasing productivity by enabling individuals to produce money earnings in the money market sector and the nonmarket sector; inputs into the utility function (Grossman, 1999).

The model assumes that the inherited initial health stock depreciates as the individual is getting old and when it lowers beyond a certain limit death happens. The model further assumes an inter-temporal utility function, duration of life is fixed given the date of planning and a variable that is endogenous. Therefore, gross investments determine the length of life since it enters the production function as inputs such as medical care and consumption of alcohol which produces an output of health. The amounts of quantities of health stock maximizing utility determines the length of life subject to production and resource limitations.

The consumer maximizes an inter-temporal utility given as;

$$U = U(\Phi oHo, \Phi iHi ..., \Phi nHn, Zo, Zi..., Zn) \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (2.13)$$

Where Ho is health stock that is inherited, Hi is health stock in a particular period (i th), Φi is the flow of service given a unit of stock, hi = ΦiHi, is the overall utilization of "health inputs" and Zi is the overall utilization of other things in the period I and bears a positive cost to the individual.

The consumers choose a set of goods and services that directly affects utility and enters directly as an investment and a consumption commodity that defines productive labor hours available. When health stock is improved it reduces unproductive time which is lost while sick therefore increasing the monetary value which is a return to investing in health.

The gross investment less depreciation in the stock of health less gross investment yields net investment:

$H_{i+1} - H_i = I_i - \delta_i H_i$, …….(2.14)

Where,

Ii is gross investment, δi the depreciation rate in the i th period. The individual's age determines the depreciation rates and is presumed to be exogenous. The household production functions are derived from gross investments made in health and the consumption of other goods and services that enter the utility function as follows:

$I_i = I_i(M_i, TH_i; E_i)$

$Z_i = Z_i(X_i, T_i; E_i)$ …….(2.15)

Where;

I represent investment in health, Mi is medical services; Xi is a vector of non-health inputs, Zi is the overall utilization of other things that bears a positive cost to the

individual; THi and Ti is time for improving health through consumption of health and non-health goods respectively; Ei is Education or knowledge. The model assumes the efficiency of production is affected by a shift in education in the nonmarket sector of the economy similar to the effects of changes in technology in the market sector.

Optimizing the Grossman model yields the Investment and consumption model. Under the investment model, good health gives individuals more days to work in the market to earn wages, while the consumption model treats health as a good that yields utility to an individual. Health stock and medical care are a function of wage rate, prices of medical care and age. The model treats health stock as a function of income proxied by wage rate (Grossman, 1999).

The major shortcomings of this model are that it treats health demand with certainty neglecting observed random occurrences like illness and perfect information flow since it assumes the individual has perfect information regarding his capital stock (Hren, 2012). This model is however significant in this study as it explains the significance of investing in health as a good and also shows the relationship between an individual's income and health stock. The individual produces and consumes health while making investment decisions until the point where marginal benefit equals the marginal cost of health.

2.3 Empirical Literature

Cook (2002), studied the effects skilled attendance at birth has on maternal deaths in the developing countries. World Bank and United Nations data from 100 developing countries was analyzed using multiple regression analysis. The study results exhibited that a third of the births were delivered by untrained or trained traditional attendants. The number of doctors was strongly negatively correlated to the maternal mortality ratio more than the

number of nurses while attendants at birth by a trained practitioner had the highest negative significant effect on the maternal mortality ratio. The study further found that a higher level of care does not necessarily lower MMR in developing countries since a larger percentage of the population could not afford the services and delay in looking for care from skilled health professionals. The current study adopted skilled attendants and incorporated contraceptive use and prenatal care to analyze the effect on maternal mortality. Cook (2000) differed from the current study since the study analyzed the effects of the different trained health practitioners on maternal health.

Conway and Kutinova (2003) analyzed how prenatal care affected maternal health and its outcome in New York. Data was obtained from the National Maternal and Infant Health Survey of 1988. The research used the modified Rosenzweig and Schultz utility function to analyze data collected for women utilizing prenatal care in New York. The study used hospitalization duration of the mother beyond her infant and change of the mother's weight status after delivery as measures of maternal health while number of prenatal visits for prenatal care. The study analyzed a sample of 6,531 and 6,757 observations for hospitalizations and weight status respectively. The findings established that prenatal visits had a negative and significant effect on hospitalization duration and weight status (underweight and overweight).

The study concluded that prenatal care reduces maternal mortality and avoids lengthy hospitalizations after delivery when the service is obtained on a timely basis. They also analyzed the effects of government investment through the Medicaid program in helping pregnant women access prenatal services. They observed that such initiatives increased service availability and led to long-term cost savings in medical bills. This study provides

insight into the expected results of how prenatal care affects maternal mortality rates and also adopted Rosenzweig and Schultz's utility function in analysis.

Jokhio et al. (2005) carried out a study in Pakistan to establish how maternal and perinatal mortality are affected by traditional birth attendants. A clustered randomization sampling was used to select the traditional attendants while financial and logistical considerations were used to identify the subdistricts. The study was conducted in seven districts in Pakistan and all the pregnant women were eligible for selection. To analyze the effect on perinatal and maternal mortality the study used a quasi-likelihood binary regression model with a random intercept. The traditional attendants were trained and the identified pregnant women were followed through six months before delivery and six weeks postpartum.

The results showed that perinatal mortality significantly reduced while the effect on maternal mortality was not statistically significant. Despite the increased number of referrals, the number of health facility deliveries did not increase since the women were required to organize their transport and the intervention did not involve the availability of maternal care. The study pointed out the importance of other non-medical factors like income that ought to be considered to lower maternal mortality. The current study focused on the effects of facility delivery on maternal mortality in Kenya, Uganda and Tanzania using the Panel Auto-Regressive model.

Stover and Ross (2010) sought to find out how increased use of contraceptives affects maternal mortality in developing countries. Data obtained from 146 Demographic and Health Surveys and United Nations organizations for the period 1990 to 2005 was analyzed using direct and indirect methods. Total Fertility Rate and maternal mortality

rates were indicators of the independent variables. Under the direct method, contraceptives lead to a lowering of the Total Fertility Rate (TFR) which lowers births, therefore reducing maternal deaths and risky births. Using a demographic projection model, the study estimated the number of deaths occasioned by pregnancy given the fertility rate remained constant then applied the 1990 maternal mortality rates to those deaths to determine averted deaths given the drop in fertility.

Using the Indirect effect method, the research carried out a time series analysis between contraceptive use and demographically high-parity births. The proportionate change in births is compared to demographic risks and the percentage change in contraception use among women. The analysis thereafter examines the correlation between the proportion of births given a specific risk and the Maternal Mortality Rate. Using the two-stage indirect method the study analyzed the relationship between contraceptive use and maternal mortality rates. The analysis showed that TFR is highly associated with contraceptive use and subsequently positively related to maternal mortality.

The study concluded that an increase in contraceptive uptake reduces the total fertility rate leading to a decline in maternal mortality. As contraceptive use increased, the high-risk births reduced so were the high parity deaths. The study provides insight to the current study on how contraceptive use affects maternal mortality in developing countries.

Seyfried (2011) carried out a study in the Democratic Republic of Congo to establish how maternal health is affected by the utilization of family planning. The Demographic and Health Survey for the year 2007 was analyzed using logistic regressions. The study sought to determine the effects of the availability of family planning knowledge and modern contraceptive use on maternal mortality in a developing country. The findings revealed

that modern contraceptive use decreases risks of death associated with pregnancy causes. Women are empowered by being at liberty to make fertility choices and through growth in health service access.

The study further pointed out the need to incorporate education attainment in women, access to health facilities, number of children per woman and access to clean drinking water. Attainment of primary level of education increased the likelihood of the use of contraceptives hence lower maternal deaths while aging had a negative relationship with maternal death. The present study sought to establish how the utilization of contraceptives on a macro level affects maternal mortality in Kenya, Uganda and Tanzania and whether the findings of Seyfried (2011) will be similar.

To ascertain whether maternal deaths are related to contraceptive use, Ahmed et al. (2012) conducted a study in 172 developing countries where the unmet contraceptive needs were met. Data for the period 1990-2010 was obtained from the Maternal Mortality Estimation Inter-Agency Group and WHO websites. The study applied multilevel regression analysis and correlation analysis. The percentage of female deaths caused by pregnancy was an indicator of maternal mortality while GDP, general fertility rate and contraceptive use were the independent variables.

The study revealed that a nonlinear negative association exists between contraceptive use and maternal deaths. Maternal deaths significantly dropped among women using contraceptives. The study concluded that developing countries can use contraceptives use as a significant and effective approach to decrease maternal mortality given the high rate of unmet needs. In the present study, contraceptive use, prenatal care and facility delivery

were analyzed using the Panel Auto-Regressive Distributed Lag (ARDL) model to determine their effect on maternal mortality rate.

Koch et al. (2014) examined the association between the educational level obtained by women and contraceptive use with maternal mortality in Chile. Data from 1957 to 2007 was analyzed using time series. The study examined the deviations in maternal mortality given deviations in the average female schooling years. Maternal mortality, contraceptive prevalence rate and school enrolment were indicators of the respective variables.

The study outcomes exhibited that, there was a considerable increase in contraceptive use given improved women's schooling resulting in a lower total fertility rate and subsequently lowering maternal mortality. Thus, the study pointed out that making available maternal health services may not necessarily lead to a reduction in maternal mortality underscoring the importance of education level in women. The results of this study provided further variables that indirectly affect maternal mortality.

Montgomery et al. (2014) examined the relationship between the presence of skilled practitioners during hospital admissions and maternal mortality rates in India. The study explored antenatal care, delivery and postpartum skilled care, level of education and their effects on maternal deaths between 2001 and 2003. A sample was obtained from the District Level Health Survey and India's Million Death Survey for women aged from 15 to 49 years. The sampled population was interviewed on their uptake and knowledge of antenatal care, education level, age, attendance at birth by a skilled practitioner and health consumption.

Using bivariate analysis, the study found that the likelihood of maternal death occurring for admitted expectant mothers was significantly higher since they were deemed more complicated, while regions with deeper facility delivery coverage had a lower likelihood of maternal deaths. Despite the overall positive association between facility delivery and reduced maternal mortality, the study found that in areas with poor-quality care, this relationship was insignificant. This suggests that the quality of care provided in health facilities is a critical factor in determining maternal mortality outcomes. The current study sought to find how maternal mortality is affected by the utilization of contraceptives, prenatal care and facility delivery in Kenya, Uganda and Tanzania.

Sajedinejad et al. (2015) sought to find out the effects of macrostructural factors on maternal mortality on a global level using the Pearson Correlation test and cross-sectional regression for 179 countries in 2010 ecological data. The macrostructural factors included education level, private sector and trade, governance, employment rate, health expenditure, economic policy and debt. The study found education, governance and private-sector trade had the most significant positive effect on maternal mortality. The study further highlighted employment, private sector infrastructure, economic policy and debt as slightly significant with negative coefficients, while health expenditure had the least negative significance on maternal mortality. The utilization of health services can be accelerated by implementing programs that will lower poverty, increase literacy and empower women. The study provides insight into other factors that affect maternal mortality.

Okeke et al. (2016) sought to establish the effect of Nigeria's Midwives Service Scheme on pregnancy and birth outcomes. The scheme aimed at bridging the shortage of skilled

health practitioners. The study used a difference-in-difference (DID) approach to compare changes in maternal health outcomes in MSS communities (intervention group) with non-MSS communities (comparison group) and a regression analysis for estimation. Data was collected from Household surveys between 2009 and 2014. The empirical results revealed a rise in antenatal care utilization but there was no significant increase in skilled birth attendance. Okeke et al. (2016) identified lack of accommodation and irregular salary payments for midwives as the main challenges facing the success of the program. The study suggested a holistic approach is required to address the complexity of improving maternal health outcomes. This study is relevant to the current research as it focuses on key variables of interest, namely: skilled birth attendance, antenatal care, and maternal mortality. The study is however limited since it covered a shorter period of one year and a limited geographical sample size.

Gitobu et al. (2018) evaluated the impact of Kenya's Free maternal Health Care Policy on the utilization of health facility delivery services and the effect on maternal and neonatal mortality. The policy was implemented in 2013 to increase access to quality maternal health services. The study adopted a time series analysis and autoregressive integrated moving average models to assess trends in the utilization of delivery services, maternal mortality ratio (MMR), and neonatal mortality rate. The analysis covered the two years before and after the implementation of the policy. The data was drawn from 77 public health facilities across 14 counties, focusing on the number of deliveries, maternal mortality ratios, and neonatal mortality rates.

The study found there was a significant increase in health facility deliveries. The implementation of the policy led to a 29.5% increase in health facility deliveries, rising

from 234,601 to 303,705. However, the maternal mortality rate remained relatively unchanged. The study suggests that the removal of user fees is not sufficient to reduce maternal mortality. The quality of care, availability of relevant infrastructure and addressing delays in service delivery were identified as deterrents to the effectiveness of the policy. The study provides valuable insights into the relationship between facility delivery and maternal mortality in Kenya. By examining the factors influencing women's choices regarding where to deliver and the impact of these choices on maternal health outcomes, the study contributes to the current study, by providing a better understanding of the challenges and opportunities for reducing maternal mortality in Kenya.

Rai et al. (2022) conducted a study in rural India to determine the association of prenatal care and facility delivery services with maternal and infant deaths. Using descriptive statistics and multivariate logistic regression modelling the study was conducted in Birbhum District, West Bengal state from 2012 to 2021. Using data obtained from the health and demographic surveillance system (HDSS), the study sampled 59,395 individuals using a self-weighted sampling technique drawn from 13,053 families within the 351 villages.

Rai et al. (2022) found that utilization of antenatal care services had a negative effect on both maternal and infant deaths while inexpert facility deliveries were linked to high maternal deaths. Further, the use of prenatal and facility delivery care was essential for reducing maternal and infant mortality in rural India. Traditional birth attendants also played a complementary role in waiting homes and helped strengthen referral systems. This study focuses on antenatal care and facility delivery as significant factors, making it relevant to the current study.

Joseph et al. (2023) analyzed the influence of home delivery on maternal mortality in the Longido district, Tanzania. Longido District recorded both the second-highest maternal mortality and home delivery compared to the other districts. The study, therefore, sought to assess maternal health complications associated with home delivery, investigate the effectiveness of traditional birth attendants in handling birth complications and the effects of integration of health facility delivery with community systems to improve maternal mortality.

Maternal health and home delivery data were obtained from the Tanzania Demographic and Health Survey for the period 2016 to 2020 and questionnaires issued to a sample of expectant women respectively. The study adopted the Yamane formula to identify the sample size and a structured questionnaire to collect data. Using descriptive statistics and multi-linear regression the study analyzed the relationship between home deliveries and maternal mortality.

The regression results found maternal mortality was significantly correlated to health complications after home delivery and the traditional methods of treating the complications. The study also found that inadequate skills among traditional birth attendants and delays in referrals contributed to maternal mortality in Longido. Despite Tanzania implementing free maternal services through the universal access to maternal health policy, the percentage of home deliveries was still high in the study region and subsequently maternal mortality. The study recommended the integration of traditional birth attendants and cultural practices with medical professionals to help reduce avoidable maternal deaths. This study provides valuable insight into the current research since, the maternal mortality rate remains high in the region, despite increased investment in

maternal health. The research suggests that expanding the availability of maternal health services alone may not be sufficient to significantly reduce maternal deaths, highlighting the importance of factors influencing the consumption of these services.

2.4 Overview of the literature

The studies reviewed revolve around the central themes of maternal health, skilled attendance at birth, contraceptive use, and the role of prenatal care. Cook (2002) and Montgomery et al. (2014) both focus on the impact of skilled attendance at birth on maternal mortality. Cook (2002) found that trained practitioners significantly reduced maternal mortality, while Montgomery et al. (2014) emphasized that the quality of care in health facilities was crucial to reducing maternal deaths. These findings align with the research by Okeke et al. (2016), which examined the effect of Nigeria's Midwives Service Scheme and found that while antenatal care increased, skilled birth attendance did not increase, and ultimately did not have an effect on maternal mortality. This highlighted that increasing the number of skilled practitioners alone may not be sufficient to reduce maternal mortality.

Contraceptive use and family planning as critical factors in reducing maternal mortality were examined in studies by Stover and Ross (2010), Seyfried (2011), Ahmed et al. (2012), and Koch et al. (2014). These studies used various methodologies, such as time-series and regression analysis, to demonstrate that increased contraceptive use significantly lowers fertility rates, reduces high-risk births, and, consequently, maternal mortality. They also identified education and healthcare access as pivotal factors influencing contraceptive use, further reducing maternal deaths.

In terms of prenatal care, Conway and Kutinova (2003), Rai et al. (2022), and Gitobu et al. (2018) explored how antenatal care and facility deliveries affect maternal mortality. They found that timely and adequate prenatal care reduces complications, while Gitobu et al. (2018) noted that Kenya's Free Maternal Health Care Policy led to an increase in facility deliveries but no significant reduction in maternal deaths. The studies collectively emphasize that while interventions such as fee removal and healthcare facility access can improve maternal outcomes, the quality of care and other socioeconomic factors play an essential role in lowering maternal mortality.

The studies reviewed collectively demonstrate that while skilled birth attendance, contraceptive use, and prenatal care are critical factors in reducing maternal mortality, their effectiveness is heavily dependent on the quality of care, accessibility of services, and broader socioeconomic conditions. Econometric tools were used in estimating the effects of contraceptive use, prenatal care and health facility delivery on maternal mortality rate such as General Linear Regression analysis, time series analysis and sampling. The current study was conducted using panel design. These models were preferred since the study was anchored on panel data analysis.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter dispenses the approach applied in achieving the study objectives. The chapter encompasses the research design, theoretical framework, empirical model, how the variables are defined and measured, source, type and analysis of data

3.2 Research Design

The study was conducted through a panel design and data from the three countries, for the period 2000 to 2016 were analyzed to obtain inferences about the study. The panel design provides a comparative analysis of how Kenya, Uganda and Tanzania are implementing the various initiatives to reduce maternal deaths.

3.3 Theoretical Framework

The study is anchored on the Rosenzweig and Schultz (1982) health production function in a modified version. The standard health framework defines the association between inputs and outputs over a specified period. The framework considers social, economic and environmental factors as inputs into the health production function.

The model is entrenched on an individual's behavior of maximizing utility in which we presuppose that humans maximize an inter-temporal lifetime utility function comprised of multiple periods in each of which choices are made regarding consumption, leisure and savings.

According to Thorton (2002), the Rosenzweig and Schultz production model can be utilized to find the general effect of health investment e.g. medical service consumption on the health stock of the population. The women of productive age maximize the following

utility function,

$$U = U(N, R, M) \quad (3.1)$$

Where,

U – Utility function

N – Nonmedical commodity that yields utility, *U*, but does not have an effect on households' health;

R - Health-associated utility yielding good or behavior and affects mortality status e.g. exercise, smoking.

M - Health status measured by maternal mortality level.

Given a health production

$$M=M(R, W, \mu) \quad (3.2)$$

Where;

M and R is as defined above

W – Healthcare utilization services defined as contraceptive use or prenatal care use or use of facility delivery services

μ- Random variables unique to an individual's health, caused by either genetic or environmental conditions; not influenced by the household's health expenditure.

The households maximize 3.1 given 3.2 limited by a budget constraint given as

$$I= PnN + PrR + PwW \quad (3.3)$$

Where,

I is income and *Pn*, *Pr*, *Pw* are the respective prices of goods N, R, and W.

The optimization of the Rosenzweig and Schultz model yields demand functions (equations 3.4, 3.5 and 3.6) which represent the optimal choices made by the consumer for U, R and M given their prices and income, Y.

$$N = Dn\ (Pn, Pr, Pw, Y, \mu) \qquad (3.4)$$

$$R = Dr\ (Pn, Pr, Pw, Y, \mu) \qquad (3.5)$$

$$W = Dw\ (Pn, Pr, Pw, Y, \mu) \qquad (3.6)$$

Contraceptive use, prenatal care use and health facility delivery services are functions of input prices, income (Y) and household random characteristics (μ). Through the production function, maternal mortality for household j is a function of demand for W and other variables specified as

$$MMRj = f((Dw\ (Pn, Pr, Pw, Y, \mu), Dr\ (Pn, Pr, Pw, Y, \mu), \mu) \qquad (3.7)$$

Where MMR is Maternal mortality Rate

Also according to Grossman, MMR can be affected by wage rate and education. At the macro level, individual MMR functions are aggregated to get;

$$MMR = MMR\ (Dw, Dr, \mu, GDP) \qquad (3.8)$$

Where GDP is a proxy for household income at the macro level

The households, therefore, make optimal choices on the combination of inputs they consume to derive maximum utility given their budget constraints. The model emphasizes the need to jointly approximate the demand functions for health production inputs and the production function that relates behavior to health outcomes. Maternal mortality

represents the health outcomes and it is improved with the consumption of purchased health inputs, W.

3.4 Empirical Model

The empirical model adopted the Rosenzweig and Schultz health production function with modification. It is expected that maternal mortality will be influenced by the utilization of maternal health care services (Campbell & Graham, 2006 and WHO, 2016), hence was expressed as a function of Total fertility rate, delivery by skilled attendant, contraceptive use and prenatal care; the GDP level was a control variable. Since GDP is used as a proxy for a country's economic strength. GDP correlates to better development, higher literacy levels and improved healthcare systems which can influence maternal mortality rate. As such limiting the observed effects on maternal mortality rate to contraceptive use, prenatal visits and facility delivery.

The study utilized equation 3.8 with modification for the individual countries, stated as;

$$MMR_{it} = f(GDP_{it}, TFR_{it}, DH_{it}, CPR_{it}, PC_{it}) \quad (3.9)$$

Where: MMR*it,* is the maternal mortality rate in a specific country and period*;* GDP*it,* is the GDP per capita in county *i* and the respective year*;* TFR*it,* represents the total fertility rate in a particular country and period*;* DH*it,* is the sum of facility deliveries a particular country *in period t;* while CPR*it* is contraceptive prevalence rate for family planning in a particular country and period; and PC*it* represents the utilization of prenatal care.

To achieve the study objectives, the study utilized the Panel Auto-Regressive Distributed Lag (ARDL) model and carried out Hausman tests to either adopt a Pooled Mean Group (PMG) estimator, Mean Group (MG) estimator or Dynamic Fixed Effects (DFE) estimator. The macro estimators were adopted since the study period (T) and number of

observations (N) were large. MG estimator by Pesaran and Smith (1995) allows the country coefficient to vary both in the short and long run. Thus, coefficient estimation involves approximating country-specific regressions and coefficients computed as the unweighted mean for the individual country. PMG gives provisions for the short-run coefficients and intercepts to adjust to the long equilibrium and variance varies among countries while constraining the long-run slope coefficients to be homogenous across countries in this case across Kenya, Uganda and Tanzania. The DFE is similar to PGM in that it allows for country-specific intercept. However, allowing coefficients of the co-integrating vector to be equivalent in the different panels. The model also confines the short-run coefficients and adjustment speed to be equivalent. According to Baltagi, Grin, and Xiong (2000), DFE models suffer from simultaneous equation bias since the error term influences the lagged dependent variables.

The ARDL model to estimate MG was represented as;

$$MMR_t = \alpha_i + \beta_i \mu MMR_{i,t-1} + \gamma_i X_{it} + \varepsilon_{it} \ldots\ldots \qquad 3.10$$

Where; i stands for country 1,2,3...5, X represent all the independent variables explained in equation 3.9, while θi explained below, represents parameters in the long run.

Where

$\theta_i = \frac{\gamma_i}{1-\beta_i}$ and the panel estimator in MG given by;

$\hat{\theta} = \frac{1}{N}\sum_{i=1}^{N} \theta_i$ and $\hat{\alpha} = \frac{1}{N}\sum_{i=1}^{N} \alpha_i$

The general ARDL model that was used to estimate PMG and DFE took the following form;

$$MMR_{it}=\sum_{j=1}^{p-1}\alpha_{mm_r}^{i}(MMR_i)_{t-j}+\sum_{j=0}^{q-1}\gamma_{mm_r}^{i}(x_i)_{t-j}+\varphi_i+\mu_i+\varepsilon_{it}\ldots 3.11$$

Where; Xi the *(k x 1)* is explanatory variables for group i while μ_i the fixed effects. Element γ are similar across all the countries in PMG, hence PMG model took the following form

$$\Delta MMR_{it}=\theta_i\ \left(MMR_{i,t-1)}-\beta_i X_{i,t-1}\right)+\sum_{j=1}^{p-1}\alpha_{mm_r}^{i}(MMR_i)_{t-j}+\sum_{j=0}^{q-1}\gamma_{mm_r}^{i}(x_i)_{t-j}+$$

$$\varphi_i+\mu_i+\varepsilon_{it}\ldots 3.12$$

Hausman test was utilized to verify if MG and PMG significantly differ. The test involved testing the null hypothesis that: the estimated β_{MG} – estimated β_{PMG}=0(no difference); against alternative hypothesis: estimated β_{MG} – estimated $\beta_{PMG}\neq 0$(there is difference). If the calculated p-values of the Hausman test was higher compared to critical p-values of chi-square, the null hypothesis of no difference between MG model and PMG model was not rejected and the study adopted PMG model. On the other hand, if the calculated p-values of Hausman test was less than the critical p-values of chi-square, the null hypothesis of no difference between MG model and PMG model was rejected and the study adopted MG model.

3.5 Definition and Measurement of Variables

Maternal mortality rate was adopted as the measure of health outcome and the dependent variable.

Table 3. 1: Definition and Measurement of Variables

Health Outcomes	**Definition & Measurement**
Maternal Mortality Rate	The total sum of deaths of pregnant women directly associated with the pregnancy or occurring within 42 days after the

Health Outcomes		Definition & Measurement
		occurrence of birth. Measured as a ratio of 100,000 live births.
Explanation Variables		
Gross Domestic Product		The total produced goods and services calculated at the market value in a country in a given period. Measured in the country's local currency.
Total Fertility Rate		The total number of children born by a woman who has gone through the entire reproductive age.
Delivery at health facility		The sum of deliveries attended by skilled health staff. Measured as a proportion of total expected births
Contraceptive Prevalence Rate		The contraceptive prevalence rate. Measured as the ratio of women utilizing at least one method of contraception between the ages of 15-49
Prenatal Care		Women accessing prenatal care. Is measured as the number of pregnant women making at least two health visits to a health facility before delivery

3.6 Data Type and Source

The study used secondary data for the period between 2000 to 2016, collected from World Health Organization reports, World Bank reports, Demographic and Household surveys in Kenya, Uganda, and Tanzania, National Health Accounts and any other source with relevant information to this study.

3.7 Panel Data Properties

Unit root tests were performed after the determination of cross-sectional dependency in the panels to determine the stationarity levels of the variables. Panel cointegration test was further performed to establish the relationships amongst the variables in the long run and tests of multicollinearity and correlation were also performed.

3.7.1 Cross-sectional dependence

Panel data sets suffer from cross-sectional dependencies where the residuals of panel units are correlated. Dependency within units is attributed to unobserved common factors attributed to the interconnectedness of economies. Socioeconomic and common responses to shocks attributed to a common economic environment and similar country policies Sarafidis and Robertson (2009).

The absence or presence of correlation between residuals determines the unit root test adopted. The first-generation tests assume variable independence while the second-generation tests assume dependency between panels.

3.7.2 Panel Stationarity Test

The stationarity test involves testing for the presence or absence of unit root in the data set. Cross-sectional dependency within the data panels informed the adoption of either first or second-generation tests. The first-generation tests assume cross-sectional independence within the panels and include the Levin-Lin-Chu (2002) test, the Im-Pesaran- Shin (IPS) (1997) test and the Augmented Dickey-Fuller (ADF) test. According to the Levin-Lin-Chu test, the null hypothesis suggests common unit root exists in panels (H_0: $\delta = 0$), while Im-Pesaran- Shin (IPS) (1997) and Augmented Dickey-Fuller (ADF), assumes the existence of individual unit root. The alternate hypothesis postulates panels have no unit root (H_a: $\delta < 0$). If the calculated values of t statistics were less than critical t values, the null hypothesis of the presence of unit root was not rejected. This implied the presence of unit root and the series was concluded to be non-stationary. Whereas if the calculated values of t statistics were more than critical t values, the null hypothesis of the presence of unit root was rejected implying the variable was stationary at the specified level.

The presence of cross-sectional dependency necessitates the second generation of panel unit root tests. The test incorporates contributions by Bai and Ng (2001), Phillips and Sul (2003a), Moon and Perron (2004a), Choi (2002) and Pesaran (2003). Bai and Ng (2001) separately test for the presence of unit root in the common and individual components while Phillips and Sul (2003a) and Moon and Perron (2004a) combines the two components. On the other hand, Pesaran (2003) considers one-factor modeling by loading the residuals.

The study carried out cross-sectional dependency tests to determine the appropriate stationarity method to be adopted. The null hypothesis postulated no cross-sectional dependence while alternate suggested the presence of cross-sectional dependence.

3.7.3 Panel Co-integration Test

Co-integration test, tests whether non-stationary variables have a long run relationship. Variables may seem to wonder in the short run but converge in the long run. This study adopted the Johansen Fisher Panel cointegration, Kao residual cointegration test and Augmented Dickey-Fuller (ADF) test.

3.8 Diagnostic Tests

Before interpreting the study findings, correlation tests were conducted to test multicollinearity. This was to guarantee efficiency, consistency, unbiasedness and reliability of the estimators.

3.9 Data Analysis

Tests of stationarity and cointegration were carried out to ensure the results were reliable and meaningful. To test for Panel stationarity, the study adopted the Pesaran CIPS test.

Hausman test was performed to choose either the MG or the PMG or the DFE model. Subsequently, the study chose either equation (3.10) or (3.11) or (3.12) and estimated to achieve all the study objectives. If the p-value of β2, β3, and β4 was less than 0.05, the null hypothesis of β's=0 will be rejected. Thus, contraceptive prevalence use, prenatal visit and delivery at a health facility were concluded to substantially affect maternal mortality in Kenya, Uganda and Tanzania. However, if the p-values of β2, β3, and β4 were more than 0.05, the null hypothesis of β's=0 was not rejected and thus, the independent variables insignificantly affects maternal mortality.

CHAPTER FOUR

EMPIRICAL FINDINGS

4.1 Introduction

This chapter presents the findings for the respective study objectives. The chapter contains descriptive statistics, panel data properties, diagnostic tests and empirical results.

4.2 Descriptive statistics

Descriptive statistics explains the variable characteristics by measuring the central tendency in terms of mean standard deviation, minimum and maximum as presented in Table 4.1.

Table 4. 1: Descriptive Statistics

Variable	Mean	Std. Dev	Min	Max	Skewness	Kurtosis
Maternal Mortality rate (MMR)	552.55	137.24	346.00	854	0.25	2.04
Gross Domestic Product (GDP) (USD million)	684.00	308.13	239.47	1410.53	0.44	2.38
Total Fertility Rate (TFR) (Number)	5.4	0.8	3.7	6.9	-0.12	2.45
Facility Delivery (DH) (%)	49.3	10.6	36.0	74.2	0.82	2.25
Contraceptive Prevalence Rate (CPR) (%)	35.1	10.9	19.7	66.3	0.96	3.45
Prenatal Care four visits (ANC) (%)	52.0	6.5	41.9	66.0	0.28	2.28

Source: Author's (2022)

Table 4.1 presents the total number of observations for each variable (n) across the three East African Community countries for 17 years (T) totalling to 51 observations (N). The panel data was balanced hence the findings were efficient.

The mean MMR was 552.5 with 346 and 854 as the minimum and maximum values respectively. The MMR had a positive skewness of 0.25. The mean GDP in the three countries was $ 684 million from 2000 to 2016, while the maximum and minimum GDP were $ 1411 million and $ 239 million respectively. GDP had a standard deviation of 308.13 and a positive skewness of 0.44. The average Total Fertility Rate during the study period stood at 5.4 children per woman who had gone through the entire reproductive age. The minimum TFR was 3.7 children while the maximum was 7.4 children. The mean rate was however higher than the global average TFR of 2.6 children (WHO, 2022). The standard deviation was 0.83 children.

The average percentage of women delivering at health facilities was 49.3 during the study period with the minimum and maximum of 36.0 and 74.2 percent respectively. This was significantly low compared with the world average coverage of 83.0 per cent between 2014 and 2020 (WHO, 2022). The Delivery at Health facilities had a positive skewness.

The mean contraceptive prevalence rate was 35.0 per cent in the region from 2000 to 2016. The minimum and maximum percentages registered in the period were 19.7 and 66.3 respectively.

The pregnant women who made four visits for antenatal care constituted 52.0 per cent of the total number of expectant women attending ANC services in the three nations during the period. This proportion did not diverge significantly from the world average of 57.2 percent between 2015 and 2021 (UNICEF, 2022). The level of prenatal care access is an

indicator of health care utilization and coverage. The standard deviation was 6.5 percent while the minimum and maximum percentages were 41.9 and 66.0 respectively.

4.3 Panel Data properties

Time series data tests were done to guarantee efficiency, consistency and reliability of the estimators. Panel data properties were analysed to ensure the regression results were not spurious.

4.3.1 Cross-sectional dependence

Panel data sets may suffer from cross-sectional dependence which affects the stationarity test adopted. If the residuals within the panel sets are not correlated, first-generation tests are adopted while the presence of dependency necessitates the use of second-generation tests. The cross-sectional correlation of errors could be due to common unobserved shocks within a socioeconomic establishment. Panel estimation without evaluating effects caused by cross-dependency can result in inconsistent and misleading results (Sarafidis and Robertson 2009). Using first-generation unit root tests on panels exhibiting dependency characteristics leads to substantial size distortions hence conventional variable estimators and generalised method of moments estimators are not effective in estimation since they ignore cross-sectional dependence (O'Connell (1998).

The tests involved checking the calculated p-value against the critical value. Table 4.2 tabulates the results of the cross-sectional dependence test.

Table 4. 2: Cross-section dependence test

Test	**Statistic**	**Probability**
Breusch-Pagan LM	13.30065	0.0040

Test	Statistic	Probability
Pesaran scaled LM	4.205224	0.0000
Pesaran CD	-0.242310	0.8085

Source: Author's (2023)

The results of two out of the three tests had a p-value of less than 5 percent, hence the null hypothesis was rejected implying the presence of cross-sectional dependence. Therefore, the second-generation panel unit root test was necessary.

4.3.2 Panel unit root test

This test ensures large size alterations are avoided in the unit root test and the study adopted the Pesaran CIPS test. Eviews (2013), requires testing whether the data had a constant, trend or none. The first step in carrying out the second-generation panel unit root test was the determination of the presence of either a constant trend or none within each data set. The test was carried out to determine the parameters to include while carrying out the stationarity tests. The null hypothesis was that the data did not have a trend or constant and needed to be differenced to make it stationary while the alternate postulates that the data follows a trend and constant indicating that the data is stationary. Table 4.3 tabulates the regression results in the variables.

Table 4. 3: Intercept and trend analysis of the variables

	Variable	Coefficient	t-Statistic	Probability
ANC	Constant	52.03830	57.45687	0.0000***
	@Trend	4.731975	11.24938	0.0000***
CPR	Constant	35.05294	22.99973	0.0000***
	@Trend	3.508021	14.37875	0.0000***
DH	Constant	49.3451	33,36983	0.0000***
	@Trend	5.01047	18.15736	0.0000***
FERT	Constant	5.39402	46.61601	0.0000***
	@Trend	0.468462	9.606931	0.0000***
GDP	Constant	684.0044	15.85291	0.0000***
	@Trend	76.88554	25.26646	0.0000***
MMR	Constant	552.5490	28.75180	0.0000***
	@Trend	45.02050	7.831283	0.0000***

Source: Author's (2023)

The probabilities of the trend and constant were below the critical significance levels and hence the null hypothesis was rejected depicting the presence of constant and trend. The Pesaran CIPS test was therefore conducted having fulfilled the prerequisite requirement of presence of constant and trend and results exhibited in Table 4.4.

Table 4. 4: Pesaran CIPS test

	CIPS	P- value	Conclusion
Level			
MMR	-5.30123	<0.01***	Stationary
DH	-1.63022	>=0.10	Not Stationary
PC	0.19824	>=0.10	Not Stationary
CPR	-0.48473	>=0.10	Not Stationary
GDP	-1.14986	>=0.10	Not Stationary
First difference			
DH	-3.61901	<0.01***	Stationary
PC (ANC)	-2.95165	<0.05***	Stationary
CPR	-3.99803	<0.01***	Stationary
GDP	-3.47304	<0.01***	Stationary

Source: Author's (2023)

The Panel unit root results indicated that maternal mortality ratio was stationary at level while skilled attendant at birth (DH), contraceptive prevalence rate, prenatal care and GDP were stationary at the first difference.

4.3.3 Panel data cointegration

Testing of the presence of long-run relationships within the variables guarantees reliable results and Johansen Fisher panel cointegration test (Johansen, 1995), Kao residual cointegration test and Augmented Dickey-Fuller (ADF) test were adopted in the study. The null hypothesis specified no cointegration between variables and the alternate

depicted otherwise. Table 4.5 shows the result of the Johansen-Fisher panel cointegration test.

Table 4. 5: Johansen Fisher panel cointegration test

Series: MMR DH ANC CPR FERT GDP **Null hypothesis: no cointegrating equations** **Lag interval (in first difference): 1 to 1**		
Hypothesized No. of Cointegrating Equations	Trace (P value)	Eigen (P value)
None	0.0000	0.0000
At most 1	0.0000	0.0000
At most 2	0.0000	0.0000
At most 3	0.0000	0.0000
At most 4	0.0000	0.0007
At most 5	0.0001	0.0001

Source: Author's (2023)

According to the P values, the null hypothesis was rejected and the test concluded presence of cointegration.

Table 4. 6: Kao residual cointegration test

	t-statistics	**Probability**
ADF	-2.97631	0.0014

Source: Author's (2023)

The results of the cointegration test showed the presence of cointegration since the null hypothesis of no cointegration was rejected.

Table 4. 7: Augmented Dickey-Fuller (ADF) test

Variable	Coefficient	t-statistic	Probability
RESID (-1)	-0.35917	-3.92537	0.0003
D (RESID (-1))	0.47122	3.766558	0.0005

Source: Author's (2023)

The ADF test results were consistent with the results of the Johansen Fisher panel cointegration and Kao residual cointegration tests and the test concluded the presence of cointegration.

4.3.4 Lag Selection

Before panel data analysis, the study determined the optimal lag length, to ensure the model specification avoids bias in estimation. The optimal lag length was chosen based on the results of the Akaike Information Criteria (AIC), Final Prediction Error (FPE), Schwarz Information Criteria (SIC) and Hannan- Qiunn Information Criteria (HQ). The results of all the lag length criteria suggested 2 lags.

4.4 Diagnostic tests

4.4.1 Multicollinearity test

The study carried out a multicollinearity test to establish inter-correlations levels among the independent variables. High correlation between the independent variables affects the reliability of results since the coefficient's confidence intervals tend to be wide and statistic small. The presence of multicollinearity is shown by the coefficient value being higher than 0.5 in absolute value. Table 4.8 shows the pairwise correlation result between the independent variables.

Table 4. 8: Correlation matrix

	PC	CPR	GDP	FERT	DH
PC	1				
CPR	.2533	1			
GDP	.1724	.8132	1		
FERT	-4259	-.9514	-7686	1	
DH	.1448	.4892	.7642	-.4367	1

Source: Author's (2022)

The correlation matrix results show presence of pairwise correlation between variables. From the results, there is high correlation between GDP and CPR of 0.8132, GDP and Fertility rate of -0.7686, GDP and skilled attendance of 0.7642 and fertility rate and CPR of 0.95. The rest of the coefficients were below 0.5, hence no multicollinearity amongst PC, CPR and skilled attendance (DH). Given the high multicollinearity detected, GDP and fertility rates were dropped from the estimation equation since they would lead to inefficient and biased results.

4.5 Hausman test

To determine whether Mean Group (MG), Pooled Mean Group (PMG) or Dynamic Fixed Effect (DFE) estimators differ significantly, the study used the Hausman test. The Hausman test was utilized to verify if the results of MG and PMG significantly differ. The test involved testing the null hypothesis that: the estimated β_{MG} – estimated $\beta_{PMG}=0$ (no difference); against the alternate hypothesis: estimated β_{MG} – estimated $\beta_{PMG}\neq 0$(there is difference). If the calculated p-values of the Hausman test will be higher compared to the critical p-values of chi-square, the null hypothesis will not be rejected and the study will adopt the PMG model. On the other hand, if the calculated p-values of the Hausman test will be less than the critical p-values of chi-square, the null hypothesis will be rejected

and the study will adopt the MG model. The p-value of the Hausman test was 0.9975, therefore the null hypothesis was not rejected and the study adopted the PMG model since it allows heterogeneity in the short-run dynamics with a common long-run impact.

4.6 Empirical results

The objective of the study was to establish the effects of contraceptive use, prenatal visits, and health facility delivery on maternal mortality in Kenya, Uganda and Tanzania. The optimal lag structure was fixed with the lowest lag length selected. The summary of the results is presented in Table 4.7.

Table 4. 9: Empirical results

Long run			
Dependent variable: Maternal mortality rate			
Independent variable	**Coefficient**	**Std Error**	**P-value**
DH	-2.220580	0.971165	0.0313
ANC- Prenatal care	-1.622348	0.561939	0.0081
CPR	-3.398798	4.185911	0.4248
Short run			
Dependent variable: Maternal mortality rate			
Independent variable	**Coefficient**	**Std Error**	**P-value**
COINTEQ01	-0.532141	0.220183	0.0023
D (DH,3)	-0.028020	6.164345	0.9964
D (DH (-1),3)	-0.280802	3.489022	0.9365
D (DH (-2),3)	-0.162773	2.179816	0.9411
D(ANC,2)	8.137294	6.755142	0.2401
D (ANC (-1),2)	-0.971543	2.462718	0.6967
D (ANC (-2),2)	-2.506392	1.553330	0.1197
D (CPR,3)	1.181845	3.822141	0.7598

D (CPR (-1),3)	5.997669	2.695166	0.0357
D (CPR (-2),3)	6.653354	2.976117	0.0349
C	-0.542034	1.457939	0.7133

Source: Author's (2023)

The error term adjustment coefficient (COINTEQ01) measures the adjustment speed between short term disturbances and the long run equilibrium state. The rate at which disequilibrium is experienced in the short run is adjusted in each term. The error adjustment coefficient was negative and statistically significant implying a long-run association exists between maternal mortality rate, delivery at health facility, CPR and prenatal care. The coefficient of -0.53 implied that short-run adjustments of independent variables will congregate to an equilibrium state in the long run.

4.4.1 Effects of contraceptive use on maternal mortality in Kenya, Uganda and Tanzania

The first study objective was to establish the effect of contraceptive prevalence rate on maternal mortality in Kenya, Uganda and Tanzania. To achieve this objective, the study utilized the PMG/ARDL model. The results displayed in Table 4.9. At level, the CPR coefficient was statistically insignificant in the long run hence contraceptive use was not an important determinant of maternal mortality. The short-run results indicated that the coefficient of CPR was not an important determinant of maternal mortality in the near term but became significant in the subsequent two periods. Contraceptive use had a positive effect on maternal mortality in the first lag and second lag. Given a unit increase in CPR in the first and second lag, the maternal mortality rate increased by 5.98 and 6.65 units respectively. This finding contradicts the studies by Ahmed, Li, Liu, and Tsui (2012), Stover and Ross (2010) and Seyfried (2011). According to Stover and Ross (2010) and

Seyfried (2011) contraceptive use had a negative effect on maternal in 146 developing countries and Congo respectively. However, this study findings supported the findings by Izugbara et al. (2018) that indicated that most women in the East African region discontinued contraceptive use within a year and CPR utilization differs amongst the different countries, hence the negative insignificant effect in the long-term. Izugbara et al. (2018) further stated that the consumption of contraceptives in the region was still significantly low to have a meaningful effect on fertility and subsequently on maternal deaths.

4.4.2 Effects of prenatal visits on maternal mortality in Kenya, Uganda and Tanzania.

The second objective of the study was to determine the effect of prenatal visit on maternal mortality. The short-run coefficient of prenatal care was negative and statistically insignificant. In the long run, the coefficient showed a negative significant effect on maternal mortality rate. The long run coefficient of 1.6 indicated that given a unit growth in prenatal care resulted to a 1.6-unit reduction in maternal mortality. The study findings indicated that utilization of prenatal care services reduces maternal mortality in the long run. The findings supported the findings by Conway and Kutinova (2003) and Rai, Barik and Chowdhury (2022), that concluded that timely access to pre-birth care significantly reduced maternal mortality. Montgomery et al. (2014) found that knowledge of antenatal care affected the timely utilization of health services. The study found increased utilization of ANC with the advancement of age and education level hence a delay in the effect on maternal mortality. The current study did not factor literacy and age of pregnant women but found the finding consistent with the current study since ANC did not have a significant effect in the short run.

4.4.3 Effects of health facility delivery on maternal mortality in Kenya, Uganda and Tanzania.

The third objective of the study was to explore the effect of health facility deliveries on maternal mortality in Kenya, Uganda and Tanzania. The study findings showed that facility delivery had a negative significant effect on maternal mortality. The effect was however insignificant in the near term but displayed a negative and important effect on maternal mortality.

The coefficient of delivery at health facility was 2.22 indicating a 2.22 unit increase in facility delivery resulted in a 2.22 unit reduction in maternal mortality rate holding all other factors constant. The result concurred with findings by Cook (2002) and Jokhio et al. (2005) which indicated that the cost of health care and other non-medical factors were important factors affecting access to maternal healthcare services in the short run. Cost affects access to services, quality and timeliness, hence the insignificant negative effect in the short term. The studies downplayed the effects of more investment in medical services since they did not transform into positive health outcomes in developing countries. Other factors like education, availability of affordable public transport and distance to health facilities impede access to care on a timely basis. The study findings were also consistent with the results by Rai et al. (2022) which found that untrained traditional birth attendants led to increased maternal and infant deaths. The study emphasized the need to train traditional birth attendants and increase ANC as a catalyst to increase delivery at health facilities.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

5.1 Introduction

This chapter presents the study summary, conclusions and policy implications inferred from the results of the study. The chapter also highlights and suggests areas for further research.

5.2 Summary

Globally maternal mortality rate as a key indicator of health outcomes, has continued to be very high given the World Health Organisation (WHO) targets. The global deaths vary across the regions with developing countries accounting for 99 percent. While the global maternal deaths have been on a downward trend, Sub-Saharan Africa continued to register very high deaths accounting for 66 percent of the global deaths. Some countries recorded maternal deaths of 900 per 100,000 live births compared to 8 deaths given 100,000 live births in the European Union region. The world mortality rate stood at 214 deaths per 100,000 births in 2016 (WHO), 2016).

The high death rates were recorded despite several initiatives by governments and international organisations. These initiatives included and not limited to the Alma-Ata Declaration of 1978 which required all nations to urgently implement primary health care, the Millennium Development Goal (MDGs) which had a goal dedicated to maternal mortality, Sustainable Development Goals (SDGs) to accelerate the gains in MDGs. Despite the initiatives, maternal deaths have continued to be high in Kenya, Uganda and Tanzania. The maternal deaths in Kenya, Uganda and Tanzania have been above the global deaths despite a downward trend in deaths since 1990. In 2016, Tanzania recorded

the uppermost mortality rate of 539, Uganda (381) while Kenya recorded the least mortality rate of 346 given 100,000 births. To reduce the high maternal mortality rates, countries have been encouraging the utilization of contraceptives, prenatal care services and facility delivery services.

The overall objective of this study was to explore the effects of contraceptive use, prenatal visits and health facility delivery on maternal mortality in Kenya, Uganda and Tanzania. The specific objectives were; to determine the effect of contraceptive prevalence rate on maternal mortality in Kenya, Uganda and Tanzania, to establish the effect of prenatal visits on maternal mortality in Kenya, Uganda and Tanzania and to examine the effect of delivery at a health facility on maternal mortality in Kenya, Uganda and Tanzania. Data was obtained from World Health Organization reports, World Bank reports, and Demographic and Household surveys (Kenya, Uganda and Tanzania) for the period between 2000 and 2016.

The study was based on the Rosenzweig and Schultz model which embodies an analysis of inputs and outputs, where consumers derive utility from the consumption of health. Before the data was analyzed, panel data properties were determined to ensure the reliability of that the results.

The study adopted the Pooled Mean Group estimator with the Panel Auto-Regressive Distributed Lag (ARDL) model. The study results found contraceptive use was not an important determinant of maternal mortality both in the short and long run. While prenatal care use and delivery at health facility reduced maternal mortality in the long term but did not have an effect in the short term. The short-run inconsistency of the effect of delivery at health facility on maternal mortality concurred with findings by Cook (2002) and

Jokhio et al. (2005) which indicated that the cost of healthcare and other non-medical factors were important factors affecting access to maternal healthcare services in the short run. Cost affects access to services, quality and timeliness, hence the insignificant negative effect in the short term. The mixture of results points to different regional factors that affect the consumption of healthcare services. Socio-culture, education and availability of infrastructure could affect the effectiveness of policy implementation in Kenya, Uganda and Tanzania.

The results of the study point to the challenge Kenya, Uganda and Tanzania are facing in the achievement of the Sustainable Development Goal of reducing maternal deaths to less than 70 deaths per 100,000 live births by 2030. Key barriers include limited access to quality healthcare, especially in rural areas, where skilled birth attendants and emergency obstetric services are scarce. Economic constraints and inequality further exacerbate the problem, with many women unable to afford care. Additionally, socio-cultural factors, such as lack of education, increase risks for maternal complications. Inadequate healthcare infrastructure, shortages of trained health professionals, and poor service quality also contribute to the slow reduction in maternal mortality rates. Without significant improvements in healthcare systems, governance, and international support, Kenya, Uganda and Tanzania are unlikely to meet the SDG target by 2030.

5.3 Conclusions

The study concluded that contraceptive use does not have a direct effect on maternal mortality in Kenya, Uganda and Tanzania. This is because the results did not have a significant effect on maternal mortality. It can also be concluded that prenatal care use in the long term reduces maternal mortality. However, it was not an important determinant in

the short run. Similarly, facility deliveries reduce maternal mortality. However, the results indicated delivery at health facility had a negative significant effect in the long run

5.4 Policy Implications

The findings from the study matched several studies that have shown that increase in health care translates to positive health outcomes. There is need for Kenya, Uganda and Tanzania to invest more in delivery services at health facility. Efforts should be made by Health Ministry and County Departments of Health (CDoHs) to increase awareness of free delivery services at public health facilities in Kenya. However, in Uganda and Tanzania awareness of delivery services at health facilities instead of home deliveries should be increased. Governments should adhere to develop infrastructure geared towards timely access to delivery at health facilities. The increase in infrastructure development and health investment will further deepen the use of delivery services by bringing the services closer to the population.

The region needs to scale up the awareness and use of community trained health staffs through outreach programs and health promotional activities to increase more prenatal visits. In order to reach more people, radio and television campaigns should be intensified to educate the population on the importance of prenatal care. Initiatives geared at reducing the user fees like ‘Linda Mama’ in Kenya should be adopted within the region to widen the scope of women accessing ANC services. Further community health workers should encourage women to attend not less than recommended WHO antenatal visit four visits in the course of the pregnancy.

5.5 Contribution to knowledge

This study provides opportunities for further research in health economics by highlighting gaps in current knowledge. The study findings provided information on effects of contraceptive use, prenatal care and delivery at health facility in Kenya, Uganda and Tanzania. The study differed with earlier reviewed studies which concentrated on the general effects of these variables on maternal mortality in other regions.

The study indicated that delivery at health facility had a negative effect on maternal mortality given a long period but was insignificant in the short term. The findings contradict general theory and reviewed studies that concluded that facility delivery had a negative influence on maternal mortality both in the long and short terms. The study results therefore, provided insight on the region-specific outcomes. The study further analyzed the empirical analysis between prenatal care and maternal mortality and found a positive short run relationship. This contradicted reviewed studies that generalized prenatal care to have a negative effect on maternal mortality.

Lastly, since the study was specific to Kenya, Uganda and Tanzania, the findings can provide useful insight to the different governments, NGOs and the regional body to make decisions regarding maternal deaths so as to achieve the SDGs targets.

5.6 Areas for Further Research

The present research focused on the effects of contraceptive use, prenatal care and delivery at health facility on maternal mortality rate. Maternal deaths are contributed by other factors other than health care e.g. education, physical infrastructure, religion, gender inequality and culture. Further studies are needed in the analysis of non-health variables

on maternal mortality. The study proposes incorporating the variables alongside health factors to analyse the effects on maternal mortality.

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APPENDICES

Appendix I: Lag Selection Criteria

VAR Lag Order Selection Criteria
Endogenous variables: ANC CPR FERT GDP DH MMR
Exogenous variables: C
Date: 10/04/23 Time: 11:31
Sample: 2000 2016
Included observations: 45

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-996.9047	NA	9.19e+11	44.57354	44.81443	44.66334
1	-511.8429	819.2155	2004.709	24.61524	26.30146	25.24384
2	-399.8080	159.3384*	74.45735*	21.23591*	24.36746*	22.40332*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Appendix II: Data Set

COUNTRY	YEAR	MMR	GDP	FERT	SKILLED (DH)	CPR	PC
Kenya	2000	708	397.48266	5.178	42.6	38.5	50.34
Kenya	2001	702	395.32953	5.112	42.26667	38.4	50.34
Kenya	2002	692	389.54271	5.045	41.93333	38.4	50.34
Kenya	2003	678	429.78784	4.979	41.6	39.3	52.3
Kenya	2004	653	451.66872	4.913	41.96667	39.3	53.16667
Kenya	2005	618	511.61642	4.843	42.33333	40.2	54.03333
Kenya	2006	583	685.95453	4.767	42.7	41.2	54.9
Kenya	2007	545	825.6666	4.682	43.06667	42.4	55.76667
Kenya	2008	513	902.07003	4.587	43.43333	43.8	56.63333
Kenya	2009	472	905.13179	4.482	43.8	45.5	47.1
Kenya	2010	432	951.68796	4.369	47.4	47.9	49.2
Kenya	2011	398	971.63333	4.248	51	50.4	51.3

COUNTRY	YEAR	MMR	GDP	FERT	SKILLED (DH)	CPR	PC
Kenya	2012	373	1136.8714	4.123	54.6	53	53.4
Kenya	2013	364	1210.388	3.999	58.2	55.6	55.5
Kenya	2014	358	1315.8045	3.879	61.8	58.3	57.6
Kenya	2015	353	1336.8833	3.765	66	66.3	59.7
Kenya	2016	346	1410.5276	3.663	70.2	61.6	61.8
Tanzania	2000	854	410.95233	5.689	37.32	24.7	66
Tanzania	2001	819	406.53867	5.675	38.84	25.3	65.1
Tanzania	2002	788	411.97235	5.666	40.36	25.9	64.2
Tanzania	2003	763	431.27969	5.659	41.88	26.3	63.3
Tanzania	2004	741	459.25928	5.651	43.4	26.7	62.4
Tanzania	2005	721	492.63138	5.638	43.4	27.4	61.5
Tanzania	2006	703	485.49749	5.616	43.26667	28.5	57.76
Tanzania	2007	685	552.83953	5.584	43.13333	29.8	54.02
Tanzania	2008	666	687.39045	5.542	43	31.2	50.28
Tanzania	2009	656	695.21678	5.489	42.95	32.7	46.54
Tanzania	2010	644	743.40378	5.427	42.9	34.4	42.8
Tanzania	2011	628	781.43701	5.358	52.15	35	44.11667
Tanzania	2012	615	867.86768	5.287	61.4	35.8	45.43333
Tanzania	2013	593	970.41694	5.215	61.925	36.5	46.75
Tanzania	2014	574	1030.0929	5.146	62.45	37.2	48.06667
Tanzania	2015	556	947.93345	5.079	62.975	38	49.38333
Tanzania	2016	539	966.47462	5.015	63.5	39	50.7
Uganda	2000	578	261.869	6.866	36	21.7	42.78333
Uganda	2001	550	239.47319	6.823	39	22.8	41.9
Uganda	2002	537	245.50008	6.776	39.58	22.8	42.96
Uganda	2003	520	243.90153	6.723	40.16	22.8	44.02

COUNTRY	YEAR	MMR	GDP	FERT	SKILLED (DH)	CPR	PC
Uganda	2004	512	296.04694	6.662	40.74	22.6	45.08
Uganda	2005	491	325.59037	6.594	41.32	19.7	46.14
Uganda	2006	473	347.99036	6.516	41.9	23.7	47.2
Uganda	2007	465	416.89862	6.429	41.95	23.7	47.28
Uganda	2008	455	467.90057	6.333	42	25	47.36
Uganda	2009	442	793.48329	6.227	47.13333	26.5	47.44
Uganda	2010	430	815.87368	6.111	52.26667	27.9	47.52
Uganda	2011	419	825.83844	5.983	57.4	30	47.6
Uganda	2012	412	783.71792	5.845	60.76	30.1	50.06
Uganda	2013	401	803.50937	5.699	64.12	32.3	52.52
Uganda	2014	394	876.3543	5.547	67.48	32.3	54.98
Uganda	2015	387	840.40157	5.394	70.84	34.3	57.44
Uganda	2016	381	730.62504	5.242	74.2	35	59.9

Appendix III: Tables

Table A 1: Regression results

Dependent Variable: (MMR, 3)				
Method: ARDL				
Date: 05/04/22 Time: 00:30				
Sample: 2000 2016				
Included observations: 51				
Dependent lags: 1 (Fixed)				
Dynamic regressors (3 lags, fixed): D (SKILLED) D (ANC) D (CPR)				
Fixed regressors: C				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Long Run Equation				
D(SKILLED)	-2.220580	0.971165	-2.286511	0.0313
D(ANC)	-1.622348	0.561939	-2.887054	0.0081
D(CPR)	-3.398798	4.185911	-0.811961	0.4248
Short Run Equation				
COINTEQ01	-0.532141	0.220183	-2.416842	0.0023
D (SKILLED,3)	-0.028020	6.164345	-0.004545	0.9964
D (SKILLED(-1),3)	-0.280802	3.489022	-0.080482	0.9365
D (SKILLED(-2),3)	-0.162773	2.179816	0.074673	0.9411
D(ANC,2)	8.137294	6.755142	1.204607	0.2401
D(ANC(-1),2)	-0.971543	2.462718	-0.394500	0.6967
D(ANC(-2),2)	-2.506392	1.553330	1.613560	0.1197
D(CPR,3)	1.181845	3.822141	0.309210	0.7598
D(CPR(-1),3)	5.997669	2.695166	2.225343	0.0357
D(CPR(-2),3)	6.653354	2.976117	2.235582	0.0349
C	-0.542034	1.457939	-0.371781	0.7133
Mean dependent var	1.176471	S.D. dependent var		10.82090
S.E. of regression	1.199290	Akaike info criterion		6.661336
Sum squared resid	1.451911	Schwarz criterion		7.917943
Log-likelihood	-1.638401	Hannan-Quinn criteria.		7.152864