DETERMINANTS OF MATERNAL MORTALITY IN KENYA

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DECLARATION

I declare that this project proposal is my original work and that it has not been submitted to any other University for any degree award.

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X53/12694/2018

Signature ..... Date 06/12/2022

This research proposal has been submitted for examination with my approval as the University Supervisor.

PROF. DAMIANO MANDA KULUNDU

Signature ..... Date 06/12/2022

DEDICATION

This work is dedicated to my family.

ACKNOWLEDGEMENT

I recognise the continuous guidance and inspiration derived from my Supervisor, Prof. Damiano Manda Kulundu. Your input has been vital in the accomplishment of this work.

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ABSTRACT

This paper evaluates the determinants of maternal mortality in Kenya. Current estimates from Kenya National Bureau of Statistics, show the country's maternal mortality ratio at a wobbly 342 per 100,000 live births. The mentioned statistics are greater than the world's average of 211 per 100,000 live births. The study incorporated a cross sectional study for childbearing women between the age of 15 to 49 years who participated in the 2014 National and Demographic Health Survey as respondents or those who were recognized as siblings who had died (maternal mortality cases) via the direct sisterhood method. Incorporating evidence from reviews, coupled with a binary logit regression analysis, the study found that, where one resides, parity, Age, post-natal clinic attendance, Marital Status and education level significantly influenced maternal mortality in Kenya, while ante-natal care and lower educational attainment were insignificant. Referencing the above conclusion, its vital for the government to invest in awareness creation on the importance of postnatal clinic attendance. Further effort is also required from the government and other key stakeholders in the health sector to make such services easily accessible and affordable in order to minimise maternal mortality in Kenya.

CHAPTER ONE: INTRODUCTION

1.1. Introduction

The number of maternal deaths and/or health issues while pregnant, during birth, immediately following delivery, or within 42 days of pregnancy termination remains high (WHO, 2019). This is despite global socio-economic gains and advancement in medical technologies and practices since the advent of industrial revolution. Maternal mortality is therefore defined as deaths occurring as a result of difficulties experienced during pregnancy or delivery. This is according to the report by UNICEF (UNICEF, 2019). United Nations (UN) inter-agency statistics continue to illustrate its evident that Maternal Mortality has decreased by approximately 38% between 2000 and 2017 though major disparities occur between regional and countries of the world.

For instance, a large number of the nations in the Africa region experience maternal mortality that is higher than 300 per 100,000 live births (UNICEF, 2021). In Kenya, the scourge stands a whopping 342/100,000 live births. See **Error! Reference source not found.** below.

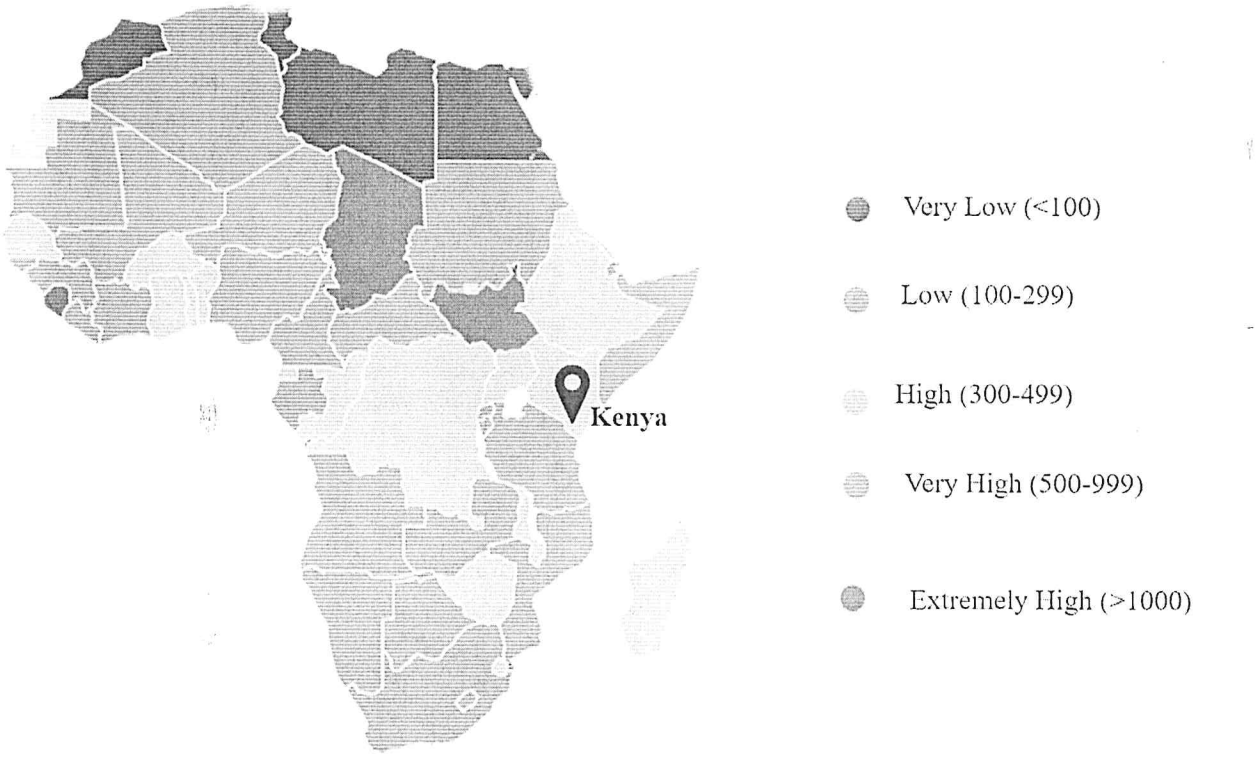


Figure 1; Maternal mortality in Kenya compared to other countries in the Africa region as of 2021 (UNICEF, 2021)

However, this is as opposed to the Sustainable Development Goals (SDG) 3 that is geared to decreasing maternal mortality, reducing it by the year 2030 to 70 deaths in every 100,000 live births (UN Women, 2022). SDG 3 continues to illustrate that the above goal can only be achieved coupled with other progressive interventions including widespread accessibility to reproductive and sexual healthcare services plus the incorporation of reproductive health in the national policies and programs

United Nations Population Fund (UNFPA) illustrates that there is a global agreement on the need to curb maternal deaths occurring due to preventable causes (UNFPA, 2022). Despite the stated global consensus coupled with several years of progressive advancements, close to 300,000 women still die of preventable causes during pregnancy or at child birth; approximately one maternal death every 2 minutes (UNFPA, 2022). The ICPDPA (or the International conference on Population and Development programme of action) has too incorporated the need to eliminate maternal deaths

(UNFPA, 2022). This spearheaded the Launch of '*every woman every child*' movement in the year 2010 to take care of women, children and adolescent needs all over the world.

Direct maternal deaths are mostly caused by obstetric problems due to pregnancy, which include maternal deaths throughout pregnancy, childbirth, or post childbirth, as well as difficulties caused by errors and overlooked intervention, treatments that are either inappropriate or not well done (WHO, 2016). Further, other direct causes such as bleeding (or as commonly known in medical terms as haemorrhage), unsafe infections, unsafe obstructed labour, unsafe hypertensive disorders and unsafe abortions are just but examples.

Indirect causes include but not limited to maternal mother's anaemia condition, affected by malaria, maternal mother's tuberculosis status, her heart disease conditions, and any other maternal mother's illnesses that might occur in pregnancy nevertheless are not specifically related to direct pregnancy causes. They existed before to or in pregnancy time albeit not specific to pregnancy direct causes; these comprise of anaemia, malaria, tuberculosis, heart disease, amongst others exacerbated by the physiological consequences of pregnancy. The WHO definition of maternal mortality has also been adopted by the UK's CMACE. It does, however, divide the causes of maternal death into four categories. These are classified according to timing (pregnancy period plus within 42 days after delivery); known reasons, such as obstetric problems; causes that are not direct; fortuitous and late fatalities (Cantwell et al., 2011)

The Kenya Population and Housing Census (KPHC) conducted in twenty nineteen by Kenya National Bureau of Statistics (KNBS) estimated that the population stands at approximately 50 million (Muinde et al., 2021). Of these, nearly 50% are less than 18 years. Only 42% of births are attended by trained medical professionals, and another fifty three percent of women who were pregnant have on the lower four visits to pre-birth care, contributing to the high maternal mortality rate. 50% of the population lives in poverty, 9.6% of pregnant women have HIV, and 10% of people who give birth at home receive

postnatal checks. The neonatal rate of mortality is 33 deaths in every 1,000 live births, the fertility rate is 4.6, and the HIV prevalence among people aged 15 to 49 is 8.7% for females and 5.6% for males.

In Kenya, the Ministry of Health and parastatal organizations are the main stakeholders in the health sector, which includes the public health system and accounts for 49% of the entire health facilities. With over 289000 maternal fatalities, 2,700,000 neonatal deceases and 2,600,000 stillbirths happening yearly, perinatal and mortality continues to be a serious public health concern on a global scale. Maternal Mortality Ratio (MMR) in Kenya as of 2016 (UNFPA, 2016) stood at 355 maternal fatalities in every 100,000 live births. This situation is further complicated by other multi-faceted challenges that continue to bedevil Kenya's women. UNICEF country reports in 2019 indicated progress being made from over the time but more remains to be done to improve the policy environment, (UNICEF, 2019).

Studies continue to focus the underlying causes and drivers of Kenya's rising maternal mortality in light of the policy-based interventions that have been initiated but are yet to catalyse the attainment of the intended targets. As a result, the necessity to research not just health-related aspects but also other complexities around them in Kenya. The country is grappling with the enactment of evidence-based policies targeted to stemming the scourge of maternal mortality.

1.2. Statement of the Research Problem

Maternal mortality remains high in Kenya. Current estimates from Kenya National Bureau of Statistics, show the country's level at a wobbly 342 in every one hundred thousand born alive. This figure is greater than the worldwide figure of 211 in every 100,000 live births. If this worrying trend was to be maintained, Kenya will not attain its local and global international commitments on maternal healthcare services. For instance, under SDG 3.1, which Kenya is among the countries that have signed up to its envisioned attainment which seeks to decrease by 2030, the global maternal mortality ratio (MMR) to be lower than seventy in each 100,000 live births. Among the major obstacles to Kenya's progress

include limited data to inform decision-making processes at the national level in addition to creating public awareness. At the moment, Kenya's policies on healthcare are vested in the national government via the country's Ministry of Health. The implementation of these policies, on the other hand, is mainly vested with the County Governments that operate at the sub-national level. But data to inform the interfacing between the two arms of government remains a big hurdle, according to Kenya Health Sector Strategic Plan 2018-2023 (MOH, 2018). This situation presents a big impediment to the country's quest to provide universal health coverage in line with Kenya's long-term development agenda, dubbed the *Vision 2030*, as well as the UN Twenty Thirty Agenda for Sustainable Development. The proposed study thus seeks to address the indicated data gaps by: (a) establishing the determinants of maternal mortality across the country through a desk survey that will mainly focus on official data derived from Kenya Demographic Health Surveys (KDHS) between 2014 and 2022; (b) providing a detailed policy analysis on key macro- and micro-level interventions.

1.3. Study Objectives

The main objective of this study is to evaluate the determinants of maternal mortality in Kenya.

1.3.1 Specific Objectives

Specifically, the study aims to:

a) To evaluate the socio-demographic determinants of maternal mortality in Kenya.
b) To examine the socio-economic determinants of maternal mortality in Kenya.
c) To outline the policy implications based on the results of the study.

1.4. Justification of the study

Evidence-based decision-making is critical to the implementation of the Sustainable Development Goals (SDGs) at the global, regional, and national levels. Kenya is among the countries of the world that subscribe to the SDGs and continues to implement them in conjunction with its own national development agenda, the *Vision 2030*. At the center of both the SDGs and the *Vision 2030* is the provision of universal healthcare services. Kenya is currently implementing a strategic plan on health covering the period 2018-2023. Among the major facets of this intervention is maternal healthcare. Under this component, the country aims to reduce maternal mortality to less than 70 per 100,000 live

births by 2030.A comprehensive knowledge on the explanations of determinants of maternal mortality and morbidity will therefore be essential for planning successful maternal and child health programs in the country.

CHAPTER TWO: LITERATURE REVIEW

2.1. Introduction

Search for appropriate literature was divided into section one and two. Section one of the literature pursuit concentrated on the important variables and factors that contribute to maternal indisposition and mortality. The second phase involved looking for critical interventions and novel techniques to reduce maternal morbidity and death relative to the previous portion's determinants. For purposes of comparison, a variety of literature reviews spanning industrialized and developing nations were examined. Articles relating to maternal mortality and morbidity and recent publications with publication years between 2002 and 2010 met the inclusion criteria. However, some significant publications from 1992 were included since they include important data. The fact that the research studies involved had received ethical approval was another requirement for inclusion. Language was a factor for exclusion because only English literature was looked at. PubMed, Scopus, Science Direct, as well as other online search engines are used to find the articles for this thesis (Google scholar). During the literature retrieval, the following search terms were used: Determinants, Maternal mortality and morbidity, Maternal health, Health system, and interventions. Other pertinent information was obtained from United Nations web pages such as WHO, UNICEF, UNFPA, and UNDP. Kenyan country health strategy policy plans are used. The important indicators illustrated in this study are from the Kenya Demographic Health Survey (KNBS, 2009, 2014).

2.2. Theoretical review

McCarthy & Maine, (1992) developed a structure for investigating the maternal deaths determinants in order to better find out how maternal mortality is impacted by direct and indirect factors. The two looked at the outlines produced by Davis and Blake (1956), Bongaarts (1978), and (Mosley & Chen, 1984). Davis & Blake (1956) began by categorizing how fertility levels are affected by variables that are intermediate that are impacted by societal factors. They defined 8 intermediate variables of fertility: marital status, rate of intercourse, contraception, sterility, induced abortion, fecundity location, spontaneous intrauterine mortality and fertility period. The analytical paradigm based on social

structure and fertility was later examined by Bongaarts (1978). In his study on the proximal fertility determinants, he lowered the 8 variables of intermediate fertility mentioned by Davis and Blake (1956) to 3. Exposure factors, factors of purposeful fertility control and also factors of natural marital factors were its intermediate variables. Mosley & Chen (1984) also presented a paradigm for analysing child survival. They included both social and biological aspects in their framework, as well as approaches used by initial medical and social scientists to analyse child survival in underdeveloped nations, as supported by (Davis & Blake, 1956) and (Bongaarts, 1978). (McCarthy & Maine, 1992) evaluated previous writers' analytical research and included sociocultural, unknown, and expected components in their framework. They classified their determinants as remote determinants, determinants that are intermediate, and health determinants. The order of consequences of health in their approach included implications, pregnancy, and disability. The determinants known to be intermediate included elements that were unknown and unanticipated, in addition to status of health, reproductive status, healthcare behaviour, accessibility to health services, and utilization of health care services. The community's socioeconomic and sociocultural condition of a pregnant woman were distant determinants. In examining the factors of maternal deaths in Kenya, this study employs a modified paradigm entrenched on (McCarthy & Maine, 1992)

2.2.1. Social Capital Theory

The early theorisers and scholars claimed that the ideal of social capital idea is believed to have been in small communities as a result of human interactions, yet the concept of social capital has recently gained popularity. According to the researchers, social capital assists people in making informed decisions and can be analyzed in relation to specific health concerns (Krieger, 2011). According to the social capital theory as applied to this study, the degree of education and networks of a woman can be used to calculate her social capital. Maternal health care practitioners can use this theory to assess the global rate of maternal mortality. Several philosophers claim that maternal health knowledge in Kenya is deficient.

2.2.2. The Health Belief Model

Among the behavioural theories is the Health Belief Model that aid in explaining why there exist such a high frequency of maternal death in Kenya and other African countries (HBM). According to the model, a person determines whether or not to make changes based on five major variables. These are expected vulnerability, perceived severity, expected advantage, alleged prompt to act, and expected barriers to acting (Edberg, 2007). Every step outlines why an individual would either prefer to make adjustments or not. Women who are pregnant will be fruitful in reducing the rate of maternal mortality if they evaluate this model and steps to curb the developing scourge of maternal mortality and do not allow any apparent behaviour to affect them. These theories provided a framework for determining how maternal mortality, a health care outcome, is influenced by sociodemographic and service delivery factors.

2.2.3. Gender Equity Theory

Gender equity theorem elucidates gender equity in health care, social-economics, nutrition, and sex relations. According to theory of gender equity, maternal fatalities and the dangers connected with them should be avoided. In terms of justice and human rights, this approach aids to develop justice and women equality. Having this notion in place gives women a feeling of belonging at their frequent check-ups since they will be treated equitably, allowing them to get quality service and relevant information before and post pregnancy (Aboderin & Beard, 2015). The information acquired assists women in making health-related decisions without any impediments that may encourage maternal death. According to the research, professional health care providers have not yet registered expectant mothers who pass away at home and as a result, there is avoidance of reporting of such situations by family members. Due to reporting failures and concealed abortions linked with complications, information on maternal mortality in the social environment has been restricted.

2.3. Empirical review

Some predictors of death of mothers discussed above have been used by studies that examine the maternal mortality determinants. They concentrate on the distant (socioeconomic and sociocultural) or the intermediate (health/medical) determinants. (Masturoh et al., 2017) conducted a case-control and observational study to find out the maternal mortality predictors using the paradigm of (McCarthy & Maine, 1992). The study concentrated on intermediate (medical/health) and socioeconomic factors. By

means of path analysis, the researchers discovered that prenatal coverage and difficulties in obstetric increased the likelihood of mothers mortality in the Indonesian district of Brebes. They noted that prenatal coverage was impacted by the mother's employment and educational level. The socio-cultural determinant variables were not taken into account by the author when calculating maternal mortality. In order to uncover the factors contributing to maternal mortality, my study intends to take socio-economic as well as socio-cultural influences into account.

Data extracted from DHS (demographic and health surveys) for the years 1991, 2004, and 2011 were used in a different study i.e Meh et al (2019) on the aspects that play a role to maternal mortality in Cameroon. To analyze maternal mortality, the author modified the paradigm from (McCarthy & Maine, 1992). Socioeconomic, sociocultural, and intermediate (medical/health) variables were the main topics of the study. Meh demonstrated that there exist connections between age, parity, age, education, and maternal deaths using a logistic regression. Death of mothers was substantially correlated with ethnicity and domestic violence, and there was a substantial association between distance to the nearest medical/health institution in north potion of Cameroon and maternal mortality in the same region, according to the author's data.

Another ecological study on the maternal mortality determinants conducted between 2008 and 2016 by (Girum & Wasie, 2017) based on information obtained from global databases including sociocultural, socioeconomic, and intermediate (medical/health) topics variables from a sample of 82 developing nations. According to their findings, the maternal mortality ratio was inversely related to prenatal coverage, skilled labor and delivery attendance, accessibility to better water and sanitation, literacy among adults, and per capita GNP (gross national income). Furthermore, their research found a link between maternal mortality ratio and socioeconomic factors, medical care, and illness.

Zolala et al., (2012) investigated predictors of Iran's maternal fatalities using data from 2001 to 2008 from several districts. Multiple regression analysis revealed that literacy among males and employment

were found to be inversely associated to mortality of mothers. The data also revealed a substantial link between maternal deaths and the percentage of midwives. Socioeconomic, sociocultural, and intermediate (medical/health) influences were among those investigated.

Between 1997 and 2006, (Alvarez and others, 2009) carried out a multi-ecological study on forty five Sub-Saharan African nations utilizing information from international databases such as the World Bank, UNICEF, UNDP and WHO. Their research focuses on socio- economic and cultural, and intermediate variables. Their regression analysis's findings revealed a connection between the maternal mortality ratio's socio cultural/economic factors.

The causes of maternal mortality in SSA were investigated by (Buor & Bream, 2004). Using information from global databases like the World Bank, UNAIDS, the UN, DHS, and global and countrywide statistical agencies, they concentrated on intermediate (medical/health) and socioeconomic factors for 28 countries. In order to determine a correlation among the determinants and the proportion of maternal deaths, their study used bivariate correlation as well as additional nonparametric methods, including regression and Kendall's tau-c values. The findings revealed a substantial correlation amongst maternal mortality, GNP per capita, and life expectancy.

2.4. Overview of the Literature Review

McCarthy & Maine (1992) noted that their framework's components were not all-inclusive of the factors influencing maternal mortality, allowing for the addition of new elements or the reduction of current ones. This is clear in the study on the factors of maternal mortality in Cameroon undertaken by (Meh et al., 2019). Other factors of maternal mortality known from the Cameroon Demographic and Health Surveys (CHDS) were integrated by the author. They incorporated additional female factors related with maternal health outcomes (domestic violence, race, and religion). The factors were deemed to be appropriate for the study's environment. The components were divided further into community and household levels. As a result, my analysis was built on a revised framework that included maternal mortality factors from each significant McCarthy and Maine framework issue. Medical/health, economical, and cultural factors all impact maternal mortality.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Conceptual Framework

A modified conceptual framework based on the work of McCarthy and Maine to do the analysis of factors influencing maternal mortality in Kenya since it indicates the impact social, biological, and cultural factors on maternal mortality, it is the highly detailed outline for investigating determinants of maternal mortality. Moreover, it is an often-employed framework in research on the variables that affect maternal health. According to how close it is to the outcome, each factor of dearth of mothers in the modified analysis is categorized as either distant or intermediary. While distant determinants have an effect on the result through their impact on the intermediate factors, intermediate determinants are more directly impactful on maternal mortality. The revised paradigm makes a distinction between factors affecting maternal mortality at both on a personal and communal levels.

Maternal health care will relate to all procedures performed throughout the treatment process. This is a comprehensive approach that encompasses a comprehensive package that supports mother, newborn, and child health during their life cycle (Kerber et al., 2007. Provision of care given by families and societal group, as well as outpatient and awareness programs and clinical care provided all through the lifespan, including adolescents, pregnancy, delivery, the post-natal period, and infantile period," write Kerber et al. Saving lives is dependent on the extensive inclusion and combined quality packages of service provision, such that care delivered at each instance and location aids to the efficiency of the entire covered programs" (Kerber et al., 2007). Adolescent health, ANC, labor and delivery, PNC, abortion, and family planning will all be included in the analysis if the care approach continuum is used. Although newborn and child health are aspects of the broad aspect of care, they shall be ignored for the purposes of this thesis. Additionally, this thesis makes use of the conceptual framework of (McCarthy & Maine, 1992). The Ministry of Health applied the framework in western Kenya and customized it for that region. This study's conceptual framework was chosen as its foundation because of how comparable their contexts were. To more accurately investigate the Kenyan context, various

changes were made. The framework illustrates the different tiers of factors that affect maternal morbidity and death. It classifies the different factors into three groups: proximate, intermediate, and contextual (Bitew et al., 2016). The framework may be used to examine how these determinants affect outcomes for healthy pregnant women, newborns, and mothers as well as maternal and perinatal illness and death.

3.2 The Econometric Model

The study will make use of logit regression to examine the determinants of maternal mortality. Logit regression has been used to find out the probability of an event occurring in this case (maternal death) given certain conditions (i.e., the independent variables. The logic regression model is identical to any other model-building technique, including linear or multiple regression. The goal is to determine the model that best defines the connection between a group of independent variables and the outcome (dependent or response variable), commonly referred to as covariates. The logit-regression equation differs from the linear regression model since the dependent observations in logit regression are dichotomous or dualistic. Logit analysis is essentially a probability regression model that expresses the dichotomous variable, Yi, as a non-linear function of the explanatory variable Xi, and can be understood as the likelihood that the mother will die or survive given the variable in the model..

Two primary reasons for choosing logit model are:

i) It is a very flexible and straightforward model to use from a mathematical perspective, ; and

ii) It is susceptible to a biological valid analysis (Hosmer and Lemeshow, 1989).

The specific form of the logit model is indicated below:

$$y(x) = \frac{e\beta^0 + \beta^{1x}}{1 + e\beta^0 + \beta^{1x}}$$

Where y(x) = Chances of occurrence of an event occurring (Maternal mortality)

e = the base of natural logarithms approximately 2.718

β = Coefficients estimated

x = Independent variable (Age, Education, Region, Marital status, Antenatal clinic)

In transforming y(x) is central in the study of logistic regression and transformation defined as y(x), as follows:

g(x) = In [-------]/1 - y(x) = $\beta^0 + \beta^{1x}$

This transformation is important because it possesses a lot of desirable characteristics of linear regression. The logit, y(x), is linear in its parameters, can be continuous, and can range from -∞ to +∞ depending on the range of x.

3.3 Estimable Model

The logistic model adopted in the study is specified by looking at the effects of the predictor variables (Age, Education, Region, Marital status, Parity, Postnatal Clinic) on maternal mortality, as illustrated in the equation below:

$$mm = \beta 0 + \beta 1(\text{young mothers}) + \beta 2(\text{old mothers}) + \beta 3(\text{Primaryeducation}) + \beta 4(\text{secondaryeducation}) + \beta 5(\text{highereducation}) + (\beta 6\text{region}) + \beta 7(\text{maritalstatus}) + \beta 9(\text{parity}) + \beta 10(\text{postnatalclinic}) + \varepsilon i$$

$\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8, \beta_{79}, \beta_{10}$ are the coefficients to be estimated.

ε_i is the stochastic error term.

3.4 Definition, Measurement and Signs of Variables.

3.4.1 Dependent variable

Maternal mortality will be the study's outcome variable. A deceased woman will be assigned this status if a respondent says "yes" when asked if her female sibling died while pregnant, at childbirth, or within two months of delivery. The dependent variable will be coded as binary, with 1 indicating mothers death (dead relatives), whereas live women (respondents) will be coded as 0.

Table 3.1 Determinants of maternal mortality

Variables	Measurement	Expected Signs
	Dependent Variable	
Maternal Mortality	Dummy variable taking the value of 1 if maternal mortality occurred and 0 if otherwise	
	Independent Variables	
Young mothers	Dummy variable taking the value of 1 if young mother 15-34 years and 0 otherwise	Positive
Old mothers	Dummy variable taking the value of 1 if old mother 35-49 years and 0 otherwise	Positive
Primary dummy	Dummy variable taking the value of 1 if the mother attained primary education and 0 if otherwise.	Negative
Secondary dummy	Dummy variable taking the value of 1 if the mother attained secondary education and 0 if otherwise.	Negative
Higher dummy	Dummy variable taking the value of 1 if the mother attained higher education and 0 if otherwise.	Negative
Region	Dummy variable taking the value of 1 if the mother resided in rural region and 0 if the mother resided in urban region.	Positive
Marital status	Dummy variable taking the value of 1 if the mother was ever married and 0 if otherwise.	positive
Parity	Dummy variable taking the value of 1 if the mother had present live birth and 0 if otherwise.	Positive

Postnatal Clinic	Dummy variable taking the value of 1 if the mother attended postnatal clinic and 0 if otherwise.	Negative

3.5 Diagnostic Tests.

The following tests will be conducted to examine whether the study violates the assumptions of logistic regression.

3.5.1 Test for Multicollinearity

Occurs when predictor variables have high correlations, which causes estimations of the regression coefficients to be unstable and unreliable. It is also possible that the signs and magnitudes of logistic regression coefficient estimates will be incorrect. VIF will be used to measure the amount of multicollinearity. All in all, a VIF more than 4 or tolerance below 0.25 suggests the possibility of multicollinearity and necessitates additional examination. When VIF exceeds 10 or tolerance falls below zero point one, then the variables are correlated and should undergo rectification.

3.5.2 Test for Heteroscedasticity

This emanates where the variance of the residuals is unequal across a range of measured values. Breusch-Pagan test will be used to determine the presence or absence of heteroscedasticity.

3.6 Data Source

This study will utilize data from the National and Demographic Health Survey (2014) for women of childbearing age (15-49 years) who participated in the survey as respondents or who were identified as deceased siblings (cases of maternal mortality) using the direct sisterhood method. This method identifies deceased siblings through select questions asked of the respondents and is widely used by the Demographic and Health Survey Program and maternal health studies to obtain periodic estimates of maternal mortality. In Kenya, the survey typically spans five years and is normally conducted by Kenya National Bureau of Statistics, (KNBS). A representative sample of 40,300 households was used in the study design, of which 39,679 households were chosen. Of the aforementioned, 36,430 households were successfully interviewed. According to the KDHS 2014, study report, a total of 32,172 women of child bearing age between 15 and 49 years were eligible for the study, but only 31,079 were

interviewed. Those selected and successfully interviewed on the full women's questionnaire were a total of 14,741 out of the eligible 15,317, translating to a 96% response rate. An exclusion criterion was applied in establishing the population of the study, informed by the response on attendance of antenatal clinic. Statistical analyses will be performed using STATA. Maternal mortality ratios for 2014 will be computed. Survey adjusted simple and multivariable logistic regression analyses will be used to investigate the association of the independent variables and maternal mortality in Kenya using pooled data for KDHS,2014. Statistical significance for all regressions performed will be determined at $p < 0.05$.

CHAPTER FOUR

DATA ANALYSIS, FINDINGS AND DISCUSSION

4.0 Introduction

This study mainly aimed at evaluating the factors influencing maternal mortality in Kenya and outlining the policy implications based on our finding. This chapter presents an analysis of the data collected and the study findings. The study's data analysis was done in three main stages: First, cleaning and coding of KDHS 2014 was done to construct the dependent and independent variables of interest. Second, statistical analysis of the variables and their significance levels was done by STATA version 14 and finally, reporting and discussion of findings was then done with an aim of comparing our study findings with other empirical work related to maternal mortality. Analyses were undertaken namely descriptive analysis and linear analysis.

4.1 Descriptive statistics

4.1.1 Summary statistic

Result in Table 1 reveals that on average, about 0.58% of the household had experienced maternal mortality of a sibling resulting from complications from pregnancy or child birth in Kenya under the period of study. Findings further shows that on average, about 3.22% of maternal mothers attended postnatal clinic. This can be interpreted as an existence of variation across different regions in maternal mothers attending attended postnatal clinic in Kenya. Further, the study shows that on average, about 76.41% of the maternal mothers were married, however, a high standard deviation of 42% reflects a regional disparity in marital status of the maternal mother (implying some regions had high number of married maternal mothers while others had a few). In regard to parity (which was measured as whether a mother has presently live birth or pregnancy), the result shows that about 48.3% of maternal mothers had presently live birth or pregnancy. However, there is a regional disparity in the parity states of maternal mothers during the study period that is reflected by a large standard deviation (49.97%).

Further, the study shows that about 32.77% of maternal mothers were living in rural areas while 37.29% were living in urban areas. See Table 1.

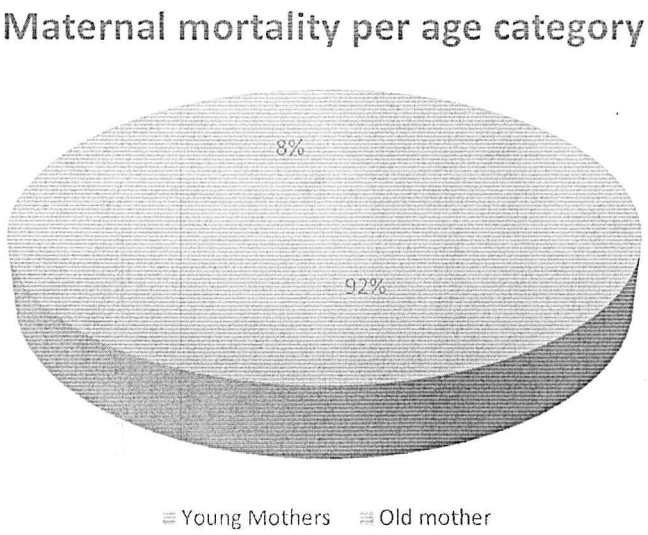
Table 1: Descriptive statistics

Variable	obs	Mean	Std dev	Min	Max
Maternal mortality	6,151	.0058527	.076285	0	1
young mother-1	6,151	.838888	.3676641	0	1
0ld mother -1	6,151	.161112	.3676641	0	1
Mother attended post-natal clinic-1	6,151	.6542026	.4756662	0	1
Mother ever married - 1	6,151	.7641034	.4245924	0	1
Present live birth/pregnancy- 1	6,151	.4830109	.4997519	0	1
Primary -1	6,151	.5374736	.4986343	0	1
Secondary-1	6,151	.2417493	.428178	0	1
Higher -1	6,151	.0817753	.2740444	0	1
Rural dummy-1	6,151	.3729475	.4836276	0	1

4.1.2 Descriptive Results age category and maternal mortality

Results in Figure 2 reveals that on average, older mothers had a higher maternal mortality rate of 92% as compared to the young mothers at 8%.

Figure 2:Age category and maternal mortality

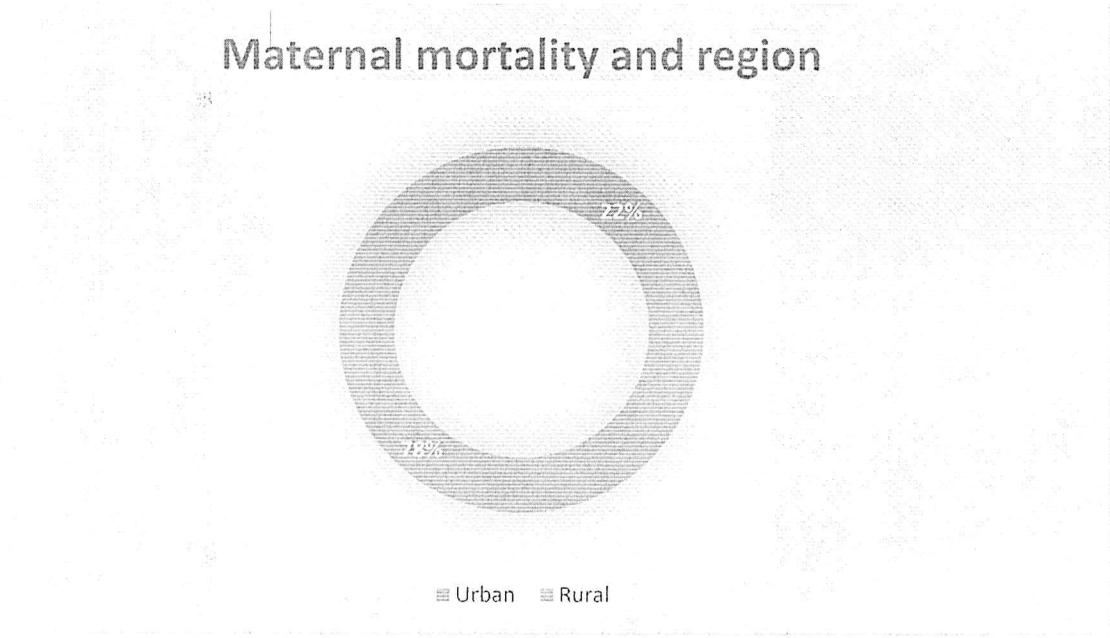


Author's Computation 2022

4.1.3 Descriptive Results of region and maternal mortality

Results in Figure 3 reveals that on average, mothers living in rural areas had a higher maternal mortality rate of 78% as compared to those living in urban areas at 22%.

Figure 3:Cross tabulation of region and maternal mortality

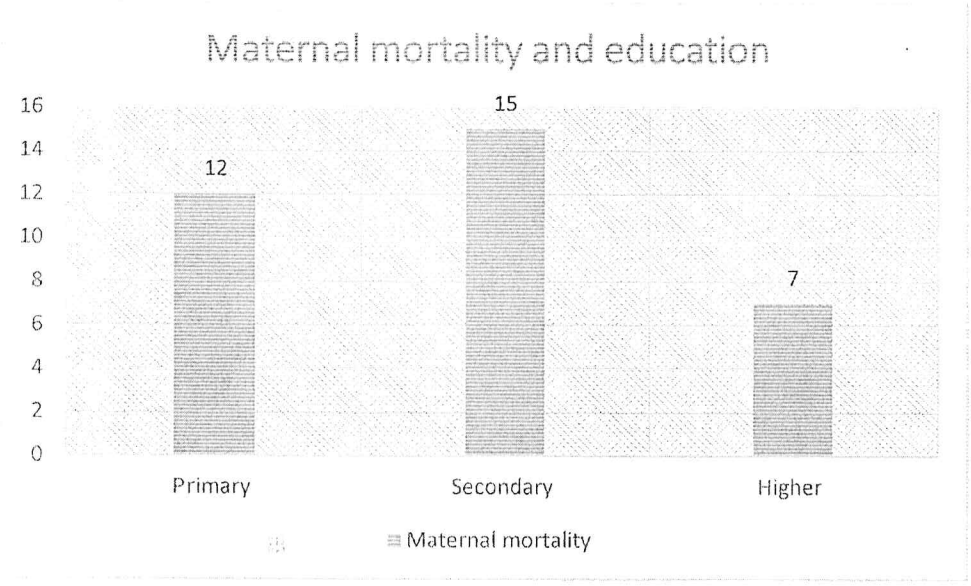


Author's Computation 2022

4.1.4 Descriptive Results of educational level and maternal mortality

Results in Figure 4 reveals that on average, mothers who had attained primary education had a maternal mortality rate of 12% as compared to those who attained secondary and higher education at 15% and 7% respectively.

Figure 4: Cross tabulation of educational level and maternal mortality

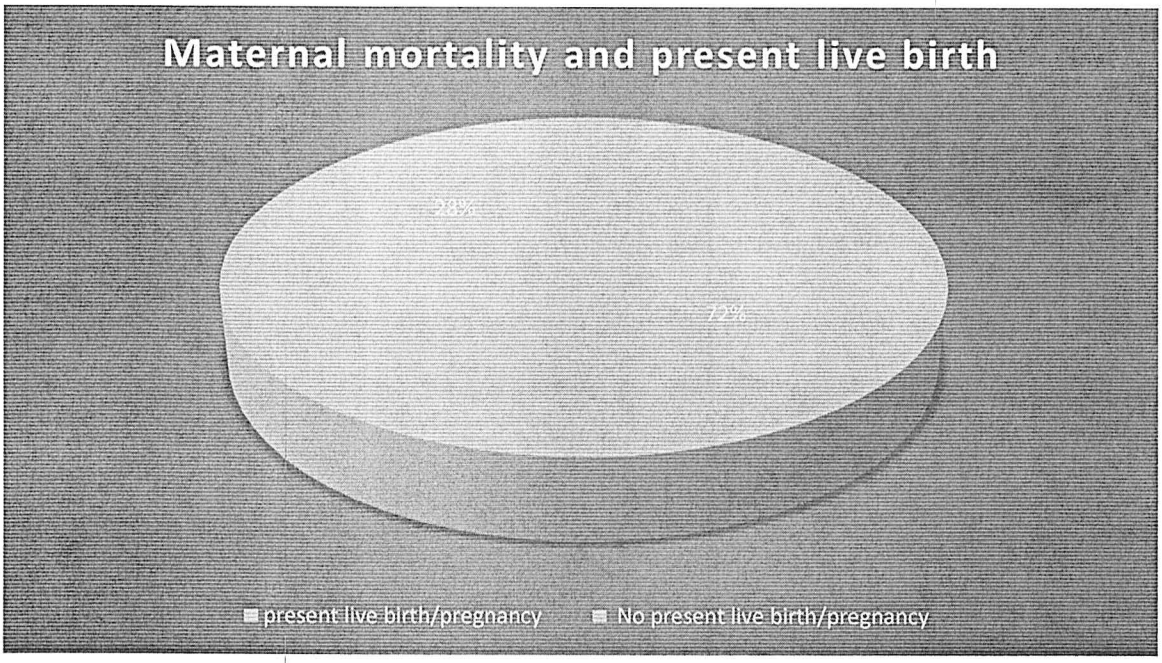


Author's Computation 2022

4.1.5 Descriptive Results of parity and maternal mortality

Results in Figure 5 reveals that on average, mothers who had a present live birth/pregnancy had a higher maternal mortality rate of 72% as compared to those without at 28%.

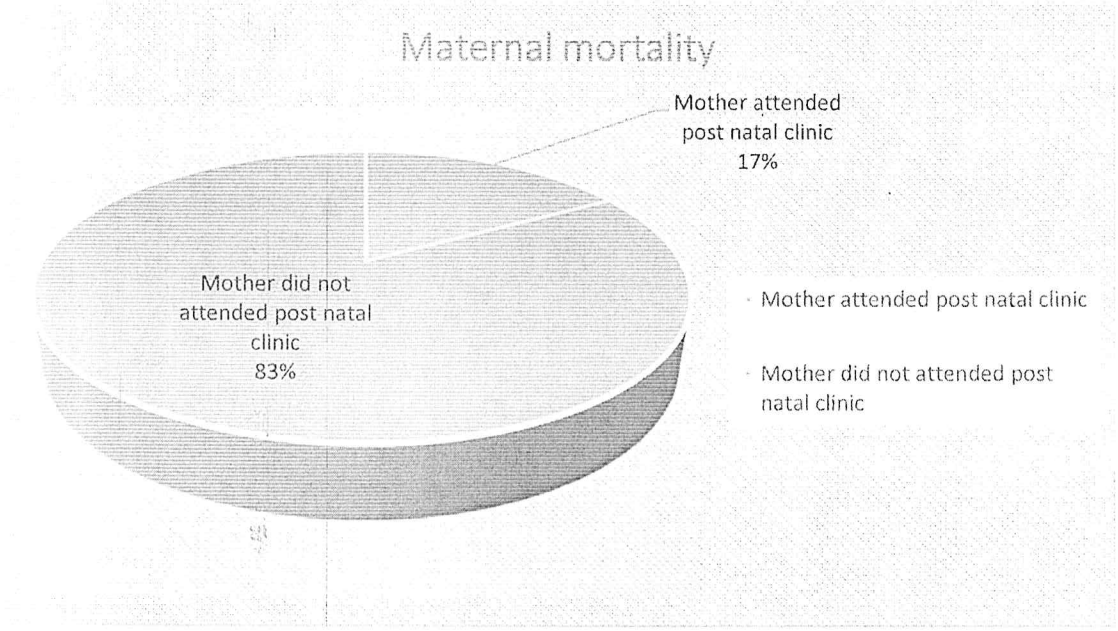
Figure 5;Cross tabulation of parity and maternal mortality



Author's Computation 2022

4.1.7 Descriptive Results of postnatal clinic and maternal mortality

Results in Figure 5 reveals that on average, mothers who had a present live birth/pregnancy had a higher maternal mortality rate of 72% as compared to those without at 28%.

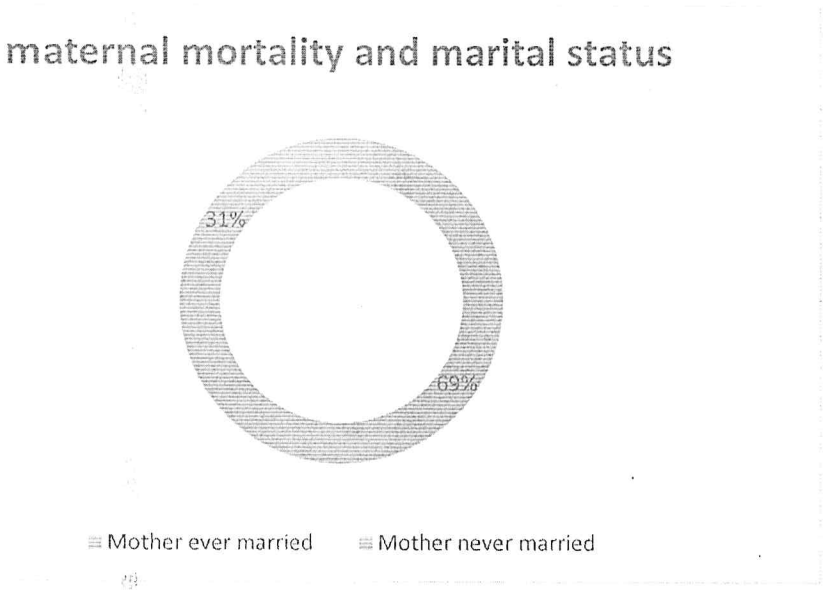


Author's Computation 2022

4.1.7 Descriptive Results of marital status and maternal mortality

Results in Figure 6 reveals that on average, ever married mothers had a higher maternal mortality rate of 69% as compared to those who were never in any union at 31%.

Figure 6;Cross tabulation of marital status y and maternal mortality



Author's Computation 2022

4.2 Diagnostic tests

4.2.1 Multicollinearity test

Multicollinearity is a serious problem in cross sectional data set as the one being utilized in this study. Its presence in the data set inflate the standard errors of some or all of the regression coefficients thus leading to spurious result that are inconsistent. To assess the multicollinearity status of the variables in the data set, this study computing VIF. This is important since the VIF indicates whether an explanatory variable has a strong linear relationship with the other an explanatory variables in the model. Hair, Black, Babin and Anderson (2019) suggest that if VIF is less than 10, then collinearity is inconsequential and does not pose a problem in linear regression analysis. Result in Table 10 shows that multicollinearity was not a serious problem in our data set since all the VIF was less than 10.

Table 2: Multicollinearity Test

Variable	VIF	1/VIF
young mother-1	1.14	0.879574
Mother attended post-natal clinic-1	1.03	0.971195
Mother ever married - 1	1.05	0.951100
Present live birth/pregnancy- 1	1.67	0.599304
Primary -1	2.33	0.428535
Secondary-1	2.28	0.437830

Higher -1	1.71	0.586103
Rural dummy-1	1.07	0.931801

4.2.2 Heteroskedasticity test

Breusch & Pagan, (1979) opines that Heteroscedasticity an assumption in linear regression analysis (such as a binary logit that is being utilized in this study) where the residuals at each level of the explanatory variables display a systematic change in the range of measured values. Its existence renders the predicted coefficients biased and thus unreliable. The study used a Breusch–Pagan test for heteroskedasticity. Result in Table 3 reveals that heteroskedasticity was a serious problem in our data set and as such, we used robust standard errors in our regression.

Table 3: Breusch-Pagan test for Heteroskedasticity

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: fitted values of maternal mortality

chi2(1) = 4718.09

Prob > chi2 = 0.0000

4.3 Regression analysis

4.3.1 Marginal effects

This study main aim was to evaluate the factors influencing maternal mortality in Kenya and outline the policy implications based on the results of the study. The study's dependent variable was a binary outcome assigned to a deceased woman if a respondent will indicate "yes" to whether her female sibling died while pregnant, during childbirth, or within 2 months of delivery and zero if otherwise. As such, the study utilized one of the binary models (logit) after confirming that the errors were non-normally distributed. The key explanatory variables considered in the model included age, marital

status, post-natal clinic, parity, place of residence (region) and educational level of the maternal mothers.

In order to reveal the changes in the probability or likelihood of observing changes in maternal mortality in Kenya due to changes in one of our explanatory variables, we computed the marginal effects shown in Table 4. From the result, we observe that if all other factors were held constant, living in rural areas increased the likelihood of maternal mortality marginally by about 0.81%. Therefore, residing in rural areas has a positive and significant effect on maternal mortality. A plausible explanation for this could be as a result of the proximity to quality healthcare facilities and expertise mainly found in urban areas. The distance may hamper easy access by women in search of care hence contributing to the aforementioned rate of maternal mortality in rural areas. More precisely when it comes to emergency situation that need immediate attendance by specialized personnel. The distance may delay the time in which the woman gets to have the condition addressed hence leading to unanticipated fatalities.

Further, when all other factors were held constant, it was observed that failure to attend postnatal clinics increased the likelihood of observing maternal mortality marginally by approximately 0.41%. The variable was therefore found to have a positive and statistically significant effect on maternal mortality. A possible explanation for above could be as a result of lack of early detection of post birth related complications that could be easily and timely addressed if otherwise.

Subsequently, when all other factors are held constant, an additional year of a young mother marginally decreases the likelihood of observing maternal mortality by approximately 0.44%. Hence the variable was found to have a negative and statistically significant effect on maternal mortality. A possible explanation for this could be the motherhood experience that comes with age as well as exposure to various practices. Advancement in age also comes with an increased level of preparedness in terms of the readiness to deliver.

Table 4: Marginal effects and Logit regression model

Variables	marginal effect
young mother	-.00438
	(.0021965)
Rural dummy -1	.008078***
	(.0023782)
Primary – 1	.0006196
	(.0047287)
Secondary-1	.0045103
	(.0049338)
Higher-1	.0044285
	(.0053827)
Present live birth/pregnancy- 1	.0022614
	(.0022173)
Mother ever married – 1	-.0023577
	(.0025702)
Mother attended post-natal clinic-1	.0040729*
	(.0018631)

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

CHAPTER 5: DISCUSSIONS AND POLICY IMPLICATIONS

5.1 Summary of the Study Findings.

The primal drive of this study was to determine the factors influencing the maternal mortality among Kenyan women. Principally the study set out to answer the following research questions: what are the socio-economic, demographic and health factors influencing maternal mortality in Kenya using a KDHS -2014 data set.

To answer the said questions, the study anchored around three theories (the social capital theory, Health belief model theory and gender equity theory). Further, the study questions were addressed using a binary logit regression model to ascertain the effect and the significant of the independent variables on the dependent variable. For the purposes of making robust and unbiased inferences, statistical diagnostic tests including the VIF for multicollinearity and the Breusch Pagan test for Heteroskedasticity were carried out.

Empirically, the study found that, rural residence, young mothers and post-natal clinics had significant effect on the maternal mortality in Kenya while marital status, parity and educational attainment were found to have insignificant effect on maternal mortality in Kenya. Specifically, on one hand, the study found out that residing in rural areas, and skipping postnatal clinics increase the probability of maternal mortality. That is residing in rural region by 0.81%, and skipping post-natal clinic by 0.41% respectively. On the other hand, additional age decreases the chances of maternal mortality by 0.44%.

5.2 Conclusions of the Study Findings.

Considering the findings stated in section 5.2 of this chapter, this study makes the following conclusions: one, residing in rural region has a positive and significant effect on the maternal mortality rate in Kenya. Two, skipping postnatal clinics has a positive and significant effect on the maternal mortality in Kenya. Three, additional age has a negative and significant effect on the maternal mortality rate in Kenya. Lastly, education attainment and parity have an insignificant effect on the maternal

mortality in Kenya. Further, being married has a negative and insignificant effect on the maternal mortality in Kenya. Equally, not seeking post-natal clinic among potential maternal mothers has a positive and significant effect on the maternal mortality in Kenya. However, both parity and educational attainment were in-significant in influencing maternal mortality in Kenya.

5.3 Policy Implications.

Based on the described conclusions, the findings imply that, to reduce the maternal mortality in Kenya, effort should be made by both the government (national and county) and key stakeholders in health sector to focus on rural potential maternal mothers in provision of cares such as post-natal clinics so as to reduce the chances of maternal mortality. There should be deliberate effort to educate young mothers and potential mothers on the advantages of going for post-natal clinics. This will ultimately help in early detection of risk factors underlying maternal mortality in Kenya.

5.4 Suggestion for Further Research.

Based on the facts that our Pseudo R squared was below 10%, we believe that there are more relevant variables that were not included in the model. Such variable may include other socio-economic factors, community factors, demographic factors and so on. We were limited by the secondary data used in our analysis. We thus recommend further studies on the same topic through increased relevant variables.

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Appendix

Logit model regression output from Stata

Logistic regression — Number of obs = 6,151; Wald chi2(9) = 47.65; Prob > chi2 = 0.0000; Log pseudolikelihood = -199.04065; Pseudo R2 = 0.0992

maternal_mortality	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
young_mother	-.7605593	.3629427	-2.10	0.036	-1.471914	-.0492047
old_mother	-.8668816	.6652528	-1.30	0.193	-2.170753	.4369899
region						
Rural	1.514563	.4435277	3.41	0.001	.6452648	2.383861
PRIMARY	.1075916	.8207073	0.13	0.896	-1.500965	1.716148
Secondary	.7831811	.8463193	0.93	0.355	-.8755743	2.441936
Higher	.7689715	.9258001	0.83	0.406	-1.045563	2.583506
Parity						
Yes	.4183389	.4333796	0.97	0.334	-.4310694	1.267747
Marital_Status						
Married	-.3743163	.373896	-1.00	0.317	-1.107139	.3585064
Postnatal_clinic						
No	.8537855	.4661162	1.83	0.067	-.0597854	1.767356
_cons	-6.596127	.7928718	-8.32	0.000	-8.150127	-5.042127

Marginal effects from logit regression output from Stata

```
. margins, dydx (young_mother old_mother i.region PRIMARY Secondary Higher i.Parity i.Marital_Status  i.Postnatal_clinic)

Average marginal effects                        Number of obs     =      6,151
Model VCE    : Robust

Expression   : Pr(maternal_mortality), predict()
dy/dx w.r.t. : young_mother old_mother 1.region PRIMARY Secondary Higher 1.Parity 1.Marital_Status 1.Postnatal_clinic
```

	dy/dx	Delta-method Std. Err.	z	P>|z|	[95% Conf.	Interval]
young_mother	-.00438	.0021965	-1.99	0.046	-.0086851	-.0000749
old_mother	-.0049923	.0039123	-1.28	0.202	-.0126604	.0026757
region						
Rural	.008078	.0023782	3.40	0.001	.0034168	.0127391
PRIMARY	.0006196	.0047287	0.13	0.896	-.0086485	.0098877
Secondary	.0045103	.0049338	0.91	0.361	-.0051598	.0141804
Higher	.0044285	.0053827	0.82	0.411	-.0061214	.0149783
Parity						
Yes	.0022614	.0022173	1.02	0.308	-.0020845	.0066072
Marital_Status						
Married	-.0023577	.0025702	-0.92	0.359	-.0073952	.0026799
Postnatal_clinic						
No	.0040729	.0018631	2.19	0.029	.0004212	.0077246

Note: dy/dx for factor levels is the discrete change from the base level.