

FACTORS INFLUENCING MATERNAL MORTALITY IN KENYA

By

PERRY OLIVER OSIKO

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Declaration

I hereby declare that this research paper is my original work and has never been presented either in whole or in part to any other examining body for the award of certificates, diploma or degree.

Signature

Date

Perry Oliver Osiko

X53/64512/2013

The research paper has been submitted for examination with my approval as the University Supervisor

Signature:

Date.....

Professor GermanoMwabu

Dedication

This research is dedicated to my family, lecturers, classmates and work colleagues, without their support, prayers, patience and understanding, the compilation of this work would not have been possible. I would also wish to dedicate it to all other academicians, researchers and other readers.

Acknowledgement

I acknowledge the almighty lord for the gift of life and resources to enable me undertake this course and for showering me with His grace and mercies. To Him I attribute my successes.

First of all I'm very much grateful to my supervisor for his support and all the knowledge he has impacted in me and the ideas provided as I was doing my project.

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Abstract

This research seeks to establish the factors that influence maternal mortality in Kenya. Various strides aimed towards achieving of the millennium development goal (MDGs) number five on reducing maternal mortalities have been made. However, Kenya was unable achieve this goal by end of 2015. This calls for more studies to inform policy in this area.

The study looks at non-clinical aspects that influence occurrence of maternal mortality in Kenya. Maternal mortality is measured using Ramos approach, applied to data from Kenya Demographic and Health Survey of 2008/09.

Binary logit model was employed to evaluate the magnitudes of how various factors influence maternal mortality. Study findings indicate that mother's age, marital status, female autonomy, wealth index and region of residence have significant influence on maternal mortality.

List of Abbreviations

BLM: Binary Logit Model

CDC: Centre for Disease Control and Prevention.

CDF: Cumulative Density Function.

FCI: Family Care International.

ICRW: International Centre For Research On Women.

KDHS: Kenya Demographic and Health Survey.

KEMRI: Kenya Medical Research Institute.

LPM: Linear Probability Model.

MDG: Millennium Development Goals.

ML: Maximum Likelihood.

NUHDSS: Nairobi Urban Health and Demographic Surveillance System.

PDF: Probability Density Function.

SBA: Skilled Birth Assistant

USAID: United States Agency for International Development.

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CHAPTER ONE

1.0 INTRODUCTION

This chapter looks at maternal mortality in Kenya, objective of the study, the research questions and justifications as to why the study should be under taken.

Background Information

1.1.1 Maternal Mortality

Maternal mortality is death of a woman while pregnant or within forty two days of termination of pregnancy. This is irrespective of the duration of pregnancy and does not take to account maternal deaths which result from maternal exposure to accidental incidences.

Kenya has been making significant strides towards achievement of 147 maternal mortalities per 100,000 livebirths target as stipulated in the sustainable development goals and the millennium development goals. However, more still needs to be done.

Women in developing countries experience higher chances of death during pregnancy and child birth than those in developed countries, Koblinsky (2003). This is majorly due to women in developed countries having better access to emergency services in case of complications during delivery, majority attending antenatal care during pregnancy and better accessibility to maternity centre.

Due to high maternal mortality rate, in September 2000 United Nations general assembly placed maternal mortality as the fifth millennium development goal (MDG). Recommendations of the assembly hence obliged member states to pull their weights towards reducing the world maternal mortality rates by three quarters by 2015.

In comparison to neighbouring countries, Kenya's maternal mortality rate remains high. A major boost geared towards reversing this trend came in 2013 by the incoming government incorporating free maternal care as one of its key areas to be addressed. Subsequently on taking office, the new administration abolished user fee in accessing maternal care in public facilities.

More ground in reducing high maternal mortality rates in Kenya has been achieved through the first lady Mrs. Margaret Kenyatta incorporating maternal and child health in her strategic framework for engagement. In collaboration with the county governments, she has managed to push for setting up of thirty four clinics all focused towards maternal and child care.

1.2 Statement of the Problem

Similar to other developing countries, Kenya's high maternal mortality rate is majorly attributable to: majority of women having low autonomy in decision making in regard to their health, cultural practises and poverty. As much as concerted efforts are being put in place by concerned government agencies and stakeholders to revert this trend, inadequacies in clinical management and inaccessibility to health centres have continued to stand out as hindrances to progress..

Currently in Kenya, the number of single parents seems to be drastically increasing. This is attributable to increase in numbers of educated women, women autonomy, life style choices and women empowerment. In incidences where the single parent dies due to pregnancy complications, her children most of the time are left with no one to look upon for guidance and provision. If school going, the children end up discontinuing with education and embracing child labour in order to make ends meet. Subsequently, this affects the quality of their life and their future,

Maternal mortalities often affect women in their prime age (Gill et al, 2007). This has an impact not only on the household but also on the community and the society at large. If the deceased was playing a prominent role in the community, a huge gap is left by her demise. The mortality also makes the immediate family and entire community to part with their financial resources in order to organize a decent send off for the deceased. According to price to high study which studied disruptions caused by maternal mortality in Rarieda, Gem and Siaya sub counties, family and community are pushed to trade off other priority financial obligations due to maternal mortality. Additional expenditure due to maternal mortalities also force household to exceed their annual spending. Lastly, maternal mortality leaves the immediate family with psychological and health effects.

If the current high levels maternal mortality is not reversed, we stand to have a much impoverished and disintegrated society. This will lead to an economy that lacks the necessary numbers of citizenry to grow it. Hence a reverse to the current trends is called for. It's on this basis that there is need for this study to be carried out to ascertain the contributory factors to the high mortality rates in Kenya.

1.3 Research Questions

- 1) What are the effects of maternal education on maternal mortality?
- 2) How does mother's age influence maternal mortality?
- 3) How does mother's socio-economic status influence maternal mortality?

1.4 Objective of the Study

1.4.1 General Objective

To determine factors that influence maternal mortality in Kenya.

1.4.2 Specific Objectives

- 1) To establish the effects of maternal education, mother's age and mother's socio-economic status on maternal mortality.
- 2) To develop policy recommendations based on findings of the study.

1.5 Justification of the Study

The study offers better understanding of the factors that have continued to influence the high mortality rates in Kenya. Kenya still experiences very high maternal mortality rate as much as substantial efforts by the government and other stakeholders have increasingly been put in place. According to Family Care International (FCI), maternal mortality is directly linked to neonatal mortality. Hence a mother's mortality is most of the time a double tragedy. This study informs policy on better ways of achieving the goals which were not attained in the millennium development goals as we move towards the sustainable development goals.

This study comes in to better understand the various influences to maternal mortality in Kenya. From the findings of the study, recommendations developed advises policy on how best the high maternal mortality rates currently being experienced can be reversed.

1.6 Scope of the Study

This study looks at how socio-economic aspects, age of mother, marital status and region of residence influence maternal mortality in Kenya. Study inferences are based on findings of the Kenya demographic health survey 2008-09.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction to Literature Review

This chapter expounds on maternal health, theoretical review, empirical review and the conceptual framework.

Current estimates indicate that in Kenya, up to 146,700 women die each year due to pregnancy related complications. Family Care International (FCI), The International Centre For Research on Women (ICRW) and KEMRI- CDC (2014), revealed that in every two hours, a woman dies during pregnancy or child birth in Kenya. The unfortunate occurrence is that most of these deaths are preventable. In rural Kenya, similar to other sub Saharan countries, bad geographical terrain and poor road network contribute largely to inaccessibility to health facilities. With most expectant women being unable to access health facilities in due time, the country has been associated with up to 21% of expectant women not delivering in health facilities. These come despite the free maternal services being offered in public clinics and facilities.

Maternal mortality in Kenya is also exacerbated majority of the populace inability to access comprehensive sexual and reproductive health services. In essence, currently there is need for government and other non governmental agencies with interests in reproductive health to gear more efforts towards family planning and provision of contraceptives to women who want to space or avoid pregnancy.

Other areas which are of key importance in reversing the maternal mortality trends in Kenya include: improvement of policies which safe guard resource allocation, increase in access to quality antenatal care and strengthening of health promotion activities.

2.1 Theoretical Review

Theoretical review focuses on three theories which explain aspects that influence maternal mortality and how specific variables influence maternal mortality. The theories of importance are: modernization perspective theory, gender stratification perspective theory and the dependency perspective theory.

2.1.1 Modernization Perspective Theory

According to modernization perspective theory, a high standard of living as a resultant of economic development has a positive influence in reducing maternal mortality in a country. The reduction in maternal mortality in developed economies is majorly attributable to advanced medical technology that the stable economies avail to address health needs their citizens.

As much as economic development has a direct influence on health consumption, modernization perspective theory fails to address health inequalities that occur across individuals in the same society.

2.1.2 Gender Stratification Perspective

This theory tends to address numerous short comings of the modernization theory. In gender stratification perspective, differences such as gender, social class and ethnicity play a major role in ensuring we have a working social system.

Women empowerment both economically and in decision making places women in a good position to positively influence their life. This in line translates to better health and less morbidity and mortality which might result from pregnancy.

2.1.3 The dependency Perspective Theory

According to the Prebisch who developed the dependency perspective theory, global economic growth does not directly translate to similarity in growth patterns between the developed and developing countries. This difference is attributable to developed economies being production driven economies while developing being more consumer driven economies. This and inability of developing economies to rely on substitute products result to: distortions to economies of many developing countries, reduction in rate of economic growth and increase in income inequalities.

Dependency theory further states that, modernization does not help to equalize income in and between countries. This failure continues to aggravate the gap between rich and poor countries making poor countries lack substantial resources to fund health and service programs. Hence states are pushed towards taking loans from international financial institutions and to build trade dependency tendency. Such association is associated with decline in progress towards reduction in prevalence in maternal mortality, (Miller, 1992).

2.2.1 Maternal Education

Education has a strong influence on the status of an individual in the society. Jamison et al (2006) state that lower societal and household status associated with lack of education is correlated to higher gender violence, lower legal protection and in turn high rates of maternal mortality.

Highly educated women have good jobs and have better access to quality maternal care, Joseph et al (2003). Due to increase in women accessing education in Iran, the number of early marriages has dropped drastically. This together with improved women access to resources and female autonomy has also has a positive influence in reducing the numbers of mortalities due to child birth.

Education also enables women to better understand risks associated with over working during pregnancy and importance of taking a break prior to the delivery date. Due to education, women spend a substantial number of years in school. This makes them less likely to get married at a young age. By marrying post their teen years, these women experience reduced chances of maternal mortalities associated with early motherhood. Moreover, educated mothers are better placed to understand the challenges associated with giving birth at very advanced ages where chronic ailments such as hypertension, renal vascular disease and diabetes complicate pregnancy.

Schooled women are better placed to understand the anatomy of the body and physiology of reproduction. The learned are much better placed to take complications and risks seriously and together with their household embrace emergency services when the services are called for and not to take the services for granted.

Educated women are less likely to accept dangerous practises and cultural deeds during and after pregnancy. Some of the beliefs especially in the African continent prohibit expectant mothers from accessing health care from skilled birth attendants. Hence cultural beliefs stand as a high contributory factor to maternal mortality, Lori (2009).

Through education, a woman is able to informatively convince her husband on the best family planning practise for her to embrace. Education also makes mothers more aware of safe motherhood practises and risks involved in procuring illegal abortions.

Hence education stands out as an insurance against maternal and infant mortality.

2.2.2 Age of mother at first birth

Age of mother during pregnancy has a very strong influence on her health. Various studies indicate that, pregnancy at a young age and after 35 years has numerous implications on a woman's health. Pregnancy at very young ages or after 35 years exposes the woman to high chances of mortality during delivery. In most of sub-Saharan Africa more than 50% of women begin child bearing by 19 years, this exposes them to risk of maternal mortality.

The high mortality rates in mothers less than 20 years is highly attributable to the mother being too young that her body is unable to support the pregnancy and share nutrients with the developing foetus. Engelen et al (2004) attribute the high mortality rates in the teen phases to high incidences of puerperal toxemia in the first pregnancy. In their teens, most women are still undergoing body development and are unable to withstand the morbidity resulting from puerperal toxemia. There is also tendency of the first labor to be more difficult and many a times the young mother to be body becomes overwhelmed and gives in to mortality. Early initiation into child bearing also lengthens the reproductive span of a woman and hence exposes women to more maternal risks. This young mothers to be are also prone to pregnancy complications and are less likely to tackle the problems in their occurrence. This acts as a large contributor factor to high maternal mortality rates in teens.

Maternal deaths are least between ages of 20 to 24. Meanwhile with second and third delivery, possibilities of maternal mortalities occurring are much reduced as compared to the first birth. However, from the fourth delivery maternal mortality chances become more pronounced. With child bearing beginning after 35 years, risks of maternal mortality are very high, majorly due to women past thirty fives being susceptible to diseases such as: hypertension, renal vascular disease and diabetes. These diseases complicate pregnancy.

2.2.3 Professional Assistance During Delivery

Despite current efforts by government to ensure skilled birth deliveries, there still stands a lot of to be achieved. For instance in north eastern Kenya, despite the area being covered by over 21 primary hospital and 14 dispensaries, the facilities are severely underutilized. Most women are hesitant to seek skilled delivery at these facilities; they instead prefer to deliver at home. These occur despite very high maternal mortality rates being recorded in the area. Main reasons for this, is attributable to ignorance, inaccessibility of the facilities and lack of awareness of existence of the facilities. In most of the rural settings in Kenya, preference for traditional birth attendants or healers is still very rampant. This is attributable to, majority of

household's belief in cultural norms. Hence a good number of the populace has preference for traditional attendants in spite having professional skilled birth assistants in health facilities.

Professional birth assistant's facilitation during delivery plays a major role in detecting signs of potential risks and employ called for intervention in real time. During delivery an emergency might arise. In such an occurrence there is need to engage skilled personnel and equipments. Unfortunately this lacks at house hold level. This exposes the mother who delivers away from a health facility to high probability of succumbing to mortality during delivery.

During delivery there is need for maintenance of antiseptic environment. However, in absence of professional assistance, the maintenance of such as environment remains a challenge in most rural settings. This leaves the mother and the child exposed to infections which might act as a contributory agent to mortalities. Assistance during delivery also plays a large part in the birth attendant providing needed empathetic psychological and social support to the woman, her partner and family during labour, birth and post partum period, Middleberg (2003).

Lastly, professional assistant comes in handy to determine need for referral in case the expectant woman develops complications during delivery.

2.2.4 Mother's Socio Economic Status

There has been a shift from the past in the employment patterns of women in Kenya. Previously most females were involved in agricultural activities but currently according to KDHS 2008/09 more are employed in professional, technical and managerial positions.

Socioeconomic factors largely influence maternal mortality. This is quite evident in that in higher income countries the risks associated with maternal mortalities are lower in comparison to lower income countries. This is due to developed countries being better placed to offer better antenatal delivery and post natal services. At household level women with better income are more likely to deliver under watch of a professionally well trained birth attendant. They are also better placed to access better specialized care. If need be, the high socio economic cadre mothers to be also poses a willingness and ability to procure efficient antenatal and postnatal services.

Women with good income have better power to make decisions in regard to best family planning service and choice of contraceptives to use. They are also better placed to convince their partners on their reasons for settling on a contraceptive or family planning choice. Furthermore, women in high socio-economic cadre are less likely to indulge in illegal unsafe abortion and dangerous traditional practises. This makes them less prone to maternal mortality.

On the other hand, low socio economic status predisposes a woman to hostile family environment originating from marital conflicts, divorce, separation and spouse abuse. Women in low socio economic quintiles are prone to unhealthy traditional practises such as reduced dietary intake during pregnancy, teenage pregnancy and physical labour during pregnancy. However, this is not always the case with richer women. Poverty also subjects women to unhygienic poor living conditions, predisposing them to infections. Due to poverty as indicated in a study on factors associated with use of appropriate maternal health services in slum settlements in Nairobi (2009), majority of women in our slums attend facilities which are ill equipped and lack well trained personnel.

2.3 Empirical Literature Review

Various studies have been conducted regarding direct and indirect influences to maternal mortality. Despite most studies focusing on obstetric causes, socio-economic and cultural practises have also come out as aspects of significance. These findings have necessitated more studies in these areas. Inferences from the studies, some explored in this section show that maternal mortality is also influenced by: maternal education, professional conducted delivery, attendance of antenatal clinic, maternal economic status, marital status, age of mother and region of residence of the woman.

2.3.1 Maternal Education

Koch et al (2012) in a study called the link between maternal education and decreased maternal mortality in Chile, found that a year increase in maternal schooling had a beneficial influence on maternal mortality. In the study findings, an additional year of schooling corresponds to a decrease in maternal mortality of 29.3/100,000 live births. Expectant mothers delivering by aid of a skilled birth attendant also came out as a key factor in reducing maternal mortality.

Data on women's education was examined throughout the study in order to distinguish the study group's level of education. Other independent variables of interest were: woman's income per capita, total fertility rate, delivery by a skilled attendant, birth order, clean water and sanitary sewer. Change in the mortality trends over the years including effects of education on maternal mortality in the study was assessed using segmented regression technique.

Karlsen et al (2011) carried out a cross sectional survey in twenty four randomly selected countries in Latin America, Asia and Africa. In their findings using logistic regression analysis to investigate factors causing maternal mortality, they observed that maternal mortality was prevalent in all the regions of their study. However, in areas where women were less educated maternal mortality was higher than in areas where women were better educated. This was despite all women studied giving birth at health facilities. The reason for the disparity was highly credited to women who are less educated giving birth during their teen years, not attending antenatal clinics and their involvement in other harmful traditional practises.

In Enugu state in Nigeria, Onal et al (2006) observed in a study carried out to determine impact of formal education on expectant woman's choice of health facilities that, there was a significant correlation between the choice of facility to deliver and a woman's level of education. Analysis in the study was carried out using descriptive inferential statistics. In the study, level of education prominently featured as an influence to quantity and level of care that expectant mothers received.

2.3.2 Age of Mother

Ramos (2007) carried out a comprehensive assessment of maternal deaths in Argentina. The study entailed constructing a verbal autopsy to determine influences to maternal mortality. Findings of the study indicated that number of maternal mortalities was high in women who gave birth at a young age and in those who gave birth after the age of 35.

In this assessment study, mothers who died in public hospitals between 2001 and 2002 formed the case group while surviving mothers who underwent similar morbidity as the dead during pregnancy formed the control wing.

2.3.3 Professional Assistance During Delivery, Region of Residence and Marital Status.

Kahn et al (2013), in a longitudinal surveillance study based on Rufiji demographic surveillance site, found that marital status and age of mother were strong influences to maternal mortality. According to the study, married women experienced better protective effect of up to 62% compared to women who had never been married. Further findings indicate that this protective effect associated with marriage reduced likelihood of maternal mortality by up to 18%.

This study also found out that, women aged between twenty to twenty nine years were 56% more likely to experience maternal mortality compared to mothers aged less than twenty years. However mothers aged between 30 to 39 years were found to be 154% more predisposed to maternal deaths in comparison to mothers aged less than twenty years.

Taquchi et al (2008) observed level of uptake of professional delivery care in Pandeglong rural and Serang urban district in Indonesian. Through logistic regression, clustering and stratification relationship between maternal mortality and presence of health professional during delivery was examined.

Study findings indicate that majority of maternal deaths occurred among women who delivered at home. However, minimal incidences of maternal deaths also occurred under professional skilled birth attendants. Maternal deaths under professional assistance were majorly due to expectant mothers seeking professional care late.

On maternal mortalities in informal settlements in Nairobi city, Ziraba et al (2009), observed that in two slums in Nairobi where the study was conducted, most maternal mortalities occur in women who deliver outside health facilities and without help of skilled birth assistants (SBA).

The study was based on Nairobi urban health and demographic surveillance system (NUHDSS) and verbal autopsy data on women aged between 15 and 49 gathered from respondent members of bereaved families.

2.3.4 Mother's Socio Economic Status

Retrospective epidemiology on social factors associated with maternal mortality in Madhya Pradesh India authored by Joshi et al (2007), indicated that up to 55% of maternal deaths occurred among subjects in low socio-economic cadres. The study was based on verbal autopsy, door to door survey and hospital records.

On a study termed influence of socio-economic background and antenatal programmes on maternal mortality in Surabaya, Indonesia focusing on 59 maternal deaths as the case and 177 survivors who were admitted in the same facilities as the dead as controls. The study measured socio-economic status using questionnaires and elicited comparison between the different variables using central tendency paired t-test and chi squared test. To distinguish relationship between independent variables and dependant variable chi squared test was employed. While logistic regression model was used, to control potential confounders and predict maternal mortality possible risk factors.

Conclusions drawn from the study indicated that socio-economic factors such as living in rural areas, poor hygiene, unavailability of antenatal care and unemployment had very high influence on maternal mortality.

Cross sectional study documented by Jat et al (2011) on factors affecting maternal services in Madhya Pradesh in India, employed multilevel logistic model to account for factors influencing maternal health consumption by individuals, the community and the entire district under study. The study population comprised of women aged between 15 and 49 years who had delivered a child in the past three years.

Inference drawn from the study indicated that household socio-economic status and mother's education greatly influence use of antenatal care and delivery through skilled birth attendants.

2.4 Knowledge Gaps to be Filled

Despite Kenyan government commitment to maternal health care through introduction of free maternal health care service in public clinics and facilities, indications are, there is still a lot that needs to be done. Currently a number of regions still have very high maternal mortality rates attributable to: lack of maternal education, low socio-economic status and poor uptake of family planning services. For example, Siaya Sub County the maternal mortality rate is 740 maternal deaths / 100,000 live births. This mortality rate is more than double the country's national maternal mortality average.

Government efforts together with improvements in number of health facilities, increase in numbers of educated women and improved road work experienced in the few past years across the country seems not to be bringing the drastic decline in Kenya's maternal mortality rates. This calls for better understanding of the various influences that motivate the high mortality rate.

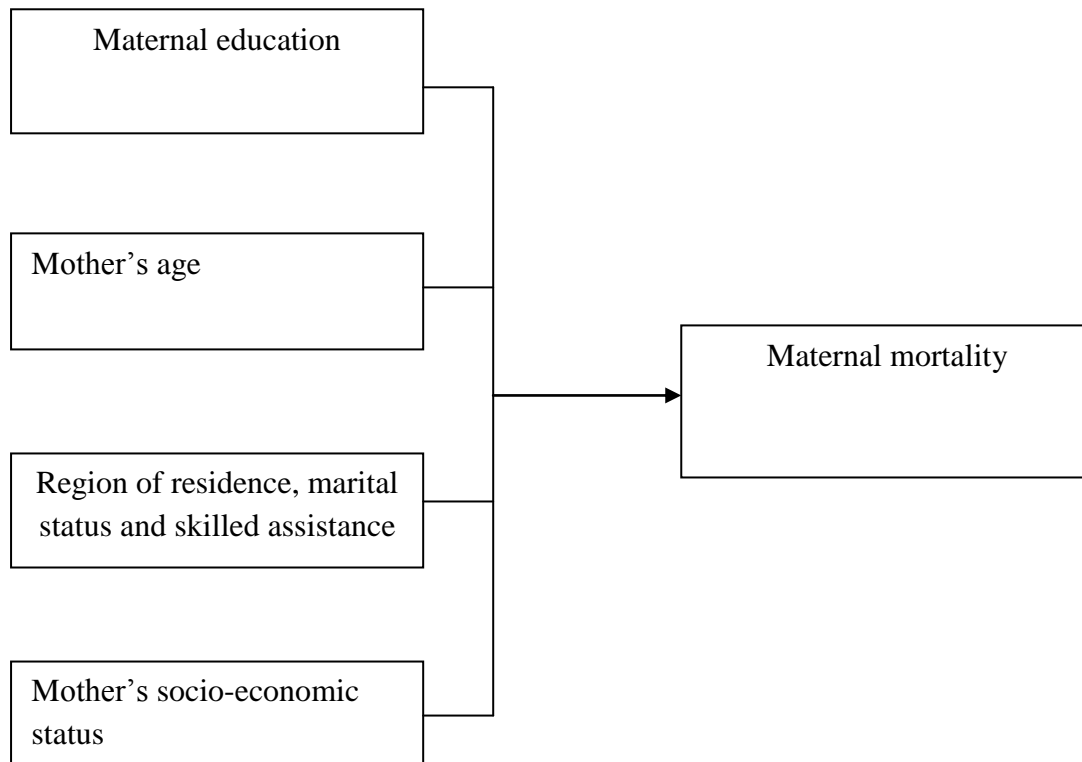
This study comes in handy to provide the vital information that will better inform steps being taken to reduce maternal mortality rates.

2.5 Conceptual Framework

Figure 1: The conceptual framework

Independent Variables

Dependent Variable



Source: author (2015)

Figure 1: Indicates relationship between Mother's education, Mother's age, region of residence, marital status, skilled assistance during delivery, Mother's socio economic status and maternal mortality

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter looks at model used in the study, source of data, and determinants to maternal mortality.

3.2 Data Source

The project is based on 2008/09 Kenya demographic and health survey (KDHS). The survey designed by USAID, was aimed at assisting Kenya monitor fertility, maternal health, child health and reproductive trends. It was carried out between November 2008 and February 2009.

KDHS provides a comprehensive look into broad sets of demographic and socio economic issues affecting Kenya's population and the impacts of this attributes to the health status of Kenya's population. In comparison to census and other integrated survey programs it stands out in permitting more detailed data collection.

3.3 Study Population

The study focuses on 8,444 Kenyan women aged 15-49, interviewed during 2008/09 demographic health survey in Kenya.

3.4 Analytical Model

The study is carried out in line with the Ramos model. This model seeks to identify all deaths of female of reproductive age in Kenya based on relevant sources of data as per findings of the KDHS 2008/09 interviews.

KDHS 2008/09 on the other hand measured maternal mortality based on direct sibling history method where respondents were asked three sets of questions. First they were asked how many children a mother had given birth to. Second question set was on age at which the sibling died. While the last set of questions, aimed at finding out if deceased was pregnant at time of death, died during child birth or within two months after pregnancy.

3.5 Data Analysis

Stata statistical software gives: descriptive, correlation and regression findings which enable distinguishing of associations between the various variables in the study.

3.4.1 Econometric Model

Model Specification

Binary logistic model adopted in the study is specified by looking at the effects of the independent variables (mother's educations, Mother's age, Mother's age at first birth, Mother's place of current residence, marital status, and Mother's wealth index) on maternal mortality, as in the equation below:

$$mm = \beta_0 + \beta_1 medu + \beta_2 ag@1b + \beta_3 padd + \beta_4 ag + \beta_5 pcr + \beta_6 ms + \beta_7 wi + \varepsilon_i$$

In the equation

mm is maternal mortality

medu is mother's education

ag@1b is mother's age at first birth

ag is mother's age

pcr is place of current residence.

ms is marital status.

padd is professional assistance during delivery.

wi is mother's wealth index

$\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7$ are coefficients to be estimated.

ε is the stochastic error term.

3.4.2 Binary Outcome Estimation

Binary Logistic Model

Binary logit model in the study enables determination of how each explanatory variable influences occurrence of maternal mortality.

Maternal mortality(*y*) being a binary outcome, the latent y^* is linear to the observed χ s through the structured equation below which also gives us the probability of observing *y*

$$y^*_i = \chi_i \beta + \varepsilon_i \dots \dots \dots \text{Equation 1}$$

Where

y^*_i is the latent dependent variable (maternal mortality)

χ is a vector of independent variables (mother's education, mother's age, mother's age at first birth, professional assistance during delivery, wealth index, place of current residence and marital status).

β is a magnitude of the effect a respective independent variable has on maternal mortality.

ε is the error (disturbance) term

i is number observations

The latent variable realized in equation 1 (y^*) is linked to the observed dependent binary outcome y by equation

$$y_i = \begin{cases} 1 & \text{if } y^*_i > 0 \\ 0 & \text{if } y^*_i \leq 0 \end{cases}$$

Equation 2

From the above presence of maternal mortality (positive cases) is observed as $y = 1$, while absence of mortality is observed as $y = 0$

Hence, logit model adopted is given by the cumulative distribution function (cdf) as illustrated in the equation below;

$$\text{Prob}_i = \Lambda(Z_i) = \Lambda(\alpha + X_i \beta) = \frac{1}{1 + e^{-Z_i}} = \frac{1}{1 + e^{-(\alpha + X_i \beta)}} \quad \text{Equation 3}$$

While probability of observing maternal mortality will be given by:

Since the coefficients of the logit model are not identifiable without the assumptions made about the mean and variance of the random error term, the study therefore makes interpretations on the probability of observing the independent variable through computing the marginal effects.

3.4.3 Estimation of the Model

Based on assumptions on the variance of the error term, sample size being larger than 500, having a limited number of variables to be estimated and need for estimates that are consistent, efficient and asymptotically normal; maximum likelihood estimation is employed in the study to determine probability of maternal mortality estimates. For uniqueness of the

ML estimates and practicability likelihood function is also employed as given by stata software.

3.4.4 Interpretation

To summarize the effect of the independent variables on the dependent variable, the marginal effect which indicates partial change in the probabilities of an outcome is examined and inferences drawn

To establish significance of the study findings, coefficients of the marginal effect of the logit model adopted is compared to results obtained through the coefficients from probit and linear probability models.

3.6 Variables

Table 3.1: determinants of maternal mortality in the study

Variables	Expected signs
Age of the mother	+
Age of the mother at 1 st birth	-
Marital status	-
Maternal education	-
Place of current residence	+
employment	+
Wealth index	-
Female autonomy	+
region	-

Source: author (2015)

CHAPTER FOUR

RESULTS

4.1. Introduction

This chapter establishes the effects of maternal education, mother's age at first birth, the extent to which professional assistance during delivery and socio economic factors influences maternal mortality in Kenya. logit model will be employed to estimate the factors and thus presents descriptive and econometric results as presented herein.

4.2. Descriptive Statistics

In describing maternal mortality and the relevant determinants, the study considered mainly average, range and standard deviation. As indicated in Table 4.1 below, a total of 6079 respondents were surveyed. Specifically, the study considered maternal mortality as the dependent variable, age of the mother, age of the mother at first birth, marital status, maternal education, male as house hold head, place of current residence, employment, wealth index and regions as independent variables. Based on the findings in Table 4.1, 10.9% of the respondents were reported to have experienced maternal mortality with the average age being 28 years old where the older respondent was 49 years while the young respondent was 15 years. Age of the mother at first birth was shown to be approximately 19 years with the youngest being 11 years and the oldest mother giving birth was found to be 39 years old. Furthermore, 62.7% of the respondents were married with 24.1% staying in urban area.

Table 4.1: Summary Statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
Maternal Mortality	6078	0.1089174	0.3115612	0	1
Age of the mother	6079	28.23557	6.664807	15	49
Age of the mother sq.	6079	841.6595	405.5889	225	2401
Age of the mother at 1 st birth	6079	18.99539	3.529872	11	39
Age of the mother at 1 st birth sq.	6079	373.2829	147.3328	121	1521
Married	6079	0.6267478	0.4837081	0	1
Urban	6079	0.2413226	0.4279207	0	1

Primary education	6079	0.5642375	0.4958972	0	1
More than Secondary education	6079	0.2219115	0.4155661	0	1
Hospital delivery	6053	0.4255741	0.4944706	0	1
Male as household head	6079	0.7080112	0.4547146	0	1
Mother Employed	6056	0.5475561	0.4977744	0	1
Wealth Index	6079	2.81214	1.516036	1	5
Female Autonomy	6079	0.3725942	0.4835351	0	1
Nairobi Region	6079	0.0681033	0.2519438	0	1
Central Region	6079	0.0815924	0.2737652	0	1
Coast Region	6079	0.1452542	0.3523859	0	1
Eastern Region	6079	0.1223886	0.327761	0	1
Rift valley Region	6079	0.1743708	0.3794592	0	1
Western Region	6079	0.1299556	0.3362822	0	1
North Eastern Region	6079	0.0959039	0.2944837	0	1

The study also revealed that 56.4% and 22.2% of the respondents had primary education and secondary/more than secondary education respectively. On hospital delivery, it was found that less than half of the respondents (42.6%) had been attended to by a skilled professional. On employment, 54.8% of the mothers in the study, reporting to be employed. Most of the respondents on the other hand in the study belonged to the mid-level wealth index classification. Similarly, the study established that 37.3% of the respondents were autonomous in making decision regarding their own health. Regions of interest in the study with substantial respondent numbers were; Rift valley region, coast region, western region, and eastern region with 17.4%, 14.5%, 12.9% and 12.2% respectively.

4.3. Correlation Analysis

Correlation matrix was undertaken to establish the relationship between maternal mortality related variables and independent variables of interest to the study. The positive and negative signs in the analysis are indicative of the direction of association between variables. From

Table 4.2 below, maternal mortality was found to be negatively correlated with urban residence, secondary/ more than secondary education, hospital delivery, wealth index and female autonomy while there is a positive correlation with the rest of the study variables.

Age of the mother was negatively related to urban residence, primary education, hospital delivery, and wealth index. On the other hand, age at first birth had a negative correlation to primary education and mother employment respectively. Lastly, primary education was negatively correlated to secondary or more than secondary education, hospital delivery and wealth index.

Table 4.2: Correlation Matrix

Variables	Maternal Mortality	Age of the mother	Age of the mother at 1st birth	Married	Urban	Primary education	Secondary/ More than secondary education	Hospital Delivery	Male	Mother Employed	Wealth Index	Female Autonomy
Maternal Mortality	1.0000											
Mother's age	0.1447	1.0000										
Age of the mother at 1st birth	0.0001	0.3286	1.0000									
Married	0.0410	0.0600	0.0227	1.0000								
Urban	-0.0388	-0.0842	0.1861	0.0455	1.0000							
Primary Education	0.0092	-0.0931	-0.2218	-0.0286	-0.1120	1.0000						
Secondary/More than Secondary Education	-0.0312	0.0450	0.3686	0.0027	0.2682	-0.6092	1.0000					
Hospital Delivery	-0.0250	-0.0494	0.2326	-0.0026	0.3551	-0.0653	0.3600	1.0000				
Male as house hold head	0.0047	-0.0211	0.0162	0.6504	0.0606	0.0212	0.0354	0.0324	1.0000			
Mother Employed	0.0040	0.1634	0.0597	-0.0047	-0.0174	0.0961	0.1153	0.0986	-0.0090	1.0000		
Wealth Index	-0.0276	-0.0626	0.2525	0.0155	0.6491	-0.0105	0.3960	0.4775	0.0544	0.0854	1.0000	
Female autonomy	-0.0340	0.0769	0.0800	0.2293	0.0105	0.0166	0.0778	0.0714	0.1657	0.0988	0.0714	1.0000

4.4. Regression Results

4.4.1. Introduction

Logit model was applied in the study to estimate the influence of various factors on maternal mortality in Kenya. Findings are tabulated in Table 4.5 below. However, linear probability model and probit models were estimated and their results indicated in the appendices (annex 1 and 2). To summarize the effects of the independent variables on the dependent variable, marginal effect was examined for probit and logit models. From the Table 4.5 and appendices, the study found a p value of 0.0000 across all the models which was less than 5% with the log likelihood ratio of negative 1961.3199 and 1956.9326 for logit and probit models respectively implying that the variables considered fit the model(s) well. This shows that all variables used in the model(s) were jointly significant in explaining maternal mortality in Kenya.

In either models, the pseudo R or the R squared was very low such that the logit, LPM and probit models had 0.0524, 0.0377 and 0.0546 respectively. This is normal for cross sectional studies. From the results in both models, being married, staying in urban, female autonomy, coast region, and northern regions were found to be statistically significant in determining maternal mortality. On the other hand, age and age square were found to be statistically significant in the logit and probit models only while wealth index was shown to be significant only in the logit and LPM models. Based on the three models, logit model appears to be robust.

From the logit results; age, age square, married, urban residence, wealth index, female autonomy, coast region and north eastern region were significant factors that influenced maternal mortality whereas the rest of the factors were not statistically significant. Among the significant factors, mother's age, being married, wealth index, residing in coastal region and residing in north eastern region were negatively related to maternal mortality on the other hand mother's age square, staying in urban area and female autonomy significantly reduced the probability of maternal mortality. Table 4.5 below indicates more other details of marginal effects of the logit model of various independent variables.

Table 4.5: Marginal Effects of the Logit Model: Maternal Mortality

Variables	ME	Std. Err.	z	P>z	[95% Confidence Interval]	
Age	0.0151571***	0.0047511	3.19	0.001	0.0058452	0.024469
Age Squared	-0.0001384*	0.0000742	-1.87	0.062	-0.0002839	7.01e-06
Age of the mother at first birth	-0.0115044	0.0074727	-1.54	0.124	-0.0261506	0.0031418
Age of the mother at first birth squared	0.0002185	0.0001777	1.23	0.219	-0.0001297	0.0005668
Married	0.0308736**	0.012021	2.57	0.010	0.0073128	0.0544343
Urban	-0.0388334***	0.0143053	-2.71	0.007	-0.0668713	-0.0107955
Primary Education	0.0152689	0.0126897	1.20	0.229	-0.0096025	0.0401403
More than Secondary Education	-0.0019767	0.0166458	-0.12	0.905	-0.0346019	0.0306485
Hospital delivery	0.0052881	0.0096006	0.55	0.582	-0.0135288	0.024105
Male as house hold head	-0.0123202	0.0124436	-0.99	0.322	-0.0367093	0.0120688
Mother Employed	-0.0070478	0.0085303	-0.83	0.409	-0.0237668	0.0096712
Wealth Index	0.0068081*	0.0040059	1.70	0.089	-0.0010433	0.0146595
Female Autonomy	0.04189***	0.0088438	4.74	0.000	0.0245565	0.0592235
Nairobi Region	-0.0064892	0.0230706	-0.28	0.778	-0.0517067	0.0387283
Central Region	-0.0197163	0.0184633	-1.07	0.286	-0.0559037	0.0164712
Coast Region	0.0629921***	0.0141936	4.44	0.000	0.0351732	0.0908111

Eastern Region	-0.016366	0.0163077	-1.00	0.316	-0.0483285	0.0155966
Rift Valley Region	-0.0003035	0.0142503	-0.02	0.983	-0.0282336	0.0276267
Western Region	0.0210314	0.0145203	1.45	0.147	-0.0074278	0.0494906
North-Eastern Region	0.0394856**	0.0194145	2.03	0.042	0.001434	0.0775373

Logistic Regression

Number of observations=6029

LR chi2(20)=217.07

Prob>chi2=0.0000

Pseudo R2=0.0524

Log likelihood=-1961.3199

*** Significance at 1%, ** significance at 5% and * significance at 10%

4.4.2. Interpretation and Discussion of the results

From Table 4.5 above, the study indicates significant values at 1%, 5% and 10% significance levels. Mother's age, being married, residing in urban area, female autonomy and residing in coastal region were found to be statistically significant at 1% significance level. Only mother's age square was shown to be significant at 5% significance level. On the other hand, wealth index and residing in the north eastern region were found to be statistically significant at 10% significance levels.

At 1% significance level, the study revealed that a one year increase in mother's age increased the probability of the maternal mortality by 1.51% holding other factors constant. This implies that as a woman ages, the likelihood of maternal mortality increases. The significance of mother's age square is too small (0.0001384) implying non linearity of age.

A woman being married was also found to increase the probability of her succumbing to maternal mortality. The results show that being married raises a woman's likelihood of experiencing maternal mortality by 3.93% holding other factors constant. The positive association may be attributed to more children as advocated by traditional cultures increases the likelihood of pregnancy complications at some points.

The study sought to understand the contribution of current place of residence, whereby residing in urban areas was seen to reduce the probability of maternal mortality by 3.88% on holding all other factors constant as compared to residing in rural areas. Urban residence is associated with ease of access to information and transport among other factors.

Among the socio economic factors, the study considered the wealth index in levels and found out that a change from lower wealth level to higher wealth level leads to a 0.68% probability increase in maternal mortality on all the other factors being held constant. This may be attributable to individuals in higher wealth cadres being more preoccupied in enhancing their economic well-being and reacting to complications when it's too late. This finding was surprising and it contradicted with the results obtained by Joshi et al (2007) on social factors associated with maternal mortality in Madhya Pradesh India.

Their results on maternal deaths indicated high occurrence among the subjects on low socio-economic quintile.

Female autonomy was found to be a significant factor that reduces probability of maternal mortality by 4.19% when all the other factors are held constant. The likelihood of a woman dying due to pregnancy reduces significantly if a woman autonomously makes decisions about her own health.

Considering different regions explored in this study, at 1% significant level, the study showed that residing in coast region significantly increases the probability of maternal mortality by 6.29% holding other factors constant. This implies that a higher maternal mortality will be experienced by mothers living in coastal region which may be attributed to cultural practices of the communities that reside in the area. Similarly, the study showed that at 10% significant level, the probability of maternal mortality increases by 3.95% holding other factors constant for mothers residing in North eastern region.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND POLICY RECOMMENDATIONS

5.1 Introduction

This chapter explores: study findings, policy recommendations and areas to be explored in further studies. In this chapter factors influencing maternal mortality looked at in the study will inform policy.

5.2 Summary and Conclusions of the study findings

The study reviewed theoretical and empirical literatures to establish the factors behind maternal mortality in Kenya. From the literature, maternal mortality rate is indicated as a perennial persistently. The current estimates show that mothers and girls die each year due to pregnancy related complications. Based on this, the study made use of Kenya Demographic and Household survey (KDHS) of 2008 which contains factors associated maternal mortality in Kenya. The logit regression model has been employed in estimation. The dependent variable in the study was maternal mortality while the independent variables used include: the age of the mother, age of the mother at first birth, marital status, maternal education, place of current residence, male as household head, employment, wealth index and regions. At 99%, 95% and 90% confidence intervals, the study revealed that mother's age, mother's age square, married, urban residence, wealth index, female autonomy, coast region and north eastern region as significant determinants of maternal mortality. Urban residence and female autonomy were shown to reduce maternal mortality whereas mother's age, being married, wealth index, coast region and north eastern region positively and statistically increased maternal mortality. In Conclusion, to control the impact of maternal mortality, there is a need to consider the study findings obtained and indicated to be statistically significant.

5.3. Policy Recommendations

Since independence, Kenya has been operating a moderate policy approach towards maternal mortality. However, the new move which came with the current administration lead to introduction of free maternal services mid-2013. Currently, policies in place

include increasing access to reproductive health, sexual health and family planning services. In order to improve on policies which safeguard resource allocation, increase in access in skilled labour delivery, strengthening of health promotion activities and increased access to quality antenatal care, there is a need to consider age of the mother's, marital status, place of residence, income levels, female autonomy, coast region and north eastern region.

The ministry and the other relevant stakeholders need to target married mothers more compared to single mothers on pregnancy matters to reduce the high numbers of mortalities in pregnancy amongst them. Also the same should be done to the mothers of older age as they are associated with high likelihood of maternal mortality.

There is need to develop and implement policies targeting individuals in higher wealth cadres. As from the study, movement from lower wealth quintiles towards higher wealth quintiles is associated with increase of maternal deaths.

On regions observed to have high numbers of maternal mortality; namely coastal and north eastern regions. The county governments need to establish more health facilities and improve accessibility to health facilities as these regions are faced with very poor road networks and most homesteads being located far from health facilities. By the relevant authorities taking the necessary measures to improve accessibility to health facilities and improved antenatal and postnatal care the high mortality trends will be reversed.

5.4. Areas of further study

The study has mainly considered factors influencing maternal mortality in Kenya using a cross sectional data. The study recommends further study on maternal mortality considering other data sets over time relating with other independent factors. Similar study could give a clear picture of maternal mortality if primary data could be conducted across counties seeking clear information on income and actual maternal mortality cases which has not been captured in this study.

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APPENDICES: OTHER BINARY REGRESSION RESULTS

Annex 1: Linear Probability Model (LPM)

Mortality	Coefficients	Std. Err.	t	P>t
Age	0.0075428	0.0046808	1.61	0.107
Age squared	-6.70e-06	0.0000762	-0.09	0.930
Age of the mother at first birth	-0.0115841	0.0081861	-1.42	0.157
Age of the mother at first birth squared	0.0002048	0.000196	1.04	0.296
Married	0.0257724**	0.0109358	2.36	0.018
Urban	-0.0387548***	0.0137015	-2.83	0.005
Primary Education	0.0163789	0.0129824	1.26	0.207
More than Secondary Education	0.0013266	0.0163929	0.08	0.936
Hospital delivery	0.0055277	0.0095592	0.58	0.563
Male as house hold head	-0.008599	0.0115898	-0.74	0.458
Mother Employed	-0.0094737	0.0085537	-1.11	0.268
Wealth Index	0.0068433*	0.0040297	1.70	0.090
Female Autonomy	0.0477145***	0.0098031	4.87	0.000
Nairobi Region	-0.0027366	0.0203335	-0.13	0.893
Central Region	-0.0188861	0.0171554	-1.10	0.271
Coast Region	0.071647***	0.0147403	4.86	0.000
Eastern Region	-0.0156319	0.0151324	-1.03	0.302
Rift Valley Region	-0.000971	0.0135823	-0.07	0.943
Western Region	0.0225846	0.0145303	1.55	0.120
North-Eastern Region	0.0395378**	0.0195866	2.02	0.044
Constant	-0.0052767	0.1003995	-0.05	0.958
Number of observations = 6029 F(20, 6008) = 11.76 Prob> F = 0.0000 R-squared = 0.0377 Adj R-squared = 0.0345 Root MSE = 0.3056				

Annex 2: Marginal Effects of the Probit Model: Maternal mortality

Mortality	Coefficients	Std. Err.	t	P>t
Age	0.0145781***	0.0047419	3.07	0.002
Age squared	-0.0001281*	0.000075	-1.71	0.088
Age of the mother at first birth	-0.0124112	0.0076162	-1.63	0.103
Age of the mother at first birth squared	0.0002367	0.0001815	1.30	0.192
Married	0.032952***	0.0117198	2.81	0.005
Urban	-0.0413248***	0.0141178	-2.93	0.003
Primary Education	0.0176629	0.0127163	1.39	0.165
More than Secondary Education	0.0007589	0.0165198	0.05	0.963
Hospital delivery	0.0035058	0.0095251	0.37	0.713
Male as house hold head	-0.0139698	0.0122413	-1.14	0.254
Mother Employed	-0.0078101	0.0084958	-0.92	0.358
Wealth Index	0.0069497*	0.0039814	1.75	0.081
Female Autonomy	0.0417352***	0.0090642	4.60	0.000
Nairobi Region	-0.0053753	0.0220784	-0.24	0.808
Central Region	-0.021949	0.0179334	-1.22	0.221
Coast Region	0.0633767***	0.0142485	4.45	0.000
Eastern Region	-0.0168963	0.0156881	-1.08	0.281
Rift Valley Region	-0.0031627	0.0139012	-0.23	0.820
Western Region	0.0200514	0.0143518	1.40	0.162
North-Eastern Region	0.038178**	0.0192551	1.98	0.047
Number of observations = 6029 LR chi2(20) = 225.85 Prob> chi2 = 0.0000 Log likelihood = -1956.9326 Pseudo R2 = 0.0546				