DETERMINANTS OF UNDER-FIVE MORTALITY IN KENYA: AN APPLICATION OF NEGATIVE BINOMIAL REGRESSION ANALYSIS

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DECLARATION

I declare that this research project is my own original work. It is being submitted for the degree of Master of Science in Medical Statistics at the University of Nairobi. To the best of my knowledge, it has not been submitted before in part or in full for any degree or examination at this or any other university.

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DEDICATION

This work is dedicated to my family for their relentless support. I also dedicate this project to all the mothers who sacrifice a lot to ensure their children remain healthy.

ABSTRACT

Introduction: Under-five mortality is a key indicator of the state of public health of a society. Globally, approximately six million children die every year before reaching their fifth birthday. Although the global under-five mortality rate declined by 53 percent between 1990 and 2015, the under-five mortality in Kenya remains high in spite of government efforts to reduce its burden and currently stands at 52 deaths per 1000 live births.

Objective: The main objective of this study was to determine the factors influencing under-five mortality in Kenya.

Methodology: The study involved analysis of secondary data from a population based cross sectional survey, the 2014 KDHS. The population of interest were the mothers who were age 15-49 years and had given birth in the five-year period preceding the survey. The software used in data management and analysis was STATA software version 12. Descriptive statistics including frequencies and tabulations provided an overall picture of the distribution of the number of under-five deaths. The negative binomial regression model was used to evaluate the influence of selected determinants on under-five mortality.

Results: 15,755 women who had at least given birth to a singleton in the five years preceding the survey were included in the final analysis. The mean age of the women was 29.12 years (SD=6.88). Women living in rural areas had a 13% reduced risk of having a child die before their fifth birthday (IRR; 0.87, 95% CI; 0.74-1.02). Each additional child born with a preceding birth interval of less than 24 months increased the risk of the mother losing the child through death before the attainment of their fifth birthday by 2.41 times (IRR; 2.41, 95% CI; 2.23-2.60). Every additional child delivered when the mother was either less than 18 years or above 35 years old, increased the risk of the mother losing a child by 17% (IRR ;1.17, 95% CI; 1.06-1.29). The women who had given birth to five children or more at the time of the interview had a 26% (IRR 1.26, 95% CI; 1.08-1.46) higher risk of losing a child before attainment of their fifth birthday compared to those who had given birth to less than five children.

Conclusion: Preceding birth interval, parity and maternal age at birth are key determinants of under-five mortality in Kenya. Educating the public on family planning will improve child survival.

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LIST OF ABBREVIATIONS AND ACRONYMS

AIDS	Acquired Immune Deficiency Syndrome
HIV	Human Immunodeficiency Virus
KNBS	Kenya National Bureau of Statistics
KDHS	Kenya Demographic and Health Survey
MDG	Millennium Development Goals
SDG	Sustainable Development Goals
UN-IGME	United Nations Inter-agency Group for Mortality Estimation
UNICEF	United Nations International Children Education Fund
SSA	Sub-Saharan Africa
WHO	World Health Organisation
KDHS	Kenya Health and Demographic Survey

CHAPTER ONE: INTRODUCTION

1.1 Background

Under-five mortality is a huge burden worldwide. Children, who are considered the most vulnerable members of society suffer the most in case of catastrophes such as droughts war, floods and earthquakes. In countries affected by conflict such as Somalia, Democratic Republic of Congo, Southern Sudan and Syria, children are particularly vulnerable to all forms of abuse. In such set ups, child deaths occur because of violence or due to the consequences of the conflict such as starvation, poor sanitation and lack of quality health care. It is noteworthy that majority of the African countries with the highest under-five mortality rates have recent history of war or other disasters.

The under-five mortality rate[1] is a sensitive measure of the outcome of a wide variety of investments in maternal and child health services. Additionally, infant mortality rate[2] is an important indicator of population health especially in developing countries (Masuy-Stroobant and Gourbin, 1995). Furthermore, the coverage of child health interventions in the society is a reflection of social and economic development which if high, is associated with a reduction in disease burden and subsequently, reduced under-five mortality.

[1] Under-five mortality rate is the probability of dying between birth and exactly five years of age, expressed per 1,000 live births

[2] Infant Mortality rate is the probability of dying before the first birthday expressed per 1,000 live births

Globally, it is estimated that 5.6 million children below the age of five years died in 2016 (WHO, 2017). The top five countries which account for a large proportion of the deaths are China, Ethiopia, India, Nigeria, Pakistan and the Democratic Republic of Congo. More than one million under-five deaths occur in India per year (Vakili et al., 2015). It is indeed unfortunate that 25% of the world's deaths of children below five years occur in Africa (Liu, 2015). At 81 deaths per1000 live births, the Sub Saharan region has the highest burden of under-five mortality in the world. Europe on the other hand has the lowest at 11 deaths per 1000 live births. Moreover, the country with the highest under-five mortality rate in the world is Angola at 167 deaths per 1000 live births (Alkema et al., 2016).

The most vulnerable period of a child's life is the first 28 days. An estimated 2.6 million neonatal deaths occur every year and approximately the same number are stillbirths (WHO, 2017). Although under-five mortality is declining globally, the proportion of neonatal deaths is rising. Between 1990 and 2013, the neonatal mortality rate reduced from 33 to 20 deaths per 1000 live births (United Nations Inter-Group for Child Mortality Estimation, 2014). Currently, neonatal deaths account for 44% of all under-five deaths (UNICEF, 2017).

From the 2014 KDHS, the infant mortality rate stands at 39 deaths per 1,000 live births, while the under-five mortality is 52 deaths per 1,000 live births. Although, in the ten years preceding the 2014 KDHS the under-five mortality rate declined, the neonatal mortality rate exhibited a lower percentage reduction compared to the infant mortality rate. The under-five mortality rate however, varies across the different regions in the country. Nyanza region has the highest under-five mortality rate, which is approximately twice that of Central region. Nairobi, on the other hand, an urban region whose majority of residents live in informal settlements has

the second highest under-five mortality rate in the country at 72 deaths per 1000 live births (KNBS and ICF Macro, 2015).

1.2 Causes of Child Morbidity and Mortality

Over the years, the world has gone through an epidemiologic transition. As a result, the burden of infectious diseases has reduced and there has been an increase in non-communicable diseases. The demographic changes have been characterised by increased life expectancy, decreased under-five mortality and reduced fertility. The different regions of the world are in different stages of the epidemiologic transition with Africa and Asia still having a high burden of infectious diseases (Santosa et al., 2014). Most conditions that cause newborn deaths in Africa and Asia are uncommon in the developed countries and when they occur, they rarely cause death. Pneumonia, birth asphyxia, diarrhoea, preterm birth complications and malaria are the leading causes of death in under-five children worldwide. In addition, malnutrition is an underlying contributor to approximately 45% of all child deaths (WHO, 2017). Unfortunately, undernutrition is likely to persist due to global warming which has resulted in frequent droughts especially in the Sub-Saharan region. Further, preterm birth complications are the leading cause of death in the neonatal period worldwide. In countries where the mortality rate is low, congenital malformations account for majority of deaths. On the other hand, in high mortality regions, infections and other complications arising during the intrapartum period such as birth asphyxia, account for a greater percentage of the deaths, especially among the poor (Lawn et al., 2014). In 2013, half of the 6.3 million under-five deaths were due to infections (Liu et al., 2015). Currently, pneumonia and diarrhoea account for a majority of the children out patient hospital visits and admissions in low-income and middle-income countries. Moreover, the epidemiology of childhood pneumonia is similar to that of diarrhoea, which may be due to similar predisposing

factors such as undernutrition (Walker et al., 2013). Globally, pneumonia accounts for approximately one million children deaths every year. In addition, malaria is a significant contributor to child deaths especially in areas with high transmission of malaria whereby 70% of those who die from malaria are children under five years of age (WHO, 2017). Moreover, amongst those infected with HIV, children below five years are at the highest risk of AIDS-related deaths. Globally, an estimated 1.8 million children below 15 years are living with HIV (UNAIDS, 2016). Further, in 2015, Sub-Saharan Africa contributed 75·4% of all new HIV infections (Wang, 2016). Currently, Kenya is ranked fourth in the world based on the burden of HIV/AIDS (UNAIDS, 2017). It is encouraging that the HIV prevalence has been declining over the years from 10.5% in 1996 to 5.9% in 2015 (NACC, 2016). Additionally, the number of newly infected children with HIV declined from 12,000 to 6600 between 2010 and 2016, (UNAIDS, 2017). This is mainly due interventions such as HIV education and awareness, condom use, use of antiretroviral drugs among others. According to NACC (2016), HIV accounts for 15 percent of under-five child deaths in Kenya. Further, HIV-infected children are more likely to suffer malnutrition compared to those who are HIV negative (Nalwoga et al., 2010). The relationship between HIV, tuberculosis and malnutrition is complex. Both HIV and tuberculosis infections increase the vulnerability to malnutrition while malnutrition reduces the immune status and hastens disease progression (Rose, Hall and Martinez-Alier, 2014). Furthermore, the risk of malnutrition among children whose mothers are HIV infected is high. This is especially among children whose mothers are not educated, are single mothers or come from the poorest households (Magadi, 2011). For children with tuberculosis infection, malnutrition is the most important predictor of both outcome and mortality even in the background of HIV co-infection (Hicks et al., 2014).

1.3 Efforts and Strategies to Improve Child Survival

In 1990, the World Summit for Children adopted a set of specific goals to enhance child survival through strategies such as enhancing access to clean water and improved sanitation by the year 2000. At the end of 10 years, 63 countries managed to reach the target of reducing under-five mortality by at least 33%. Subsequently, in 2000, the world adopted the Millennium Development Goals (MDGs). The MDG goal number 4 aimed at decreasing child mortality by two-thirds, from 93 to 31 deaths per 1000 live births. Although the world did not attain the MDG 4, the global under-five mortality rate declined by more than half (United Nations, 2015). Since September 2015, the world is working towards achieving the Sustainable Development Goals (SDGs). The SDG goal number 3 aims to end preventable deaths among the under-five by the year 2030 (UNDP, 2016).

Throughout the world, the strategies being implemented by governments in partnership with non-governmental organisations in effort to reduce child mortality include immunization. Between 2000 and 2013, the measles vaccine has helped prevent approximately 15.6 million deaths (United Nations, 2015). Other strategies include use of long lasting insecticide treated nets, treatment of infections such as pneumonia with appropriate antibiotics and access to clean water. In addition, pregnant women are encouraged to attend antenatal clinics and give birth while being assisted by a skilled birth attendant.

In Kenya, the Kenya Health Strategic Plan is the guide to improving the health status of the citizens in line with the county's vision 2030. As indicated in the strategic plan, the government intends to invest in the health infrastructure. In addition, the government plans to ensure maternity services, emergency services, diagnosis and treatment of HIV, TB and malaria

are available for free. Furthermore, there are plans to ensure health services are easily accessible to women, children and youth (Ministry of Health, 2013).

1.4 Problem Statement

Kenya is one of the countries in the world with a high under five mortality rate currently estimated at 52 deaths per 1000 live births (KNBS and ICF Macro, 2015). Although the Sub Saharan Africa (SSA) region had a 38 percent decline in neonatal mortality between 1990 and 2015, Kenya's rate of decline was 19 percent (United Nations Inter-Group for Child Mortality Estimation, 2015). While results of under-five mortality determinants have been documented in past studies, few studies have used the latest KDHS 2014 to examine the determinants of under-five mortality in Kenya. This study aimed to apply the negative binomial regression model, a precise measure of association well suited for the analysis of count data especially when dealing with a rare event such as under-five mortality.

1.5 Justification

Preventing child deaths should be a priority for all nations. Since the future of a population is dependent on children surviving to reproductive age, we must therefore do all it takes to enhance child survival. The Kenyan constitution guarantees all children the right to life and the right to the highest attainable standard of health healthcare. Moreover, the government aims to eliminate preventable under-five deaths by the year 2030 which means the trend in reduction of under-five mortality in Kenya should be accelerated. In resource limited settings such as Kenya, it is paramount to identify the most important factor so as to adopt cost effective interventions in reducing under-five mortality. The findings from this study will be useful to the policy makers as well as managers of the devolved health system.

1.6 Study Hypothesis

1.6.1 Null Hypothesis

There is no association between selected determinants and under-five mortality in Kenya.

1.7 Research Question

What are the determinants that influence under five mortality in Kenya?

1.8. Objectives

1.8.1 General Objective

The main objective of this study is to determine the sociodemographic factors influencing under-five mortality in Kenya.

1.8.2 Specific Objectives

1. To determine the influence of socioeconomic factors on under-five mortality in Kenya.
2. To determine the influence of demographic factors on under-five mortality in Kenya.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Kenya is among countries with a high under-five mortality rate. The high under five-mortality rate is due to various determinants that interact in a complex manner. The specific factors include birth interval, birth order, socioeconomic status, residence, maternal age, education level among others. Additionally, the utilization of maternal and child health services specifically antenatal and postnatal care services, delivery under skilled birth attendants, family planning, immunization and curative services influences the under-five mortality rate (Saikia, Singh, Jasilionis and Ram, 2013). The country has done well over the years to improve maternal and child health indicators such as, contraceptive prevalence rate and immunization coverage. Currently, majority of the married women in Kenya use a method of contraception while 71 percent of children age 12-23 months are fully vaccinated (KNBS and ICF Macro, 2015). Further, introduction of the rotavirus vaccine in the routine infant immunization program in Kenya in July 2014 has significantly contributed to the reduction in deaths and hospital admissions in children under 5 years (Van Hoek et al., 2012). Regional differences in mortality in the country are attributable to differences in socioeconomic, demographic and environmental factors.

2.2 Maternal Age at Birth

The age of a woman at birth, influences the chances of survival of the child. Children born to women who are extremes of age are at a higher risk of suffering complications such as low birth weight, prematurity and neonatal mortality. Lately, more women especially in the developed countries are starting child bearing at an older age as some women choose to pursue academic as well as career development while delaying child bearing. Medical technology has

also advanced thus enabling women to conceive at an advanced age. In Kenya, 18 percent of women start child bearing between ages 15-19 years. The prevalence of early child bearing is more or less the same across rural and urban areas but it varies across regions with the highest in Nyanza and the lowest in Central and North Eastern regions (KNBS and ICF Macro, 2015). Worldwide, 6.7 percent of stillbirths are attributable to maternal age above 35 years. Furthermore, adolescent pregnancy is also associated with increased risk especially if the adolescent is younger than 16 years (Lawn, et al., 2016). Moreover, Aras, (2013), studied the relationship between maternal age at birth and low birth weight among Whites through multivariate analysis of North Carolina births. The mothers below 15 and those aged 40 and above were at a greater risk of giving birth to low birth weight babies compared to those aged between 25-29 years. Elsewhere, from a large population-based study involving more than 250,000 participants from six low-middle income countries, adolescents below 15 years exhibited a higher relative risks for preterm and low birth weight deliveries compared to older adolescents and adults. Early adolescence was however, not significantly associated with stillbirths. Socio-economic determinants, suboptimal antenatal clinic attendance or inadequate delivery care could not explain the increased risk in preterm birth and low birth weight (Althabe et al., 2015).

2.3 Maternal Education

Countries with higher rates of maternal schooling have higher rates of child survival. The education level of the mother and her occupation significantly affects under-five mortality (Kyei and Gyekye, 2011). Children born to women with at least secondary education have an almost three times better chance of survival compared to children born to uneducated women (United Nations, 2015). After adjusting for other covariates women with at least primary education are

more likely to immunize their children in comparison to those who have less than primary education (Onsomu et al., 2015). Similarly, from the analysis of infant and child mortality in Nigeria, children born to mothers who have at least secondary level of education exhibited a lower risk of death in infancy compared to children whose mothers have never been to school (Adedini et al., 2015; Ezeh et al., 2015). Elsewhere from a study that looked at how maternal education affects child health in Turkey, mothers who completed primary school were more likely to attend prenatal clinics, were at a lower risk of very low birth weight births, more likely to start prenatal care early in addition to being more likely to have children with higher anthropometric measurements. It is more probable that maternal education affects child survival through other ways apart from influencing access to quality health care. This is because in Turkey, all women are able to access quality health care services for antenatal clinics visits and delivery regardless of their level of education (Güneş, 2015).

Educating a woman improves the chances of survival for her children particularly in the developing countries. This is partly because educated women are able to understand the importance of accessing quality health services for themselves and their children. In addition, education is an important determinant of employment of women as noted in Limpopo province in South Africa (Kyei and Gyekye, 2011). With a good education, a woman is able to secure a well-paying job and provide for her children. Maternal education is also associated with good nutritional outcomes in children making school enrollment of girls a key component of maternal and child health programs in Sub-Saharan Africa (Gakidou et al., 2010).

2.4 Birth Interval

Preceding birth interval of the child is significantly associated with mortality (Sahu et al., 2015). Close birth interval and high birth order increase the risk of infant mortality. The risk is

even higher if the child is not breastfed. Further, the length of the preceding birth interval is inversely related to stunting. Having many children who are closely spaced in the family, increases the risk of undernutrition for the children. A child who has more than four older siblings is more likely to be underweight compared to a child who has less than four older siblings (Asfaw et al., 2015). This may occur possibly because as the birth order increases, there is increased competition for the resources available to the household including food. The level of childcare also reduces as the number of children to in the household increases (Kayode et al, 2012).

In India however, differences in anthropometric measurements may be attributed to sociocultural practices which vary by religion and region. Although stunting is widespread, Indian firstborns are taller than African firstborns are. The firstborn height advantage however, only applies to sons and is attributable to eldest son preference resulting in greater resource allocation to the firstborn sons compared to the other children. This significantly disadvantages the siblings and is evident from the second child onwards (Jayachandran and Pande, 2015).

2.5 Residence

Under five mortality varies across different regions depending on whether the region is urban or rural. Children born in rural areas exhibit a higher under-five mortality risk than children born in urban areas (Ezeh et al., 2015). The likely explanation is that it is easier for those living in urban areas to access quality health care facilities (Kayode, Adekanmbi and Uthman, 2012). Moreover, mothers in rural areas are less likely to attend antenatal clinics or deliver in a health facility. They are also at a higher risk of very low birth weight babies compared to mothers living in urban areas (Güneş, 2015). On the other hand, Saikia et al.,

(2013), attributes the rural–urban gap in infant mortality to socioeconomic determinants such as household wealth index and mother's level of education.

In Kenya, the percentage of fully vaccinated children is higher in urban areas at 83% compared to 77% in rural areas. In addition, the prevalence of malnutrition among the under-five children living in urban areas is 9% lower than that of children living in rural areas. Breastfeeding practices however, are worse in urban areas compared to rural areas (KNBS and ICF Macro, 2015). For a majority of the women in formal employment, they are only able to exclusively breastfeed until the end of their maternity leave. Although the under-five mortality rate in Kenya has been declining, the decline is more rapid in rural areas compared to urban areas. The explanation for this is the deplorable state of urban slums where the under-five mortality rates are higher than the national average for rural as well as urban areas (Kimani-Murage et al., 2014). Moreover, in India, breastfeeding of rural infants significantly contributed to the reduction in the rural–urban gap in infant mortality (Saikia et al., 2013). On the contrary, according to Musafili et al., (2015), there was no association between type of residence and neonatal mortality for the period between 2005 and 2010 in Rwanda, a country where more than half the population live in the rural areas.

2.6 Wealth Index

Infant mortality, an outcome indicator, is a measure of the socioeconomic wellbeing of a society. If there are differences in infant mortality between rural and urban areas, it indicates an unequal distribution and use of resources by type of residence (Saikia et al., 2013). The family's wealth is a valuable determinant of neonatal mortality. Children from poor families are at a higher risk of acquiring infections partly because they have less resistance due to undernutrition. The risk of being underweight and stunted among the poorest is 2.3 and 1.8 times higher

respectively as compared to the richest category (Prinja et al., 2017). The poor also have low coverage with preventive interventions such as immunization (Lakew, Bekele and Biadgilign, 2015). Although we are aware of the interventions that reduce child mortality, children especially from the poor communities continue to die because they are unable to access these services. These children face difficulties in accessing clean water, good nutrition as well as quality health care services. In a study that looked at the role wealth-related inequality in health coverage in Sub-Saharan African countries, 89% of the countries in the study would increase the skilled birth attendance coverage if the wealth-related inequality was eliminated (Hosseinpoor et al., 2011). While analyzing the infant and child mortality in India, Sahu et al., (2015), found household wealth to be significantly associated with child mortality. On the contrary, Musafili et al. (2015), found no statistically significant association between household wealth and neonatal mortality using data for the period between 2005 and 2010 in Rwanda.

2.7 Parity

The Total fertility rate in Kenya declined from 4.9 to 3.9 births per woman between 2003 and 2014 (KNBS and ICF Macro, 2015). This is partly attributable to the education system a result of which women delay their sexual debut, postpone marriage and child bearing to focus on school (Chicoine, 2012). Further, education goes hand in hand with increased uptake of contraceptives. Consequently, women in urban areas have at least one child less than rural women (KNBS and ICF Macro, 2015).

High parity births are associated with worse pregnancy outcomes compared to low parity births. Using DHS data from ten countries with a high fertility rate, Sonneveldt et al., (2013), determined that coverage for maternal and child health interventions such as skilled birth attendance while adjusting for poverty is better for low parity women compared to high parity

women. In addition, in a study conducted at Muhimbili National Hospital, in Tanzania, neonates born to women with high parity were three times more likely to get a poor Apgar score compared to neonates born to women with low parity (Mgaya et al., 2013). High parity is also a risk factor in maternal mortality. In another study also carried out in Tanzania, 54% of the women who died due to maternal causes were at high parity. When the mother dies, the chance of survival for the newborn reduces. This is because the neonate is more likely to suffer from nutritional deficiencies, as formula feeding is not easily accessible. The child may also not be able to access quality health care in good time (Yamin et al., 2013).

2.8 Skilled Birth Attendance

Skilled birth attendance is vital in protecting the health of both mother and baby. The risk of maternal and perinatal mortality is highest during labour and the subsequent 24 hours after birth. A study involving community surveillance data in Bangladesh reported that almost half of all neonatal deaths occur within 24 hours of birth and 83.6% of all neonatal deaths occur within the first week of life (Halim et. al, 2016). The risk of death reduces by 20 percent if either a medical doctor, nurse or midwife conducts the delivery (UNICEF, 2017). Where these highly qualified health care workers are not available, other health care providers such as community health workers conduct deliveries especially in rural areas and urban slums. The presence of a skilled birth attendant however, is not enough. Timely and effective obstetric services are key in reducing both maternal and neonatal deaths (Adegoke et al., 2012).

In Kenya, only 61% of deliveries occur in health facilities (KNBS and ICF Macro, 2015). Among the challenges in accessing health facilities to the expectant women in the country include distance to the health facilities from their homes, lack of transport and lack of finances (Kitui et al, 2013). Some women on the other hand do not appreciate the need for hospital

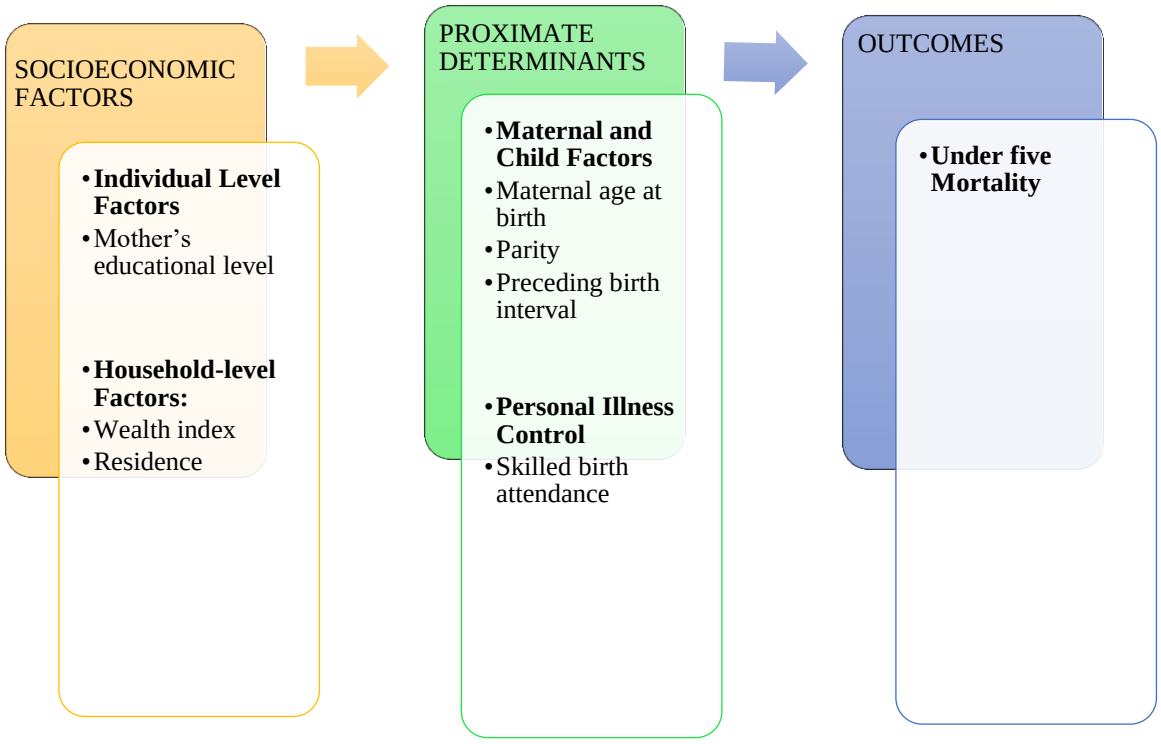
deliveries. In a study carried out in Ghana, participants reported maltreatment by midwives, costs associated with health facility delivery, difficulties in transportation and precipitous labor as some of the barriers to health facility deliveries (Crissman et al., 2013). After adjustment for other factors, women whose husbands accompanied them for antenatal clinic visits were more likely to deliver under a skilled birth attendant compared to those whose husbands did not attend antenatal clinics. The woman's level of educational, employment status, religion, number of antenatal clinic visits and number of children were statistically significant in determining skilled birth attendance (Mangeni et al., 2012). In addition, women consider the quality of care as determined by the availability of required drugs, medical equipment and skilled health care providers when choosing the place of delivery (Adegoke et al., 2012).

2.9 Conceptual Framework

The determinants of child survival can either be classified as social economic or biological. Social science research, focuses mainly on the influence of socioeconomic and cultural factors in child mortality while medical research focuses on specific disease processes. The Mosley and Chen theoretical framework was specifically developed for the study of the determinants of child survival in developing countries. The objective of the framework was to integrate the research methodologies used by demographers and epidemiologists. The argument is that the socioeconomic and cultural factors operate through a set of proximate determinants which directly influence child survival. Maternal education for instance affects child survival through proximate determinants by influencing access to child health services (Mosley and Chen, 1984). The operational framework was developed based on the Mosley and Chen (1984), theoretical framework.

2.10 Operational Framework

Figure 1: Operational framework



CHAPTER THREE: METHODOLOGY

3.1 Study Design

The study involved secondary data analysis from a cross sectional study KDHS, conducted between May and October 2014. The Kenya Demographic and Health Survey (KDHS) is a population based survey carried out every five years to monitor the health and population status in the country. Information collected included demographic data of the household members, breastfeeding practices, health seeking behaviour, nutritional status of women and children, gender based violence, knowledge and behaviour regarding sexually transmitted infections and diseases including HIV/AIDS. Data collected is used to estimate among others the fertility rates, Contraceptive prevalence rates, immunization coverage as well as maternal and under-five mortality rates.

3.1.1 Negative Binomial Regression Model

Negative binomial regression is a type of generalized linear model in which the parameters are estimated using maximum likelihood estimation. It is appropriate for the analysis of count data. The method of analysis is suitable when the variance of the dependent variable is not equal to the mean. The dependent variable could be the number of times a particular event occurs or it could be a rate. In this study, the outcome variable is the rate of child deaths per woman.

The negative binomial regression model for an observation *i* is:

$y_i \sim$ Negbin (μ_i, k)

By using log as a link function:

$\text{Log } \mu_i = O_{i+} x_{i1}\beta_{i1} + x_{i2}\beta_{i2} + \cdots + x_{in}\beta_{in}$

$E(\boldsymbol{y}_i) = \mu_i$

$\text{Var}(\boldsymbol{y}_i) = \mu_i + k\mu_i^2$

Where:

y_i is the outcome variable for individual i, in this study it is the rate of child deaths per woman

μ_i represents the expected value of y_i

Oi represents the offset variable for individual i

β_i is the coefficient of variable i

k is the dispersion parameter

3.2 Study Area Description

The study area was Kenya, a country in the Sub-Saharan region with total land area of 569,295 KM². The country which is further sub divided into 47 counties had an estimated total population of 43 million in 2014 (KNBS, 2015).

3.3 Study Population

The study population were all women aged 15-49 years who had given birth to a live infant in the preceding 5 years. The children may or may not have been alive at the time of the interview.

3.4 Inclusion Criteria and Exclusion Criteria

The respondents were women aged 15-49 years found at the sampled household. For the woman to be interviewed, she should have spent the night before in that particular household and given informed consent to questioning.

3.5 Sampling Procedure

The sampling frame for the KDHS 2014 was the Fifth National Sample Survey and Evaluation Program (NASSEP V). Multi stage cluster sampling was used. For the First Stage the team selected a total of 617 urban and 995 rural clusters and for the Second Stage, 25 households were selected per cluster, making a total sample size of 40,300 households. Out of these, 39,679 households were covered during the survey. Women aged 15-49 years in all selected households were interviewed. The response rate for the household interviews was 99% while the response rate for the women aged between 15-49 years was 97%. It is possible to estimate all the indicators at the national level, for urban and rural areas separately and at the regional level. It is also possible to estimate selected indicators at the county level.

3.6 Description of Variables

3.6.1 Dependent Variable

Number of under-five children who died in the five years preceding the study per woman.

3.6.2 Independent Variables

The independent variables are factors that influence under-five mortality.

These include:

- Maternal age at birth – This is the actual age in years the woman was when she gave birth to a particular child.
- Preceding Birth Interval – This is the period in months between the previous birth and the current. The ideal spacing period between births is at least 24 months.
- Maternal level of education- This refers to the level of education of the mother. It is categorized as no education, primary level, Secondary level and higher education level
- Wealth index- This refers to the social economic status of the household the woman belongs to, which falls in either: poorest, poorer, middle, richer or richest categories.
- Type of Residence- Refers to the area of residence which is either urban or rural.
- Skilled birth attendance- Whether a woman delivered under the care of a skilled birth attendant (doctor or a midwife) or not.
- Parity- Refers to the total number of children a woman has ever given birth to at the time of the interview.

Table 1: Variables as used in the analysis

Variable	Definition
Dependent Variable	
Under-five mortality	Number of under-five children who died in the five years preceding the study per woman
Independent variables	
Maternal age risk	Number of under-five children delivered while in the high risk age groups (below 18 years or above thirty five years) per woman
Mother's highest level of education	Categories: 0 "No education" 1 "Primary" 2 "Secondary" 3 "Higher"
Preceding birth interval risk	Number of under-five children delivered with preceding birth interval of less than 24 months per woman
Skilled birth attendance	Whether all children were born under the care of a skilled birth attendant 0"No" 1"Yes"
Type of Residence	Categories: 1"Rural" 2"Urban"
Wealth index	Categories: 1 "Poorest" 2 "Poorer" 3 "Middle" 4 "Richer" 5 "Richest"
Parity	Categories: 0 "4 and below" 1 "5 and above"

3.7 Data Management Plan

3.7.1 Data Sources

The study utilised secondary data from the KDHS 2014 downloaded from The Demographic and Health Surveys (DHS) Program website.

3.7.2 Statistical Analysis

The analysis followed checking for completeness, consistency and accuracy of the data. The influence of the type of residence, birth interval, education level, wealth index, age of the woman at birth, parity and skilled birth attendance on the rate of the under-five child deaths per woman was evaluated. Frequency distribution of each variable and each category for each of the categorical variables were calculated and presented. Using STATA software version 12 (StataCorp LLC, 2011), negative binomial regression model, which was significant, was used to

measure the effect of each of the independent variables on the rate of under-five child deaths per woman and the Incidence Rate Ratio (IRR), was reported. The statistical significance was measured using the 95% confidence intervals and P values.

3.7.3 Data Security and Confidentiality

The data did not include any variables that could identify the respondents. Further, the data was kept in a password-protected computer.

3.7.4 Data Sharing

Once complete, the study findings will be availed to the public through the DHS Program website and also though publication of the work in a reputable journal.

3.8 Study Assumptions and Limitations

The study involved analysis of countrywide cross sectional survey data conducted in 2014. The survey results were prone to sampling and non-sampling errors. The non-sampling errors, which are impossible to avoid, were due to mistakes arising during data collection and data processing. On the other hand, sampling errors arise from the fact that all possible samples vary. Training of the teams involved in the survey aimed at mitigating on the non-sampling errors. In order to handle the sampling errors, probability sampling was used. Further, after analysis the 95% confidence intervals provided the range within which the true value for the population lies.

3.9 Ethical Consideration

The interviewer explained the purpose of the survey to the interviewee and consent was obtained before administration of the questionnaire. Permission to use the KDHS 2014 data was obtained from The Demographic and Health Surveys (DHS) Program, ICF INTERNATIONAL.

CHAPTER FOUR: RESULTS

4.1 Study Sample

In this study, 15,755 women were included in the final analysis. The women included in the analysis had given birth to at least one child in the five years preceding the interview. Additionally, the women were either listed as wives or as heads of households and were all aged between 15-49 years at the time of the interview. Further, only singleton births were included in the analysis. This is because past studies have shown that multiple births have a heightened risk of experiencing death and hence their inclusion would have overstated the actual rates of under-five mortality (Vogel et al., 2013). The mean age of the women was 29.12 years (SD=6.88).

The next section shows a summary table of the socio-economic characteristics of the women age 15-49 who had at least a birth in the five years preceding the survey.

Table 2: Women Socioeconomic characteristics

variable	level	Number	Percentage
Woman highest level of education	no education	2,882	18.29
	primary	8,314	52.77
	secondary	3,389	21.51
	higher	1,170	7.43
Household wealth index	Poorest	4,675	29.67
	Poorer	3,219	20.43
	Middle	2,805	17.80
	Richer	2,620	16.63
	Richest	2,436	15.46

The table below shows a summary of the demographic characteristics of the women age 15-49 included in the study.

Table 3: Women demographic characteristics

Variable	Level	Number	Percentage
Type of Residence	urban	5,465	34.69
	rural	10,290	65.31
Number of dead children per woman	None	14,846	94.23
	One	836	5.31
	Two	68	0.43
	Three	3	0.02
	Four	1	0.01
	Five	1	0.01
All children delivered under skilled birth attendance	Yes	9,139	58.01
	No	6,616	41.99
Number of children born when the mother age at birth was below 18 or above 35 years	None	12,127	76.97
	One	2,994	19.00
	Two	560	3.55
	Three	70	0.44
	Four	4	0.03
Parity	Four and below	11,415	72.45
	Five and above	4,340	27.55

Majority of the respondents at 65.31% reside in rural areas while 34.69% live in urban areas. Out of the women whose children had died, 5.31% lost one child while 0.43% of the women lost two children, a much smaller proportion at 0.02% had three dead children, 0.01% had four dead children while 0.01% of the women had five dead children in the five years preceding the study.

The number of women who had given birth to one child at a birth interval of less than 24 months were 15.56%, while 2.72 % had given birth to two children, 0.54% had three children, 0.10%, had four children and 0.02% had five children.

The percentage of women who had given birth to all their children under the care of skilled birth attendants was 58.01%, while 41.99% had given birth to at least one child without the assistance of a skilled birth attendant.

The percentage of women who gave birth to one child while in the high-risk age group (aged below 18 years or above 35 years) was 19.00%, 3.55% gave birth two children, 0.44% gave birth to three children and 0.03 % gave birth to four children.

At the time of the interview, 72.45% of the women had given birth to four children or less and 27.55% had given birth to at least five children.

The descriptive analysis in the preceding section provides a summary of the characteristics of the respondents. However, it does not provide information on the association between the risk factors and under-five mortality. In order to address this gap, binomial regression analysis is used. This study presents the results of the negative binomial regression analysis as shown in Table 4.

4.2 Negative Binomial Regression Analysis of the Determinants of Under-five Mortality in Kenya

Table 4: Effect of socioeconomic and demographic factors on the rate of child deaths per woman using negative binomial regression model

Covariate	Level	IRR	Std Err	95% Confidence interval	P value
Residence	Urban (ref)				
	Rural	0.87	0.07	0.74 - 1.02	0.094
Education Level	No education (ref)				
	Primary	1.27	0.12	1.06 - 1.54	0.012*
	Secondary	1.13	0.14	0.88 – 1.45	0.354
	Higher	0.98	0.19	0.68 - 1.44	0.955
Wealth Index	Poorest (Ref)				
	Poorer	1.11	0.11	0.92 - 1.35	0.283
	Middle	1.18	0.13	0.96 – 1.46	0.118
	Richer	1.10	0.13	0.87 – 1.40	0.412
	Richest	0.96	0.14	0.72 -1.28	0.778
Parity	4 and below (Ref)				
	5 and above	1.26	0.10	1.08 -1.46	0.003*
Birth Interval		2.41	0.10	2.23 - 2.60	0.000*
Mother age at birth		1.17	0.06	1.06 -1.29	0.002*
Skilled birth attendance		0.93	0.07	0.80 - 1.08	0.347

* Significant at level <0.05

Negative binomial regression analysis was used to evaluate the influence of socioeconomic and demographic factors on the rate of under-five child deaths per woman. The dependent variable was the number of under-five child deaths per woman and the independent variables were type of residence, birth interval, education level, wealth index, parity, age of the woman at birth and skilled birth attendance.

Adjusting for birth interval, education level, wealth index, age of the woman at birth, parity and skilled birth attendance, the average number of under-five deaths was13% less for women living in rural areas compared to those living in urban areas (IRR; 0.87, 95% CI; 0.74-1.02).

In addition, while adjusting for type of residence, birth interval, wealth index, age of the woman at birth, parity and skilled birth attendance, there is no strong pattern of association between under-five mortality rates and the household wealth index.

The women who have primary level of education have a 27% higher risk of having lost a child before its attainment of the fifth birthday compared to those who had no education while adjusting for all other covariates (IRR; 1.27, 95% CI; 1.06 - 1.54). The other levels of education do not show any significant association with the risk of under-five mortality.

While adjusting for the type of residence, education level, wealth index, parity, age of the woman at birth and skilled birth attendance, the average number of child deaths per woman increased by 2.41 times (IRR; 2.41, 95% CI; 2.23-2.60), for each additional child born with a preceding birth interval of less than 24 months.

Skilled birth attendance reduced the average number of child-deaths per woman by 7% (IRR; 0.93, 95% CI; 0.80-1.08), while adjusting for all other variables. However, it is noteworthy that the finding was not statistically significant.

Moreover, every additional child delivered within the high risk age groups (when the mother is either less than 18 years or over 35 years), increased the average number of child deaths per woman by 17% (IRR ;1.17, 95% CI; 1.06-1.29), while adjusting for type of residence, birth interval, education level, parity, wealth index and skilled birth attendance.

The women who had given birth to five children or more at the time of the interview had a 26% (IRR; 1.26, 95% CI; 1.08-1.46) higher risk of having lost a child before its attainment of the fifth birthday compared to those who had given birth to less than five children while adjusting for all other covariates.

CHAPTER FIVE: DISCUSSION

5.1 Discussion

In this study, using the negative binomial regression analysis, preceding birth interval, parity and age of the mother at birth are all risk factors of under-five mortality. The results show that the length of the preceding birth interval has a negative association with under-five mortality. For each additional child born when the preceding birth interval is less than 24 months, the rate of under-five deaths per woman increases. This is similar to findings from the 2011 Ethiopia Demographic and Health Survey (EDHS) data (Gebretsadik and Gabreyohannes, 2016) and the Nigeria Health and demographic survey (Kayode et al., 2012). Further, the study findings show that giving birth while aged below 18 years or above 35 years increases the rate of under-five child deaths per woman in comparison to giving birth between 18-35 years. On the other hand, a study carried out in Nigeria demonstrated increased under-five mortality in mothers in the age group 26-30 years and increased odds of under-five mortality as the age group increased (Kayode et. al, 2012). The study also shows that women who had given birth to five children or more, at the time of the interview, had a 26% higher risk of having a child die compared to those who had less than five children. This is similar to findings by Sonneveldt et al., 2013 and Kayode et al., 2014.

The study found that the type of residence of a woman had no significant association with the risk of a child dying before their fifth birthday. These findings are similar to a study carried out in Rwanda, which reported no significant association between type of residence and under five mortality (Musafili et al., 2015). Arguments put forward regarding the fading urban advantage in relation to under-five mortality attribute the higher risk in urban areas to the

deplorable state of slums (Kimani-Murage et al., 2014). This could explain the 13% reduced risk of a woman living in rural areas losing a child compared to a woman living in urban areas even though this association was not statistically significant.

Women who had delivered all their children under skilled birth attendance had a 7% reduced risk of under-five child deaths per woman. Although this is not statistically significant, skilled delivery reduces neonatal mortality through provision of comprehensive health care services to women and their newborns during labour and the immediate postpartum period (Utz, Siddiqui, Adegoke, and Broek, 2013). Tura et al., (2013), reports that in low and middle-income countries, health facility delivery reduces the risk of neonatal mortality by 29 percent.

There was no strong pattern of association between the rate of under-five child deaths per woman and the mother's level of education, which is different from findings from various studies. For instance, a study carried out in Ghana showed mothers who had attained primary or junior high school education were 45% less likely to experience under-five death compared to mothers who had no formal education (Kanmiki et al., 2014).

There was also no significant association between household wealth index and the rate of under-five child deaths per woman. This was similar to a study carried out in Ghana by Kanmiki et al., (2014). However, these findings differ with most findings from various other studies (Ettarh and Kimani, 2012; Singh and Tripathi, 2013; Sahu et al., 2015).

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The study aimed to evaluate the socioeconomic and demographic determinants of under-five mortality in Kenya using data from the KDHS 2014. The survey data was suitable for the study because it contained information collected from women of reproductive age detailing the birth histories of all the children born within the five years preceding the study. The dataset also contained household level information, which was useful. In addition, the survey data provided a large sample suitable for studying under-five mortality, which is a rare event. The selected factors were the type of residence, birth interval, mother's highest level of education, household wealth index, parity, age of the woman at birth and skilled birth attendance. Using negative binomial regression analysis, the results revealed that the preceding birth interval, parity and the age of the mother at birth were significant determinants of under-five mortality in Kenya. Specifically, giving birth while aged below 18 or above 35 years, a preceding birth interval of less than 24 months and giving birth to five children or more were significant risk factors for under-five mortality. This therefore means that child survival is dependent on how many children a woman chooses to have and when she decides to have them. This is useful information for the policy makers and other stakeholders in the health sector for the purposes of decision making in regards to areas of focus when addressing public health interventions in maternal and child health programs.

6.1 Recommendations

Based on the conclusions arrived at in this study, one of the recommendations is investment in health education focusing on family planning by the stakeholders in the health sector.

Secondly, further studies to look into the level of knowledge among women age 15-49 on the factors contributing to under-five mortality.

REFERENCES

Abuya B.A., Onsomu E.O., Kimani J.K., & Moore D., (2011). Influence of Maternal Education on Child Immunization and Stunting in Kenya. *Maternal child health J*. 2011, 15: 1389-1399. 10.1007/s10995-010-0670-z.

Adedini, S. A., Odimegwu, C., Imasiku, E. N., Ononokpono, D. N., & Ibisomi, L. (2015). Regional Variations in Infant and Child Mortality in Nigeria: A Multilevel Analysis. *Journal of biosocial science, 47*(2), 165-187.

Adegoke, A., Utz, B., Msuya, S.E., & Van den Broek, N. (2012). Skilled Birth Attendants: Who is who? A descriptive study of definitions and roles from nine Sub Saharan African countries. *Plos One,* 7(7), e40220.

Alkema, L., Chou, D., Hogan, D., Zhang, S., Moller, A. B., Gemmill, A., … Say, L. (2016). Global, Regional, And National Levels And Trends in Maternal Mortality Between 1990 And 2015, with Scenario-Based Projections To 2030: A Systematic Analysis by the UN Maternal Mortality Estimation Inter-Agency Group. *The Lancet, 387*(10017), 462–474. https://doi.org/10.1016/S0140-6736(15)00838-7

Althabe, F., Moore, J.L., Gibbons, L. et al. (2015). Adverse maternal and perinatal outcomes in adolescent pregnancies: The Global Network's Maternal Newborn Health Registry study. *Reprod Health*, 12: S8

Aras, R. Y. (2013). Is Maternal Age Risk Factor for Low Birth Weight? *Archives of medicine and health sciences*, 1(1), 33.

Asfaw, M., Wondaferash, M., Taha, M., & Dube, L. (2015). Prevalence of undernutrition and associated factors among children aged between six to fifty nine months in Bule Hora district, South Ethiopia. *BMC Public health*, 15(1), 41.

Chicoine, Luke, E. (2012). Education and Fertility: Evidence from a Policy change in Kenya, discussion paper series, *Forschungsinstitut zur Zukunft der Arbeit*, No. 6778.

Creanga, A. A., Berg, C. J., Syverson, C., Seed, K., Bruce, F. C., & Callaghan, W. M. (2015). Pregnancy-related Mortality in the United States, 2006–2010. *Obstetrics & Gynecology*, 125(1), 5-12.

Crissman, H., Engmann, C. M., Adanu, R. M., Nimako, D., Crespo, K., & Moyer, C. A. (2013). Shifting norms: Pregnant women's perspectives on Skilled Birth Attendance and Facility Based Delivery in Rural Ghana. *African Journal of Reproductive Health*, *17*(1), 15 – 26

Demombynes, G., & Trommlerova, S.K. (2010). What has driven the decline of infant mortality in Kenya? Policy Research Working Paper No. WPS 60572010, World Bank.

Emina, J., (2011). Monitoring of Health and Demographic Outcomes in Poor Urban Settlements: Evidence from the Nairobi Urban Health and Demographic Surveillance system. J. *Urban Health*, 88(Suppl. 2):S200–S218.

Ettarh & Kimani. (2012). Determinants of under-five mortality in rural and urban Kenya. *Rural and Remote Health,* 12:1812.Retrieved from: www.rrh.org.au/journal/article/1812

Ezeh, O. K., Agho, K. E., Dibley, M. J., Hall, J. J., & Page, A. N. (2015). Risk Factors for Postneonatal, Infant, Child and Under-5 Mortality in Nigeria: A pooled cross-sectional analysis. *BMJ open*, *5*(3), e006779.

Fotso, J. C., Ezeh, A. C., Madise, N. J., & Ciera, J. (2007). Progress towards the Child Mortality Millennium Development Goal in Urban sub-Saharan Africa: The dynamics of Population Growth, Immunization, and Access to Clean Water. *BMC Public Health, 7*(1), 218.

Fotso, J.C., (2012). Child Growth in Urban deprived settings: Does household Poverty status matter? At, which stage of Child Development? *Health Place*, 18(2):375–384.

Gakidou, E., Cowling, K., Lozano, R., & Murray, C. J. (2010). Increased Educational attainment and its Effect on Child Mortality in 175 countries between 1970 and 2009: A systematic analysis. *The Lancet*, *376*(9745), 959-974.

Green, S. B. (1991). How many subjects does it take to do a regression analysis? *Multivariate behavioral research*, *26*(3), 499-510.

Güneş, P. M. (2015). The role of Maternal Education in Child Health: Evidence from a compulsory Schooling law. *Economics of Education Review*, *47*, 1-16.

Halim, A., Dewez, J. E., Biswas, A., Rahman, F., White, S., & van den Broek, N. (2016). When, Where, and Why Are Babies Dying? Neonatal Death Surveillance and Review in Bangladesh. *PLoS ONE, 11*(8), e0159388. http://doi.org/10.1371/journal.pone.0159388

Hallett, T.B., (2010). Measuring and correcting biased child mortality statistics in countries with generalized epidemics of HIV infection. *Bulletin of the World Health Organisation,*88 (10):761–768.

Hicks, R. M., Padayatchi, N., Shah, N. S., Wolf, A., Werner, L., Sunkari, V. B., & O'Donnell, M. R. (2014). Malnutrition associated with unfavorable outcome and death among South African MDR-TB and HIV co-infected children. *The International Journal of Tuberculosis and Lung Disease*, *18*(9), 1074-1083.

Hosseinpoor, A. R., Victora, C. G., Bergen, N., Barros, A. J., & Boerma, T. (2011). Towards universal health coverage: The role of within-country wealth-related inequality in 28 countries in sub-Saharan Africa. *Bulletin of the World Health Organization*, *89*(12), 881-889.

Inter-agency U.N., (2012). *Group for Child Mortality Estimation, Levels & Trends in Child Mortality* – Report. The UN Inter-agency Group for Child Mortality Estimation; New York.

Jayachandran, S., & Pande, R. (2015). *Why are Indian children so short?* (No. w21036). National Bureau of Economic Research.

Kanmiki, E.W., Bawah, A.A., Agorinya, I, Achana, F.S., Awoonor-williams, K.J., et al. (2014). Socio-economic and demographic determinants of under-five mortality in rural northern Ghana. *BMC Int Health Hum Rights* 14(24).

Kayode, G. A., Adekanmbi, V. T., & Uthman, O. A. (2012). Risk factors and a predictive model for under-five mortality in Nigeria: Evidence from Nigeria demographic and health survey. *BMC pregnancy and childbirth*, *12*(1), 10.

Kayode, G.A., Ansah,E., Akua, I., Agyepong, M., Amoakoh-Coleman, Grobbee,D. E., Klipstein-Grobusch,K. (2014). Individual and community determinants of neonatal mortality in Ghana: A multilevel analysis. *BMC Pregnancy and Childbirth*, 14(165).

Kenya National Bureau of Statistics (KNBS) and ICF Macro. (2009). Kenya Demographic and Health Survey 2008–09. Kenya National Bureau of Statistics and ICF Macro, Calverton, Maryland.

Kenya National Bureau of Statistics (KNBS) and ICF Macro. (2015). Kenya Demographic and Health Survey 2014. Kenya National Bureau of Statistics and ICF Macro, Calverton, Maryland.

Kimani-Murage, E. W., Fotso, J. C., Egondi, T., Abuya, B., Elungata, P., Ziraba, A. K., ... & Madise, N. (2014). Trends in childhood mortality in Kenya: The urban advantage has seemingly been wiped out. *Health & place*, *29*, 95-103.

Kinney, M. V., Kerber, K. J., Black, R. E., Cohen, B., Nkrumah, F., Coovadia, H., ... & Lawn, J. E. (2010). Sub-Saharan Africa's mothers, newborns, and children: where and why do they die? *PLoS Med*, *7*(6), e1000294.

Kitui J., Lewis S., Davey G. (2013). Factors influencing place of delivery for women in Kenya: An analysis of the Kenya demographic and health survey, 2008/2009. *BMC Pregnancy and Childbirth*, 13(40). Retrieved from: http://www.biomedcentral.com/1471-2393/13/40.

Kyei, K. A., & Gyekye, K. B. (2011). Determinants of unemployment in Limpopo province in South Africa: exploratory studies. *Journal of Emerging Trends in Economics and Management Sciences*, *2*(1), 54-61.

Lakew, Y., Bekele, A., & Biadgilign, S. (2015). Factors influencing full immunization coverage among 12–23 months of age children in Ethiopia: Evidence from the national demographic and health survey in 2011. *BMC public health*, *15*(1), 728.

Lawn, J. E., Blencowe, H., Oza, S., You, D., Lee, A. C., Waiswa, P., ... & Mathers, C. (2014). Every Newborn: Progress, priorities, and potential beyond survival. *The Lancet*, *384*(9938), 189-205.

Lawn, J. E., Blencowe, H., Waiswa, P., Amouzou, A., Mathers, C., Hogan, D., ... & Shiekh, S. (2016). Stillbirths: Rates, risk factors, and acceleration towards 2030. *The Lancet*, *387*(10018), 587-603.

LeVine, R. A., & Rowe, M. L. (2009). Maternal literacy and child health in less-developed countries: Evidence, processes, and limitations. *Journal of Developmental & Behavioral Pediatrics*, *30*(4), 340-349.

Lisonkova, S., Janssen, P. A., Sheps, S. B., Lee, S. K., & Dahlgren, L. (2010). The effect of maternal age on adverse birth outcomes: Does parity matter? *Journal of Obstetrics and Gynaecology Canada*, *32*(6), 541-548.

Liu, L., Oza, S., Hogan, D., Perin, J., Rudan, I., Lawn, J. E., & Black, R. E. (2015). Global, regional, and national causes of child mortality in 2000–13, with projections to inform post-2015 priorities: An updated systematic analysis. *The Lancet*, *385*(9966), 430-440.

Madise, N. J., Ziraba, A. K., Inungu, J., Khamadi, S. A., Ezeh, A., Zulu, E. M., ... & Mwau, M. (2012). Are slum dwellers at heightened risk of HIV infection than other urban residents? Evidence from population-based HIV prevalence surveys in Kenya. *Health & place*, *18*(5), 1144-1152.

Magadi, M. A. (2011). Cross-national analysis of the risk factors of child malnutrition among children made vulnerable by HIV/AIDS in sub-Saharan Africa: Evidence from the DHS. *Tropical Medicine & International Health*, *16*(5), 570-578.

Mangeni, J.N., Mwangi, A.,Mbugua, S.,Mukthar,V. K. (2012) Male Involvement In Maternal Healthcare as a Determinant Of Utilisation Of Skilled Birth Attendants In Kenya, *East African Medical Journal* Vol. 89 No. 11

Masuy-Stroobant G, Gourbin C. (1995). Infant Health and Mortality Indicators: Their Accuracy for Monitoring the Socio-Economic Development in the Europe of 1994. *Eur J Pop*, 11: 63–84

Measure, D. H. S. (2008). Measure DHS Statcompiler. *ORC Macro, Calverton, MD*.

Mgaya, A. H., Massawe, S. N., Kidanto, H. L., & Mgaya, H. N. (2013). Grand multiparity: Is it still a risk in pregnancy? *BMC pregnancy and childbirth*, *13*(1), 241.

Ministry of Health. (2013). Transforming Health: Accelerating Attainment of Universal Health Coverage. Kenya Health Sector Strategic and Investment Plan (KHSSPI) July 2013-June 2017.

Musafili, A., Essén, B., Baribwira, C., Binagwaho, A., Persson, L. Å., & Selling, K. E. (2015). Trends and social differentials in child mortality in Rwanda 1990–2010: Results from three demographic and health surveys. *J Epidemiol Community Health*, jech-2014.

Mutua, M.K., Kimani-Murage, E., & Ettarh, R.R., (2011). Childhood vaccination in informal urban settlements in Nairobi, Kenya: Who gets vaccinated? *BMC Public Health*,11 (1):6.

NACC. (2016). *Kenya Aids Response Progress Report 2016*. Nairobi. Retrieved from http://nacc.or.ke/wp-content/uploads/2016/11/Kenya-AIDS-Progress-Report_web.pdf

Nalwoga, A., Maher, D., Todd, J., Karabarinde, A., Biraro, S., & Grosskurth, H. (2010). Nutritional status of children living in a community with high HIV prevalence in rural Uganda: A cross-sectional population-based survey. *Tropical Medicine & International Health*, *15*(4), 414-422.

Ndirangu, J., (2010). Decline in early life mortality in a high HIV prevalence rural area of South Africa: Evidence of HIV prevention or treatment impact?. *AIDS*, 24(4), 593–602.

Onsomu, E. O., Abuya, B. A., Okech, I. N., Moore, D., & Collins-McNeil, J. (2015). Maternal education and immunization status among children in Kenya. *Maternal and child health journal*, *19*(8), 1724-1733.

Prinja, S., Sharma, A., Tripathy, J. P., Rana, S. K., Aggarwal, A. K., & Dalpath, S. K. (2017). Inequalities in nutritional status among under five children in Haryana state, India: Role of social determinants. *Indian Journal of Community Health*, *29*(1), 81-88.

Rose, A. M., Hall, C. S., & Martinez-Alier, N. (2014). Aetiology and management of malnutrition in HIV-positive children. *Archives of disease in childhood*, *99*(6), 546-551.

Rutstein S.O., Rojas G., ORC Macro; & Calverton, M.D., (2006). Guide to DHS Statistics. Demographic and Health Surveys.

Sahu, D., Nair, S., Singh, L., Gulati, B. K., & Pandey, A. (2015). Levels, trends & predictors of infant & child mortality among Scheduled Tribes in rural India. *The Indian journal of medical research*, *141*(5), 709.

Saikia N., Singh A., Jasilionis, D., Ram, F., (2013). Explaining the rural-urban gap in infant mortality in India. *Demographic Research*, 29:473e506

Santosa, A., Wall, S., Fottrell, E., Högberg, U., & Byass, P. (2014). The development and experience of epidemiological transition theory over four decades: A systematic review, Global Health Action, 7:1, 23574

Singh, A., Pallikadavath, S., Ram, F., & Alagarajan, M. (2013). Do antenatal care interventions improve neonatal survival in India? *Health policy and planning*, czt066.

Singh, R. & Tripathi, V. (2013). Maternal factors contributing to under-five mortality at birth order 1 to 5 in India: A comprehensive multivariate study *Springer Plus*, 2:284

Sonneveldt, E., Plosky, W. D., & Stover, J. (2013). Linking high parity and maternal and child mortality: What is the impact of lower health services coverage among higher order births? *BMC public health*, *13*(3), S7.

Tura, G., Fantahun, M., Worku, A. (2013). The effect of health facility delivery on neonatal mortality: Systematic review and meta-analysis. *BMC Pregnancy Childbirth*. 13 (18), pmid:

23339515

UNAIDS. (2016). Children and HIV fact sheet. United Nations. Geneva, Switzerland. Retrieved from: http://www.unaids.org/sites/default/files/media_asset/factSheet_Children_en.pdf

UNAIDS. (2017). Data 2017. *Joint United Nations Programme on HIV/AIDS*, 1-248. https://doi.org/978-92-9173-945-5

UNICEF. (2012). The State of the World's Children. 2012. Retrieved from www.unscn.org/layout/modules/resources/files/rwns5.pdf

UNICEF. (2017). Maternal Health: Current Status plus progress. Retrieved from https://data.unicef.org/topic/maternal-health/delivery-care/

United Nations Inter-Group for Child Mortality Estimation. (2014). Levels and trends in child mortality: Report 2014. *UNICEF WHO World Bank Group United Nations*. https://www.unicef.org/media/files/Levels_and_Trends_in_Child_Mortality_2014.pdf

United Nations Inter-Group for Child Mortality Estimation. (2015). Levels and trends in child mortality: Report 2015. *UNICEF WHO World Bank Group United Nations*, 74. Retrieved from: https://doi.org/10.1016/S0140-6736 (10)60703-9

United Nations, (2012). *World Urbanization Prospects*: The 2011 Revision. Department of Economic and Social Affairs, Population Division, United Nations, New York.

United Nations. (2015).*The Millennium Development Goals Report*. United Nations, New York. Retrieved from: https://doi.org/978-92-1-101320-7

United Nations. (2015). Sustainable Development Goals. United Nations, New York. Retrieved from: https://sustainabledevelopment.un.org

Vakili, R., Emami Moghadam, Z., Khademi, G., Vakili, S., & Saeidi, M. (2015). Child Mortality at Different World Regions: A Comparison Review. *International Journal of Pediatrics*, *3*(4.2), 809-816.

Van de Poel, E., O'Donnell, O., & Van Doorslaer, E., (2007). Are urban children really healthier? Evidence from 47 developing countries. *Soc. Sci. Med.*, 65(10):1986–2003.

Van Hoek A. J., Ngama, M., Ismail, A., Chuma, J., Cheburet, S., Mutonga, D., Kamau, T., Nokes D.J. (2012). A cost effectiveness and capacity analysis for the introduction of universal rotavirus vaccination in Kenya: Comparison between Rotarix and RotaTeq vaccines. *PLoS One* 7(10): e47511

Vogel,J.P. , Torloni, M. R., Seuc, A., Betrán, A., P., Widmer, M., Souza, J.,P., Merialdi, M. (2013). Maternal and Perinatal Outcomes of Twin Pregnancy in 23 Low- and Middle-Income Countries. PLoS One.8 (8)

Wang, H., Liddell, C. A., Coates, M. M., Mooney, M. D., Levitz, C. E., Schumacher, A. E., ... & Sandar, L. (2014). Global, regional, and national levels of neonatal, infant, and under-5 mortality during 1990–2013: A systematic analysis for the Global Burden of Disease Study 2013. *The Lancet*, *384*(9947), 957-979.

Wang, H., Wolock, T. M., Carter, A., Nguyen, G., Kyu, H. H., Gakidou, E., ... & Coates, M. M. (2016). Estimates of global, regional, and national incidence, prevalence, and mortality of HIV, 1980-2015: The Global Burden of Disease Study 2015. *The lancet. HIV*, *3*(8), e361-87.

Walker, C. L. F., Rudan, I., Liu, L., Nair, H., Theodoratou, E., Bhutta, Z. A.,... & Black, R. E. (2013). Global burden of childhood pneumonia and diarrhoea. *The Lancet*, *381*(9875), 1405-1416.

Walker, N., Hill, K., & Zhao, F., (2012). Child mortality estimation: Methods used to adjust for bias due to AIDS in estimating trends in under-five mortality. *PLoS Med*.; 9(8):e1001298.

WHO. (2014). WHO-CHERG provisional estimates 2014. Retrieved from www.who.int/healthinfo/ statistics/ChildCOD_method.pdf.

WHO. (2017). Children: Reducing Mortality. Retrieved from: http://www.who.int/mediacentre/factsheets/fs178/en/

WHO. (2017). Media Centre: Malaria Fact sheet. Retrieved from: http://www.who.int/mediacentre/factsheets/fs094/en/

World Bank. (2013).The World Bank; Washington DC: 2012/2013. *African Development Indicators.*

Yamin, A. E., Boulanger, V. M., Falb, K. L., Shuma, J., & Leaning, J. (2013). Costs of inaction on maternal mortality: Qualitative evidence of the impacts of maternal deaths on living children in Tanzania. *PloS one*, *8*(8), e71674.

APPENDICES

1. WORKPLAN

	April 2017	May 2017	June 2017	July 2017	August 2017	September 2017	October 2017	November 2017	December 2017
Proposal development									
Proposal defense									
Data analysis									
Results compilation									
Final project defense and submission									
Graduation									

2. BUDGET

Expenditure Item	**Amount in KSH**
Internet Access	30000
Printing and binding	25000
Travel Costs	20000
Total	75,000