

**DETERMINANTS OF UNDER-5 MORTALITY IN
KENYA DURING UPSURGE AND DECLINING TRENDS PERIOD**

BY

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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 Population Studies 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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This research project has been submitted for examination with our approval as University

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DEDICATION

This work is dedicated to my beloved wife Mary Wamuyu who gave me strength to successfully finish this course. I would like also to dedicate this research to Willy, Wachira, Moses and their families for their relentless efforts and support.

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ABSTRACT

Under-5 mortality remains to be high in Kenya in spite of the government efforts and increased interventions to help reduce its prevalence. A number of multi factors have led to this relatively increased rate especially in Kenya where poverty is still a concern. Mortality rates have been fluctuating with cases of decline as well as upsurge unlike a consistent decline. This study was carried out to examine the factors that were associated with under-5 mortality during the upsurge period using KDHS 2003 and those of decline period, using KDHS 2008/9. A total of 12,028 children under the age of five were captured in the two KDHS datasets out of which 875 of them died before their age of 5. KDHS study whose data was adopted used a structured questionnaire that was pretested to collect the household's socio-economic, environmental and behavioral characteristics.

The study findings have showed that in both KDHS 2003 and 2008, there is a significant variation on the under-5 mortality between children in households with improved sources of drinking water and those with a non-improved source of drinking water. Also, the duration of breast feeding, mother's age at child birth as well as the family size significantly affects under-5 mortality in both datasets. However, place of delivery with children whose mothers delivered in their homes compared to those who deliver in the public and private health facility was only significant in KDHS 2008/9 data.

The study concludes that increased use of both public and health facilities, prolonged breast feeding and delayed age of birth are among the main factors supporting the decline of under-5 mortality and interventions should be increased to support these programs. Use of non-improved water sources, short breast feeding periods, young mothers and large families are associated with increased cases of under-5 mortality. However, the study gives short term solutions, and integrated efforts from all sectors would help in addressing these challenges.

TABLE OF CONTENTS

| | |
|---|-----|
| DECLARATION | ii |
| DEDICATION | iii |
| ACKNOWLEDGEMENTS | iv |
| ABSTRACT..... | v |
| CHAPTER ONE | 1 |
| INTRODUCTION | 1 |
| 1.1 Background of the study | 1 |
| 1.2 Statement of the problem | 5 |
| 1.3 Research Question..... | 6 |
| 1.4 Objectives of the study..... | 6 |
| 1.4.1 Specific Objectives | 6 |
| 1.5 Justification of the Study..... | 7 |
| 1.6 Scope and Limitation of the study | 8 |
| CHAPTER 2 | 9 |
| LITERATURE REVIEW | 9 |
| 2.1 Introduction..... | 9 |
| 2.2 Theoretical Background..... | 10 |
| 2.2.1 Social Demographic factors | 11 |
| a. Mother’s age at childbirth..... | 11 |
| b. Duration of breastfeeding..... | 11 |
| 2.2.2 Socio economic factors | 12 |
| a. Place of delivery | 12 |
| b. Tetanus toxoid..... | 13 |
| c. Mother’s educational level..... | 14 |
| d. Family size | 16 |
| e. Birth Interval | 16 |
| 2.2.3 Environmental factors | 17 |
| a. Source of water | 17 |
| b. Type of Toilet facility | 18 |
| 2.3 Conceptual Framework | 20 |
| 2.4 Operational Framework | 21 |

| | | |
|---|---|----|
| 2.5 | Operational Hypothesis..... | 24 |
| CHAPTER 3 | | 25 |
| DATA AND METHODOLOGY | | 25 |
| 3.1 | Introduction..... | 25 |
| 3.2 | Data and Rationale..... | 25 |
| 3.3 | Definition and Measurement of Variables | 26 |
| 3.4 | Methodology of Data analysis | 31 |
| CHAPTER 4 | | 33 |
| FINDINGS FROM THE STUDY | | 33 |
| 4.1 | Introduction..... | 33 |
| 4.2 | Descriptive Statistics of the Study Population | 33 |
| 4.3 | The Association of Children’s Background Characteristics and Under-5 mortality..... | 37 |
| 4.4 | Results of the Multivariate Analysis..... | 43 |
| 4.5 | Discussion of the findings..... | 46 |
| CHAPTER FIVE | | 51 |
| SUMMARY, CONCLUSION AND RECOMMENDATIONS | | 51 |
| 5.1 | Introduction..... | 51 |
| 5.2 | Summary..... | 51 |
| 5.3 | Conclusion | 52 |
| 5.4 | Recommendations for Policy | 53 |
| REFERENCES | | 54 |

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Mortality and its converse indicator, longevity or life expectancy are among the most important measures of well-being and development in developing countries. Since child mortality has an overwhelming influence on life expectancy, it is important to analyze the determinants of child mortality in Kenya. Moreover, child mortality indicates the health status of not only child but also the health status of mothers as well as society as a whole.

Under-five mortality (U5M) is the probability of dying between birth and the age of 5 of life (Lawn 2011). According to the millennium development goals report of 2011, the highest levels of under-five mortality are found in sub Saharan Africa. Estimates show that at least one in eight children die before the age of five (129 births per 1000 live births) which is nearly twice the average in developing countries and about 18 times the average of the developed nations (UNICEF 2011). This situation is no different in Kenya. Although there has been a decline in under-five mortality, Kenya is still quite far from achieving its MDG target of 33 deaths per 1000 live births. Could Kenya have achieved its MDG target if no time was lost during the increase period?

Under-five mortality is still high in Kenya in spite of the government's efforts and commitment to create an enabling environment for the provision of quality health care and reduction of mortality levels. After Independence in the early 1960s, child mortality in Kenya fell rapidly. Until around 1980, the under-5 mortality rate (U5MR), fell at an annual rate of about 4 percent per annum. This rate of decline slowed in the early 1980s, to about 2 per cent per annum (Kabubo et al 2012).

In the 15 to 20 year period following independence, Kenya economic growth was strong and operated to mitigate the potentially harmful influence of very high fertility and rapid population growth on living standards. After this period of growing prosperity, a number of internal and external factors including sharp increase in government expenditures and an adverse movement in terms of trade started to reverse the trend from one of improving to one of declining living standards, that continued at least into the early 1990s (Mturi 1995). Trends in mortality levels among Kenya's young child population have largely mirrored these changes in the macroeconomic health of the country.

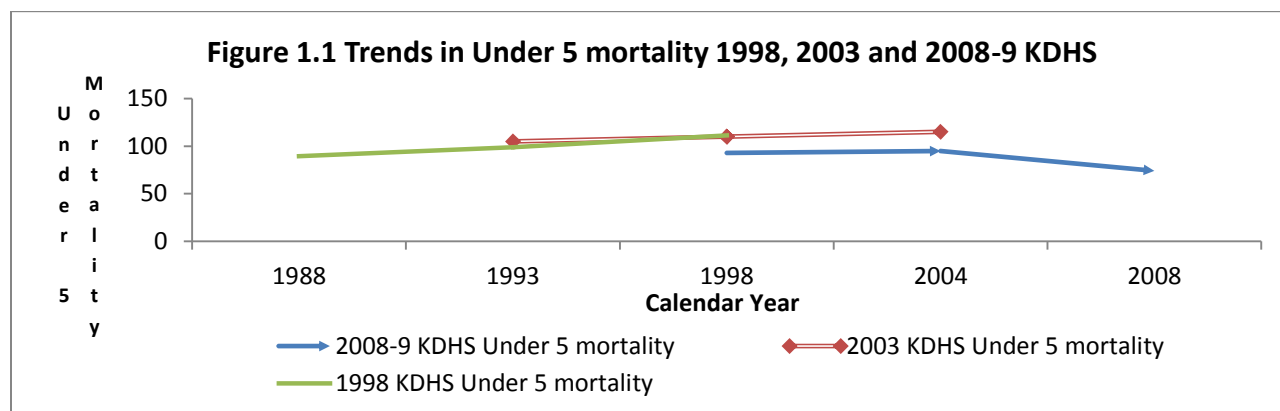
Data from the 1998 Kenya Demographic and Health Survey showed that, far from declining, the U5MR increased by as much as 25 percent from the late 1980s to the mid-1990s (National Council for Population and Development, Central Bureau of Statistics, and Macro International Inc. 1999). This adverse trend coincided with a number of other adverse trends: stagnation in growth of per capita income, declining levels of immunization, falling school enrolment, and the emergence of an HIV/AIDS epidemic. Data obtained from birth histories indicated a 24 percent increase in the U5MR from the mid-1980s to the mid-1990s with enormous regional differentials.

The rising trends in the early 90's is attributable to a number of factors including increased poverty, adverse effects of economic poverty and cost recovery programs associated with structural adjustments programs, increased childhood malnutrition, decreased use of certain maternity care services, decline in coverage of child immunizations, inability of the public health systems to provide services and the HIV/AIDS epidemic and the ethnic clashes that were rocking parts of the country (Ikamari 2004).

However, the recent 2008/9 KDHS showed a reversal in the 1990 and early 2000 levels and differentials. The under-five mortality declined by 36 percent from 115 deaths per thousand to 74 deaths per thousand while the infant mortality declined by 32 percent from 77 to 52 deaths per thousand.

A number of factors may have contributed to the broad decline in under mortality in Kenya. One prominent possibility is the decline in malaria prevalence which has coincided with the scaling up of the use of insecticide-treated bed-nets (ITN) and other anti-malarial interventions, including indoor residual spraying, use of more effective artemisinin-based drugs, and improved diagnostic capacity at health facilities. The decline in malaria in Kenya has been documented in a number of studies (Buttenheim 2008). The 2003 and 1998 KDHS, provides evidence of a worsening under-5 mortality situation in the 1990s and early 2000s with a decline in late 2000s as shown below.

| Table 1.1 Under 5 mortality rates | | | |
|--|-------------------------------|-----------------------------|-----------------------------|
| Approximate years | 2008-9 KDHS Under 5 mortality | 2003 KDHS Under 5 mortality | 1998 KDHS Under 5 mortality |
| 1984-1988 | | | 89.6 |
| 1989-1993 | | 105 | 98.9 |
| 1994-1998 | 93 | 110 | 111.5 |
| 1999-2003 | 95 | 115 | |
| 2004-2008 | 74 | | |



Among the interventions which may have contributed to the decline in malaria, growth in ITN usage appears to be most substantial. Several rigorous studies have shown that ITN usage prevents malaria transmission (Mutunga 2004) one longitudinal study of 3500 Kenyan children under age five found that ITN usage was associated with a 44 percent drop in mortality risk. Mutheu, et al (2009) estimate that the number of African children living in malaria-endemic conditions who were protected by an ITN grew from 1.7 million (1.8 percent) in 2000 to 20.3 million (18.5 percent) in 2007. The effectiveness of such mosquito nets has been shown by a previous distribution program in Kenya, where a ten-fold increase in the number of young children sleeping under nets between 2004 and 2006 resulted in 44 per cent fewer deaths from malaria than among children not protected by them (Mutunga 2007).

Programs aimed at strengthening PMTCT programs owing to the fact that duration of breastfeeding is an important predictor of infant mortality were enhanced in mid-2000's. HIV testing among pregnant women increased from 31% in 2005 to 83% in 2008, and 67% of pregnant women with HIV received efficacious ARVs for PMTCT in 2009 (WHO 2013). Other possible factors leading to reduced mortality includes increase in immunization rates, births in medical facilities, treatment of childhood fever, antenatal care, and access to safe water and sanitation facilities. Finally, overall economic growth may have played a role, by increasing levels of income, leading to improved nutrition and access to medical care. Over the period 2004-2008, growth rates of GDP per capita averaged 4.3 percent in Kenya (IMF 2010). Given that many changes have taken place simultaneously, it is difficult to definitively attribute a causal effect to particular interventions.

1.2 Statement of the problem

The pace at which mortality declines with increasing age ultimately determines the proportion surviving to specific ages. Normally, mortality is expected to decline very rapidly after birth like in most industrialized countries, with infant and under-five mortality rates being relatively low. In these settings the highest proportion of under-five deaths occur in the first few days of life and are related to genetic, maternal, and perinatal factors. However, in less-developed countries with Kenya being included, environmental and nutritional risks to survival persist through infancy and afterwards, and those risks will be reflected in an attenuated age pattern and an overall higher level of mortality under age five.

Every country is striving to reduce the under-5 mortality and achieve the MDG goal 4. Kenya is no different, and with the proportion of child deaths during the under-5 period being still high, the child survival Millennium Development goal cannot be met. Kenya enjoyed a rather impressive and sustained decline in under-5 mortality rate (U5MR) of 3 percent to 4 percent per annum during the period from 1965 to 1980 (Hill et al., 1998). This experience slowed but with a steady improvement in the late 1980's after which the rates plateaued and then begin to rise. The rate declined to less than 2% between 1980 and 1990. Apparently, from 1990 and in the early 2000s, the declining mortality rates saw a reversal and the rates were rising or almost stagnating. The rise becomes pronounced in the 1990s as well as the early 2000s.

From the 2009 KDHS findings, under-5 mortality has now reversed and currently exhibits a declining trend. The findings show a decline in under-5 mortality which marks the initial signs of the country achievement of the MDG 4. However, with about 1 in 14 children unable to survive to age five (ICF Macro, 2009), Kenya like many other nations in sub-Saharan Africa, is not on track to achieve the Millennium Development Goal 4. In overall, Kenya only secured to reduce

the under 5 mortality by 17% for the period 1984-2008 from 89.6 deaths per 1000 to 74 deaths per 1000. With the country being committed to achieving the MDG on child mortality, it is therefore prudent to understand the factors that led to the increase in mortality rather than the expected decline by exploring the contrasting factors affecting under-5 mortality during the two periods. The study, therefore, sought to assess the risk factors that led to reversal of declining trend by evaluating the differences in the factors supporting mortality decline and the comparison to those backing upsurge and to suggest some interventions to help reduce the problem. KDHS 2003 will be used for the analysis of factors which contributed to the upsurge and KDHS 2008-9 for decline trend analysis. This data was downloaded from the Demographic and Health Survey Programs website <http://www.dhsprogram.com>.

1.3 Research Question

To what extent was the difference in the determinants of under-5 mortality in Kenya during mortality upsurge and decline periods?

1.4 Objectives of the study

The main objective of the study is to contrast the determinants of under-5 mortality in Kenya during mortality upsurge and declining periods

1.4.1 Specific Objectives

- i. To determine mechanisms through which socio economic factors influences under 5 mortality in Kenya.
- ii. To determine factors influencing under 5 mortality for the period 1999-2003 in Kenya (upsurge period).
- iii. To determine factors influencing under 5 mortality for the period 2004-2008 in Kenya (decline period).

1.5 Justification of the Study

The first five years of life are the most crucial to the physical and intellectual development of children and can determine their potential to learn and thrive for a life time. Although there has been a substantial reduction in infant and child mortality rates in most developing countries in the recent past, it still remains a major public health issue in Sub Saharan Africa countries including Kenya.

The underlying causes of child deaths in Kenya are factors that can be addressed with significant results for overall health of children. Child deaths are the direct result of disease and malnutrition, which in turn result from inadequate access to food, shelter, health care, safe water, sanitation and education (UNICEF, 1992). The access to these basic services is largely determined by the availability and distribution of resources.

The level of success of any health policy or health care intervention depends upon the correct understanding of socio-economic, environmental and cultural factors which determine the occurrence of diseases and deaths. Morbidity information is mostly derived from clinics and hospital, and yet, incidences of mortality obtained from hospitals represent only a small proportion of all illnesses as many cases do not seek medical attention (GoK, 2010; GoK, 2004). Thus, hospital records may not be appropriate for estimating incidence of under-5 deaths and are too sketchy to be used for program developments. This research will make use of population-based morbidity data from a nation-wide survey and attempt to determine differences in factors that leads to reversal of mortality trends.

The findings would be aspirational in recommending supportive measures that would control for reversal of under-5 mortality trend and support mortality decline. The focus on children below five years; who are at the highest risk of contracting disease, aimed at addressing a population in which the findings of the study would bring about major changes in mortality. The study results will add knowledge on the determinants of child mortality during the under-5 mortality, most high mortality regime in Kenya (1999-2003) and the determinants of under-5 mortality during the low mortality regime in Kenya for the period 2004-2008. The results obtained from this study will add information

to this problem and eventually help in the achievement of the millennium development goals of reducing under-five mortality by two-thirds by 2015.

1.6 Scope and Limitation of the study

The Study focused on a population at risk of death; children aged between 0-59 months. The data was drawn from two Kenya Demographic and Health Survey-KDHS (2003&2008). This represents a national coverage study. The study was limited by a number of factors related to the nature of DHS data used. First, DHS data does not allow one to attribute child morbidity to specific causes of death, hence the study cannot show how the risk factors contribute to mortality directly but rather to morbidity (Becher, 2004). Second, this study use the birth history data of the respondents, mothers, from Kenya DHS and the data are reported retrospectively. Therefore, using this retrospective birth data may decrease the quality of the data that might suffer from missing report due to the lapse of memory of the respondent (mothers). From the experience of most studies that used DHS data, for longer recall period, the respondent might be misreporting the important information, one of these are under-5 mortality. One of the most common errors is omission of reporting child death, particularly death at the infancy period.

The other problem of using retrospective data is that some variables are measured by the current situation. In this case, the current variables are taken as the proxy of the past to investigate the relationship between under-5 mortality and variables. On the other hand, this study also excludes under-5 death for child born to mothers under age 15 due to the sampling unit of DHS survey that include only respondents age of 15-49 years old. Generally omission of deaths and births, incompleteness of the date of births and deaths, age at death are also important errors that affect the trend of infant and child mortality and also might bias the analysis too. However, in both KDHS, these problems are not significant (KDHS, 2003 and 2008). Finally, HIV& AIDS, though being important factor of mortality was not considered due to lack of data.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter reviewed theories and literature related to the risk factors associated with mortality incidences in children below five years. It provided the conceptual model, the operational framework and the hypotheses for the study.

Child survival interventions were launched by the United Nations Children's Fund (UNICEF) and WHO in the 1980s after the world economic meltdown. The current focus of the development community in relation to child survival is Millennium Development Goal 4 (MDG 4), which aims to reduce the global rate of under-five mortality by two thirds between 1990 and 2015.

Globally, tremendous progress has been made on the reduction of under-5 mortality. However, this has been unequally distributed. At the regional level, the decline in under-five mortality rates between 1990 and 2012 were over 60% for three WHO regions: the Americas, European and the Western Pacific regions. Mortality rates among children under the age of five remain strikingly high throughout the majority of Sub-Saharan Africa. This means that the WHO African region has increasing share of under-five deaths (WHO 2012).

By 2050, consequently, 37% of the world's children under age five will live in Sub-Saharan Africa; while close to 40% of all live births will take place in that region. This is very hazardous if the risk and the exposure rates are not addressed. There is a possibility that the mortality numbers might stagnate or even increase if no much progress will take place in the African region. Despite Sub-Saharan Africa's relatively high rates of under-five mortality, there are signs of progress in the region. The pace of decline in the under-five mortality rate has accelerated

over time, with an increase from 0.8 % per year in 1990-1995 to 4.1% per year in 2000-2012. Currently, childhood mortality remains a big issue for these developing countries, especially as researchers attempt to distinguish what factors contribute to the high levels (WHO 2012).

2.2 Theoretical Background

There is general consensus in the literature that a household's socio-economic and environmental characteristics do have significant effects on under-5 mortality (Kombo, 2009). As observed in most studies, a household's income has a significant effect on the survival prospects of children. Higher mortality rates are experienced in low income households as opposed to their affluent counterparts (Rutstein 2005).

The mother's level of education is strongly linked to child survival. Higher levels of educational attainment are generally associated with lower mortality rates, since education exposes mothers to information about better nutrition, use of contraceptives to space births, and knowledge about childhood illnesses and treatment (Kamal 2012). Larger differences have been found to exist between the mortality of children of women who have attained secondary education and above and those with primary level of education or less (Woldemicael, 2007).

On the household's environmental characteristics, safe source of drinking water supply has a significantly negative effect on child mortality. The same holds true for those with sanitation, which in most cases is taken to be access to a flush toilet or a ventilated improved pit latrine. Differentials by urban/rural residence have commonly been observed, with urban areas having more advantages and therefore better child survival prospects.

As concerns the demographic variables, the patterns of mortality by maternal age and birth order are typically U-shaped (Filmer and Pritchett 2010). Children born to both relatively old and young women have higher mortality rates than others; the interpretation of the effect of maternal

age at birth on child mortality must be biological, i.e., it depends on reproductive maturity (Garde 2010). Moreover, first and higher order births also have higher mortality rates since the birth order reflects the components of the child's biological endowment (Schell *et al* 2007). As for the child's gender, it is widely believed that male mortality is higher due to biological disadvantages. Twins face a higher mortality risk (Fayehun, 2010).

2.2.1 Social Demographic factors

a. Mother's age at childbirth

The patterns of mortality by maternal age just like birth order, is typically U-shaped. Children born to both relatively old and young women have higher mortality rates than others; the interpretation of the effect of maternal age at birth on infant mortality must be biological, i.e., it depends on reproductive maturity. Young mothers are usually inexperienced in looking after the infant (Kibet, 2010). Children born of young mothers also tend to be underweight, malnourished and perhaps anaemic, a combination of which increases the risk of diseases. Maternal age is considered a proxy for a host of factors including family size, educational level, modernity, knowledge and practice related to childcare and energy or capacity to care for a child (Mock et al. 1993).

b. Duration of breastfeeding

Breast milk contains the nutrients, antioxidants, hormones and antibodies needed by a child to survive and develop. Infants who are exclusively breastfed for the first six months of life and continue to be breastfed until two years of age and beyond develop fewer infections and have less severe illnesses than those who are not, even among children whose mothers are HIV-positive (UNICEF and WHO 2012). Babies are born with protection against certain diseases because antibodies from their mothers were passed to them through the placenta. After birth,

breastfeeding babies get the continued benefits of additional antibodies in breast milk. But in both cases, the protection is temporary.

Several studies in developing countries have found that exclusive breastfeeding plays an important role in protecting infants against infectious diseases, one of the major causes of child mortality. According to the DHS comparative studies (number 27 of 1998), in 24 countries, children age 0-2 months who are fully breastfed have lower prevalence of infections than those who are partially breastfed (Kuate-Def and Fosto 2005). On average, infections prevalence is 57 percent higher among partially breastfed children. However, the protective effect of breastfeeding becomes less important as children age due to the introduction of other food supplements. In Brazil, there were no significant differences in these prevalence's between breastfed and non-breastfed children even after controlling for the confounding effects of age, family income and under five mortality (Barros and Victoria, 1990).

2.2.2 Socio economic factors

Socio-economic factors are the independent variables that act through proximate determinants to influence the level of morbidity and mortality. They can be grouped into individual level, household level and community variables. Socio-economic factors may affect, directly and indirectly, environmental, behavioural, nutritional and demographic risk factors with the exception of age and sex (Victoria et al., 1997).

a. Place of delivery

Differentials in mortality by urban/rural residence have commonly been observed, with urban areas having more advantages and therefore better child survival prospects. The place of residence is one of the predictors of child health in general and mortality in particular. In developing countries, socio-economic status, access to health services and environmental conditions all affect the health of children of the rural areas. Children in urban areas where

proper sanitation and water are available, and where modern treatment is more frequent will have lower incidences of under-5 mortality (Stalling 2004). In Ethiopia, rural children exhibited more than five higher odds of experiencing mortality than their urban counterparts. In Eritrea, children living in urban areas are 46% less likely to experience mortality before the age of five. The variation in prevalence between urban and rural persisted even after adjusting for environmental, behavioral and other socio-economic variables. Researchers suggest that the difference in mortality prevalence between urban and rural areas is attributable to differences in literacy status, type of water source and latrine availability. Place of residence, urban-rural, affects mothers' exposure to education and the extent to which proper sanitation, clean water and health care facilities are available (Woldemicael, 2001).

Mustafa and Odimegwu (2008) using 2003 DHS data set for children by using logistic regression models, examined socioeconomic determinants of infant mortality rate both in urban and rural setting. They found similar results like in the case of Tanzania, that regional variation exists in infant and child mortality between the different provinces of Kenya with increased risk in the rural areas.

b. Tetanus toxoid

Tetanus is an important cause of death among neonates. Neonatal tetanus is caused by infection of the newborn, especially the umbilical stump, with tetanus organisms. This depends on the environment where the delivery took place and if it's un-hygienical and unsterilized instruments were used in the cutting of the cord. Vaccination of two doses of tetanus toxoid given to the pregnant woman one month apart during early pregnancy is nearly one hundred times effective in prevention of tetanus among the new born (Nair et al, 2010).

Mortality from neonatal tetanus remains an important, yet preventable, cause of child mortality especially neonatal mortality. Blencowe et al (2010) review identified three studies of moderate-quality providing supporting evidence of a large effect of tetanus toxoid immunization on neonatal tetanus mortality, when at least two doses are given at least 4 weeks apart with the last dose given during the current pregnancy. The study gave an estimate that two or more properly timed doses of tetanus toxoid immunization given to pregnant women or women of childbearing age will reduce neonatal tetanus mortality by 94% (Blencowe 2010).

c. Mother's educational level

Mother's education has frequently been used as a proxy indicator of socio-economic status in international surveys and studies. However, mother's education is also thought to be associated with hygiene, care seeking, and treatment of illness behaviours pertaining to early childhood morbidities (Stalling 2004). Some authors argue that socio-economic factors including education may have a greater effect on infections mortality than on morbidity (Root 2001). According to them, well-educated mothers may be unable to reduce risk of exposure due to factors beyond their control, such as a contaminated community environment, or lack of water. However, their knowledge and wealth may allow them to use healthcare services more effectively than uneducated women (Root 2001).

The mother's level of education is strongly linked to child survival. Higher levels of educational attainment are generally associated with lower mortality rates, since education exposes mothers to information about better nutrition, use of contraceptives to space births, and knowledge about childhood illnesses and treatment. Larger differences have been found to exist between the mortality of children of women who have attained secondary education and above and those with primary level of education or less.

The relationship between parental education and family income/wealth with the occurrence of infections has been studied more than any other socio-economic variable. Many studies have shown a negative and significant relationship between level of education as well as family income and infections morbidity; being significantly lower among children of more educated mothers (secondary or higher) than among children of mothers with no or primary education (Woldemiceal, 2001).

Goro (2007) used data from 1993, 1998, and 2003 DHS surveys in Ghana to examine the determinants of infant and child mortality in three northern regions by using multivariate logistic regression model found that education of mothers, birth order of child and marital status of mothers are powerful significant determinants for infant mortality, while only mothers education have a significant impact for child mortality. Similarly, Twum-Baah et al (1994) indicated that children born to mothers with higher educational level associated with lower risk of infant and child mortality as compared to children born to mothers with primary education level or non-educated.

Baker (1999) applied the Brass indirect estimation of the level of child mortality by using the data that was gathered by the Malawi Diffusion and Ideological change project (1998) from the three administrative region of Malawi: the North, Canter and South to examine the pattern of regional variation of child mortality and selected maternal, socioeconomic and environmental factors. He found that the significant variation of child mortality between North and Canter, between North and South but not between South and Canter. Educational variations between those regions contribute for this regional variation of infant and child mortality. However, education is associated with high child mortality variation if health service not readily available.

Other study in Kenya by Hill (2000) found that mother's educational levels have a significant impact on infant and child mortality while urban areas are associated with high risk of child mortality than rural areas. However, controlling for HIV prevalence child mortality is lower in urban areas (Hill et al 2000). Generally, child mortality in urban areas is lower than in rural areas.

d. Family size

Family size has been found to influence infections in many studies. When many people live together, the chance of contact with pathogens increases, and hygiene may deteriorate (Woldemicael 2001; Manun'ebo et al., 1994). A large number of children in a household increase the likelihood of having disease like infections because of crowding and competition for mother's time and attention and other resources (Woldemicael, 2001). In Eritrea, the probability of having diarrhea is about 60% higher if there are six or more children living in the house than if the number of children is less than three. In Ethiopia, the odds of having infections associated with the number of children remained significant even after controlling for all environmental, behavioral and other socio-economic variables considered in a study conducted in study.

e. Birth Interval

Birth intervals of short duration are associated with adverse pregnancy outcomes, increased morbidity during pregnancy, and increased infant and child mortality (Rutstein 2005). Kumar and Gemechis (2010) uses data from Ethiopia DHS survey 2005 and employs cross tabulation technique to examine the selected socioeconomic, bio-demographic and maternal health care factors that determine child mortality in Ethiopia. The result shows that among socioeconomic variables, birth intervals with preceding birth have significant impact to lowering the risk of child mortality. The result conformed that the child mortality risk associated with

children of less than 2 years of birth interval with previous child was highest (15 percent) and lowest (4.2 percent) for the children whose birth interval was 4+ years.

Mutunga (2004) used data from 2003 DHS in Kenya to investigate the impact of socioeconomic and environmental variables of infant and child mortality in urban areas of Kenya. The results show that the child mortality was lower for children with birth interval of more than 2 years. A 2008 study by Rutstein using DHS data found that the risk of mortality rapidly decreases as the birth interval increases up to 24-29 months and then decreases more slowly with longer birth intervals, but increases again for intervals of 96 or more months (Rutstein 2008).

2.2.3 Environmental factors

The effect of the environment on health is complex and is conditioned by a wide range of characteristics and behaviours. For example, the effect of improved water and toilet facilities on child health may vary depending on parental education, child feeding practices or income (Timaeus and Lush, 1995). Environmental factors include water sources, availability of toilet facilities and method of excreta disposal. Most environmental factors are usually associated with socio-economic status and place of residence (Rustein 2000).

a. Source of water

The health benefits of improved water supply have been established in several studies. Improved sources of drinking water are less likely to be contaminated and likely to prevent the spread of water-related diseases, such as infections and cholera. Using DHS data from eight Sub-Saharan African countries, Fayehun (2010) establishes that in countries with low under-five mortality such as Namibia and Lesotho, the proportion of children living in households with an improved source of drinking water is greater than in countries in the high under-five mortality group. Seventy one percent of households in Namibia and 55% of households in Lesotho access

their drinking water from improved sources. Conversely, in countries with high under-five mortality at least 40% of children live in households with an open well or surface water as their source of drinking water (Fayehun, 2010).

Mutunga (2007) observes that even if water is from a clean tap, fetching it with unclean containers and improper storage can facilitate contamination with infection causing organisms. WHO (1984) reiterates that the most common and widespread danger associated drinking water is contamination either directly or indirectly by sewage, other waste including human and animal excrement. If drinking water is contaminated and then used in preparing foods, it may result to further cases of infection. Faecal contamination of any other source of pollution may introduce a variety of intestinal pathogens, parasites and bacteria.

Teklemariam *et al* (2000) holds that the organisms in water may cause severity from mild to sometimes fatal dysentery, cholera and typhoid. Using clean and treated water can prevent infections. Families who have plentiful supply of safe piped water and use it properly have reduced correlation of under-5 mortality.

b. Type of Toilet facility

Researchers have shown that children living in households with some kind of toilet facility are less likely to be sick than children in households which do not have toilet facilities. In Ghana, the risk of having infections was found to be significantly associated with toilet facility, where children living in houses with toilet facilities are about 50% less likely to contract infections than children living in houses with no such facilities (Buttenheim 2008). A similar finding was reported in Rural Zimbabwe where a cohort study on childhood infections was conducted for 45 weeks in two neighboring semi-arid communities with similar characteristics in terms of healthcare provision, water supply and socio-economic characteristics but different in terms of sanitation and population density. One community was densely populated and had

improved sanitation facilities while the other was less dense but openly defecated. Children from the less dense community that openly defecated had three times as many episodes of infections as the community which was densely populated but used an improved sanitation (Root 2001). Similar results have also been obtained from studies in Uganda, Brazil, Bangladesh and Ethiopia (Genser et al 2006; Buttenheim 2008).

Buttenheim (2008) argues that child's toileting matters more than adult toileting behaviours in creating a safe, hygienic environment and reducing diarrheal disease especially in crowded urban slums. Only one study conducted in Southwestern Ethiopia identifies availability of a toilet facility as a risk factor associated with infections (Teklemariam *et al* 2000). This could be explained by poor use of the toilet facility for instance having faeces on the floor of the toilets which are later transferred to food by flies. Other studies have also highlighted that first it is the safe disposal of children's feces that provides the greatest health benefit and that sanitation improvements are likely to make the greatest impact in crowded urban areas where faecal matter can easily contaminate residential areas (Ezzati et al. 2005, Buttenheim 2008). In Salvador Brazil, the effect of poor socio-economic conditions on infections incidence was mediated by inadequate sanitation and childcare related variables and showed strongest association in children older than 36 months (Genser et al., 2006).

As highlighted by Klaauw & Wang (2004), access to toilet facility can reduce under-five mortality rate significantly in rural areas of India as a whole. In urban Kenya, access to modern sanitation facilities, flush toilets, reduces diarrhea prevalence in urban areas and ultimately reduce the child mortality, Mutunga (2007). In a study of Balk *et al.* (2005), the principal component analysis is used to combine the correlated variables which influence on mortality.

From their analysis it is found the mortality is correlated positively with the complete lack of toilet facilities and negatively with access to flush toilets.

Access to a flush or pit toilet is potentially a very important determinant of infant and child mortality in developing countries. Children in households that lack such access could have higher exposure than other children to diseases such as tetanus and digestive disorders.

2.3 Conceptual Framework

As noted by the World Bank (2005), child mortality/morbidity has broad sets of determinants which interconnect with many factors such as fertility, maternal factors, nutrition, education, infrastructure development, safe water supply, electrification, disaster prevention and relief, agricultural output, and public policies and private acquisitions that aim for income generation. Several analytical frameworks through which to view the effects of different determinants on childhood mortality and morbidity have been developed.

Mosley and Chen (1984) and Schultz (1984) made distinctions between variables considered to be exogenous or socio-economic; cultural, social, economic, community and regional factors, and endogenous or biomedical factors; breastfeeding patterns, hygiene, sanitary measures, and nutrition. The effects of the socio-economic variables are considered indirect because they operate through the biomedical factors to bring about morbidity or mortality. The bio-medical factors are called intermediate variables or proximate determinants because they constitute the middle step between the exogenous variables and child mortality (Mosley and Chen 1984; Schultz 1984).

On one hand, Mosley and Chen (1984) categorized a set of proximate determinants into five general groups that directly affect under-5 mortality. Socioeconomic factors affect child mortality through direct factors that must operate through these proximate determinates or indirectly affect under-5 mortality.

According to Mosley and Chen, the five grouped proximate determinants that directly affect infant and child mortality are:-

1. Maternal factors: Maternal factors include age, parity and birth intervals. These factors have an impact on infant and child mortality through maternal health. Two or more factors may also in a process called synergism influence maternal factors; for instance birth interval categories
2. Malnutrition and deficiency of nutrients including calories, protein and micro nutrients. Nutrient's deficiency has a negative effect on child survival. This affects both the mother and the child, where during pregnancy and the lactation period, this affects the infant and child survival through impacting the new born weight and the quality of breast milk.
3. Environmental contaminations: This relates to the hygiene including water and sanitations: each of these factors influences the risk of contracting infectious disease to either mothers or children.
4. Injury whether physical, burn and poisoning injury. Injuries heavily affect the infants and child mortality at the infanticide period.
5. Personal illness control. The risk of illness is related to immunization, use of bed net and malaria prophylaxis among others. Disease control and prevention measures during mother's pregnancy and child births are important in this case. Factors related to control of personal illness have an impact on the outcome of pregnancy as well as the child survival through its effect on both the mothers and the child (Mosley and Chen, 1984 P25-42).

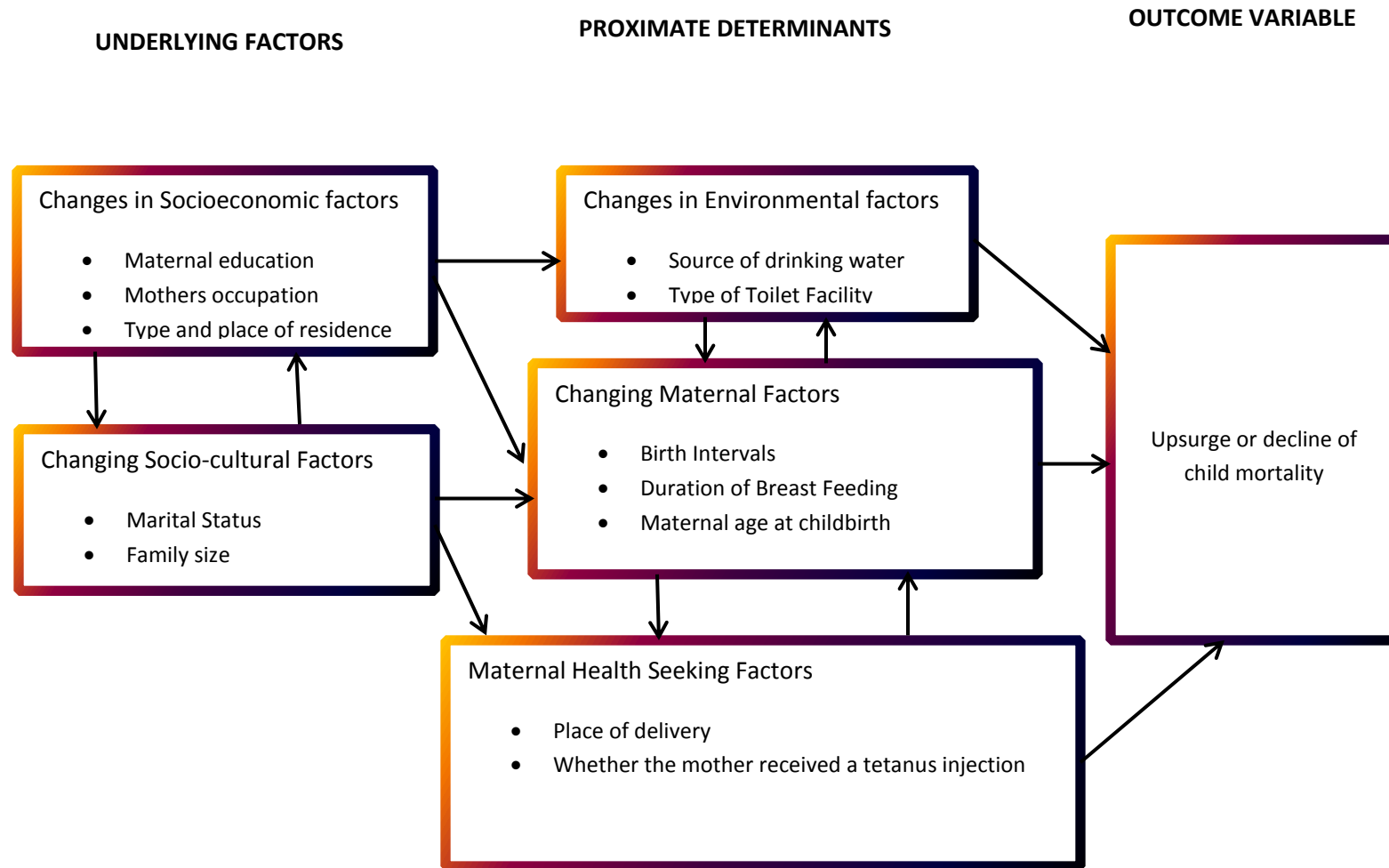
2.4 Operational Framework

The study makes use of Mosley and Chen (1984) framework modified by the writer to guide the investigation into the factors behind the upturn and downturn in under five mortality in

Kenya for the following reasons; One, this is one of the frameworks that attempts addressing the linkage between child mortality due to public interventions on one hand and social, economic and intermediate variables on the other hand. Second, Mosley and Chen framework contains a proposition of the proximate determinants of mortality which if supposedly exhaustive, child mortality would change if and only if one or more of the determinants also changes (Hill *et al* 2000). This assertion is not only relevant but also very critical in this study topic.

Thirdly, and also very important in measurement of variables, is exception of injury related factors-which will be exempted in this study. Most of the other proximate determinants proposed in the model (the maternal factors, environmental contamination, deficiency in nutrients and control of personal illness) can be measured either directly or by use of a proxy from the available rounds of demographic and health survey data collected in Kenya during the period of study. Finally, Mosley and Chen frameworks and its variants is the most extensively used framework for studying mortality changes, trends and determinants. The conceptual framework adopted for this study is as shown in Figure 2.1 below:

Figure 2.1: The Operational Framework



Source: Adopted from Mosley and Chen's (1984) Conceptual Framework

2.5 Operational Hypothesis

- i. There is a negative relationship between maternal age and under-5 mortality prevalence
- ii. A shorter birth interval is associated with a heightened risk of under-5 mortality
- iii. Children who are exclusively breastfed for the first 6 months or for up to 24 months period are less likely to experience under-5 mortality as compared to those who are breastfed for a short duration or no breastfeed at all.
- iv. Children born by mothers with secondary education or higher have low under-5 mortality incidences compared to children born of mothers with no education.
- v. Under-5 mortality cases are low among children residing in households with a toilet facility compared to those residing in households with no toilet facility.
- vi. Households with improved sources of drinking water are associated with reduced risk of under-5 mortality as compared to children born in household with a non-improved source of drinking.
- vii. Receiving a tetanus jab is associated with a reduced risk of experiencing under-5 mortality from lockjaw disease especially during the first two weeks of birth.
- viii. Being born outside a health facility is associated with a heightened risk of experiencing under-5 mortality.

CHAPTER 3

DATA AND METHODOLOGY

3.1 Introduction

This chapter presents a description of the sources of data, sample selection, data quality and the analytical tools to be used in the study so as to yield the necessary conclusions of under-5 mortality determinants in Kenya.

3.2 Data and Rationale

The data used in the empirical analysis was obtained from the Kenya Demographic and Health Surveys (KDHS) 2003 and 2008/9. KDHS provides information on fertility, mortality, health issues, socio-economic and environmental conditions. KDHS is a nationally representative sample of women aged 15 to 49 and men aged 15 to 54 selected from 400 clusters (sample points) throughout the eight provinces in Kenya. The 2003 KDHS covered 8,195 women aged 15-49 and 5,949 children aged less than 60 months from 8,561 households in the months of April to August, 2003. The 2008/9 DHS covered 8,444 women aged 15-49 and 6,079 children aged less than 60 months.

As is often the case with data on child mortality, information comes from surveys among women. A special survey questionnaire for women called the women's questionnaire is administered to capture data on women's birth history. For each live born child the month of birth is recorded and whether or not the child is still alive at the time of the interview. If a child died during the observation period, the age at which the child died is asked. The age of death is observed within intervals; in case a child died within a month after birth, the age of death is recorded in days, if the child died between one month and two years, it is recorded in months, and otherwise it is recorded in years. Because we are only interested in child mortality until age five, we will artificially right-censor at this age.

3.3 Definition and Measurement of Variables

i) Dependent variable

The dependent variable in the study is under five mortality rate. Under-five mortality rate is the instantaneous risk of dying between birth and before a child celebrates their fifth birthday. The variable is measured as the number of deaths recorded in the age interval, 0-59 months, as a division of the person's months lived in the same age interval. Under-five mortality is expected to have changed over the entire study period. This is measured as the duration of survival since birth in months.

ii) Mother's age at childbirth

This is the exact age of the mother at the birth of the index child. This is computed as the difference of the maternal date of birth which was adjusted for the missing dates and the imputed dates of child birth. The variable makes use of a number of age categories including; <20 years, 20-34 years and 35+ years. The risk of a child dying varies by the age of the mother at birth with very young mothers (<20 years) and old mothers (35+ years) being associated with an increased risk of under-5 mortality experience. Change of mother's age at birth during the study is partly related to the change in child mortality trend.

iii) Birth Interval

This variable refers to the length in months of the preceding birth before the index child. Three categories will be used including <24 months; 25-47 months; 48+ months. A shorter birth interval is associated with a heightened risk of under-5 mortality and vice versa. Birth intervals will however be expected to change over the entire period of study.

iv) Duration of breastfeeding

This defines the amount of time in months that the child feeds on breast milk without being weaned. Three categories of less than 6 months, 6-24 months and more than 24 months will be used. Cases where mother is still breast feeding, the child died while still breast feeding, inconsistent data and mothers who do not know the exact duration were not considered. Conventionally, shorter periods of breast feeding are associated with increased chances of child death and vice versa.

v) Educational level

This variable refers to the highest level of education that either the mother or the father has attained. In this case, two variables have been used for this study; the maternal education and paternal education. The KDHS collected information on the highest educational level of respondents at the time of the interview. The six categories identified by the KDHS were no education, primary incomplete, primary complete, secondary incomplete, secondary complete, and higher education. For the purpose of this study, due to the few cases of responses in some of the categories, the responses were reclassified into three; no education, primary and secondary and above. It is expected that parents with no education will experience higher risks of under-5 mortality as compared to those with secondary schooling and above.

vi) Type of Toilet facility

This refers to how the household disposes human excreta. Respondents were asked whether the dwelling had some kind of toilet facilities. Literature also establishes that the presence of a toilet facility alone is not sufficient but the type of the available facility and how its usage. The availability of a toilet facility was categorized into two: no toilet facility and toilet facility present. The type was categorized into improved and non-improved. It is expected that

households without any form of facility for human waste disposal will tend to adversely suffer heightened under-5 mortality from the consequences of poor sanitation as compared to the rest. De facto residents were excluded from the analysis.

vii) Source of water

This variable is defined as the source of water for drinking in the sampled household. The health benefits of improved water supply have been established in several previous studies (Esrey and Habicht, 1986). Clean water prevents the spread of water-borne diseases, such as infections and cholera (Buttenheim, 1998). In Kenya the major sources of water include piped source within the dwelling or plot, public tap, tube well or borehole, protected well or spring, rainwater, lakes, streams and rivers. The water sources were further categorized into improved and un-improved sources for the purposes of this study.

viii) Tetanus toxoid

This variable measures whether or not the mother received a tetanus toxoid injection during pregnancy or at birth. It is measured as 1 for single or no tetanus injection and 2 for more than one injection. Studies have shown that receiving a tetanus jab is associated with a reduced risk of experiencing under-5 mortality from lockjaw disease especially during the first two weeks of birth.

ix) Family size

Family size defines how large a household is. Three categories were used which includes; 1-3 people in the household, 4-6 people and 7+ people in the household. Studies have shown that as the family size increases, this is associated with an increased risk of experiencing under-5 mortality in the family due to deprivation of some basic needs.

x) Marital Status

Marital status defines the state of the household and its relation to the protective effect. Children from never married and single parents are at higher risks of mortality than those of currently married couples. The study will use 3 categories; currently married, never married and formerly married in the analysis.

xi) Place of delivery

This refers to the place where the child was born. The categories used here are 1 for being born at home, 2 for being born in a government health facility and 3 for being born in a private health facility. It is hypothesized that being born outside a health facility is associated with a heightened risk of experiencing under-5 mortality. For those who gave birth on their way, don't know and other, this was excluded from the analysis.

Table 3.1: Variable descriptions and categorization

| Variable and classification | Variable Name and Categorization |
|--|--|
| Dependent Variable Under 5 mortality rate | Child alive at the time of survey 0. No 1. Yes |
| (a) Socioeconomic factors: | Mothers level of education: 0. No education 1. Primary level 3. Secondary and above Place of residence: 1. Urban 2. Rural |
| (b) Socio-cultural Factors: | Marital Status: 1. Never married 2. Currently married 3. Formerly married Family Size: 1. 1-3 Members 2. 3-6 Members 3. 7+ Members |
| (c) Maternal Factors: | Mothers Age at Birth: 1. Less than 20 years 2. 20-34 years 3. More than 34 years Duration of Breast feeding: 1. Less than 6 months 2. 6-24 months 3. More than 24 months Preceding Birth Intervals: 1. Less than 24 months 2. 24-47 months 3. More than 48 months |
| (d) Environmental factors: | Source of Drinking Water: 1. Improved Water Source 2. Unimproved Water Source Type of Toilet facility: 1. Improved Toilet Facility 2. Unimproved toilet facility 3. No toilet facility |
| (e) Maternal Health Seeking : | Place of delivery: 1. Home 2. Public facility 3. Private facility Tetanus Toxoid: 1. Once or None 2. Two or More |

3.4 Methodology of Data analysis

Descriptive and inferential statistics were employed in data analysis in this study. The background characteristics of the study sample were presented using percentage distribution. At the multivariate level of analysis, Cox proportional hazards model was employed to examine the relationship between the outcome variable (under-five mortality) and a set of selected independent variables. Being a semi-parametric model, SPSS version 21 software is used.

Cox proportional hazards model (i.e. survival analysis) is appropriate in analyzing censored observations. This means that, using Cox proportional hazards regression analysis, both the occurrence of under-five mortality and the time when the child died were considered as the outcome variables (Cox, 1972). Cox regression procedure is a useful technique for analysis of survival data and it takes care of censoring concern in mortality data. This is because some children are not fully exposed to the mortality risk. In social science research, censoring occurs when the outcome of an observation case is not fully known. Cox regression analysis allows for the inclusion of censored data and it models censored time-until-event data as a dependent variable where it can be assumed that the covariates have a multiplying effect on hazard rates (Hosmer et al 2008).

The outcome variable in this study was treated as the time between birth and death of a child under age five years; or until the observation is censored. Children known to have died (i.e. non-censored) were regarded as the cases, while children who were still alive at the time of the survey were treated as right-censored observations. The outcome variable takes into consideration the children's survival status as well as the month of their death or the last month they were known to be alive (Hosmer et al 2008).

Further, besides the analyses at the univariate and bivariate levels, the multivariate analysis involved fitting a model using 2003 and 2008 KDHS. These models provide understanding on the influences of contextual factors on children's survival chances.

Measures of association (i.e. fixed effects) were expressed in this study as hazard ratios (HR) and p-value was used for significance. The precision of random effects was determined by the standard error (SE) of the covariates.

CHAPTER 4

FINDINGS FROM THE STUDY

4.1 Introduction

This chapter is organized into three sections; section one deal with the distribution of the study population by different socio-economic, socio-demographic and environmental characteristics while section two gives the distribution of the study variable by the different socio-economic, socio-demographic and environmental characteristics. Finally, section three deals with the multivariate analysis of the various characteristics. For each section, the analysis contains the results for each of the two datasets under analysis.

4.2 Descriptive Statistics of the Study Population

From table 5.1, a total of 12,028 children were included in this study. Of these children, 5,949 were from the KDHS 2003 data and 6,079 for KDHS 2008-9. For deaths, 502 (8.4%) children died before the age of 5 for KDHS 2003 and 373 (6.1%) for KDHS 2008-9. On the other hand, 5,447 (91.6%) were alive and 5,706 (93.9%) were alive in the time of the survey for KDHS 2003 and 2008-9 respectively.

Results revealed that proportion of the children from families with 4-6 members were (50.1%) and (51.7%) of the population for KDHS 2003 and 2008/9 respectively. On the other hand, families with more than 7 members and 1-3 members were (35.6% vs 14.3%) and (34.3% vs 14.0%) for KDHS 2003 and 2008/9 respectively.

Table 4.1: Descriptive characteristics of the Study Population

| Variable | Attribute | KDHS 2003 | | KDHS 2008-9 | |
|----------------------------|----------------------------|-----------|------------|-------------|------------|
| | | Frequency | Percentage | Frequency | Percentage |
| Child is alive | Characteristics | n=5949 | | n=6079 | |
| | No | 502 | 8.4 | 373 | 6.1 |
| | Yes | 5447 | 91.6 | 5706 | 93.9 |
| Family Size | 1-3 Members | 850 | 14.3 | 851 | 14.0 |
| | 4-6 members | 2981 | 50.1 | 3141 | 51.7 |
| | 7+ members | 2118 | 35.6 | 2087 | 34.3 |
| Marital Status | Never married | 355 | 6.0 | 383 | 6.3 |
| | Currently married | 5113 | 85.9 | 5181 | 85.2 |
| | Formerly married | 481 | 8.1 | 515 | 8.5 |
| Mothers age at child birth | <20 years | 3576 | 60.1 | 353 | 5.8 |
| | 20-34 years | 42368 | 39.8 | 4566 | 75.1 |
| | > 34 years | 5 | 0.1 | 1160 | 19.1 |
| Place of Delivery | Home | 3455 | 58.7 | 3429 | 57.1 |
| | Public Facility | 1553 | 26.4 | 1946 | 32.4 |
| | Private Facility | 876 | 14.9 | 630 | 10.5 |
| Duration of Breast feeding | Less than 6 months | 518 | 13.8 | 595 | 15.1 |
| | 6-24 months | 2879 | 76.5 | 2942 | 74.7 |
| | > 24 months | 367 | 9.8 | 404 | 10.3 |
| Tetanus Toxoid | Once or None | 1926 | 48.6 | 1756 | 43.6 |
| | Two or more | 2009 | 51.1 | 2272 | 56.4 |
| Preceding Birth Intervals | <24 months | 1051 | 23.1 | 1104 | 23.6 |
| | 24-47 months | 2354 | 52.9 | 2381 | 50.9 |
| | > 48 months | 1046 | 23.5 | 1194 | 25.5 |
| Mothers level of education | No education | 3159 | 53.1 | 3215 | 52.9 |
| | Primary level | 2001 | 33.6 | 1989 | 32.7 |
| | Secondary or above | 789 | 13.3 | 875 | 14.4 |
| Type of toilet facility | Improved Toilet Facility | 901 | 15.7 | 603 | 9.9 |
| | Unimproved Toilet Facility | 3465 | 60.4 | 3847 | 63.3 |
| | No Toilet Facility | 1369 | 23.9 | 1629 | 26.8 |
| Source of Drinking Water | Improved Water Source | 1640 | 28.4 | 3339 | 54.9 |
| | Unimproved Water Source | 4128 | 71.6 | 2740 | 45.1 |

For both surveys, majority of the children's mothers were currently married (85.9% vs 85.2%) for KDHS 2003 and 2008/9 respectively. For both datasets, those women who were never married had the least population (6.0% vs 6.3%). Mother's age at birth was also varying; unlike in KDHS 2003 where majority of the mothers gave birth at a younger age of less than 20 years (60.1%), in KDHS 2008/9, majority of the mothers gave birth at the age of 20-34 years (75.1%). Only 876 (0.1%) of the KDHS 2003 mothers gave birth at above the age of 35 years, with only 353 (5.8%) giving birth below the age of twenty for KDHS 2008/9.

For both datasets, more than half of the mothers gave birth in their homes (58.7% vs 57.1%) for KDHS 2003 and 2008/9 respectively. Use of private facilities had the least number of mothers with only 14.9% and 10.5% for KDHS 2003 and 2008/9 respectively. Use of government facilities in delivery was gaining popularity with an increase in population as shown in 32.4% for KDHS 2008/0 as compared to 26.4% in KDHS 2003.

The mean duration of breastfeeding in the study population had a marginal increase 16.81 (± 1.8193) and a median of 16 months as compared to 16.4446 (± 2.103) months with a median duration of 17 months for the upsurge and decline period respectively. More than three quarter (86.2%) of the children in the KDHS 2003 population had breastfeeding duration of more than six months with majority (66.4 %) having breastfeeding duration of between 12-24 months. However, for KDHS 2008-9, 84.9% breastfed for at-least six months with majority (68.3 %) having breastfeeding duration of between 12-24 months. It was evident that mothers stop breast feeding at 12 months, 18 months and 24 months of breast feeding with at least a combined 35% of the mothers reporting to have stopped breast feeding at any of the three stages in both analysis.

More than half (51.1%) of the mothers to children in the study population received less than two tetanus injections during their pregnancy for KDHS 2003 as compared to 56.4% in KDHS 2008-9. Majority of these mothers (41.5% and 40.2%) for KDHS 2003 and KDHS 2008/9 respectively received two tetanus injections during their pregnancy. This represents a decline in administering of tetanus injection for the 2 periods.

Majority of the children mothers had not gone through any formal education with 53.1% and 52.9% for KDHS 2003 and 2008 respectively reporting “no education.” Two thousand and one (33.6%) of KDHS 2003 mothers had attained basic primary level of education. Of these primary school level mothers, 71.6% of them drink water from a non-improved source, 60.4% make use of a non- improved toilet facility and 55.1% of them received more than one tetanus injections during pregnancy. However, 41.5% of these mothers gave birth below their age of twenty with 50.7% giving birth at their homes. For 2008-9 data on the other hand, 32.7% (1,989) had attained primary school level of education and of these mothers, 54.7% of them drink water from an improved source, 63.3% make use of a non-improved toilet facility and 58% of them received more than one tetanus injections during pregnancy. Apparently, only 5.8% of the sampled mothers, they gave birth below their age of twenty with 57.1% giving birth at their homes.

Majority of these household use a non-improved toilet facility (60.4% vs 63.3%) for KDHS 2003 and 2008/9 respectively. Using KDHS 2003 data, majority of the children (71.6%) lived in households with a non-improved water sources including open dams, rivers and streams while 28.4% lived in households with an improved water sources. Consequently, use of improved water source has almost doubled and in KDHS 2008-9, 54.9% of all sampled households were using an improved source of water.

4.3 The Association of Children's Background Characteristics and Under-5 mortality

Table 4.2 and 4.3 presents selected child's characteristics in relation to under-5 mortality.

Table 4.2a: Bivariate analysis of under 5 mortality and child's background characteristics: KDHS 2003

| KDHS 2003 (n=5949) | | | |
|-----------------------------|-----------------------------------|----------------|--------------|
| Variable | Attribute | Child is Alive | |
| | | No | Yes |
| Type of Residence | Urban | 124(8.2%) | 1410 (91.8%) |
| | Rural | 378 (8.6%) | 4037 (91.4%) |
| | $X^2=0.337a; P=0.59*4; df=1$ | | |
| Mother's Level of Education | No education | 319 (10.1%) | 2840 (89.9%) |
| | Primary level | 148 (7.4%) | 1853 (92.6%) |
| | Secondary or above | 35 (4.4%) | 754 (95.6%) |
| | $X^2 =30.434a; P =0.000; df =2$ | | |
| Family Size | 1-3 members | 116 (12.9%) | 734 (87%) |
| | 4-6 members | 247 (7.7%) | 2734 (92.2%) |
| | 7+ members | 139 (6.4%) | 1979 (93.5%) |
| | $X^2 =39.50a; P =0.000; df =2$ | | |
| Marital Status | Never married | 23 (6.7%) | 332 (93.2%) |
| | Currently married | 426 (8.3%) | 4687 (91.7%) |
| | Formerly married | 53 (11%) | 428 (88.9%) |
| | $X^2 =5.984a; P =0.05; df =2$ | | |
| Preceding Birth Intervals | <24 months | 139 (13.2%) | 912 (86.8%) |
| | 24-47 months | 174 (7.4%) | 2180 (92.6%) |
| | > 48 months | 79 (7.6%) | 967 (92.4%) |
| | $X^2 =34.469a; P =0.000; df =2$ | | |
| Mothers Age at Birth | <20 years | 320 (8.9%) | 3256 (91.1%) |
| | 20-34 years | 181 (7.6%) | 2187 (92.4%) |
| | > 34 years | 1 (20.0%) | 4 (80.0%) |
| | $X^2 =4.0006a; P =0.135*; df =2$ | | |
| Duration of Breast Feeding | Less than 6 months | 316 (61.0%) | 202 (39.0%) |
| | 6-24 months | 167 (5.8%) | 2712 (94.2%) |
| | > 24 months | 8 (2.2%) | 359 (97.8%) |
| | $X^2 =3.923; P =0.141*; df =2$ | | |
| Place of Delivery | Home | 300 (8.7%) | 202 (91.3%) |
| | Public Facility | 130 (8.4%) | 2712 (91.6%) |
| | Private Facility | 58 (6.6%) | 59 (93.4%) |
| | $X^2 =1221.761a; P =0.000; df =2$ | | |
| Tetanus Toxoid | Once or None | 114 (5.9%) | 1812 (94.1%) |
| | Two or more | 103 (5.5%) | 1906 (94.4%) |
| | $X^2 =1.184; P =0.295*; df =1$ | | |
| Type of Toilet Facility | Improved Toilet Facility | 67 (7.4%) | 834 (92.6%) |
| | Unimproved Toilet Facility | 282 (8.4%) | 3173 (91.6%) |
| | No Toilet Facility | 120 (8.8%) | 1249 (91.1%) |
| | $X^2 =1.319a; P =0.517*; df =2$ | | |
| Source of Drinking Water | Improved Water Source | 113 (6.3%) | 1527 (93.1%) |
| | Unimproved Water Source | 367 (8.9%) | 3761 (91.1%) |
| | $X^2 =6.155; P =0.013; df =1$ | | |

Table 4.2b: Bivariate analysis of under 5 mortality and child's background characteristics: KDHS 2008/9

| KDHS 2008/9 (n=6079) | | | |
|-----------------------------|--|--|---|
| Variable | Attribute | Child is Alive | |
| | | No | Yes |
| Type of Residence | Urban Rural <i>X²=1.267a; P=0.28*8; df=1</i> | 81(5.5%) 292 (6.3%) | 1386 (94.5%) 4320 (93.7%) |
| Mother's Level of Education | No education Primary level Secondary or above <i>X² =7.729c; P =0.021; df =2</i> | 214 (6.6%) 123 (6.1%) 36 (4.1%) | 3001 (93.3%) 1866 (93.8%) 839 (95.8%) |
| Family Size | 1-3 Members 4-6 members 7+ members <i>X² =76.089c; P =0.000; df =2</i> | 108 (12.6%) 172 (5.4%) 93 (4.4%) | 743 (87.3%) 2969 (94.5%) 1994 (95.5%) |
| Marital Status | Never married Currently married Formerly married <i>X² =17.953c; P =0.000; df =2</i> | 13 (3.3%) 309 (5.9%) 51 (9.9%) | 370 (96.6%) 4872 (94%) 464 (90%) |
| Preceding Birth Intervals | <24 months 24-47 months > 48 months <i>X² =18.356c; P =0.000; df =2</i> | 96 (8.6%) 119 (4.9%) 84 (7%) | 1008 (91.3%) 2262 (95%) 1110 (92.9%) |
| Mothers Age at Birth | <20 years 20-34 years > 34 years <i>X² =3.541c; P =0.170*; df =2</i> | 21 (5.9%) 267 (5.8%) 85 (7.3%) | 332 (94%) 4299 (94.1%) 1075 (92.6%) |
| Duration of Breast Feeding | Less than 6 months 6-24 months > 24 months <i>X² =819.666c; P =0.000; df =2</i> | 241 (40.5%) 96 (3.2%) 28 (6.9%) | 354 (59.4%) 2846 (96.7%) 376 (93%) |
| Place of Delivery | Home Public Facility Private Facility <i>X² =1.104c; P =0.575*; df =2</i> | 204 (5.9%) 121 (6.2%) 32 (5%) | 3225 (94%) 1825 (93.7%) 598 (94.9%) |
| Tetanus Toxoid | Once or None Two or more <i>X² =.134d; P =0.714*; df =1</i> | 72 (4.1%) 88 (3.8%) | 1684 (95.8%) 2184 (96.1%) |
| Type of Toilet Facility | Improved Toilet Facility Unimproved Toilet Facility No Toilet Facility <i>X² =4.111c; P =0.128*; df =2</i> | 29 (4.8%) 230 (5.9%) 114 (6.9%) | 574 (95.1%) 3617 (94%) 1515 (93%) |
| Source of Drinking Water | Improved Water Source Unimproved Water Source <i>X² =.009d; P =0.925*; df =1</i> | 204 (6.1%) 169 (6.1%) | 3135 (93.8%) 2571 (93.8%) |

Key: *p>0.05- No significance

Results presented in Table 4.2 revealed that mother's education as a socio-economic variable is statistically significant with under-five mortality incidences unlike type of place of residence (p -value 0.05). Eight point one percent and 8.6% of these children in urban and rural areas respectively died before the age of five. This association was not however, statistically significant (p -value 0.05). Using KDHS 2008, 5.5% of children living in rural areas and 6.3% of urban children died before their age of five but this was not statistically significant at 0.05 level; (p -value 0.288). The proportion of children who died was more for mothers with little or no education. Using KDHS 2003, the proportion of children born to mothers with no education who died before their age of 5 (10.1%) was more than twice the proportion of children born to mothers with secondary or higher education (4.4%). There were almost one and a half times deaths in the proportion of children whose mothers had no education as to those with primary education (10.1% and 7.4% respectively). These findings are significant at 0.01 levels (p -value 0.000). For KDHS 2008/9, mother education was also statistically significant to under-5 mortality at 0.05 levels. The proportion of children born to mothers with no education who died before their age of 5 (6.6%) was almost twice the proportion of children born to mothers with secondary or higher education (4.1%). There were a marginally lower proportion of deaths in children whose mothers had primary level education than those with no education (6.1% and 6.6% respectively). These findings are significant at 0.05 levels (p -value 0.021).

Results in both datasets under analysis indicate a strong association of family size as well as marital status to under -5 mortality incidences. Results on family size show unique but interesting results with the number of people in the household being strongly significantly associated with under-5 mortality incidences (p -value 0.01). Under-5 mortality reduces with an increase in family size. Children living in households with less than three members had higher

cases of under-5 deaths (12.9%) compared to 6.4% of children in households with seven or more members in KDHS 2003 analysis. The relationship was similar in KDHS 2008/9 analysis but with a different magnitude. Marital status of the sample children mother's, on the other hand, was also significantly associated with under-5 deaths incidences (p -value 0.00) for KDHS 2003 and (p -value 0.05) for KDHS 2008. Children living in households with mother's currently in marriage had lower cases of under-5 deaths compared to children in households with formerly married mothers (8.3% vs 11%) and (5.9% vs 9.9%) for KDHS 2003 and KDHS 2008 respectively. However, families whose mothers were never married had the least occurrences of under-5 deaths in both datasets. This could be attributed to the age at first marriage.

Birth interval of the preceding child showed a strong association with under-5 mortality incidence (p -value 0.00) in KDHS 2003. Almost twice (13.2%) of the children born with a short preceding birth interval, less than 24 months died before their age of five as compared to 7.6% who were born after a longer birth interval of more than 48 months. Similar findings were observed for KDHS 2008/9 data with more deaths among children born with a short preceding birth interval, less than 24 months (8.6%) compared to 4.9% for children born after a longer birth interval (24-47 months) at 0.05 significant levels (p -value 0.00). Duration of breastfeeding was also significantly associated with under-5 mortality (p -value 0.00) in KDHS 2008/9 data. Children who breastfeed for 6-24 months have the least chances (3.2%) of experiencing under-5 mortality, as compared to those who breastfeed for less than 6 months (40.5%) or more than 24 months (6.6%). This association was however, not statistically significant for KDHS 2003 data (p -0.295).

Under-5 mortality was not significantly associated with maternal age at child birth (p -value 0.135) for KDHS 2003 data. However, approximately ten percent (8.9%) of children born

to mothers aged below twenty years died before the age of five as compared to 7.6% for children born to mothers' between the age of twenty and thirty five years. Also, 20.0% of the children born of older mothers (above the age of thirty five years) died before the age of five. KDHS 2008 data too does not show a significant relationship at 0.05 levels (p -value 0.17).

Health seeking variables selected also showed significant association with under-5 mortality. Place of delivery was significantly associated with under-5 mortality incidences (p -value 0.000) in KDHS 2003 data. 8.7% of the children whose mothers delivered in their homes died before the age of five as compared to 6.6% of the children for the mothers who delivered in a private health facility. This association was however, not statistically significant for KDHS 2008 data (p -value 0.575). On the other hand, mothers who were injected with a tetanus injection during pregnancy were also not statistically significantly associated with under-5 deaths incidences in both KDHS 2003 and KDHS 2008/9.

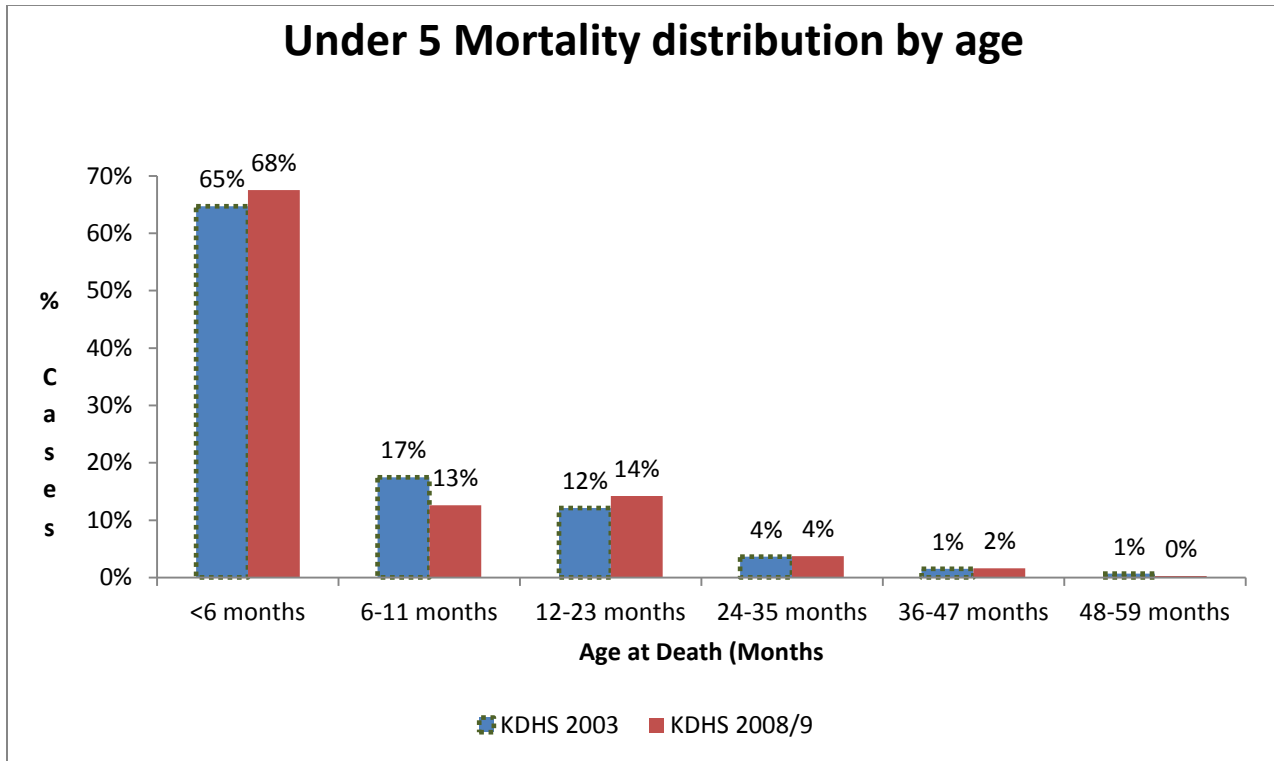
Of the selected environmental variables, toilet facility does not show a significant association with under-5 mortality (p -value 0.517) in KDHS 2003 data. However, under-5 mortality was almost the same (8.4%) among children who lived in households with a non-improved toilet facility compared to 8.8% for those living in households lacking a toilet facility. In addition, as expected, this study established that under-5 death cases were high in households with no toilet facility than those with either an improved or non-improved toilet facility. The proportion of under-5 deaths was 8.8% for households with no toilet facility and 7.4% for households with an improved toilet facility. Similar results were observed in KDHS 2008/9 data, with no statistical significance between toilet facility and under-5 mortality (p -value 0.128).

Under-5 deaths were strongly associated with sources of drinking water (p -value 0.013) in KDHS 2003. In KDHS 2003, under-5 deaths were higher (8.9%) among households with a

non-improved source of drinking water compared to households with improved water sources (6.3%). None of the environmental variables was significant at 0.05 levels, when KDHS 2008 was used with *p*-value (0.128 and 0.925) for type of toilet facility and source of drinking water respectively.

For both study periods, under-5 mortality peaked among children aged below 6 months with 65% vs 68% for KDHS 2003 and KDHS 2008 dying before the age of 6 months as shown in figure 4.1 below. Beyond six months, cases of under-5 mortality decreased with increasing age. The proportion of children who died before the age of 6 months is almost one and half times the proportion of children who died aged 6-59 months. The mean age at death of the under-5 children was 5.71 months in KDHS 2003 with that of KDHS 2008 being 5.17 (± 2.109) months.

Figure 4.1: Under-5 mortality distribution by age in KDHS 2003 and KDHS 2008/9



4.4 Results of the Multivariate Analysis

Multivariate analysis is performed by taking the conceptual framework into consideration. Stepwise Cox Proportional survival analysis-forward relative risk technique was used to assess the relative effect of the explanatory factors on the outcome factor. To avoid an excessive number of variables and unstable estimates in the subsequent model, only variables which reached a p-value less than 0.5 were kept in the subsequent analyses from the bivariate analysis. In this case all the variables were added and the model run with Table 5.3 presenting the maternal, environmental, socio-cultural, health-seeking and socio economic variables which remained as statistically significant.

Table 4.3: Cox Proportional model results of under-5 mortality in KDHS 2003 and KDHS 2008/9

| Characteristics | KDHS 2003 | | KDHS 2008/9 | |
|-----------------------------------|---------------------|---------|---------------------|---------|
| | Exp(B)-Hazard Ratio | P Value | Exp(B)-Hazard Ratio | P Value |
| Duration of Breast feeding | | | | |
| Less than 6 months | 1 | 0.000 | 1 | 0.000 |
| 6-24 months | 0.040** | 0.000 | 0.066** | 0.000 |
| More than 24 months | 0.009** | 0.000 | 0.112** | 0.000 |
| Source of Drinking Water | | | | |
| Unimproved Water Source (1) | 1 | 0.027 | 1 | 0.008 |
| Improved Water Source (1) | 0.578* | 0.005 | 0.549* | 0.036 |
| Family Size | | | | |
| 1-3 Members | 1 | 0.010 | 1 | 0.001 |
| 4-6 members | 1.663* | 0.015 | 1.332* | 0.027 |
| 7+ members | 2.100* | 0.003 | 0.607* | 0.046 |
| Mothers age at child birth | | | | |
| Less than 20 years | | | 1 | 0.014 |
| 20-34 years | 0.483* | 0.046 | 0.738* | 0.042 |
| More than 34 years | 0.783* | 0.018 | 0.774* | 0.028 |
| Place of Delivery | | | | |
| Home | | | 1 | 0.018 |
| Public Facility | | | 0.493* | 0.050 |
| Private Facility | | | 0.605* | 0.047 |

*Key: *p≤0.05; **p≤0.001*

According to the results from KDHS 2003 data, after determining all the covariates for significance ($P < 0.05$) only duration of breast feeding, source of drinking water, family size and mother's age at birth were significant at 0.05 level during the decline period. Duration of breast feeding indicates a marked differential in the risks of death before age five with hazards significantly lower for children who exclusively breast fed for more than 6 months compared to those who breast fed for less than 6 months. Children who breast fed for more than 24 months were 0.009 times less likely to experience death before their age of 5 as compared to the children who breast fed for less than 6 months. On the other hand, children who breast fed for 6-24 months were 0.04 times less likely to experience death before their age of 5 as compared to the children who breast fed for less than 6 months. Analysis of 2008 KDHS also indicated reduced risk of under-five death upon an exclusive breast feeding of more 6 months as compared to those children who breast feed for less than 6 months in the reference category. Children who breast fed for more than 24 months were 0.112 times less likely to experience death before their age of 5 compared to the children who breast fed for less than 6 months while children who breast fed for 6-24 months were 0.066 times less likely to experience death before their age of 5 as compared to the children who breast fed for less than 6 months. This relationship was statistically significant at 0.01 levels.

Results from analysis of both surveys indicated that inclusion of environmental variables into the model did significantly change the risks of dying during childhood. This suggests that the effect of maternal factors on their children survival chances was also dependent of environmental characteristics. During the declining period (KDHS 2003), children belonging to households that used an improved source of water as compared to those who used a non-improved water source had 44 percent prolonged chances of surviving and this association was

statistically significant at 99 percent confidence interval (p-value=0.005). In KDHS 2008/9 data too, the results show that children living in households using improved water were 0.456 times less likely exposed to the risk of experiencing under 5 mortality as compared to those using non improved water sources (P=0.036).

Results on family size show statistically significant association between the number of people in a household and the risk of experiencing under-5 mortality. The risk of death increases with an increase in family size. For 2003 data, children whose families have 4-6 members were 66.3 percent likely to experience death before their age of 5, while those within a family of more than 7 members were 2.1 times more likely to experience death before their age of 5 as compared to those in a family of 1-3 members. This association was statistically significant at $p < 0.05$. For KDHS 2008/9, on the other hand, children in a family with 4-6 members were 33.2% likely to experience death before their age of 5 as compared to the children in a smaller family size of 1-3 members. This association was significant at $p < 0.05$ level of significance.

Using mother's aged less than 20 years at the time of child birth as the reference; children born of older women were associated with a reduced risk of experiencing under-5 death. For instance, for KDHS 2003 data, children born of mothers aged between 20-34 years were associated with a 52 percent reduced risk of dying as compared to children born of mothers aged less than 20 years and this association was statistically significant ($p < 0.05$). In addition, with a reference of children born to mothers aged below 20 years, children born of mother's aged above 35 years were also associated with a 21.7 percent reduced risk of dying and this association was statistically significant ($p < 0.05$). For KDHS 2008-9 dataset, the same results are achieved. In this case, children born of mothers aged between 20-34 years were associated with a 26.4 percent reduced risk of dying as compared to children born of mothers aged less than 20 years

and this association was statistically significant ($p < 0.05$). In addition, with a reference of children born to mothers aged below 20 years, children born of mother's aged above 35 years were also associated with a 22.6 percent reduced risk of dying and this association was statistically significant ($p < 0.05$).

Results on mother's health seeking practices the study findings also support the hypothesis. For KDHS 2008/9, place of delivery shows that children born in a public health facility had a reduced risk (50.7 percent) of experiencing the risk of death compared to those whose mothers gave birth in their homes with a statistical significance of $p < 0.05$. Also, children born in private facility were associated with 39.5 percent reduced chances of experiencing death before the age of 5 years as compared to those whose mothers gave birth at their homes and this association had significance ($p\text{-value} < 0.05$). None of the dummies for mother's prior jab of the tetanus injection was significantly associated with the risk of dying ($p\text{-value} > 0.05$) in the two periods. For KDHS 2003, too, none of the dummies for mother's place of delivery was significantly associated with the risk of dying ($p\text{-value} > 0.05$).

Although maternal education, preceding birth intervals and marital status were significantly associated with under-5 mortality in the bivariate analysis, they failed to show any significance in the multivariate analysis.

4.5 Discussion of the findings

The study examines the effects maternal, socio-economic, environmental and cultural factors on under-five mortality in Kenya during different phases; upsurge and decline period. Cox proportional analysis was done to using KDHS data to determine the level of association of the factors with the outcome variable. Results established a strong association between under-five mortality and the duration of breast feeding. Babies are born with protection against certain diseases because antibodies from their mothers were passed to them through the placenta. After

birth, through breastfeeding, babies get the continued benefits of additional antibodies in breast milk to help improve their immune system.

The dummies for duration of breastfeeding of the child emerged as one of the strongest predictors of under-5 mortality for both the declining and upsurge periods with all the dummies showing statistical significance ($p < 0.001$) even after maternal factors were adjusted for socio-economic, maternal health seeking, environmental and socio-cultural factors. This observed association is in concurrence with past findings. When compared to children who breastfed for the shortest period (less than 6 months), those who breastfed for more than 24 months had a (99 percent and 88.8 percent) increased chances of surviving to the age of 5 for the upsurge and declining period data respectively, when child level factors were adjusted for other factors and this association was statistically significant ($p < 0.001$) as shown in the final model.

The findings are in support of UNICEF/WHO, 2009 study which indicates breast milk contains the nutrients, antioxidants, hormones and antibodies needed by a child to survive and develop. Children with exclusively breastfeeding for the first six months of life and who continue to be breastfed until two years of age and beyond develop fewer infections and have less severe illnesses than those who are not. Also, Kuate-Defo and Fosto (2005) study in developing countries have found that exclusive breastfeeding plays an important role in protecting infants against infectious diseases, one of the major causes of child mortality.

In addition, a DHS comparative study in 24 countries on children aged 0-2 months by Rayland and Riggers (1998) indicates children who are fully breastfed have lower prevalence of infections than those who are partially breastfed. On average, infections prevalence is 57 percent higher among partially breastfed children. However, breastfeeding becomes less important as

children age due to the introduction of other food supplements as KDHS 2008/9 data shows and this is in support of Barros and Victoria (1990) study.

This study also confirms that source of drinking water has a significant influence on child survival. The findings revealed that children from households that make use of improved source of drinking water have a reduced risk of experiencing under-5 mortality than children drinking water from non-improved sources. The study establishes similar findings for KDHS 2008/9 with use of improved water significantly reducing the risk of mortality incidences. The increased survival with children using improved water could be due to the fact that over the years in Kenya, more efforts seem to have been made to purify water either through water treatment chemicals even for water from other sources besides piped water as well as through sale of water purifying machines. With such programs in place, the source of water increasing seems to become less important. Unfortunately, the DHS surveys did not ask questions on whether water used for drinking and domestic use was purified or not. It is also suggested by Fayehun (2010) that the availability of better sanitation will decrease the probability of child death since better sanitation and drinking water access of the household should positively improve hygienic and health conditions for all members. On the other hand, toilet facilities did not indicate any association with mortality. Baker (1999) and Rutstein (2000) in support to above findings observe that access of toilet facilities does not have a significant effect on child mortality.

Results on family size show a statistically significant association between the number of people living in a household and the risk of under-5 mortality. Many researchers like Srivastava (1994) and Kabagenyl & Rutaramwa (2013) also suggest the same findings and concluded that the effect of family size on child mortality is statistically and substantially strong. The pattern of mortality by maternal age just like birth order is typically U-shaped. The results are in support of

Kibet (2010) study which confirmed that children born to both relatively old and young women have higher mortality rates than others and this depends on reproductive maturity. Young mothers are usually inexperienced in looking after the child (Kibet 2010). Children born of young mothers also tend to be underweight, malnourished and perhaps anaemic, a combination of which increases the risk of diseases. On mothers age, the findings of this study were similar to others finding which established that young mothers are usually inexperienced in looking after the infant and pointing to the fact that maternal age maybe considered as a proxy for educational level, modernity, knowledge and practice related to childcare and energy or capacity to care for a child. In addition, younger mothers may also not be socially and psychologically mature enough to deal with the requirements of infant and child care, or they may lack the domestic decision-making authority that older mothers may have (Alam 2000). These results confirmed the hypothesized association between maternal age and under-5 mortality.

Results revealed that none of the dummies for preceding birth intervals was significantly associated with the risk of under-5 mortality before and other factors were controlled for. This could be explained by the weak influence of preceding birth intervals on childhood mortality analysis. Instead, the findings conforms to Kombo and Ginneken (2009) results of 2005-06 Zimbabwean DHS which concludes that socioeconomic determinants have rather small and insignificant effect on infant and child mortality. They also suggest that the influence of birth order, preceding birth intervals, maternal age, type of birth and sanitation factors are more pronounced on infant mortality while weak effect on child mortality (Kombo and Ginneken 2009).

Mother's education also failed to show any association with under-5 mortality in the multivariate analysis despite the relationship in the bivariate analysis. Similar results were

obtained from Eritrea's DHS where education was found to have a significant effect on under-5 mortality in the bivariate analysis but the effect diminished after adjusting for other variables and in Israel where no linkage was established between education and mortality. The results were supported by authors who argue that socio-economic factors including education may have a greater effect on mortality rather than on morbidity since well-educated mothers may be unable to reduce risk of exposure due to factors beyond their control, such as a contaminated community environment, or lack of water and can only use their knowledge and wealth to use healthcare services more effectively than uneducated women (Root 2001).

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary, conclusion and recommendations on policy, programs and further research on the contrasting factors influencing under-5 mortality in Kenya during the upsurge and decline period as based on the findings from descriptive as well as inferential statistical techniques of analysis.

5.2 Summary

This study examined the differences in the factors influencing under-5 mortality during the upsurge and declining period in Kenya by using of 2 KDHS datasets; KDHS 2003-2008/9 . Among the socio-economic, environmental and socio-demographic factors that were hypothesized to be associated with under-5 mortality includes; mothers level of education, occupation, place of residence, marital status, family size, mothers age at birth, duration of breastfeeding, preceding birth intervals, source of drinking water, type of toilet facility, place of delivery and tetanus toxoid.

Most of the factors considered in this study were significantly associated with under-5 mortality in the bivariate analysis but only duration of breast feeding, source of drinking water, mother age at birth and family size persisted in the final model. For the declining period, on the other side, only duration of breast feeding, source of drinking water, mother's age at child birth, family size and place of delivery were significant in the final model. As expected, this study confirms a significant relationship between duration of breast feeding and under-5 mortality. The findings revealed that children who breastfeed for longer periods are at reduced risks of experiencing the risks of dying before the age of five as compared to those that breast feed for a

shorter period. The mean duration of breast feeding increased in the declining period compared to the upsurge period. Breast feeding provides hygienically nutritional ingredients of mother's milk including immunity against communicable diseases and the extended duration of breast feeding could be one of the factors that led to the reversal of mortality trend.

This study also confirms that source of drinking water has a significant influence on child survival. The findings revealed that children from households that make use of improved source of drinking water have a reduced risk of experiencing under-5 mortality than children drink water from non-improved sources. This study revealed that children born to older women have a lower risk dying before the age of 5 especially for those born to women aged 35 years and above. The mean age of the mother increased to 28.24 (± 2.4004) during the mortality decline period as compared to KDHS 2003 mean age of 22.15 (± 1.418) years. The results in 2003 support the u-shape of mortality with age of mother.

5.3 Conclusion

This study has established that under-5 mortality incidences in Kenya are influenced by demographic, socio-economic, and environmental factors. The evidence of greater risk of mortality associated with younger mothers, short and inadequate breastfeeding, lack of access to health facilities and use of unsafe water for drinking underscores the need to tailored interventions to address these factors. The negative effect of poor socio-economic context on child survival is expected to be severe in country like Kenya that is highly infrastructural deficient. Service providers especially in the government have corrupt practices that lead to non-availability of effective and high quality services.

Thus, the present study established an elevated risk of under-five mortality for communities that had poor socio-economic contexts, perhaps because young children are likely to be highly

vulnerable to un-favorable community contexts arising from lack of essential social services. The government should not only include policies addressing maternal factors but also environmental and socio economic interventions aimed at improved the lives of the children in societies that are deprived both socially and economically.

5.4 Recommendations for Policy

The present findings provide information for health planners and managers responsible on programs to reduce child mortality. Given the findings, a number of recommendations were made. First, the government and other stakeholders need to boost parental education on the importance of a healthy living environment and use of safe drinking water. This would control cases of water borne diseases and the related mortality. It is also very important for the government to take action to provide clean water supply to household's without piped water in order to reduce under 5 mortality. There is also need for policy makers to promote the need to marry and experienced and when in marriages to engage in later child bearing to increase mother's age at birth and help mothers gain more skills on child upbringing.

Programs should also aim at strengthening PMTCT programs owing to the fact that duration of breastfeeding is an important predictor of child mortality. Encouraging effective and extended breast feeding programs to children will greatly enhance the survival of children. Avoiding big families and delayed marriages will also substantially enhance survival chances of children during the first five years of life. Increased awareness of delivery at health facilities will also help to reduce child mortality. Improving the source of drinking water of a household will greatly influence to reduce child mortality and hence it should be provided to each and every household.

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