REGIONAL DIFFERENTIALS OF UNDER FIVE MORTALITY IN KENYA: A COMPARATIVE STUDY OF NYANZA AND CENTRAL PROVINCES

By

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DECLARATION

This is my original work and has not been presented for a degree in any other University.

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DEDICATION

This Project is dedicated to my late father, William Mwangi who did not only raise and nurture me but also taxed himself dearly over the years for my education and intellectual development. Dad, though you are gone, your words of wisdom still govern my life. My mother Agnes Mwangi, you have been a source of motivation and strength during moments of despair and discouragement. Your motherly care and support have been shown in incredible ways throughout my life. Thank you mum for raising me up. Steve, you always put a smile on my face and gave me a reason to live. You have taught me that courage does not always roar, but it is sometimes the little voice that says 'I will try again'. Thank you for being there for me.

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TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

The study aimed at carrying out a comparative analysis of the deteterminants of under- 5 mortality in Central and Nyanza Provinces. Data was obtained from the KDHS 2003. Children born during 5 years preceding the study who were the outcomes of singleton deliveries and who either survived the childhood period or not formed the universe of this study. Cox proportional hazard model was used in the analysis of this data. This method was chosen since it is ideal for modelling time -to -event data in the presence of censored cases.

Results of the proportional hazard models revealed that only birth interval was a significant determinant of under-5 mortality in both Central and Nyanza Provinces though maternal education and maternal age at birth exhibited weak association in Nyanza Province. The study recommends that there is need for enhancement of women education in Nyanza province and emphasis need to be put on the issue of unmet needs of family planning in both regions where birth interval has come out as a strong factor influencing under-5 mortality in both regions. The study also recommends that further research needs to be done in order to establish the behavioral factors that could be influencing child mortality in Nyanza and the contribution of diseases like malaria to child mortality in that Province.

ABBREVIATIONS AND ACRONYMS

CBS	Central Bureau of Statistics
DHS	Demographic and Health Survey
DALY	Disability Adjusted Life Years
IMR	Infant Mortality Rate
NMR	Neonatal Mortality Rate
IAP	Indoor Air Pollution
KDHS	Kenya Demographic and Health Survey
MDGs	Millennium Development Goals
MI	Macro International
MOH	Ministry of Health
NFHS	National Fertility and Health Survey
NCPD	National Council for Population & Development (currently NCPAD)
UN	United Nations
UNICEF	United Nations Children Education Fund
LDC	Low Developed Countries

CHAPTER ONE

GENERAL INTRODUCTION

1.1 Background

In Kenya, as in other developing countries, the changing economic, social, environment and health status make child survival such a big challenge. Child mortality is a key indicator for describing the social and economic wellbeing of a country. (UNICEF, 2006). It is regarded as indices reflecting the degree of poverty and deprivation of a population. World Health Organization defines Child mortality as the probability of a child dying between the first and fifth birthdays. (WHO, 2000)

Child survival has been a common agenda for Kenya's public health policies with re-newed attention as part of the United Nations Millennium Development Goals (MDGs) aimed at reducing child mortality by two thirds by 2015 (UNICEF, 2006). In Kenya, the trend in child mortality has been worrying. The rate of Child mortality has been increasing significantly with pronounce increase being recorded between the period mid-1980s and mid-1990s. (Bicego & Mahy, 2001). This was followed by a dramatically fall in child mortality in the late 1940s and early 1960s. Until around 1980, the under-five mortality rate fell at an annual rate of about 4 per cent per annum. As argued by Bicego and Mahy (2001), this substantial reduction could have been attributed to economic development but as Muganzi (1984) puts it, child mortality decline in most of the developing countries has been too rapid to be accounted for by economic development alone prompting the conclusion that medical technology has accounted for a large proportion of mortality reduction from exogenous factors thereby causing a shift in the mortality curve. Muganzi (1984) further states that some of the medical interventions that have contributed to the reduction of child mortality include among others;

control of malaria, TB, measles, cholera and other highly communicable diseases through immunization.

However, evidence from other studies in Bangladesh (Mohammed H., 2009), Goa India (Kamla-Raj, 2004) and other developing countries support the view that economic and social factors have made an equally important contribution in the reduction of child mortality in developing countries. Studies in Srilanka, Taiwan and Mauritius, Preston (1979), have shown that it was not only the importation of medical technology but also its equitable distribution and accessibility of the resources that helped reduce child mortality. In Kenya, along with medical technology there were measures such as provision of sanitary services including clean drinking water and sewerage systems, sufficient supply of food due to improved agriculture and increased in literacy rates especially among women. (Bicego & Mahy, 2001).

Data from the 1998 Kenya Demographic and Health Survey (,CBS MOH and Macro International, 1998) shows that, far from declining, the under-five mortality rate increased by 25 per cent from the late 1980s to the mid 1990s. The results from 2003 KDHS indicates a worse situation; with child mortality rate having increased from 110 deaths per 1000 children to 116 deaths per 1000 children (CBS, MOH and ORC Macro, 2004).

1.2 Background Information of the Study Regions

Nyanza Province

Nyanza Province of Kenya, on Lake Victoria, is one of Kenya's eight administrative Provinces. It is in the southwest corner of Kenya. Nyanza includes part of the eastern edge of Lake Victoria and is inhabited predominantly by the Luos and Bantu-speaking tribes such as Gusii, the Kuria and a few traces of Luhyas living in the province. The Province has a population of 4,392,196 (as of 1999 census) within an area of 16,162 km². The climate is

tropical humid in lake basin where fresh- water fishing is the most important economic activity. Agriculture, especially sugarcane, cotton and tea farming is also practiced in cool highlands of Nyanza where Bantu-speaking communities are concentrated (Watkins, 2000).

Nyanza Province is one of the provinces with worst child and adult survival outcomes in Kenya.(Watkins, 2000). The region is also characterized by high population mobility, high mortality, low life expectancy at birth, and wide spread poverty (Watkins, 2000). In the recent past, the region has witnessed high prevalence of malaria and HIV/AIDS (Otieno, 1992). The region has a wide range of health facility coverage with approximately 23 district hospitals, 130 health centre, 228 dispensaries, and 97 private clinics. (MOH, 2005)

Central Province

Central Province is situated on the foot hills of Mt. Kenya in the central part of Kenya. It is inhabited predominantly by the Kikuyu tribe who neighbor Embu, Mbeere and Meru tribes along Mt. Kenya. According to the 1999 Census the province had a total population of 3,724,159 inhabitants for an area of 13,191 km². (Ministry of states for provincial administration). The climate of Central Province is generally cooler than that of the rest of Kenya due to the region's relatively higher altitude. Central region being a highland area is also prone to pulmonary infections like pneumonia which is known to be a killer disease in children. The region has also not been spared by HIV/AIDS scourge with at one time Thika District recording high prevalence of HIV/AIDS infections (MOH, 2005). Central region also has a wide range of health facility coverage with 197 private clinics, 292 dispensaries, 9 district hospitals, 59 health centers and 23 nursing/maternity homes. (MOH, 2005)

1.3 Problem Statement

Child mortality is a key indicator for describing the social and economic wellbeing of a country. (UNICEF, 2006). It is regarded as indices reflecting the degree of poverty and deprivation of a population. Child survival has been a common agenda for Kenya's public health policies with re-newed attention as part of the United Nations Millennium Development Goals (MDGs) aimed at reducing child mortality by two thirds by 2015 (UNICEF, 2006). Child mortality increased from 110 deaths per 1000 children In 1998 to 116 deaths per 1000 children to 2003 (CBS, MOH and Macro International, 2004). Gloomy as the childhood mortality statistics at the national level look, the high regional variations in some of the Provinces is more perturbing. Except for neonatal Mortality, child mortality is highest in Nyanza Province; 84 per 1,000 children and lowest in Central Province; 10 per 1,000 children. (CBS MOH and Macro International, 2004). This implies that a child born in Nyanza Province is 8 times more likely to die than a child born in Central Province before he/she celebrates his fifth birthday. This worrying state of affairs has formed an appalling trend as observed in 3 consecutive Kenya Demographic Health Surveys, in spite of the introduction of national wide child survival programs like Primary Health Care (PHC), the Expanded Program on Immunization (EPI) and the Integrated Management of Childhood Illness (IMCI). According to 1998 KDHS (CBS MOH and Macro International, 1999) child mortality is highest in Nyanza Province at 73 per 1000 surviving children and lowest in Central Province at 6 per 1,000. The Provincial differentials seen here are consistent with those observed in the 1993 KDHS data where Nyanza Province was leading with child mortality rate of 76 per 1000 surviving children and Central with the lowest 11 per 1000 surviving children. This consistent high disparity among these two regions in one country is what has informed this study in a bid to find out the key predisposing factors responsible for these high disparities.

1.4 Key issues to be addressed/research questions to be asked

For the present study I intend to answer the following question:

- Do social economic, environment and demographic factors have similar effects on under-5 mortality in Nyanza and Central Province?

1.5 Objectives of the Study

1.5.1 General objective

To establish the effect of social economic, environmental and demographic factors on under-5 mortality in Nyanza and Central Provinces

1.5.2 Specific Objective

This study has three specific objectives as follows;

i. To establish whether the effect of demographic factors on under- 5mortality in Central are different from Nyanza Province

ii. To determine whether environmental factors have similar effects on under- 5 mortality in Central and Nyanza

iii. To establish whether the effects of socio-economic factors on under- 5 mortality in Nyanza are different from Central Province

1.6 Justification

Research on child mortality in Kenya is important because children experience a higher mortality compared to any other group. This results to a high contribution to the total loss of years of human life since it occurs early in life and hence robs the nation of future generation. Improvement in infant and child mortality may be necessary for triggering a decline in fertility. This will be a big boost to the Kenyan government which has been struggling to improve the standard of living that is always hampered by high population. This study aims at arriving at a better understanding of the association between socio-economic, bio-demographic and environmental factors and child mortality that could be plausible and

consistent with the available information. Such results could be more useful in prioritizing the intervention programmes so as to achieve one of the objectives of MGD. The measure of significant factors explaining regional variations is useful index in assisting the government in equitably allocation of resources. It could also determine how scarce resources could be used with a view to maximizing child health benefits.

1.7 Scope and limitations

The KDHS data are recorded retrospectively and can therefore suffer from misreporting for example a child who died at a very young age might not be reported. Several DHS studies show evidence of downward bias in reporting child deaths (Jacoby and Wang, 2003), that is, the longer the recall period, the more likely the possibility of the respondents to misreport the case. The quality of mortality estimates calculated from retrospective birth histories depends upon the completeness with which births and deaths are reported and recorded. Another limitation in this study is that despite being other factors that contribute to a child's death like injury and cultural practices, these variables were not collected in the data that was used for the study. Some of key cultural factors are food taboos and region rituals and superstitions surrounding child delivery, and treatment of childhood illness. There is also inability to account for non-measurable or un-observed proximate factors closely associated with child mortality such as genetic frailty, infections like HIV/AIDS, malnutrition, climatic and ecological conditions associated with causes of childhood illnesses. Another limitation is that KDHS data lacks information on the actual cause of death.

CHAPTER TWO: LITERATURE REVIEW

2.1 INTRODUCTION

This section is divided into 2 sub-sections; the first section will form critical review of relevant literature both in Kenya and other parts of the world and the second will highlight conceptual framework that will guide the study as well as operational framework which will be used in an effort to conceptually comprehend the underlying relationships between relevant variables and child mortality.

Death rates, especially during childhood have long been used to evaluate a country's level of socio-economic development and quality of life. Since death is the end result of a cumulative series of pathological processes, the biological status of surviving children reflects their position along the spectrum from good health to life threatening disability (Mosley & Chen, 1984). As stipulated by Magadi (2000), high Child mortality are due to high post-infant morbidity related to diarrhea, acute respiratory infections, malaria and other childhood conditions such as malnutrition and vaccine preventable diseases.

Regional Disparities

Apart from increased rates of child mortality in the country, high regional disparities have also been observed. Muganzi (1985) while explaining this immense variation argues that distribution of population by ethnic groups follows the administrative boundaries of the 8 provinces. Within these provinces, demarcations exists with varying degrees of not only climate and physical features but also unique social cultural practices that tend to differentiate one region from the other. Muganzi (1985) further argues that the present socio-economic structures are deeply entrenched in historical socio-economic, political administration of the

country by the former colonial government, not only for Africans but also among the various regions of the country. He further asserts that this imbalance has survived the post-independent era to the extent that structural evolution rather than revolution has increased mal-distribution of services and facilities especially in rural areas where more than 80% of the population live. This is especially so as regards such vital services as health, piped water, roads schools most of which were concentrated in former white occupied areas.

A similar opinion is held by Brookerhoff and Hewett (1998) who argue that the inhabitants of Central Province were the beneficiaries of economic and education entitlements bestowed by British Colonialists. Harden 1990 as cited by the similar study by Brookerhoff and Hewett, (1998) asserts that residents of Central Province traditionally also place higher cultural value on female education than their counterparts in Nyanza Province. He also argues that due to settlement by white settlers in Central Province, the population was greatly influenced by European lifestyles hence easy to break from cultural barriers. But one would argue that the government has exposed a majority of population to modern preventive child health care. But the study further shows that effective innovation and convenient access to this modern health care is critical.

Ikamari (1995) in his analysis of regional variations on infant and child mortality in Kenya; decomposing effects revealed that the variation in both infant and child mortality between the two mortality regions was largely due to the differences in the nature of structure of relationships between mortality and explanatory variables. He further argues that lower average level of maternal education, lower proportion of households with toilet sanitation and piped water supply, and higher proportion of low economic status households modestly contribute to the high child mortality in the high mortality region. Some of the provinces with high mortality rate are also noted for their prevalence of malaria and other related diseases (Muganzi, 1984). This is attributed to a number of factors such as their low-lying elevation

which allows extensive flooding from the humid tropical rainy weather and numerous irrigation rice schemes are a fertile breeding place for mosquito which leads to high incidence of malaria. But to contradict this argument one would argue that children living in central region; being a highland area are also prone to pulmonary infections like pneumonia which is known to be a killer disease. So in general one would argue that both regions are vulnerable to childhood illnesses but there could be diverse level of socio-economic status between these two regions. Otieno (1992) stipulates that part of the regional variation in child mortality could be attributed to etiology of certain diseases, processes and methods of prevention, ethnicity, genetic factors and others due to strong social cultural attachment especially in rural areas where there is little chance of change in certain norms concerning sickness, type of food to be eaten by children and general poor hygiene. Some of these factors that will guide this study are discussed here.

2.2 Socio- Economic Factors

In the analytical framework for the study of child survival in developing countries, Mosley & Chen (1984) have confirmed that there is a high si gnificant relationship between socio-economic factors and child survival. The framework further states that socio-economic determinants operate through the proximate determinants to influence the level of growth faltering and mortality. The association between socio-economic status and children's survival is normally analyzed by focusing on data on asset and basic facility ownership variables, individual level variables including level of education and income and also community level variables which include among others physical infrastructure and community ownership of resources (CBS, MOH and Macro International, 2004). Some of the socio-economic factors that will be measured in my study are discussed below.

(i) Mother's Education

Mother's skills, time and health operate directly on the proximate determinants to produce a healthy child Mosley & Chen (1984). Mother's education and working status has purposely been used in many analyses instead of father's education or father's occupation because of the fact that mothers are known and considered to be the first provider of health care when needed (Madise & Zulu, 1999). Ikamari (1995) asserts that due to innate feelings of care for her children, mother's behaviour in seeking and providing health care to her sick children may be an important determinant of child survival. He further argues that such behavior may vary from an uneducated mother to an educated mother and also by her working status.

According to Wang (2003) in his study on determinants of child mortality in developing countries, the elements that determine the productivity of household members are skills (typically measured by education level). He further argues that because of her responsibility for her own care during pregnancy and care for her child throughout the most vulnerable stage of its life, her education level can affect child survival by influencing her choices and increasing her skills in health care practices related to contraceptive, nutrition, general hygiene, preventive care and disease treatment. Though mothers' education may influence the kind of job she takes up and limit the amount of time she spends with the child, a wealth family may hire a skilled and attentive maid. (Banda & Shastri, 1990).

A second presumption, proposed by Bicego and Mahy (2001), hypothesizes that Particular education induced behaviours are the underlying factors of the maternal education-child survival link. For instance, they argue that a mother with higher levels of education is more inclined to utilize health services than those with no education. A similar sentiment is put forward by Hobcraft (1999) who stipulates that education may have a modest effect on health knowledge and beliefs, but a pronounced effect on the propensity to use modern medical facilities, and adopt modern health practices, because of a closer social identification with the modern world, greater confidence at handling bureaucracies or a more innovative attitude to

life among women who have some experience of school. Similar findings are in a study carried out in on best covariates of infant and child mortality in Philippines (Cabigon 2005). The study indicates that for every one-year increase in maternal education, the likelihood of mothers seeking services for child health care increases by four percent.

However other studies seem to challenge these presumptions. Shyam and Norman, (1999) in the study of Infant and Child Mortality in Nepal East-West asserts that if health care were accessible to both educated and uneducated mothers, it would be assumed that the uneducated mothers would take advantage of these services. Therefore, the difference in child health and survival between educated and uneducated mothers would be smaller in comparison to an area in which there is not access to health care services. The study further indicates that the weight of maternal education comes in disease identification and the effort to seek out health care while uneducated mothers may not be aware of where to seek health care. Therefore, differentials would, subsequently, be greater in areas of less access to health services.

The significance of maternal education can be seen even in rural and urban differential in access to health services. However, Cameron and Mellington (1999) in the study of comparison of rural and urban residents of Indonesia, postulates that primary and secondary education significantly reduces child mortality rates in both environments. A recent study on demographic and environmental factors on child mortality in Bangladesh, Mohamed (2009) shows that, the risk of child morbidity and mortality decreases as the mother's level of education increases. The study assumes that maternal education inculcates modern health knowledge, beliefs and practices which improve the effectiveness of health behavior (feeding practices, child care etc.) and the mother's education is largely related to the health status of the children aged under-five. When background variables such as residence, poverty status,

mother's work status, sex, and age of the child are taken into account, the mother's education continues to be a powerful, positive, and significant predictor of the child health status in Bangladesh. Poor women who are often the uneducated ones are less likely to report sickness. (Mohamed, 2009)

From the estimates of child survival estimates for 1969, 1979 census, Otieno (1986) stipulates that there is an increase in life expectancy for the children whose mothers have education over those whose mothers have no education. He further observes that there is possibility that the children of mothers with primary education will live approximately six years over those of mothers without education in 1979. Those whose mothers have secondary education and above have 8.6 years over those whose mothers have primary education and 14.63 years over those whose mothers are without education. Another study carried out in India using mortality data in Goa India, Kamla (2004), showed a strong association between mother's education and survival rate of children during infancy. The analysis shows that a child of a woman educated up to primary level the chances of survival increased to 2.6 percent over that of the children of illiterate mothers. The analysis further shows that as the education of the mother increases, the probability of dying also decreases considerably and the association becomes even stronger when maternal age of the mother is controlled.

The study on relationship between Maternal Education and Infant Mortality in sub-Saharan Africa carried out using micro-level data from 18 countries from sub-Saharan Africa, Masinde and Zulu et al (1999), indicates that maternal education is significant in 10 of the 18 African countries and that the strongest differences in the probability of dying are observed between children of mothers with no education and those of mothers with secondary or higher education. Significant differences in mortality risks between primary and 'no' education are

observed in Niger, Togo, and Zambia only, where the primary group has about 8-10 per cent lower risks than the 'no' education group. The study further indicates that the mortality risks of Mozambican infants born to women who had primary education were about 17 percent higher than those of infants whose mothers had no education showing that primary education only may not be enough to benefit these children. Infants of mothers with secondary or higher education have about 26-28 per cent lower risks of dying compared with infants whose mothers had no formal education.

Another study examining child malnutrition in developing countries Smith and Haddad (2000) found that significantly elevated risks of neonatal mortality are associated with low levels of maternal education However, after controlling for economic status, only five of the seventeen countries were statistically significant. In contrast, post neonatal mortality figures were found to be twice as sensitive to maternal education as neonatal mortality rates. Stunting and under-weight status in children were found to be even more highly correlated with maternal education than mortality rates. In terms of non-use of health services, namely non-use of tetanus toxiod during pregnancy and non-use of antenatal services, this study found that even after controlling for economic status, the link between low levels of maternal education and non-use of health services remained strong. For instance, non-use of tetanus toxoid during pregnancy is roughly twice as likely in children of non-educated mothers as those possessing secondary education levels.

(ii) Wealth index

In low-income countries, because of the difficulty in measuring the income of the households, the wealth index is believed to be a good proxy for measuring the economic status of households (Mutunga, 2004). Wealth index is based on household ownership of material possessions such as radio, television, telephone, bicycle/scooter and car/track. It also includes the housing quality, whether the house has electricity, a finished floor and a permanent roof, that is, corrugated iron or tiles (Hill & Amouzou, 2001). Those in the high wealth index are

expected to experience the lowest fatalities of their children (Hill & Amouzou, 2001). The relationship between economic resources and child health is well documented. Heaton & Amoateng (2007), argue that families of higher socio-economic status are able to provide better healthcare for their children. They further assert that families with higher income can more easily spend money on warm clothing during cold seasons and nutritious foods especially for infants and children. Delamonica & Munijin, (2004),state that socio-economic status is also tied to basic services like information assets like TV's and Radios and amenities such as proper sanitation facilities for disposal of human waste, clean water and pollution free type of cooking fuel which are critical to children's health. They further assert that assets such as radios and TVs are important since they help in diffusion of advance knowledge and modern medical technology on child care

A study carried in Bangladesh on immunization coverage, Kabir and Halder (2007) shows Strong household wealth differences in vaccination coverage among children positively related to wealth. The study indicates that Children in the poorest quintile were least likely to have been fully vaccinated (the richest/poorest ratio was 1.56) compared to other quintiles and the percentage of children never vaccinated and partially vaccinated was highest among children in the poorest quintile. While 12% of children in the poorest quintile had never been vaccinated, this was true for only1% in the richest quintile. In addition, the rate of full vaccination was highest (87%) among children in the richest quintile compared to any other quintile. A chi-square test for the same study for trend showed a significant difference between the poor and the rich in terms of vaccination coverage as a whole in Bangladesh.

In India, (Chandrase, 1972) observes that the monthly income of the father and the mother (if she is earning) conditions the nature of the housing, medical attention, type of cooking fuel,

sanitation and type of drinking water and to a larger extent type of health services to seek. He further observes that the poor live in blighted or slum areas where the city administrators spend the least on amenities such as roads, clean water, sanitation facilities and drainage.

However, contradicting findings have emerged on relationship between economic status and infant mortality in particular. Mustafa et.al (2008) in their analysis of determinants of infant mortality in Kenya observed an inconsistent relationship between economic status (measured by wealth index) and infant mortality. While poorest households had the highest IMR; richest ones had higher IMR level than richer people. Rodgers (1980) found a weak but positive association between household annual per capital income and child survival to age 3 in Kenya. Children born to richer households have been found to experience a lower risk of death than children from poor households. Casterline et.al (1989), as quoted by Mustafa et.al (2008) observed that Egypt household income had no significant effect on infant mortality but had a statically significant effect on child mortality. This has been explained by some studies. As quoted by Mustafa et.al (2008), Doctor, (2004) in his study on infant mortality in Malawi, suggested that the excess child mortality in rich households might be attributed to the high AIDS related mortality in these households. (DeRose & Kulkarni, 2005) have argued that the significant is high on child mortality because resources become more important as children make the transition from breastfeeding to the adult diet.

(iv) Maternal Work Status

Another variable which is taken as predictor variable of the child mortality is Mother's Labour Force participation. Women's work participation has been shown to have both positive and negative effects on child mortality. It is hypothesized that working women especially the ones who go out for work devote less time to the rearing of their children and

thus expose them to a greater risk of sickness and death. (Frans, Jona and Aart, 2002). A study examining differentials of Infant and Child Mortality in Pakistan, Afzal, Tariq and Ali (1989) shows that child mortality is higher among working than non working mothers. The same study indicates that child mortality is considerably higher among rural working than urban working mothers. Possibly it is because of the fact that in rural areas, majority of women work as family helpers on fields and hence they do not have cash at hand to provide better health care to their sick children.

An urban-rural comparison indicates that such differentials are conspicuous in rural areas. The possible explanation of this association may be sought in the fact that in Pakistan, a majority of women workforce starts working after marriage and only a few of the women are in white collar jobs (Mencher, 1988). The majority enters into unskilled jobs or work in the fields as family helpers. These working women devote less time to the rearing of their children and thus expose them to a greater risk of ill-health. The findings of the study further shows that in rural areas, a majority of women work as unpaid family helper on fields, are financially on leash and hence are constrained to provide better health care to their children.

A report by U.N. (1985a) as cited by Basu and Basu (1991) in a multivariate analysis of data sets from 16 developing countries on socio-economic differentials in child mortality found that the negative relationship between maternal employment and child survival was maintained even after controlling for possible confounding factors such as maternal education, urban-rural residence, mother's marital status and paternal occupation, the last two as proxies for economic level. Similarly, using aggregate data from the Registrar General of India's (1981) survey of infant and child mortality, Beenstock and Sturdy (1990) concluded that, controlling for other socio-economic factors, the relative probability of infants dying was

27 per cent higher for working than non-working mothers. They further assert that the difference would probably have been even more striking for child mortality. The same remarks apply to the multivariate analysis of Lesotho data by Banda, Lesetedi and Shastri (1990) which concluded that working women were 1.2 times more likely to experience an infant death than non-working women.

However other studies seem to contradict this negative effect of child mortality and maternal work status According to U.N. (1985a) as cited by Basu and Basu (1991), the study found that in some African countries, notably Ghana, Kenya, Liberia and Nigeria, working women had lower child mortality than non-working women. Basu and Basu (1991) continue to argue that there is also likely to be a positive association between women's employment and access to knowledge about better childbearing and childrearing practices, as well as a greater confidence and freedom in translating this knowledge into behaviour. This certainly seems to be true in the case of fertility-regulating. As Mencher (1988) has illustrated with data from villages in Tamil, it is not just the fact of more money coming to the household that counts; what seems to matter is who brings in the extra money: with total household income remaining the same, a larger proportion of it seems to be spent on child welfare if the wife is working. That is, women's wages have a higher probability of being used for household (especially child) welfare than equivalent incomes earned by men. With data from Panama, Tucker and Sanjur (1988) as cited by Basu and Basu (1991) too concluded that maternal employment had a positive impact on children's dietary intakes. Kishor and Parasuraman (1998), in the analysis poverty and child mortality in Pakistan, found out that those women who were employed took significantly greater responsibility for deciding on matters such as expenditure on food and clothing, what to cook and how to treat a sick child.

2.3 Environmental Factors

Living conditions, especially water supply and sanitary conditions and source of cooking fuel directly affect contamination of the household environment and thus may facilitate the dissemination and incidence of various infectious diseases, particularly diarrhoea (Kabir & Amin, 2000). Mutunga (2004) argues that the likelihood of contracting certain diseases and the persistence of those diseases are directly associated with the material conditions of life in which the child is born. He further asserts that adequate housing, safe drinking water within the dwelling and good sanitary facilities favour the creation of a hygienic environment, which helps to prevent disease and enables the child to survive. According to a report released by World Bank (2004), in the least developed countries, one in every five children do not live to see their fifth birthday, mostly because of avoidable environmental threats to health. This translates into approximately 11 million avoidable childhood deaths each year. The report further indicates that environmental health threats, arguably the most serious environmental health threats facing the world's population today, stem mostly from traditional problems long solved in the wealthier countries, such as a lack of clean water, sanitation, adequate housing, and protection from mosquitoes and other insect and animal disease vectors. Many in these countries live in situations that imperil their health through steady exposure to biological pathogens in the immediate environment. Some of these environmental variables to be tested in this study are discussed below.

(i) Access to clean drinking water and Sanitation

Child mortality rates are indeed substantially lower in households that have access to clean water. This sentiment has been supported by several studies. For instant, a research study in Nepal by Norman and Shyam (1999) by examining Nepal Fertility survey data shows that probability of dying among infant was 44 percent higher for those drinking lake or river water

than those using piped or tube well water. Bhargava (2003) using data from Uttar Pradesh found out that access to clean water facilities significantly reduces infant mortality. The marginal reduction in child mortality of having a sanitation facility is about 8 children out of 1000 live born children. However some studies show that access to piped water alone is not a sufficient condition for improving a child's health status. In Malawi, Baker (1999) observes that owning a pit latrine does not have a significant effect on child mortality (which is explained by the argument that just because a household has sanitation facilities does not mean that it will be used hygienically or by all members of the household), but Mutunga (2007) observes that that the source of drinking water and sanitation facilities are strong predictors of infant mortality. Duration modeling applied by Hala, as quoted by (Mutunga, 2000) to assess the impacts of water and sanitation on child mortality in Egypt, shows that access to municipal water decreases the risk and sanitation is found to have a more pronounced impact on mortality than water. Jacoby and Wang (2003) examining the linkages between child mortality household environment in rural China found that access to safe water and sanitation reduces child mortality by about 34% in rural areas They further argue that Children born in households with either flush toilets or pit latrines have lower mortality rate than those born in households without any toilet facility.

(ii) Type of cooking fuel

A report by World Health Organization (WHO, 2005) indicates that globally, almost 3 billion people rely on biomass fuels (wood, charcoal, crop residues and dung) and coal as their primary source of domestic energy. Biomass fuels have been associated with Indoor Air Pollution (IAP), which is a major, risk factor accounting for 4% of the global burden of disease measured by Disability Adjusted Life Years (DALYs). The report further states that in developing countries 28% of deaths in children under 5 years of age are associated with Acute Respiratory Infections (ARI). Indoor exposures are of greater concern because concentrations

are often much higher and greater time is spent indoors by vulnerable population sub-groups, including young children. Exposure to IAP from the combustion of solid fuels is a predisposing factor contributing to morbidity and mortality in developing countries and the worst levels of exposure are closely associated with the poorest households.

Inside the smoky dwellings of developing countries, air pollution is often higher than outdoors in the world's most congested cities (WHO, 2005). A research study done in Mewat region of Haryana, Jatrana S. (2001) revealed that the type of cooking fuel significantly affects child survival. Jacoby and Wang (2003) in the analysis of environmental determinants of child mortality in rural China observed that house- hold environmental facilities affect infant survival significantly. A similar sentiment is echoed by Prakasam and Benarjil (2005) in the analysis of India's NFHS-1 data. The data shows that persons living in households that primarily use biomass for cooking fuel have a considerably higher prevalence of active tuberculosis than persons living in households that use clean fuels. This effect is reduced when there is availability of a separate kitchen, but the study indicates that whether the household has a separate kitchen for cooking or not, child mortality rates are lower if the household uses clean cooking fuels instead of wood, crop residues or dung cakes.

With regard to the source of cooking fuel, children born in households using high polluting fuels as their main source of cooking fuel have higher mortality rates as compared to those using low polluting fuels. Higher incidence of respiratory infections which are responsible for child deaths is expected in households which use 'dirty' fuels as opposed to those using clean cooking fuels (Mutunga 2000). The results from data obtained from eighty households in a rural community in Ecuador based on their use of biomass fuel and questioned regarding a history of infant mortality and children's respiratory symptoms Seppo , Edgar , Mikael ,

Joshua and Larry ((2007) showed a significant trend for higher infant mortality among households that cooked with a greater proportion of biomass fuel (P _ 0.008). Similar trends were noted for history of cough (P _ 0.02) and earache (P < 0.001) among children living in these households. The results suggest that exposure to cooking and heating smoke from polluting fuels is significantly associated with 1–59 month mortality, after controlling for mother's age at birth, water source, asset index and household crowdedness (RR=1.95; 95% CI=1.04, 3.68) (Wichmann and Voyi, 2006).

2.4 Bio-Demographic Factors

(i) Mother's age at birth

Age of the mother at child birth has been found to be highly associated with child survival. According to UNICEF, (2006) Children born to mothers under 20 or over 35 years old are likely to have elevated risks of mortality. Pandey et al, (1998) asserts that very young mothers may experience difficult pregnancies and deliveries because of their physical immaturity. They are also likely to have limited knowledge and confidence in caring for their infants and young children. Jantrana (2001) in a study in India found that children born to young mothers (less than 20years) were 3 times more likely to die than as children born to mothers over 20years. In his analysis, Ikamari (1996) argues that young mothers are unable to get enough food for their children since they may have little influence on allocation of household resources.

This could be common in rural areas where young married women live with their mother in-laws and it takes time for them to be allocated a farming space. The other thing is that babies born to young are unwanted or unplanned. These children are either neglected or are dumped at the villages where they are taken care of by old grandmothers. The 2003 KDHS found that

the relationship between mother's age at birth and childhood mortality shows the expected U-shaped pattern, with children of youngest and oldest mothers experiencing the highest risk of death. K'Oyugi (1992) in his analysis categorized non prime ages (>20 and 35+) and prime ages (20-32yrs). He observed that children born to mothers in their non prime ages have relatively higher mortality in all the age intervals as was expected. According to a study on 29 developing countries, UN (1994), the data indicates a clear excess risk of child mortality associated with the mother being under age 18 at time of birth. All but one of the log odds estimates were positive at ($P<0.001$)

(ii) Birth Order

For social and biological reasons, both infant and child mortality often exhibit a U-shaped pattern with respect to maternal age and birth order. Parity also exhibited a higher neonatal and infant mortality at extremes of birth order (Anker, et.al. 1988). Anker further argues that while there is also a biological reason for this relationship, economic factors may also contribute to this relationship since larger family may put strains on family resources. Greater number of children in the household increases contagion of infectious diseases and greater competition for resources and child care within the household (Da Vanzo, et.al., 1983). In a study conducted in India (Ramji, 2001). The NMR was lowest for birth orders 3 (26.8) compared to birth orders 1 (34.3) and 6+ (47.9). Similarly, IMR was lowest with birth order 3 (42.5) compared to 1 (48.1) and 6+ (75.4). Relationship between this variable and child mortality has been explained through maternal depletion hypothesis. Sibling competition, impaired lactation as a result of poor health and nutrition status of the mother as well as lack of time to attend all the children (Ikamari, 1986).

(iii) Marital Status

Several studies have reported higher mortality rates for out of wedlock children compared to children of married women (UN, 1999). Marriage ensures a sense of security and social support for women which is likely to be associated with better infant and child health. High infant and child mortality may be attributed to majority of them being teenage mothers and to women without previous births as well as lack of social and economic support. (Defo, 1996). A study carried out to establish regional differences in childhood mortality in Sub-Saharan African countries, Antonia et, al (2003) indicates that children living with both parents in Tanzania are at lower risk of dying than other children. The argument according to this study is that children living with the two parents may benefit from extra care of both parents. Alternatively couples may benefit from economies of scales for child care as well as in expenditures.

(iv) Birth interval

The length of a child's previous birth interval is an extremely strong predictor of infant and child mortality. (Mosley & Chen, 2004). Mohamed (2008), found a substantial reduction in mortality at all ages up to five years associated with extending the previous birth interval from beyond 24 months to beyond 36 months, and even more so, to beyond 48 months. He further points out that this short preceding birth interval significantly influences the neonatal mortality of index child. He observed that neonatal mortality risk of index child is 74% more for preceding birth interval within 12 months and 35% more for preceding birth interval 13 – 24 months than that of longer preceding birth interval (24+ months). This as he argues may be due to maternal depletion. Post neonatal and childhood mortality is also significantly influenced by shorter preceding birth interval. Several studies report this pattern. Birth interval was observed to be indirectly proportional to infant and child mortality rates in the same study in India (Ramji, 2001), at birth intervals of < 24 months the NMR was 71.7 and

IMR was 109.5. However, when birth interval increased beyond 48 months NMR declined to 24.1 and IMR to 38.5.

According to KDHS 2003, (NCPD, CBS and Macro International, 2004), data shows that Under 5 mortality rate was 182 per 1000 for children born less that 2 years after the last sibling while it was 83 per 1000 for the children born at least 4 or more years after the last child. This is also supported in the analysis of Kenya Fertility Survey Data (UN, 1986) as quoted by K'Oyugi (1992). The study shows significant of birth intervals and child mortality even after adjusting for factors such as parents' occupation, mother's education and religion. Rusterin (1983) as quoted by K'Oyugi (1992) using data from 29 developing countries also found that children born after short birth intervals were much more likely to perish in all ages between 5 years than children born after normal length of time in almost all countries analyzed. A longitudinal study conducted in Machakos Kenya by Richard, et.al (1991) as cited by Njagi (2007) shows that the probability of having child death increases proportionate to the number of other under 5 children that a mother has. The early arrival of an infant necessitates the premature weaning of the index child exposing the weaned child to malnutrition and increase probability of contracting infectious and parasitic diseases due to lack of attention from the mother (Palloni and Milman, 1986)

2.5 Summary of Literature

From the literature it is clear that there is association between child mortality and bio-demographic, socio-economic and socio-cultural factors. Maternal education, age at first birth and birth order has been shown to be highly correlated with child mortality. However with various contradicting findings on significance of the discussed variables, it is clear that there still exist gaps as to which single variable can be directly attributed to child mortality. There is general consensus in the literature that a household's socio-economic status largely

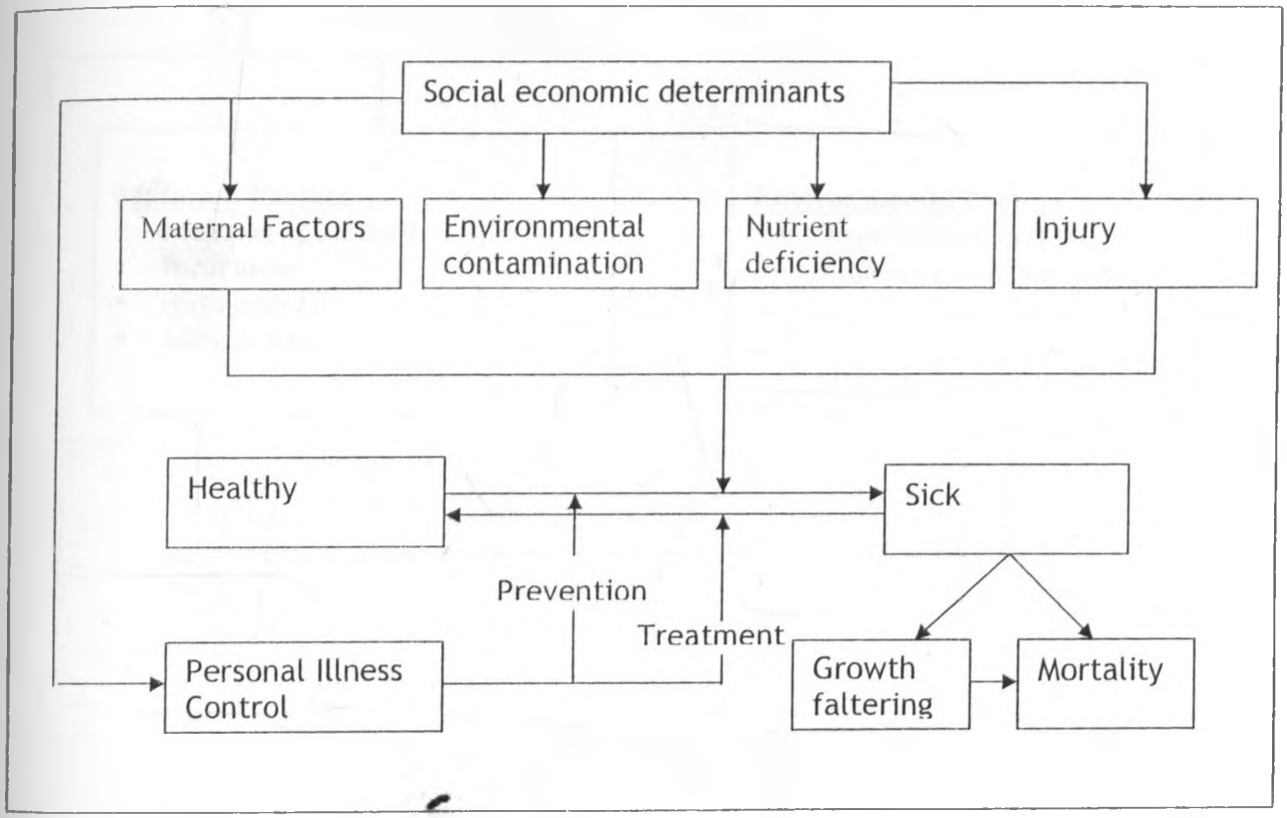
influences child survival. This is true for studies which employ both direct and indirect techniques to estimate infant and child mortality. As observed in most studies, a household's income has a significant effect on the survival prospects of children. Higher mortality rates are experienced in low income households as opposed to their affluent counterparts. 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.

As concerning the demographic variables, the patterns of mortality by maternal age and birth order are 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.

2.6.1 Description of Theoretical Framework

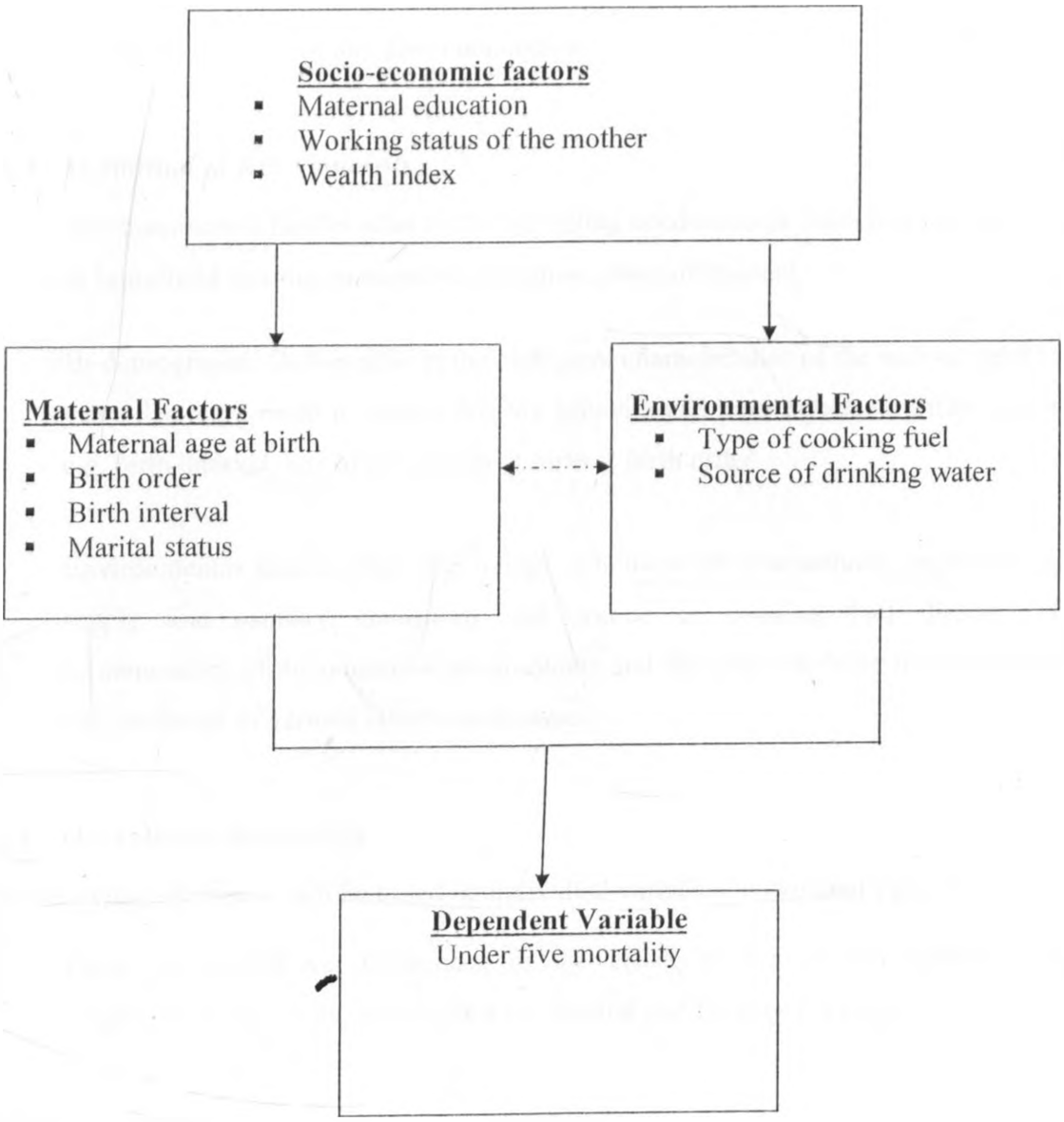
This study was based on a broad theoretical model postulated by Mosley & Chen (1984) which recognizes the fact that the socio-economic determinants operate through some biological mechanisms (intermediate variables) to produce the levels and patterns of child mortality observed in any given population. The model was chosen because it is the most popular and widely adopted model in child survival studies. This framework guided the analysis. See figure 1 below. Independent variables used to test the operational hypothesis were used to design Operational framework as shown in figure 2. However, due to limitation of the data being used, variables under injury as stipulated by Mosley and Chen were not tested.

Figure 1: Conceptual Framework for Child Survival in developing countries



Source: Henry Mosley & Lincoln Chen (1984). Population and development review, a Supplement of volume 10:29

Figure 2: Operational Framework



Adapted from Henry Mosley & Lincoln Chen (1984).

2.6.2 Conceptual Hypotheses

- Socio-economic factors and environmental factors operate through some biological mechanisms (intermediate variables) to produce the levels and patterns of child mortality observed in any given population.

2.6.3 Definition of Key Concepts

- Socio-economic factors refer to the prevailing conditions of collective relevance, such as household income, occupation education, place of resident,

- Bi-demographic factors refer to the biological characteristics of the women aged 15-49 years that are a result of certain fertility behavior and have effects on infant mortality,. e.g. birth interval, age of the mother at birth & birth order.

- Environmental factors refer the living conditions of a household especially water supply and sanitary conditions and source of cooking fuel directly affect contamination of the household environment and thus may facilitate the dissemination and incidence of various infectious diseases.

2.6.4 Operational Hypothesis

The following hypothesis will be based on individual variables/ contextual variables.

- There are significant differences in the effect of the various variables under consideration across the two regions i.e. Central and Nyanza Provinces

Table 1: Definition of the key Variables and measurement

VARIABLE	DEFINATION	MEASUREMENT (1= the reference category)	TYPE OF VARIABLE
Under five mortality	This will be the dependent variable which indicates whether the event occurred or was censored	0=censored 1=failure	Dependent
Maternal education:	Represents the highest level of formal schooling attained by the mother. Will be in 4 categories; no education, primary education secondary and higher	1=No/ prep school 2=Primary school 3=secondary+	Independent
work status of the mother	Refers to whether the mother was working during the time of the survey. It can be used as a proxy to household economic status	1=Not working 2=Working	Independent
Mother's age at birth	This variable is used as a proxy for mother's physiological, mental and emotional maturity and her experience in child care and rearing skills.	1=<20 years **(RC)** 2=20 years+	Independent
Birth order	Refers to the ordinal position in which the infant was born within the family. they will be put into 3 categories	1=1-2 children 2=3-4 children 3=5+	Independent
Birth Interval	Refers to the length of time in months between two successive live births. They are coded as less than 24 and 24+.	1= <24 months 2=24+	Independent
Wealth index	It refers to the respondents' household assets, amenities, and services. It will be classified as low index, , middle and high	1= Low 2= Middle 3=High	Independent
Source of drinking water	It represents the kind of source of water for the household. It will be measured as dummy with 2 categories. In this study, households with access to private or public tap water, as well as covered well water are considered to have safe water. those with streams, rivers and borehole water are considered as not having safe drinking water	1=safe drinking water 2=unsafe drinking water	Independent
Type of cooking fuel	Refers to the main source of cooking fuel which is categorized thus. Households using liquefied petroleum gas (LPG), electricity, kerosene and biogas are considered users of low-polluting fuels. Those using charcoal, firewood and coal are regarded as users of high-polluting fuels	1= high polluting fuels 2= low polluting fuels	Independent
Marital status	Refers to the state of union that persons were involved in at the time of the interview. 2 categories will be included in this study; Not in a union and in a union	1=Not in a union 2=in a union	Independent

CHAPTER THREE: STUDY DESIGN AND METHODOLOGY

3.1 Data Source

The study utilized data from 2003 Kenya Demographic & Health Survey. This was a nationally representative sample survey of 8,195 women age 15-49 with a response rate of 94% (91.1% in urban and 95.5% in rural areas and 3578 men age 15-49 selected from 400 sample points(clusters) throughout Kenya. The survey selected 9865 households in which 3423 were in urban area and 6442 were in rural area. In Central Province, a sample size of 1314 female respondents aged 15-49 years was interviewed. Out of these 202 were in urban areas and 1112 in rural areas. In Nyanza Province 1025 female respondents aged 15-49 years were interviewed with 243 being in urban areas and 791 in rural areas. Children born during five year preceding the survey who were the outcomes of singleton deliveries and who either survived the childhood period or not formed the universe of this study. Of 5449 children thus identified 3225 were infants and the remaining 4225 were children aged 1-5 years. Central Province had 730 children aged 0-59 months. Out of these, 33 had died. Nyanza had 792 children aged 0-59months. Out of these 114 had died. Central represented low mortality region and Nyanza represented high mortality region

3.1.2 Quality of Data

The most serious data quality problem is the selective omission of the birth histories of those who did not survive, which can lead to underestimation of mortality rates. Other potential problems include displacement of birth dates, which may cause a distortion of mortality trends, and misreporting of the age at death, which may distort the age pattern of mortality. When selective omission of childhood death occurs, it is usually most severe for deaths in early infancy. If early neonatal deaths are selectively underreported, the result is an unusually

low ratio of deaths occurring within seven days to all neonatal deaths, and an unusually low ratio of neonatal to infant deaths. Underreporting of early infant deaths is most commonly observed for births that occurred long before the survey. An examination of the ratios shows no significant number of deaths omitted in the 2003 KDHS.

3.2 Method of Analysis

This study is an analytical cross-sectional study through secondary data analysis of the 2003 Kenyan Demographic and Health Survey (KDHS) dataset for children. Cox Proportional hazard model was used in analysis of data in this study. This is a log-linear regression in which the conditional probability of dying during a given age interval is assumed to differ between individuals with different socio-economic or demographic characteristics. It was first proposed by Cox in 1972 and later described in length by Trussel & Hammerslough (1983). The Cox regression procedure is a technique for the analysis of 'survival data', that is, data that measures the time until a certain event happens; in the present study the time until a death occurs. The model blends the merits of both life table and regression techniques. Unlike the traditional life-table analysis, in which the conditional probability of dying during a given age interval is assumed to be the same for all individuals, proportional hazards models allow for the possibility that the hazard rate of an event (death) may differ between individuals with different socio-economic or demographic characteristics. Moreover since proportional hazard model is 'nonparametric in the sense that it involves an unspecified function in the form of an arbitrary baseline hazard function, this model is more flexible (kalbfleisch and Prentice, 1980). The model can be described as follows:

$$\lambda(t; z) = \lambda_o(t)e^{(\beta_1 z_1 + \beta_2 z_2 + \ldots\ldots\ldots\ldots\ldots\ldots \beta_k z_k)} = \lambda o\ (t)e^{(\beta z)}$$

Where:

$\lambda(t; z)$ representing the hazard function at time t for an individual with K (number) independent variables (z's) which may be either discrete or continuous.

β is a vector of coefficients related to specific independent variables to be estimated (e.g. mother's education, parity e.t.c)

$e\beta$ represents the risk of dying associated with each covariate, relative to the risk for the reference category

$\lambda_0(t)$ is an arbitrary, unspecified baseline hazard function. The baseline hazard function is defined when all independent covariates in a proportional hazard model take a value of zero. This is similar to a constant in an ordinary least-square regression analysis except that $\lambda_0(t)$ takes a different value at each time t. for instance, in this study the hazard function refers to the probability of an infant's death at each point in time t between his or her first and 5 year of life with K independent covariate z

CHAPTER FOUR:

DETERMINANTS OF UNDER FIVE MORTALITY

4.1 Introduction

This chapter presents the results of the factors influencing the under five mortality in Nyanza and Central Provinces using the 2003 KDHS. Children 5 years and below who were born five years preceding the survey, who were the outcomes of singleton deliveries and who either survived the childhood period or not, formed the universe of the study population. The analysis and interpretations are based on a sample population of 1522 children who were 5 years and below, 730 of whom were from Central Province and 792 from Nyanza Province. Of the 730 children from Central province, 33 had died while 142 had died in Nyanza. For the purpose of this study, Central Province represents a low mortality region whereas Nyanza Province represents a high mortality region.

In order to achieve the study objectives a conceptual framework postulated by Mosley & Chen (1984) which recognizes the fact that the socio-economic determinants operate through some biological mechanisms (intermediate variables) to produce the levels and patterns of child mortality observed in any given population was employed. The appropriate variables from KDHS 2003 were sought in order to carry out the necessary analysis. Variables were then recoded and computed as required. For socio-economic factors, the variables used were; maternal education, working status of the mother and wealth index. Some of the selected bio-demographic were; parity, maternal age at birth, birth interval and marital status. While selected environmental factors were the source of drinking water and the type of cooking fuel.

Table 4.1. Distribution of the study population by background variables for both Central and Nyanza Provinces

	Central		Nyanza	
Variable	**Frequency**	**Percentage**	**Frequency**	**Percentage**
Under five Mortality				
0=Alive	697	95.5	650	82.1
1=Dead	33	4.5	142	17.9
Maternal education				
1=No/pre-school	7	1.0	42	5.3
2=Primary school	490	67.1	560	70.7
3=secondary +	233	31.9	190	24.0
Work status of the mother	221	30.4	160	20.3
1=Not working	507	69.6	630	79.7
2=Working				
Birth Order				
1=1-2 children	390	53.5	345	43.5
2=3-4 children	209	28.6	200	25.3
3=5+	131	17.9	247	31.2
Birth Interval				
1< 24 months	76	10.4	149	18.8
2=24 Months+	423	57.9	454	57.3
3=First borns	231	31.6	189	23.9
Wealth Index				
1= Low	123	16.8	435	54.9
2= Medium	224	30.7	121	15.3
3= High	383	52.5	236	29.8
Source of Drinking water				
1=Unsafe drinking water	362	51.0	473	63.0
2=Safe drinking water	348	49.0	278	37.0
Type of cooking fuel				
1= high polluting fuels	608	85.6	732	97.5
2= low polluting fuels	102	14.4	19	2.5
Maternal age at birth				
1=<20 years	106	14.5	185	23.4
2=20 years+	624	85.5	607	76.6
Marital status				
1= Not in union	149	20.4	121	15.3
2=in a union/marriage	581	79.6	671	84.7

SOURCE: Computed from 2003 KDHS

4.2 Basic Characteristics of the Study Population

Table 4.1 provides the summary of statistics of children who were 5 years and below in Nyanza Province and Central Province by background characteristics. Majority of children were born to mothers with limited level of education. This situation is similar in both regions with more than half (67.1 and 70.7 per cent) of the children having been born to women who had primary education in Central and Nyanza Provinces respectively. However there was a slight variation in education attainment in both regions. 31 percent of children in Central Province were born to women with secondary education while in Nyanza only 24 percent of children were born to women with secondary education and above. 5.3 per cent and 1 percent of children were born to mothers with no education in Nyanza and Central respectively. More than half (69.5 and 79.5 percent) of the children were born to women who were working in Central and Nyanza Province respectively.

Economic endowment is believed to be a factor to child survival. High disparities were witnessed across the two regions of study. Pertaining household economic strengths which is measured in terms of wealth index, 18.6 percent of children in Central Province were born to women from households in low quintile while in Nyanza Province, 55 percent of the children were born to women in the low quintile. Further implied to this in general, majority of the study population in Central Province fall within high wealth index (53 %), however, in Nyanza Province majority of the study population fall within low wealth index (55 %).

A great number of children were born within a birth interval of 24 months and above with Central and Nyanza recording 46 percent and 51 percent respectively. It is also worth noting that only a small proportion of children in Central Province (17.9%) were in birth order 5 and above while in Nyanza Province 31.2 percent of under-5 were in birth order 5 and above. Still

on demographic variables, a large proportion of under-5 were born to women who were 20 years and above during the birth of the index child. In Nyanza Province, the figure stood at 76.6 percent while in Central Province it was 85.5 percent.

Environmental factors did not exhibit much variation between the two regions. Majority of the households in Nyanza and Central obtained their drinking water from unsafe sources; 63 and 51 percent respectively. The situation is similar for type of cooking fuel. Majority of the households in both Central and Nyanza were users of high polluting fuel with Central having 85.6 percent of under-five born in household holds using high polluting fuels and 97.5 percent in Nyanza

Table 4.2 Distribution of children's deaths by Covariates used in the under-5 mortality analysis in Central and Nyanza

Characteristic	CENTRAL PROVINCE			NYANZA PROVINCE		
	Survival status		Total	Survival status		Total
	% alive	% dead		% alive	% dead	
Maternal age at birth						
1=<20 years	96.2	3.8	106	84.9	15.1	185
2=20 years+	95.4	4.6	624	85.8	14.2	607
X^2 = 0.160 Sig.=0.689 (CP)						
X^2 = 0.108 Sig =0.743						
Marital Status						
1=Not in a union	95.3	4.7	149	86.0	14.0	121
2=In a marriage/union	95.5	4.5	581	85.5	14.5	671
X^2 =0.013 Sig.=0.907 (CP)						
X^2 =0.014 Sig.=0.907						
Source of drinking water						
1=Unsafe source	94.5	5.5	362	87.3	12.7	473
2=Safe source	96.8	3.2	348	83.8	16.2	287
X^2 =2.375 Sig.= 0.123 (CP)						
X^2 =1.786 Sig.= 0.181						
Type of cooking fuel						
1= high polluting fuels	95.6	4.4	608	86.2	13.8	732
2= low polluting fuels	96.1	3.9	102	78.9	21.1	19
X^2 =0.056 Sig.=0.812 (CP)						
X^2 =0.810 sig.=0.368						
Birth Order						
1= first	95.9	4.1	390	88.1	11.9	345
2=3-4	94.7	5.3	209	84.0	16.0	200
3=5+	95.4	4.6	131	83.4	16.6	247
X^2 =0.426 Sig.=0.808 (CP)						
X^2 =3.157 Sig =0.206						
Birth Interval						
1< 24 months	88.2	11.8	76	77.9	22.1	149
2=24 Months+	96.0	4.0	423	86.6	13.4	454
3=First borns	97.0	3.0	231	89.4	10.6	189
X^2 =10.874 Sig.=0.004*** (CP)						
X^2 =9.837 Sig.=0.007***						
Wealth Index						
1= Low	95.1	4.9	123	86.2	13.8	435
2= Medium	96.4	3.6	224	84.3	15.7	121
3= High	95.5	5.0	383	85.2	14.8	236
X^2 =0.676 sig=.713 (CP)						
X^2 =0.332 Sig.=0.847						
Work status of the mother						
1=Not working	95.9	4.1	221	82.5	17.5	160
2=Working	95.3	4.7	507	86.3	13.7	630
X^2 = 0.156 Sig.=0.907 (CP)						
X^2 =1.531 Sig.=0.216						
Maternal education						
1=No/pre-school	100.0	0.0	7	81.0	19.0	42
2=Primary school	95.1	4.9	490	84.1	15.9	560
3=secondary +	96.1	3.9	233	91.1	8.9	190
X^2 =0.056 Sig.=0.812 (CP)						
X^2 =6.333 Sig=.0.042**						

(CP) = Central Province **1=reference category** ***p<0.01 ** p<0.05 * p<0.10

4.3 Distribution of children's deaths by Covariates used in the under-5 mortality analysis in Central and Nyanza

Figure 4.2 shows that according to 2003 KDHS, in both regions mothers using high polluting fuels experienced higher under-5 mortality than those using low polluting fuel. However in Nyanza the mortality for those using high polluting fuel was much higher compared to their counterparts in Central Province. In Nyanza, under-5 mortality was higher among those born in households using unsafe drinking water while in Nyanza, contrary to the expected, children born in households using safe drinking water experienced higher mortality than those using unsafe drinking water. On maternal age at birth, it is surprising to note that in Central Province, children who were born to mothers 20 years and above experienced higher mortality compared to those born to mothers who were less than 20 years. In Nyanza there is no much difference in mortality for children born to women less than 20 years and those born to women aged 20 years and above. The same case applies to marital status whereby in both regions there was significant difference in under-5 mortality for children born to women in unions and those born to women who were not married. In both regions, first borns experienced higher mortality than those in birth order 3 and above. With reference to birth interval, those children born less than 24 months before the birth of the previous child experienced higher mortality compared to those born 24 months and above after the birth of the previous child.

In Central, children born to women in medium wealth index experience the lowest mortality while in Nyanza; those born in lowest index experienced the lowest mortality. Women with no education in Central did not experience any fatality while in Nyanza, women with no education exhibited the highest under- 5 mortality. With regards to work status of the mother in Central, there was not much difference in the proportion of dead children born to working

women and those born to non working women. However in Nyanza those children born to non-working mothers experienced higher mortality as compared to those born to working mothers.

4.4 Bivariate Cross Tabulation Analysis

In order to find out if there was a relationship between under-5 mortality and selected variables cross tabulations were run. Chi square test was used to estimate the likelihood that a relationship between selected covariates and dependent variable in the selected sample actually exists.

From the above figure 4.2, only maternal education and birth interval were significantly associated with under-5 mortality in Nyanza while in Central Province only the birth interval was significantly associated with under-5 mortality.

Type of cooking fuel, source of drinking water, wealth index, marital status and birth order were found not to be associated with under-5 mortality in both Nyanza and Central Province.

Table 4.3: Hazard Model of under-5 mortality associated with socio-economic, bio-demographic and Environmental Variables in Central Province – Model 1

	B	S.E	Sig.	Exp (B)
Socio-economic factors				
Maternal education				
No/pre-school ®	.000		0.815	1.000
Primary school	0.8196	88.717	0.934	3297.348
Secondary +	7.744	88.718	0.936	2308.181
Work status of the mother				
Not working ®	.000			1.000
Working	.002	0.420	0.694	1.002
Wealth Index				
Low®	.000		0.682	1.000
Medium	-.265	.553	0.562	0.767
High	.199	.515	0.912	1.220
Bio-demographic factors				
Maternal age at birth				
<20 years	0.000			1.000
20 years+	-0.036	0.626	0.954	0.964
Birth Interval				
<24 months ®	.000		0.010**	1.000
25+ Months	-1.095	0.415	0.008***	0.334
First borns	-1.546	0.611	0.011**	0.213
Birth order				
First borns®	0.000		0.909	1.000
3-4	-0.086	0.451	0.949	0.918
5+	-0.232	0.531	0.663	0.793
Marital status				
Others®				1.000
Married/in union	-0.270	0.453	0.551	0.763
Environmental factors				
Source of Drinking water				
Safe drinking water®	.000			1.000
Unsafe drinking water	-0.577	0.390	0.862	0.562
Type of cooking fuel				
high polluting fuels®	.000			1.000
low polluting fuels	0.097	0.557	0.862	1.102

NB-®-Reference categories ***p<0.01 ** p<0.05 * p<0.10

Table 4.4: Model 11: Hazard Model of under-5 mortality associated with socio-economic, bio-demographic and Environmental Variables in Nyanza Province.

	B	S.E	Sig.	Exp (B)
Socio-economic factors				
Maternal education				
No/pre-school ®	.000		0.063*	1.000
Primary school	-0.178	0.2334	0.630	0.5976
secondary +	-0.178	0.1918	0.072*	1.4567
Work status of the mother				
Not working ®	.000			1.000
Working	-0.206	0.224	0.354	0.814
Wealth Index				
Low®	.000		0.753	1.000
Medium	0.155	0.264	0.556	1.168
High	0.138	0.222	0.534	1.148
Bio-demographic factors				
Maternal age at birth				
<20 years	.000			1.000
20 years+	-0.546	0.299	0.068*	0.580
Birth Interval				
<24 months ®	0.000		0.027**	1.000
25+ Months	-0.498	0.1154	0.022**	1.5708
First borns	-0.746	0.1099	0.033**	1.3851
Birth order				
1st-2nd born ®	.000		0.267	1.000
3rd-4th born	0.396	0.307	0.198	1.485
5th born+	0.495	0.307	0.107	1.640
Marital status				
Not in union/marriage®	0.000			1.000
Married/in union	-0.124	0.276	0.653	0.883
Environmental factors				
Source of Drinking water				
Safe drinking water®	.000			1.000
Unsafe drinking water	0.232	0.513	0.243	0.243
Type of cooking fuel				
high polluting fuels®	.000			1.000
low polluting fuels	0.361	0.513	0.482	1.434

NB-®-Reference categories ***p<0.01 ** p<0.05 * p<0.10

Table 4.5: Model III: Overall model fit of under-5 mortality associated with socio-economic, bio-demographic and Environmental Variables in Nyanza Province

	B	S.E	Sig.	Exp (B)
Maternal education				
No/pre-school ®	0 .000		0.323	1.000
Primary school	-0.132	0.379	0.727	0.876
secondary +	-0.531	0.450	0.238	0.588
Work status of the mother				
Not working ®	.000		-	1.000
Working	- 0.175	0.245	0.475	0.839
Wealth Index				
Low®	0.000		0.969	1.000
Medium	0.029	0.287	0.921	1.029
High	-.054	0.288	0.850	0.947
Maternal age at birth				
<20 years ®	0.000			
20 years+	-0.591	0.326	0.070*	0.554
Birth Interval				
<24 months ®	0.001		0.044**	1.000
25+ Months	-0.453	0.230	0.048**	0.636
First borns	-0.777	0.370	0.036**	0.460
Birth order				
1st-2nd born ®	0.000		0.291	1.000
3rd-4th born	0.406	0.329	0.218	1.500
5th born+	0.522	0.335	0.119	1.686
Marital status				
Not in union/marriage®	0.000			1.000
Married/in union	-0.066	0.304	0.827	0.936
Source of Drinking water				
Safe drinking water®	.000			1.000
Unsafe drinking water	0.282	0.245	0.249	1.325
Type of cooking fuel				
high polluting fuels®	.000			1.000
low polluting fuels	0.778	0.551	0.158	2.178

NB-®-Reference categories ***p<0.01 ** p<0.05 * p<0.10

Table 4.5: Model IV: Overall model fit of under-5 mortality associated with socio-economic, bio-demographic and Environmental Variables in Central Province

	B	S.E	Sig.	Exp (B)
Maternal education				
No/pre-school ®	.000		0.740	1.000
Primary school	8.198	88.120	0.926	3632.929
secondary +	7.850	88.121	0.929	2566.861
Work status of the mother				
Not working ®	.000			1.000
Working	0.003	0.414	0.995	1.003
Wealth Index				
Low®	.000		0.584	1.000
Medium	-0.266	0.550	0.629	0.767
High	0.210	0.511	0.681	1.234
Maternal age at birth				
<20 years	.000			1.000
20 years+	-0.306	0.698	0.661	0.736
Birth Interval				
<24 months ®	.000		0.005***	1.000
25+ Months	-1.197	0.422	0.005***	0.302
First borns	-1.735	0.671	0.010**	0.176
Birth order				
1st-2nd born ®	.000		0.967	1.000
3rd-4th born	-0.034	0.483	0.944	0.966
5th born+	-0.140	0.567	0.804	0.869
Marital status				
Not in union/marriage®	.000			1.000
Married/in union	0.002	0.491	0.997	1.002
Source of Drinking water				
Safe drinking water®	.000			1.000
Unsafe drinking water	-0.631	0.404	0.119	0.532
Type of cooking fuel				
high polluting fuels®	.000			1.000
low polluting fuels	0.072	0.605	0.905	1.075

NB-®-Reference categories ***p<0.01 ** p<0.05 * p<0.10

4.4 Results of Cox Proportional Hazard Models

From this study some results confirmed the findings of the earlier studies in literature as expected while others went contrary to the expectations. The results of the Cox Proportional hazard model for Central Province using all the selected factors as shown in table 4.3 above indicate that only birth interval was a significant factor influencing under five mortality in the region. Contrary from the literature, maternal education did not show any significance as far as under- 5 mortality is concerned in Central Province. Instead, the variable exhibited big odds ratios which could be explained by skewed distribution of the sample population. The situation was similar in Nyanza where only birth interval was statistically significant. Although maternal education exhibited a weak relationship in Nyanza after controlling for wealth index and work status of the mother, the significance is not observed when all other variables are included. Still in Nyanza maternal age at birth showed a weak significance on under five mortality after controlling for birth interval, birth order and marital status. The weak significance was also observed when all covariates were included in the analysis. None of the selected environmental variable came out as a significant factor influencing under- 5 mortality in Nyanza and Central.

Though maternal education exhibited a weak significant at 90% confidence interval in Nyanza, it is worth noting that the risk of death for under-5 born to women with secondary education was 0.5 times less likely compared to women with no education while the risk of dying for under-5 born to women with primary education was 0.8 times less likely compared to under-5 born to women with no primary education. Still in Nyanza Province, maternal age birth was weakly associated with under-5 mortality at 90% confidence interval. the risk of death for under-5 born to women who were 20 years and above during the birth of the index child was 0.6 times less likely compared to that of under-5 born to women who were less than 20 years during the birth of the index child. In Central, birth interval was statistically significant at 95% confidence level. In addition, is worth noting that the risk of death for under-5 born 24 months and above after the birth of the previous child, is 0.3 times less likely compared to that of under-5 born less than 24

months after the birth of the previous child. This confirms the hypothesis that early arrival of an infant necessitates the premature weaning of the index child exposing the weaned child to malnutrition and increase probability of contracting infections and parasitic disease due to lack of attention from the mother as stipulated by Palloni and Milman (1986).

CHAPTER FIVE:

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter summarizes the study and makes conclusions based on outlined objectives in chapter 1. The final part of this chapter makes two types of recommendations; one for policy and the other for further research.

5.2 Summary

The general objective of this study was to establish whether the effects of the determinants of under-five mortality in Central which represents a low mortality region and Nyanza Province which represents a high mortality region are any different.

Some of the findings were as hypothesized while others were not. The first objective was to establish whether the determinants of child survival in Central Province are any different from Nyanza Province. From the results of the study, it is evident that there were not many differences in the effects of various variables under consideration across the two regions. Only birth interval was generally the strongest explanatory variable of under-5 mortality in both regions. However, there were existing variations in terms of the intensity of the risk in these two regions. For instance the instantaneous risk is much higher (0.6) for birth interval less more than 24 months in Nyanza Province than in Central Province which was 0.3.

The other objective of the study was to establish whether environmental factors have similar effects on child survival in Central and Nyanza. It emerged that the selected environmental variables did not have any significant influence on under- 5 survival in both Nyanza and Central.

The third objectives sought to determine whether the effects of socio-economic factors on child mortality in Nyanza are any different from Central Province. From the results of the analysis, none of the socio-economic factors had a strong significance on under-5 mortality in Central. Wealth index and maternal work status were not found to be significant determinants of under-5 in both Nyanza and Central Province. In Nyanza Province maternal education was found to have a weak significance as far as under-5 mortality is concerned. This means even though there was evidence of variations in proportions of under-5 under when considering wealth index, the variable did not display any significance in Nyanza contrary to expectations.

In response to the research question, the results suggest that the selected variables did not have any influence on under-5 mortality in Nyanza and Central Province except for birth interval. This implies that though there is high variations in under-5 mortality between the two regions under consideration, there could be other factors associated with high levels of under-5 mortality in Nyanza and not necessary those under this study. Relatively, factors that affect under five mortality in low mortality regions might not necessarily be similar to those affecting under five mortality in high mortality regions. Shyam and Norman (1999) in a study of infant and child mortality in Nepal-East west asserts that if health care were accessible to both educated and uneducated mothers, it would be assumed that the uneducated mothers would take advantage of these services. He further argues that the difference in child health and survival between educated and uneducated mothers would be smaller in comparison to an area in which there is not access to health care services. On wealth index, Mustafa et.al (2008) stipulates that household income may not have significant effect on infant mortality but had a significant effect on child mortality. In this study majority of deaths occurred in infancy and only very few deaths occurred during post infancy. For instance Central recorded only one post infant death. It is also important to note that some results came out as insignificant due to either skewed distributions or very few cases under consideration in the model – a limitation

of secondary data. The other reason could he due to high collinearly between some variables like wealth index and environmental variables

5.3 Conclusion

This study reveals that the variation in under 5 mortality between these two regions was largely due to the differences in the nature of structure of relationships between mortality and explanatory variables. As explained by Mustafa (2008) and Otieno (2005), lower average levels of maternal education, high levels of low birth intervals and low maternal age at birth modestly contribute to the high under 5 mortality in high mortality regions. The study also reveals that there could be other factors influencing child mortality in Nyanza which were not necessarily captured in this study. Cultural beliefs and practices surrounding child delivery childhood illness control and health seeking behavior could be strong factors that influence child mortality in that region.

Others factors could be based around political economy of the regions, ecological settings and existing health systems and disease patterns like malaria and HIV/AIDS which was at 15% in 2003 (UNAIDS, 2004). This study therefore suggests that different approaches need to be used while addressing under 5 mortality in high mortality regions and low mortality regions.

5.4 Recommendation

5.4.1 Policy

From the above discussions, there is need therefore to scale up education programs in Nyanza Province. Though the government has enhanced equal distribution of education in all regions through free primary education, special programs that encourage communities to place higher cultural value to female education should be implemented especially in rural areas. Community literacy programs especially for the young adolescent mothers who dropped out

of school should also be implemented. Maternal education is important since the success of other programs geared towards the improvement of child health depend on the extent to which the family can effectively utilize available resources. Since birth interval came out as a strong factor influencing under-5 mortality in both regions, there is need for special programs that fuse unmet needs of family planning with the existing programs and also strengthening programs that promote breastfeeding

5.4.2 Further research

From this study, it is evident that there could be other factors affecting child mortality in Nyanza that were not necessary captured in the KDHS. Some of these factors cultural norms and practices rotating around child birth, care and prevention and treatment of certain diseases. The KDHS data also does not capture the actual cause of death, ecological setting of the region, political economy of the region and health systems existing in the regions. The study recommends that further research be carried out to incorporate other socio-cultural variables to enable a better understanding of the socio-cultural dynamics of the communities within Nyanza and Central Province. In some communities, there are social cultural attachment especially in rural areas where there is little chance of change in certain norms concerning sickness and the general care of children.

Bio-medical research is also important to explain etiology of certain diseases, processes, methods of prevention and genetic factors contributing to under 5 mortality in Nyanza Province. This would be helpful in deeper understanding of the confounding elements of high under 5 mortality. Another recommendation is to compare the other regions and at the same time test other variables not included in this study to give a clear picture and advise on the aspects of programming. These variables are health care factors such as immunization,

prenatal and delivery care and place of delivery. Verbal autopsy is also vital in establishing the proximate cause of the child's death.

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APPENDICES

Appendix 1a: Hazard Model of under-5 mortality associated with socio-economic, bio-demographic and Environmental Variables in Central Province

	B	S.E	Wald	df	Sig.	Exp (B)
Socio-economic factors						
Maternal education						
No/pre-school ®	.000		0.410	2	0.815	1.000
Primary school	0.8196	88.717	0.007	1	0.934	3297.348
Secondary +	7.744	88.718	0.006	1	0.936	2308.181
Work status of the mother						
Not working ®	.000					1.000
Working	.154	0.392	0.155	1	0.694	1.002
Wealth Index						
Low®	.000		0.764	2	0.682	1.000
Medium	-0.314	.542	0.335	1	0.562	0.767
High	.154	.515	0.012	1	0.912	1.220
Bio-demographic factors						
Maternal age at birth						
<20 years	0.000					1.000
20 years+	-0.036	0.626	0.003	1	0.954	0.964
Birth Interval						
<24 months ®	.000		9.308	2	0.010**	1.000
25+ Months	-1.095	0.415	6.980	1	0.008***	0.334
First borns	-1.546	0.611	6.401	1	0.011**	0.213
Birth order						
First borns®	0.000		0.191	2	0.909	1.000
3-4	-0.086	0.451	0.036	1	0.949	0.918
5+	-0.232	0.531	0.190	1	0.663	0.793
Marital status						
Others®						1.000
Married/in union	-0.270	0.453	0.355	1	0.551	0.763
Environmental factors						
Source of Drinking water						
Safe drinking water®	.000					1.000
Unsafe drinking water	-0.577	0.390	2.180	1	0.862	0.562
Type of cooking fuel						
high polluting fuels®	.000					1.000
low polluting fuels	0.097	0.557	0.030	1	0.862	1.102

Hazard Model of under-5 mortality associated with socio-economic, bio-demographic and Environmental Variables in Nyanza Province

	B	S.E	Wald	df	Sig.	Exp (B)
Socio-economic factors						
Maternal education						
No/pre-school ®	.000		5.514	2	0.063*	1.000
Primary school	-0.178	0.2334	0.233	1	0.630	0.5976
secondary +	-0.178	0.1918	3.229	1	0.072*	1.4567
Work status of the mother						
Not working ®	.000					1.000
Working	-0.206	0.224	0.840	1	0.354	0.814
Wealth Index						
Low®	.000		0.567	2	0.753	1.000
Medium	0.155	0.264	0.347	1	0.556	1.168
High	0.138	0.222	0.387	1	0.534	1.148
Bio-demographic factors						
Maternal age at birth						
<20 years	.000					1.000
20 years+	-0.546	0.299	3.330	1	0.068*	0.580
Birth Interval						
<24 months ®	0.000		7.241	2	0.027**	1.000
25+ Months	-0.498	0.1154	5.260	1	0.022**	1.5708
First borns	-0.746	0.1099	4.543	1	0.033**	1.3851
Birth order						
1st-2nd born ®	.000		2.643	2	0.267	1.000
3rd-4th born	0.396	0.307	1.656	1	0.198	1.485
5th born+	0.495	0.307	2.595	1	0.107	1.640
Marital status						
Not in union/marriage®	0.000					1.000
Married/in union	-0.124	0.276	0.203	1	0.653	0.883
Environmental factors						
Source of Drinking water						
Safe drinking water®	.000					1.000
Unsafe drinking water	0.232	0.513	1.365	1	0.243	0.243
Type of cooking fuel						
high polluting fuels®	.000					1.000
low polluting fuels	0.361	0.513	0.495	1	0.482	1.434