COVARIATES OF NEONATAL MORTALITY IN KENYA

BY:

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DECLARATION

I hereby declare this research project is my original work and has not been presented for a degree in any other university.

Signed: .....

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This project has been submitted for examination with my approval as university supervisor.

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Dedicated in memory of my late parents, Joyce and Julius

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ABBREVIATIONS

ANC	Antenatal Care
IEC	Information Education and Communication
KDHS	Kenya Demographic and Health Survey
KSPAS	Kenya Service Provision and Assessment Survey
LBW	Low Birth Weight
MCH	Maternal and Child Health
TBAs	Traditional Birth Attendants
UNFPA	United Nations Population Fund
WHO	World Health Organization

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ABSTRACT

The study seeks to establish covariates of neonatal mortality in Kenya. The main study objective was to establish factors that influence neonatal mortality in Kenya. Data for this study was drawn from the Kenya Demographic and Health Survey (2003). National Council for Population and Development and the Central Bureau of Statistics (CBS) carried out the KDHS, with technical assistance from macro-international incorporated of Claverton Maryland (USA). USAID/Nairobi and DFID/UK provided financial assistance.

Survival analysis has been used to asses the association between the dependent variable and each of the explanatory variables. The study was confined to 5949 children born alive to the sample of women in the 3 years preceding the survey. The variables used in the study included: socioeconomic, socio-cultural and bio-demographic factors.

Results obtained from the life table indicate that the risk of death during neonatal period is highest immediately after birth (0-<1 day). During the first 6 days neonatal mortality remains high but decreases sharply to lower levels. The results conform approximately to the expected reversed J shaped mortality pattern.

It is evident that from the findings that maternal education, wealth index, mother's region, mother's ethnicity, her religion, her marital status, mother's age at birth, preceding birth interval and birth order were significantly associated with the risk of neonatal death. However, mother's type of place of residence though associated with the risk of neonatal deaths was found not significantly associated with neonatal mortality in both models.

The results of this study support the hypotheses that the risk of death decline with the increase in the numbers of formal schooling. Neonates born to mothers with no formal education faced substantially higher risks of neonatal death in comparison with the

educated women. However, neonates born to households with highest economic standard (richest) did not experience the lowest risk of dying as it was expected. In addition neonates born to mothers from urban areas had an elevated risk of dying compared to those born to mothers from rural areas. There were regional differentials in neonatal mortality with Nyanza province having the highest neonatal risk in both models. Neonates born to Luhya/Luo mothers experienced the highest neonatal deaths in both models. Neonates born to formerly married mothers had the highest neonatal deaths though not significant in the full model. Neonates born to women aged 45-49 had an elevated risk of dying compared neonates born to mothers in other age groups. Neonates of 6+ order births faced higher risks of death compared to first births.

The main policy implication of this study includes empowerment of women through education. Formal education of mothers is critically important to the promotion of child health and disease prevention. There is need also to develop effective health policies that incorporate public and private dimensions of investments in child health. Policy measures should aim at strengthening the current Information Education and Communication (IEC) that enhances child survival. The study recommends further research on the same by use of primary data and use of qualitative method.

CHAPTER ONE
INTRODUCTION AND STATEMENT OF THE PROBLEM

1.1 General Introduction

Neonatal mortality is the probability of dying within the first month of life (NCAPD et al., 2003). Nearly 3.4 million of the 8 million infant deaths each year occur within the first week of life and are often due to a lack of or inappropriate care during pregnancy, delivery and the post-partum period (UNFPA, 2004). The obstetric complications most likely to affect the foetus are obstructed or prolonged labour, eclampsia, ante-partum haemorrhage and infection (Ibid).

Almost 65 per cent of all infant deaths in the United States occur during the neonatal period (Child Health Research Project, 1999). In Asia, the proportion of deaths that are neonatal is between 45 per cent and 65 per cent. In Latin America the proportion of deaths that are neonatal varies between 50 per cent and 70 per cent, and in the Middle East and North Africa, between 40 per cent and 70 per cent. Sub-Saharan Africa has very few sub-regional variations, and in most countries, 50 per cent of all infant deaths occur in the neonatal period (Ibid).

Most perinatal and neonatal deaths are caused by infectious diseases, such as sepsis and pneumonia; pregnancy-related complications, such as *placenta previa* and *abruptio placentae;* and delivery-related complications, including premature birth, intrapartum asphyxia and birth trauma. Additionally, there are many indirect causes of early infant death, including poor maternal health, untreated maternal infections, including sexually-transmitted diseases, urinary tract infections, and chorioamnionitis (Ibid).

Failure to fully immunize adolescent girls and pregnant women also increases neonatal deaths from tetanus, as does unsanitary delivery and umbilical cord care. Premature birth, fetal malnutrition, and failure to exclusively breastfeed also contribute to the risk of

early death. Other indirect causes of perinatal and neonatal death include inability to recognize severe illness in a newborn, poor care seeking behavior, and inadequate access to good quality medical care. Underlying these direct and indirect causes is widespread poverty, illiteracy and gender discrimination faced by both mother and her female children in developing countries (Ibid).

Low birth weight (LBW), or birth weight less than 2500 grams, is one of the principal contributors to neonatal morbidity and mortality worldwide, and accounts for up to 70 per cent of neonatal deaths in some countries (Ibid). In many countries food intake in pregnancy is, on average, 600 calories or more below the recommended daily intake, and micronutrient deficiencies in pregnancy are common (Barnett et al., 2005). Women often eat less than normal during pregnancy because of cultural restrictions on diet. In some cultures pregnancy is seen as a 'hot' state, so only 'cold' foods are taken. Some mothers 'eat down' to avoid a large baby. Others do so because they believe that if they eat too much there will be less growing space for the baby (Ibid).

Majority of women in the developing world go through pregnancy with no prenatal care and deliver without appropriately trained assistance (Wallace et al., 1995:175). Maternal health is not simply a woman's issue; the mother's health has a direct bearing on the health of her newborn. Many complications and subsequent poor outcomes for women and infants can be prevented or minimised by early detection and appropriate interventions (NCAPD et al., 2005).

Antenatal services are designed to promote healthy behaviours and preparedness during pregnancy, childbirth, early detection of complications, and skilled and timely interventions to avoid adverse maternal and neonatal outcomes (Ibid). According to KDHS (2003), about 88 per cent of women in Kenya receive antenatal care from medical professionals, either from doctors (18 per cent) or nurses/midwives (70 per cent). Only about 2 per cent receive antenatal care from traditional birth attendants (TBAs), while 10 per cent do not receive any antenatal care.

KDHS (2003) found that 88 per cent of women make at least one antenatal care visit, 31 per cent make two or three visits, and more that 52 per cent make four or more visits. However, the majority of these women seek antenatal care relatively late in pregnancy; the median gestation at first visit is 5.9 months.

Antenatal care when sought early in the pregnancy and continued through to delivery can be more effective in avoiding adverse pregnancy outcomes. Health professionals and providers generally recommend that antenatal visits should occur within the first trimester of pregnancy and continue on a monthly basis to the 28th week (seventh month), fortnightly up to the 36th week (eighth month), or until birth (KDHS, 2003). If the first antenatal visit is made at the third month of pregnancy, this optimum schedule translates to a total of at least 12-13 visits during the duration of the pregnancy. Complications during pregnancy are an important cause of child morbidity and mortality. Antenatal clinics in Kenya as in many other sub-Saharan countries provide prophylaxis against malaria and anaemia and also allows women with known risks to be monitored and given appropriate health care (Ikamari, 2004).

Proper medical attention and hygienic conditions during delivery can reduce the risk of complications and infections that can cause the death or serious illness to the baby (Ibid). The level of assistance a woman receives during the birth of her child also has important health consequences for both mother and child (Ibid). The timing of postnatal care is important. Since most neonatal deaths occur within two days of delivery, postnatal care should be received immediately following the birth, during this critical period (Ibid).

1.2 Problem Statement

Neonatal deaths are a serious concern both in developing and developed countries (James et al., 2000). An estimated 5 million neonates die each year in the world of which 96 per cent are in the developing countries (WHO, 1996). Review of data from several developing countries concluded that, at neonatal mortality of 20 per 1000 or higher,

approximately 70 per cent of neonatal mortality occurs within the first six days of life (Boerma, 1998 c.f. KDHS, 2003).

According to KDHS, 2003 the proportion of neonatal deaths occurring in the first week of life (82 per cent) is higher than the proportions recorded in 1998 KDHS (74 per cent) and the 1993 KDHS (75 per cent). Preliminary analysis of the 2003 KDHS data show that 196 children died within the first one month of life. Thus, the probability of death in the neonate period is 33 per 1000.

Even though neonatal mortality is a serious problem, there has been little attention on understanding its causes and determinants. In the recent past, a lot emphasis has been placed on reducing child mortality largely through immunization, oral rehydration and control of acute respiratory infections.

Perinatal and neonatal mortality can be addressed by interventions in pregnancy, during labor and delivery, and in the first few weeks of an infant's life (Ibid). However, in Kenya maternal health care that is received is often characterised by an insufficient number of visits timed late into the pregnancy, the delivery care is dominated by home births, and less than half of all deliveries in the country take place in a health facility (Magadi, 2004). In addition, only 42 per cent of women have skilled attendant present at delivery. Delivery at home for example, is more than twice as common in rural areas as in urban areas, and the proportion of births with a skilled attendant ranges from only 29 per cent in Western province to 79 per cent in Nairobi (KDHS, 2003). Postnatal care as a maternal component of maternal and child care has received very little attention in Kenya (Population Council et al., 1999).

Effective reduction of such high neonatal death rates remains a major global challenge in the 21st century. This study therefore aims to establish the factors that influence neonatal mortality in Kenya.

1.3 Major issues of Problem Statement

1. Neonatal deaths are a serious concern both in developing and developed countries.
2. According to KDHS, 2003 the proportion of neonatal deaths occurring in the first week of life (82 per cent) is higher than the proportions recorded in 1998 KDHS (74 per cent) and the 1993 KDHS (75 per cent)
3. Even though neonatal mortality is a serious problem, there has been little attention on understanding its causes and determinants.

1.4 Key research question

What are the key determinants of neonatal mortality in Kenya?

1.5 Objectives

The overall objective of the study was to establish factors that influence neonatal mortality in Kenya. The specific objectives of the study were:

1. To determine differentials in the risk of neonatal mortality in Kenya by selected socio-economic, socio-cultural and bio-demographic factors.
2. To determine the influence/effect of selected socio-economic, socio-cultural and bio-demographic factors on neonatal mortality in Kenya.

1.6 Justification

In spite of the many studies that have been undertaken on infant mortality, there still exists a gap in information on neonatal mortality in Kenya. According to KDHS 2003, about 39 per cent of under-five mortality occurred during the neonatal period. In order to achieve the Millennium Development Goal target of a two thirds reduction in under-five mortality from 1990 to 2015 (United Nations, 2001), major reductions will be required in neonatal mortality (Lawn et al., 2005).

Providing skilled care at birth goes hand in hand with the Millennium Development Goal to reduce child mortality, which is strongly influenced by disproportionate rates of neonatal mortality. A skilled attendant operating in an enabling environment, which

includes support, supervision and equipment with regard to newborn care, can manage all of these complications.

Neonatal mortality accounts for 60 per cent to 70 per cent of infant mortality in many developing countries—and there are very few programs that specifically target it (Child Health Research Project, 1999). Hence there is need to reduce neonatal mortality in Kenya by expanding already existing programs to address illness in the neonatal period.

Sadly, very few programs currently existing in Kenya that target neonatal mortality hence findings from this study may be valuable for policy makers, planners and programme implementers in programming and timely interventions that will help reduce neonatal mortality. There is also need for research that will enable informed policies, more effective and efficient programs, and greater reduction of neonatal deaths.

1.7 Scope and Limitation of the Study

This study will use data from the Kenya Demographic and Health Survey (2003). The use of secondary data restricts the use of variables to only those collected in the survey. In addition, causes of neonatal mortality are difficult to ascertain in Kenya where the majority of deaths take place at home that are usually unattended by health personnel. A representative probability sample of almost 10,000 households was selected for the KDHS sample. But given the difficulties in travelling and interviewing in the sparsely populated and largely nomadic areas in the North Eastern province, a smaller number of households were selected in the province.

CHAPTER TWO
LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

2.1 Health Seeking Behaviour

Health seeking behaviour of the women especially during pregnancy has an important role to play for the health of newborn (Visaria, 1988). Mosley and Chen (1984) proposed a framework for the study of child survival in which they suggested five proximate determinants of infant mortality. Maternal factors including access to maternal health care services during pregnancy were identified as one of the key proximate determinants. The effect of maternal health care (or access to care) on the subsequent wellbeing and mortality risks in the early infant period has been documented in previous studies (Beenstock and Sturdy, 1990; Khan, 1987).

Adverse effects of poor, late and infrequent uptake of antenatal care and home deliveries have been particularly noted in connection with neonatal mortality outcomes (Beenstock and Sturdy, 1990; Stephenson, 1998). Poor antenatal care is a risk factor for adverse pregnancy outcomes for both the mother and the baby, including maternal mortality, perinatal mortality, premature delivery, low birth weight, pre-eclampsia and anemia, in many settings of the developing world (Magadi, 2004).

Information provided by the antenatal service provider on danger signs, diet and planning for delivery along with testing for anaemia, malaria and high blood pressure are important for successful management of pregnancies and subsequent well being of the child (Vilar, 1997).

Maternal health care that is provided before a woman gives birth is important (Magadi, 2004). The health care consists of regular periodic check-up of the pregnancy, advice on the appropriate diet, treatment of any pregnancy related complications, tetanus injection to prevent neonatal tetanus which has shown to be a major cause of infant deaths in developing countries such as Kenya (Ikamari, 2004).

The frequency and timing of antenatal care (ANC) allow timely identification and mitigation of possible pregnancy complications. Early, regular and continued antenatal care throughout the pregnancy are vital to manage pregnancy complications that can be detrimental to the health of the mother and the baby (Magadi, 2004). There may be differences in utilisation of antenatal care services resulting from accessibility factor (Ibid). Service access relating to affordability is perhaps of greatest relevance to slum communities (Ibid).

Previous studies show that maternal health care is vital for safe pregnancy and child birth and influences the survival and health of the child during early infancy (Kausar et al., 1999).

A number of studies have investigated the relationship between use of maternal and child health care and child survival (Ikamari, 2004). The 1985 United Nations comparative study of effects of socio-economic factors on child mortality in Nigeria and Peru (the only two countries that had appropriate data on health care) indicated that both access and utilisation of health services were positively associated with child survival (Ibid).

Studies of the all India NFHS data have shown that the place of delivery, antenatal care use, and frequency and timing of visits are associated with neonatal mortality outcomes, but not with later mortality outcomes (Stephenson, 1998). A study carried out in Uttar Pradesh, India by Rajna et al. (1998), indicated that antenatal care of the mother had a highly significant negative effect on mortality. Infants born to mothers who received antenatal care experienced a 30 per cent lower risk of dying than those who did not receive antenatal care.

Ewbank and Gribble (1993, c.f. Ikamari, 2004), argued that the provision and utilisation of health services was one of the factors closely associated with the decline in infant and

child mortality in sub-Saharan Africa. A study carried out in Addis Ababa, Ethiopia, in 1981-83 indicate that maternal mortality for women who received antenatal care was significantly lowered than that for women who had not received any antenatal care. The study found a maternal mortality rate of 2.4 per 1000 for women who had received antenatal care compared with 6.2 per 1000 for those who had not received antenatal care. These figures excluded abortion deaths. The study also found that most of the maternal deaths occurred at home either during child birth or immediately after child birth (Ibid).

An important component of efforts to reduce the health risks of mothers and children is to increase the proportion of babies delivered under medical supervision. Proper medical attention and hygienic conditions during delivery can reduce the risk of complications and infections that can cause the death or serious illness of the mother and/or baby (KDHS, 2003).

Although the majority of deliveries have no complications, sometimes sudden and unpredictable complications may arise, requiring urgent medical attention. It is estimated that 40 per cent of pregnancies world-wide develop complications, 15 per cent as life-threatening emergencies. The birth outcomes under such circumstances are greatly improved if the complications occur in the presence of a qualified attendant and in a medical facility with necessary equipment and supplies to adequately manage the complications (Magadi, 2004).

Previous studies have found associations between composite indices of socio-economic status and the utilisation of maternal health care services (Obermeyer and Potter, 1991; Obermeyer, 1993). Caldwell (1979) argued that education of the woman plays an important role in determining child survival. Hobcraft et al. (1985), showed that increased level of the mother's education are associated with improved chances of child survival in a wide range of developing countries and the association survives control for a number of socio-economic variables including husbands education and occupation.

Maternal education influences child survival through various pathways: enhanced socio-economic status, greater health choice for children, including interaction with medical personnel, cleanliness, emphasis on child quality in terms of fewer children, a greater food and capital investments (Caldwell, 1979; Ware, 1984).

Using data from the National Family health Survey 1992-93, Govindasamy and Ramesh (1997) found a positive relationship between mother's education and utilization of MCH services. Maternal education emerged as the single most significant predictor of utilisation of MCH services with no systematic differences between the north and south. The study also found that higher level of maternal education results in improved child survival to a substantial extent because preventive health services are used to a greater extent by mothers with higher education than those with little or no education. Employment status or occupation and ethnicity have also been found important determinants of utilisation of care in some studies and especially in studies done by Trakroo (1993) and Celik and Hotchkiss (2000).

2.2 Nutrition

In developing countries the limitations for achieving an adequate energy balance during pregnancy often result from a combination of factors, such as low income, poor education and increased energy expenditure imposed by maternal labour (Rosso et al., 1990). During pregnancy two types of undernutrition are observed. Firstly, women who are already undernourished when they became pregnant and secondly women with normal nutritional status who fail to meet augmented nutritional needs during pregnancy (Ibid). If a mother experiences both, the birth weight of her infant will be markedly below the average. In developing countries where the overall nutritional level is low, the probability of women experiencing both these stages of undernutrition are comparatively high (James et al., 2000).

The undernutrition among pregnant women often results in (1) premature birth of babies (less than 37 weeks) and (2) intra-uterine growth retardation leading to small for date babies (less than 2500 grams) (Ibid).

Intrauterine growth retardation (IUGR) is the most common form of LBW in the developing world (accounting for more than 60 per cent), whereas most low birth weight in infants in developed countries is due to prematurity. Risk factors for IUGR include untreated urinary tract infections (bacterial vaginosis); ascending reproductive tract infections, including syphilis, gonorrhea and chlamydia; low pre-pregnancy maternal weight and height, and low caloric intake and poor weight gain during pregnancy (Child Health Research Project, 1999).

Although there is no unanimity among different studies on the impact of iron deficiency anemia on pregnancy outcome, they support the fact that it leads to increase in the frequency of pre-term delivery, low birth weight babies and still birth (Schwartz and Thurnau 1995; Swain et al., 1994).

According to Laura Caulfield, maternal malnutrition before or during pregnancy can lead to spontaneous abortion, stillbirth, small for gestational age babies, preterm delivery, or increased risk of perinatal and neonatal death. Also, certain forms of maternal malnutrition limit neurologic development in the fetus. Furthermore, maternal malnutrition may increase the risk of maternal infection, and impair development of the fetal immune system (Child Health Research Project, 1999).

Importantly, the problem of low birth weight is intergenerational: low birth weight infants remain poorly nourished during childhood and grow up to be stunted adults who in turn give birth to small infants, and thus must be combated at several points during the life cycle (Ibid).

There is evidence to suggest that infant outcomes can be improved by increasing maternal nutritional status. According to a study carried out in 1997, Prentice and colleagues supplemented Gambian women with an extra 900 calories per day, with most of the calories coming from fat in a ground nut-based biscuit. The supplement also provided calcium and iron. The researchers noted that there was an increase in birth weight of about 136 grams. Head circumference was increased by about 3 mm. LBW was reduced by 35 per cent, and stillbirths by 55 per cent. Overall there was a 49 per cent reduction in perinatal deaths and 40 per cent reduction in early neonatal deaths but no effect on post-neonatal deaths (Ibid).

Food supplementation trials in a recent trial of micronutrient supplementation in pregnancy in rural Nepal showed a 25 per cent relative reduction of low birth weight (Barnett et al., 2005).

2.3 Demographic Determinants

Certain aspects of reproductive behaviour like early and late child bearing, short birth intervals and higher order births are expected to have a deleterious effect on neonatal mortality. The proportion of women receiving inadequate Antenatal Care rises steadily with increasing maternal age and parity (Magadi, 2004).

2.3.1 Age of the Mother

The relationship between age of the mother and neonatal mortality is considered to be a 'U' shaped one. Infant mortality rate is found to be highest at very young and old ages of childbearing and lower in middle range (about 20-39 years) (Mwondo, 2002). Analyzing the World Fertility Survey data from 34 countries Hobcraft et al. (1985) observed that children of teenage mothers have significantly higher risk of mortality even after controlling for other demographic variables and educational levels. At the same time, this study did not find an increase in mortality level for children born to mothers at ages 35 and above.

United Nations (1973) documented that young maternal age was a well-known correlate of higher infant mortality. The higher incidence of infant mortality and still births among the older mothers is because of their high susceptible to various diseases such as anaemia, diabetes, heart diseases and low blood pressure which affect the health of the child in the womb (Mwondo, 2002).

2.3.2 Birth Order

The same 'U' or 'J' shape relationship exists between birth order and neonatal mortality with lower chances of survival at both the extremes. The analysis of demographic health survey data from Brazil in 1986 showed that birth order 4-6 had the lowest risk of dying in the neonatal stages (Curtis and McDonald, 1991).

Jain et al. (1988, c.f. Mwondo, 2002), argued that age and parity are usually correlated and therefore it is difficult to isolate their independent contributions to the risk of infant death. Studies have also found that the infant mortality rate was usually high for the first order and higher order births (about 4 and higher parity) and low for middle range (second to fourth order births) (Ibid).

Michael Koenig (1999) presented an analysis of all live births from 1974 to 1990 in both the Matlab health intervention and comparison areas, in which there were 57,435 births in 24,032 sibling relationships (sibships); parity (number of children born) ranged from 1 to 11 children. By comparison, almost half of women with seven or more births had experienced the death of an infant, and 34 per cent of them had two or more infant deaths. The Matlab analysis also confirmed that a higher risk for neonatal mortality is associated with prior child loss (Child Health Research Project, 1999).

2.3.3 Birth Interval

The relationship between child spacing and neonatal mortality is considered to be stronger than the other two demographic variables. Studies based on individual level

data clearly showed that shorter birth intervals are associated with elevated mortality risk. Hobcraft et al. (1985) identified child spacing as the single most important demographic variable affecting child mortality. There is obviously a clear association between shorter birth intervals (less than 24 months) and child mortality (1-4 years). Shorter birth intervals necessitate early weaning to the older child. Additionally, the presence of younger siblings causes greater competition for food and family resources (James et al., 2000).

Rutstein (1999), in analysis of the *Demographic Health Surveys* from 18 countries, reported that the risk of neonatal mortality was significantly higher in women with less than a 24 month birth interval, and women with no previous children. Again, the risk of neonatal mortality was highest in women at the extremes of their reproductive years. Boys had a 26 per cent higher risk of dying than girls, and either sex of child was 22 per cent more likely to die in the first month of life if his or her mother received no prenatal care. Importantly, antenatal tetanus vaccinations reduced the chance of neonatal death by almost 50 per cent (Child Health Research Project, 1999).

2.4 Effect of Malaria and Neonatal Mortality

In 1994, 45 million pregnant women were living in malaria prevalent areas, with over 23 million in Sub-Saharan Africa alone. Although the effect of malaria on perinatal and neonatal mortality depends on the rate of transmission, malaria may cause up to 30 per cent of the preventable low birth weight, and 3–5 per cent of neonatal mortality in highly endemic regions. Malaria is also associated with an increased risk of spontaneous abortions and stillbirths (Child Health Research Project, 1999).

2.5 Infection

One of the leading causes of neonatal mortality in developing countries is infection (Stoll, 1997). Infection among newborn occurs due to variety of reasons and lead ultimately to

neonatal or subsequent mortality. A review of the available cross-country studies by Stoll (1997) based on hospital data suggest that nearly 7 per cent to 54 per cent of early neonatal deaths and 30 to 73 per cent of late neonatal deaths are associated with infection. According to WHO (1999) infectious diseases is associated with nearly 30-40 per cent of neonatal deaths.

However, it is important to note that the indirect causes of infection mainly lies on poor socio-economic background of the household associated with poor access to care when sickness occurs (James et al., 2000)

2.6 Mother's Ethnicity, Religious Affiliations and Marital Status

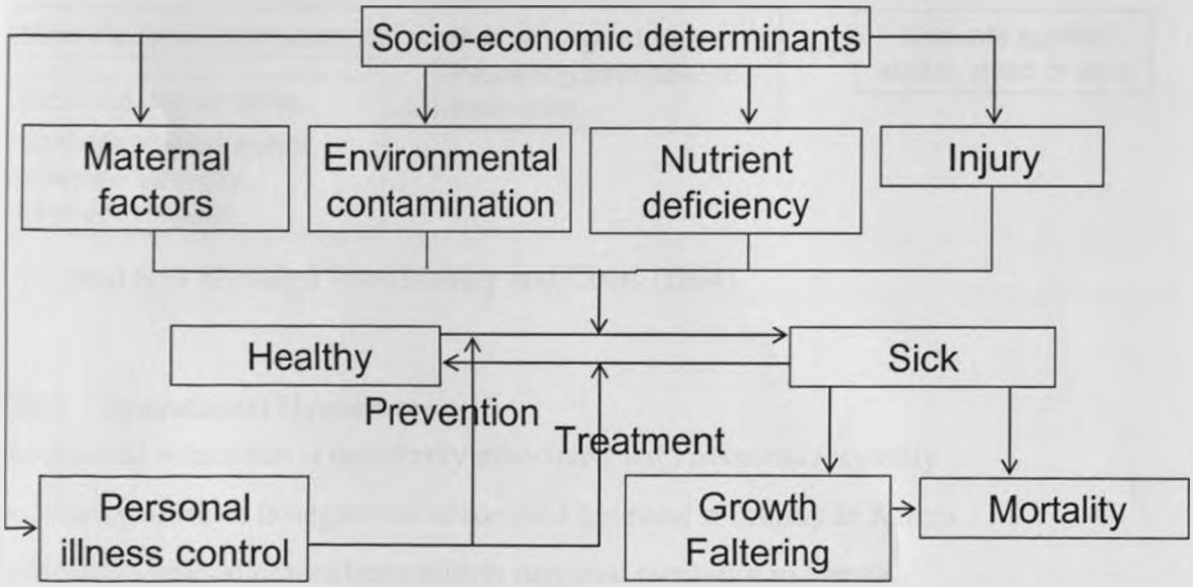
Culture, which is unique to groups of individuals, and religious affiliation factors have also been found to determine to some extent the rates of infant and child mortality. Type of marital union that closely relate to culture and religious factors has also been found to have some effect on infant and child mortality in Kenya. From the existing studies in Kenya, ethnicity and religious affiliations have been found to depict differentials in child mortality. For instance, Moslems have a higher child mortality rate compared to the Christians and the Nilotic tribes have a higher child mortality compared to the Central Bantus.

2.7 Theoretical Framework

Mosley and Chen (1984) framework will guide the analysis of the study. The proximate determinants model was originally developed to study factors affecting child mortality, and is based on the idea that all social and economic determinants of child mortality operate through a set of biological or proximate determinants to affect a child's probability of survival. Thus, this model combines social, economic, medical and biological explanations of child mortality.

Mosley and Chen (1984) grouped the proximate determinants into five categories, namely, maternal factors (mother's age and parity); environmental contamination (routes of infection); nutrient deficiency; injury; and personal illness control (preventive and curative care). All social and economic determinants of child mortality – the "distal" determinants – operate through these proximate determinants and are grouped by Mosley and Chen into individual-level, household-level and community-level variables.

Figure 1: Theoretical framework



Adopted from Mosley and Chen (1984).

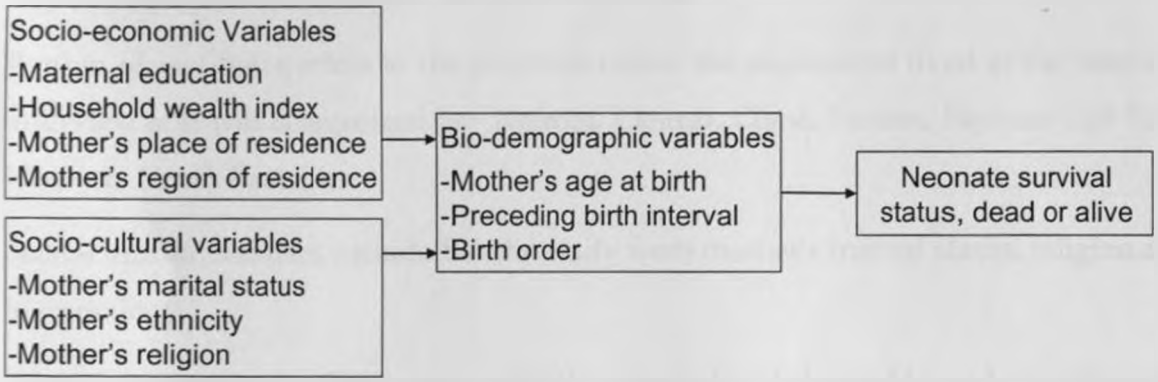
2.7.1 Conceptual hypothesis

Woman's socio-economic status, maternal factors and nutrient deficiency are associated with high neonatal mortality in Kenya.

2.8 Operational Framework

From the conceptual framework above, the following operational model explaining factors influencing neonatal mortality can be developed.

Figure 2: Operational model explaining factors influencing neonatal mortality



Adopted and Modified from Mosley and Chen, (1984).

2.8.1 Operational Hypotheses

- Maternal education is negatively associated with neonatal mortality
- Urban residence is negatively associated neonatal mortality in Kenya
- Mother's region of residence affects neonatal mortality in Kenya
- Mother's ethnicity influences neonatal mortality in Kenya
- There are variations in neonatal mortality by maternal age at birth
- There are differences in neonatal mortality by birth order
- There are neonatal mortality differentials by preceding birth order
- The higher the household wealth index the lower the neonatal mortality

2.8.2 Variable Definitions and their Measurements

Independent Variables

Socio-economic variables included in the study were mother's level of education, type of place of residence and region of residence.

Mother's level of Education represents the highest level of formal schooling attained by the respondent. 4 categories were used in the study; no education, primary education, secondary and higher.

House hold wealth index 5 categories were used poorest, poorer, middle, richer, richest

Type of Place of residence refers to the place where the respondent lived at the time of the interview and was classified as urban and rural

Region of residence refers to the province where the respondent lived at the time of the interview and was categorized as:- Nairobi, Central, Coast, Eastern, Nyanza, Rift Valley, Western, North-Eastern.

Socio-cultural variables included in the study were mother's marital status, religion and her ethnicity.

Ethnicity refers to the ethnic group that the respondent belonged to and was categorized as:- Kikuyu/Embu/Meru, Kisii/Kalenjin, Kamba, Luhya/Luo, Mijikenda/Swahili, Others.

Religion refers to the religious group to which the respondent was affiliated to at the time of the survey and was categorized as:- Catholic, Protestant/other Christian, Muslim, No religion, Other.

Marital status refers to the respondent's marital status at the time of the interview: never married, currently married and formerly married.

Bio-demographic variables included in the study were mother's age at birth, preceding birth interval and birth order.

Maternal Age at birth refers to the age of the mother at the time of birth and was classified in the five-year age groups: 15-19, 20-24, 25-29, 30-34, 35-39, 40-44 and 45-49.

Preceding Birth interval is the duration of time in months between two births. Preceding birth interval was grouped in to below 24, between 24 and 36 months and above 36 months.

Birth Order of the child was classified as first, 2-3, 4-5 and above 6.

Dependent variable

In this study, this variable refers to neonate survival status; the variable will have two main categories; dead (0) and alive (1) respectively.

CHAPTER THREE

DATA AND METHODOLOGY

3.1 Data Source

The study data for the study were drawn from the 2003 KDHS, the fourth such survey to be conducted in the country. The KDHS is a nationally representative survey of 7881 women age 15-49 years and 3407 men aged 15-54 years. National Council for Population and Development and the Central Bureau of Statistics (CBS) carried out the KDHS, with technical assistance from macro-international incorporated of Claverton Maryland (USA). USAID/Nairobi and DFID/UK provided financial assistance.

3.2 Sampling Design

The 2003 KDHS covered the entire country including the 7 sparsely populated northern districts. A two stage stratified sampling approach was utilized and the first stage involved sampling of clusters and the second stage involved selecting of households within sampled points from a list compiled during a KDHS household listing exercise.

3.3 Data Quality

Non-sampling errors and sampling errors are two types of errors that affect estimates from sample surveys. Non-sampling errors may result from shortcomings in data collection and data processing, such as data entry errors, failure to interview the right household or misinterpretation of the questions. Non-sampling errors are difficult to avoid and to evaluate statistically.

Most serious data quality problem is the selective omission from birth histories of births 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, misreporting of the age at death, which may distort the age pattern of mortality. When selective omission of childhood deaths occurs, it is usually most severe

for deaths in early infancy. If early neonatal deaths are selectively underreported, the result is an unusual 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 of early infant deaths is commonly observed for births that occurred long before the survey.

3.4 Method of Data Analysis

This study applies a hazards model to study neonatal differentials by socio-economic, socio-cultural and bio-demographic variables in Kenya.

3.4.1 Life table

Life table is central to survival analysis. In order for the objectives of this study to be realised, it was necessary to construct a life table. Having the information on the total births and observed number of deaths made it possible to construct the life table. To obtain the life table probability of surviving through the first month (that is through neonatal period) can be given by the following demographic formula:-

$$P_1 = \exp [-\{f_1 U_{ijk})$$

Where fi are the span in days in interval i

U_{ijk} are the risk of death in interval for each interval

3.4.2 Cox's Proportional Hazard Model

The hazards model was first proposed by Cox (1972 and 1975) and later described in terms familiar to demographers by Trussell and Hammerslough (1983). Cox regression is a method for investigating the effect of several variables on the time a specified event takes to happen. The hazard model was preferred for this study because it allows for the simultaneous incorporation of all age intervals and also allows for the utilisation of both uncensored and censored survival cases in the data set. The term hazard in ordinary use means risk.

The model is generally described as:

$$h(t; x1,..., xn) = h0(t) \cdot \exp(b1 \cdot x1 + ...+ bn \cdot xn)$$

where $h(t,,,)$ denotes the resultant hazard (probability of neonate dying), given the values of the n covariates (socio-economic, socio-cultural, etc) for the respective case ($x1$, $x2$, ..., xn) and the respective survival time (t).

The term $h0(t)$ is called the *baseline hazard;* it is the hazard for the respective individual (the neonate) when the values of all the covariates are equal to zero.

$b1$ represents the associated coefficients for the respective cases ($x1$, $x2$, ..., xn)

Hazard rate is the key concept of the proportional hazards model. Hazard rate measures the risk of making a transition from the absence of an event to the presence of an event, such as from being alive to being dead. Hazard rate is essentially a transition rate. The rate is measured by the ratio of number of cases experiencing the event at the end of a time interval to the total number of cases exposed to the risk of experience the event at the beginning of the time interval.

A hazard model is therefore a model that defines the risk of instantaneous occurrence of a given event. In the analysis of survival data, an event such as death of an individual can be viewed as a failure with the time at death of that particular individual being viewed as the failure time and the total duration of time lived by that particular individual viewed as the survival time.

Cox's proportional hazard model was used to account for censoring in the estimation of exposure time. The coefficients in both models were interpreted as the effects of a given variable on the odds of dying. The coefficients were exponentiated and interpreted as odds ratio. Odds greater than one represented a higher risk of dying while those less than one represented a lower risk of dying.

The first model is of neonatal mortality associated with Socio-economic, Bio-demographic and Socio-cultural variables and the second model included Socio-economic, Bio-demographic and Socio-cultural variables and tested their net effect on neonatal mortality.

CHAPTER FOUR

CHARACTERISTICS OF THE STUDY POPULATION AND DIFFERENTIALS OF NEONATAL MORTALITY

4.1 Introduction

This chapter examined the characteristics of the population understudy. Results of frequency tables analysis are presented and discussed. Frequency distributions have been used to show the basic characteristics of the 5949 live births that occurred three years preceding the 2003 KDHS. Results of bivariate and multivariate analysis carried out on the factors that are associated with neonatal deaths are presented as well as discussion of the findings. Survival analysis has been used to asses the association between the dependent variable and each of the explanatory variables. The study is restricted to the 5949 children born to the sample of women in the 3 years preceding the survey and 502 deaths recorded during the same period.

4.2 Preliminary Analysis

Descriptive statistics were produced to assess the distribution of cases in each variable (both dependent and independent) in order to facilitate recoding of variables which in turn facilitated meaningful bivariate and multivariate analysis. Specifically, recoding was undertaken to take care of variable categories with too few cases and to dichotomize the dependent variables. However, not all variables were recoded. The dependent based on the survival status of the child at the time of the survey and age at death (given in months) was recoded to age at death in days (zero day to exactly one month).

4.3 Characteristics of the Study Population

Table 4.1 presents the basic characteristics of the study population. The dependent variable of the study was the risk of death during the neonatal period. According to the results 3.3 per cent of infants died during the neonatal period. The results show that 58.1

per cent of the births were due to women with at least primary education. It is also evident that most of the women in the sample were from the rural areas. Rift Valley had the majority of the births (20.2 per cent) among the eight provinces. This was followed by western province (13.9 per cent), Nyanza (13.3 per cent), Central (12.3 per cent), Eastern (11.8 per cent), Coast (11.7 per cent), Nairobi (9.2 per cent), and 7.6 per cent for North Eastern.

The findings show that majority of the births (59.8 per cent) belonged to the protestant mothers, while 21 per cent of the births belonged to mothers who belonged to Catholic Church and about 19.2 per cent of the births belonged to mothers of other religious groups. The majority of the births (28 per cent) belonged to mothers of Luhya and Luo ethnic communities. Kikuyus, Embu and Meru communities accounted for 21.4 per cent of the live births while Kisii and Kalenjin communities accounted for 14.7 per cent of the births. Kamba and Mijikenda/Swahili accounted for 9.4 and 7.4 per cent respectively. Other ethnic groups accounted for 18.6 per cent of the births.

The table also shows that most the births (85.9 per cent) belonged to mothers who were currently married. Only 6 per cent were born of mothers who were never married while 8.1 per cent of the births belonged to mothers who were formerly married (divorced, separated, or widowed). Majority of births were due to women (51.3 per cent) in the 20-29 age bracket; 17.9 per cent were under 20 years and 17.3 were over 35 years. The table also show that most women 28.9 per cent waited for at least 24-36 months before having the next child. The data also show that 35.4 per cent of the births were of the second and third orders.

In summary regarding the distribution of background characteristics, a greater part of the births were due to women who had at least primary education. Most of the women in the sample were from rural areas. Majority of the women were in the 20-29 age bracket.

Table 4.1: Distribution of the study population by selected background variables

Variable	Frequencies	Per cent
Mother's education level		
No education	1210	20.3
Primary education	3456	58.1
Secondary education	1032	17.3
Higher	251	4.2
Wealth index		
Poorest	1499	25.2
Poorer	1117	18.8
Middle	1077	18.1
Richer	937	15.8
Richest	1319	22.2
Type of place of residence		
Rural	4415	74.2
Urban	1534	25.8
Region		
Nairobi	548	9.2
Central	730	12.3
Coast	699	11.7
Eastern	700	11.8
Nyanza	792	13.3
R/Valley	1200	20.2
Western	828	13.9
North Eastern	452	7.6
Mother's ethnicity		
Kikuyu/Embu/Meru	1274	21.4
Kisii/Kalenjin	877	14.7
Kamba	562	9.4
Luhya/Luo	1665	28
Mijikenda/Swahili	466	7.8
Others	1105	18.6
Religion		
Roman Catholic	1252	21.0
Protestant/other Christian	3555	59.8
Muslim	945	15.9
No religion	174	2.9
Other	16	0.3
Marital status		
Never married	355	6.0
Currently married	5113	85.9
Formerly married	481	8.1
5-year Age groups		
15-19	407	6.8
20-24	1616	27.2
25-29	1690	28.4
30-34	1147	19.3
35-39	665	11.2
40-44	337	5.7
45-49	87	1.5

Table 4.1 (continued)

Variable	Frequencies	Per cent
Preceding birth interval (Months)		
<24	1051	17.7
24-36	1717	28.9
36+	1693	28.4
First birth	1488	25.0
Birth order of child		
First	1488	25.0
2-3	2105	35.4
4-5	1184	19.9
6+	1172	19.7
Child Alive		
No (0)	196	3.3
Yes (1)	5753	96.7
Total	**5949**	**100.0**

4.4 Neonatal Risk of Dying

Table 4.2 presents the computed life table values for the probabilities of dying before attaining one month. The neonatal period in this study has been subdivided into intervals in days. The analysis is restricted to 5949 births that took place 3 years preceding the survey. Table 4.2 presents the results of the observed risk of death in three days intervals and the equivalent life table values. The obtained hazards (instantaneous risk of death) below indicate that the risk is highest immediately after birth (0-<1 day) at 0.0072. This could be attributed to pregnancy complications, delivery-related complications, premature birth, birth trauma untreated maternal infections including sexually transmitted diseases, urinary tract infections (Child Health Research Project, 1999). During the first 6 days neonatal mortality remains high but decreases sharply to lower levels. The results conform approximately to the expected reversed J shaped mortality pattern as shown in Figure 4.1.

Table 4.2: Empirical risk of death by days and the equivalent life table values

Interval in days	No. exposed to the risk at the beginning of the interval	No. of deaths in the interval	Hazard rate
0-< 1	5949	127	.0072
1-< 3	5822	31	.0018
6-< 9	5791	13	.0007
9-< 12	5778	5	.0003
12-<15	5773	8	.0005
15-<18	5765	0	.0000
18-<21	5765	4	.0002
21-<24	5761	2	.0001
24-<27	5759	3	.0002
27-<30	5756	3	.0002
Total		196	-

Figure 4.1: Risk of Dying

Figure 4.1 shows the hazard rate during the neonatal period given in days. According to the graph, the risk of death is high immediately after birth but drops to lower levels after the first week. The results conform approximately to the expected reversed J shaped age-specific mortality pattern.

4.5 Differentials in Neonatal Mortality

This section examines the differentials in neonatal mortality in Kenya by socio-economic, socio-cultural and bio-demographic factors. Results of the analysis carried out on the factors that are associated with neonatal deaths are examined as well as a discussion of the findings.

Table 4.3 showed sharp variations of levels of neonatal mortality with respect to education attainment. As expected, neonates born to mothers with higher education exhibited the lowest neonatal fatalities at 0.5 compared to those born to mothers with no education. Neonates born to mothers with secondary education were 0.6 times respectively less likely to die in comparison to neonates born to illiterate mothers.

Table 4.3: Association between neonatal mortality and socioeconomic, socio-cultural and bio-demographic variables

Model I

Mother's education level	B	SE	Exp(B)
No education(RC)			
Primary education	-.141	.107	.868
Secondary education	-.496	.155	.609**
Higher	-.745	.303	.475*
Wealth Index	B	SE	Exp(B)
Poorest (RC)			
Poorer	-.214	.132	.808
Middle	-.248	.135	.781*
Richer	-.351	.147	.704*
Richest	-.242	.127	.785*
Type of place of residence	B	SE	Exp(B)
Rural (RC)			
Urban	.056	.103	1.057

Table 4.3 (continued)

Region	B	SE	Exp(B)
Nairobi (RC)			
Central	-.488	.235	.614*
Coast	.027	.210	1.027
Eastern	-.108	.216	.898
Nyanza	.673	.184	1.961***
R/Valley	-.100	.194	.905
Western	.383	.190	1.467*
North Eastern	.382	.214	1.465*
Mother's ethnicity	B	SE	Exp(B)
Kikuyu/Embu/Meru (RC)			
Kisii/kalenjin	.602	.188	1.826**
Kamba	.582	.211	1.789**
Luhya/Luo	1.147	.156	3.148***
Mijikenda/Swahili	.484	.230	1.623*
Others	.912	.170	2.488***
Mother's Religion	B	SE	Exp(B)
Roman Catholic (RC)			
Protestant/Other Christian	.137	.118	1.147
Muslim	.285	.146	1.329*
No religion	-.496	.368	.609
Others	-8.890	76.840	.000
Marital Status	B	SE	Exp(B)
Never married (RC)			
Currently married	.247	.214	1.281
Formerly married	.520	.250	1.683*
Five year age groups	B	SE	Exp(B)
15-19 (RC)			
20-24	.042	.197	1.043
25-29	-.025	.197	.976
30-34	.015	.205	1.015
35-39	.153	.218	1.166
40-44	.371	.240	1.449
45-49	.835	.313	2.304**
Preceding birth interval (Months)	B	SE	Exp(B)
<24 (RC)			
24-36	-.627	.124	.534***
36+	-.567	.122	.567***
First birth	-.604	.128	.547***
Birth order of Child	B	SE	Exp(B)
First (RC)			
2-3	.093	.123	1.097
4-5	.021	.143	1.022
6+	.453	.129	1.574***

Statistical significance: ***P ≤ 0.000 **P ≤ 0.05 *P ≤ 0.10

Neonates born to women with highest wealth index had a 0.8 lower chance of dying compared to those born to mothers with lowest wealth index. However, neonates born to women with richer wealth index exhibited the lowest chance of dying of 0.7.

Regions showed sharp variations with respect to levels of neonatal mortality. Neonates born to mothers from Central Province experienced a 0.6 times lower deaths compared to those born to mothers from Nairobi Province. However, neonates born to women from Western and North Eastern provinces were both 1.5 times more likely to die and neonates born to women from Nyanza province exhibited slightly elevated risk of neonatal deaths of 2.0.

Considering mother's ethnicity, children born to women who were Mijikenda/Swahili, Kamba, Kisii/Kalenjin or 'others ' ethnicities were 1.6, 1.7, 1.8 and 2.4 times respectively more likely to die than those born to women who were Kikuyu/Embu/Meru. Neonates born to women from Luhya/Luo ethnic groups exhibited slightly elevated risk of neonatal death of 3.1 compared to the rest.

Neonates born to women who were Muslim exhibited a 1.3 higher chance of neonatal death compared to born to women who were Roman Catholic. According to the results, neonates born to women formerly married women were 1.6 times more likely to die in comparison to those born to mothers who were never married.

Neonates born to women in the age bracket 45-49 were 2.3 times respectively more likely to die compared to those born by women in the 15-19 age bracket. Neonates born to women with a preceding birth interval 24-36, 36+ and first birth were 0.5, 0.6 and 0.5 less likely to die in comparison to those born to women with a birth interval of less than 24 months. Births of order 6th or higher were 1.6 more likely to die compared to those born to women having their first birth.

No significant association was found between type of place of mother's residence and the risk of neonatal deaths in this model.

4.6 Covariates of Neonatal Mortality

Table 4.4 summarizes the results of the multivariate model in which all the variables were included. The results in this table show that neonates born to mothers with higher education experienced 0.5 times lower death risk of their neonates compared to those born to mothers with no education. Neonates born to women with secondary education were 0.6 times less likely to die compared to those born to women with no education.

Table 4.4: Covariates of neonatal mortality

Model II

Mother's education level	B	SE	Exp(B)
No education(RC)			
Primary education	-.123	.158	.884
Secondary education	-.484	.207	.616*
Higher	-.643	.344	.526*
Wealth Index	B	SE	Exp(B)
Poorest (RC)			
Poorer	-.126	.138	.882
Middle	-.018	.144	.982
Richer	.026	.163	1.027
Richest	.079	.203	1.082
Type of place of residence	B	SE	Exp(B)
Rural (RC)			
Urban	.084	.160	1.088
Region	B	SE	Exp(B)
Nairobi (RC)			
Central	.132	.313	1.141
Coast	.172	.283	1.188
Eastern	.117	.302	1.124
Nyanza	.441	.236	1.554*
R/Valley	-.120	.245	.887
Western	.081	.247	1.084
North Eastern	-.047	.308	.954

Table 4.4 (continued)

Mother's ethnicity	B	SE	Exp(B)
Kikuyu/Embu/Meru (RC)			
Kisii/Kalenjin	.617	.261	1.852*
Kamba	.535	.264	1.707*
Luhya/Luo	.998	.245	2.713***
Mijikenda/Swahili	.184	.369	1.202
Others	.694	.268	2.002*
Mother's Religion	B	SE	Exp(B)
Roman Catholic (RC)			
Protestant/other Christian	.127	.120	1.135
Muslim	.251	.226	1.285
No religion	-.326	.384	.722
Others	-8.946	78.089	.000
Marital status	B	SE	Exp(B)
Never married (RC)			
Currently married	.028	.230	1.028
Formerly married	.340	.262	1.405
Five year age groups	B	SE	Exp(B)
15-19 (RC)			
20-24	.154	.204	1.166
25-29	.229	.223	1.257
30-34	.325	.255	1.384
35-39	.442	.286	1.556
40-44	.654	.311	1.923*
45-49	1.187	.382	3.279**
Preceding birth interval (Months)	B	SE	Exp(B)
<24 (RC)			
24-36	-.618	.125	.539***
36+	-.539	.129	.583***
First birth	-.113	1.012	.893
Birth order of child	B	SE	Exp(B)
First (RC)			
2-3	.250	1.010	1.284
4-5	.059	1.021	1.061
6+	.181	1.026	1.198

-2 Log likelihood: 8527.523 df=38 X^2=161.246 Sig .000

Statistical significance

***P ≤ 0.000 **P ≤ 0.05 *P ≤ 0.10

Neonates born to mothers from Nyanza province experienced a 1.6 higher chance of neonatal death compared to those born to women from Nairobi province.

Neonates born to women from Kamba and Kisii/Kalenjin ethnic groups and 'Other' ethnicities were 1.7, 1.9 and 2.0 times respectively more likely to die compared to neonates born to women from Kikuyu/Embu/Meru ethnic groups. Neonates born to women from Luhya/Luo ethnic groups exhibited the highest risk of neonatal death of 2.7 compared to the rest.

Considering the five year age groups neonates born to women who were in the age groups 40-44 and 45-49 were 2.0 and 3.3 times more likely to die compared to born to women in the age group 15-19.

Neonates born to women with a preceding birth order of 24-36 and 36+ were 0.5 and 0.6 times less likely to die compared to those born to women with preceding birth interval of less than 24 months.

No significant association was found between wealth index, type of place of mother's residence, her religion, her marital status and birth order with neonatal risk of death.

The results from both models indicate that neonatal mortality decreases with increase in mothers' education and that neonates whose mothers had higher education had the lowest mortality. Results from both models show a consistent negative relationship between maternal education and neonatal mortality in Kenya. Neonatal mortality was highest among neonates born to illiterate mothers. Hence as the level of education increases, the risk of neonatal death is greatly reduced. There has also been significant association between maternal education and the risk of neonatal death in both models. Even with the inclusion of all factors, the effect of maternal education on neonatal mortality reduced but still remained significant.

The results of this study support the hypothesis that the risk of neonatal death decline with the increase in the number of years of formal schooling. Studies have found out that maternal education influences child survival in various ways. According to Mosley and Chen (1984), the intermediate variables through which maternal education influences child survival may be the choices and skills of the mother in the health practices related to contraception, nutrition, hygiene, preventive care, and treatment of diseases. Maternal education influences child survival through various pathways: enhanced socioeconomic status, greater health choice for children including interaction with medical personnel, cleanliness, emphasis on child quality in terms of fewer children, and greater food and capital investments (Caldwell, 1979; Ware, 1984).

Educated women are less fatalistic about children's health, more effective in allocating a greater share of family resources to children's ill health, and are more competent in accomplishing such tasks as taking sick children to health facilities without delay (Caldwell, 1979). Mothers' education attainment was intended to capture the knowledge level of child care with the underlying assumption that the higher the educational attainment, the better the child health care through enhanced socioeconomic status.

Considering wealth index, neonates born to mothers in the highest wealth index did not exhibit the lowest neonatal fatalities as expected. In the full model, though not statistically significant neonates born to women with the highest wealth index depicted unexpected relatively higher neonatal mortality compared to those from low wealth index. This could probably be attributed to poor quality of reporting regarding household possessions during the survey and the sample size used in the Kenya Demographic and Health Survey (2003). Hence the results of this study did not support the hypothesis that higher wealth index lead to higher standard of living and thus relatively lower risk of neonatal deaths. The household assets were intended to capture the effect of resources

available for the child health care and hence a proxy for standard of living in the household.

There are rural-urban differentials in relation to neonatal mortality in Kenya. Although a large sample was from the rural areas about 74 per cent, neonates born to women from the urban areas in both models experienced slightly elevated neonatal deaths compared to neonates born to women from rural areas though not significant in both models. This could be attributed to fast growing informal settlements in urban centres characterised by high poverty levels. Using data from the World Fertility Surveys, Caldwell and McDonald (1982) found that urban/rural residence had little impact on child survival for many countries. They interpreted this finding by saying that uneducated women in towns, because of poverty or location, have little access to health services though facilities are more widely available there than in the rural areas. The variable type of place of residence was intended to capture high standards of living associated higher incomes in urban centres.

Regarding regions, neonates born to mothers from Nyanza province exhibited the highest neonatal fatalities in both models. Geographical setting was found to strongly influence child survival in this study. The possible explanation for the elevated neonatal risk in the region could be attributed to high malaria and the high rate of HIV/AIDS in the area (Kiragu, 2006).

Mother's ethnicity was found to be statistically significant in both models; neonates born to women from Luhya/Luo ethnic groups exhibited the highest risk of death in both models. This variable mothers' ethnicity was intended to capture the effect of cultural influences on the risk of death during neonatal period.

Neonates born to mothers who were Muslim exhibited a 1.3 higher chance of neonatal death compared to born to women who were Roman Catholic. Mother's religion was

found to be significantly associated with the risk of neonatal death in first model. The mother's marital status was found to be significantly associated with the risk of neonatal deaths in the first model with neonates born to women formerly married exhibiting higher neonatal fatalities.

The age of the mother at birth was found to influence child survival in this study. Neonates born to women aged 45-49 exhibited the highest neonatal mortality in both models. Studies carried out found that the risk of neonatal mortality was highest in women at the extremes of their reproductive years (Child Health Research Project, 1999). The higher incidence of infant mortality and still births among the older mothers is because of their high susceptible to various diseases such as anaemia, diabetes, heart diseases and low blood pressure which affect the health of the child in the womb (Mwondo, 2002). However, the results do not indicate an elevated risk of neonatal deaths among women aged 20 and below. The variable was intended to capture the effect of age on the risk of death during neonatal period.

In both models, preceding birth interval was found to be significantly associated with risk of neonatal death. Neonates born to mothers with a preceding birth interval of more than 24 months had lower chances of death compared to those born to women with a preceding birth interval of less than 24 months. Studies show that shorter birth intervals necessitate early weaning to the older child. Additionally, the presence of younger siblings causes greater competition for food and family resources (James et al., 2000).

In both models, neonates of higher birth order 6+ exhibited slightly elevated neonatal deaths though not statistically significant in the full model. Studies have also found that the neonatal mortality rate was usually high for the first order and higher order births (about 4 and higher parity) and low for middle range (second to fourth order births) (Mwondo, 2002).

4.6 Summary of the Findings

Results from the life table indicate that the risk of death during neonatal period is highest immediately after birth (0-<1 day). During the first 6 days neonatal mortality remains high but decreases sharply to lower levels. The results conform approximately to the expected reversed J shaped mortality pattern.

It is evident that from the findings that maternal education, wealth index, mother's region of residence, mother's ethnicity, her religion, her marital status, mother's age at birth, preceding birth interval and birth order were significantly associated with the risk of neonatal death. However, mother's type of place of residence though associated with the risk of neonatal deaths was found not significantly associated with neonatal mortality in both models.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1. Summary and Conclusions

The study sought to establish covariates of neonatal mortality in Kenya. The general objective was to establish factors that influence neonatal mortality in Kenya. The specific objectives were to determine differentials in the risk of neonatal mortality in Kenya by socio-economic, socio-cultural and bio-demographic factors and to determine the influence/effect of socio-economic, socio-cultural and bio-demographic factors on neonatal mortality in Kenya. Variables were selected from the 2003 Kenya Demographic and Health Survey and some were recoded to facilitate the analysis. The analysis targeted neonates; the life table and the Cox proportional hazard model were used.

Some of the expected findings were confirmed while others were contrary to the expectations. There is a significant association between maternal education and the risk of neonatal death in the two models in Tables 4.3 and 4.4. Neonatal mortality was highest among neonates born to illiterate mothers. Even with the inclusion of all factors, the effect of maternal education on neonatal mortality remained significant.

However, neonates born to households with highest economic standard (richest) did not experience the lowest risk of dying as was expected. In addition neonates born to mothers from urban areas had a higher risk of dying compared to those born to mothers from rural areas though not significant in both models.

There were regional differentials in neonatal mortality with neonates born to mothers from Nyanza province having the highest neonatal risk in both models. Neonates born to Luhya/Luo mothers experienced the highest neonatal deaths in both models. Formerly married mothers had the highest neonatal deaths though not significant in the second model. Neonates born to women aged 45-49 had a higher risk of dying compared to the

other age groups in both models. Neonates of 6+ birth order experienced higher risks of dying compared to first births.

The importance of education particularly that of the mother has been well established and widely accepted. As has been confirmed by many other studies (Caldwell, 1979; Mosley, 1985; Hobcraft et al., 1984; Kiragu, 2006) educated women have children with increased survival chances. Mother's level of education was found to have significant impact in reducing neonatal mortality. In both models the effect of mother's education is strong and significant. Another important finding of the study is that neonatal mortality was higher in urban areas compared to rural areas though not statistically significant. Mother's region of residence, ethnicity, wealth index, her marital status and her religion were found to be significantly associated with the risk of neonatal death. Mother's age at birth, preceding birth interval and birth order were significantly associated with the risk of neonatal death. The main policy implication of the study includes empowerment of women through education.

5.2 Recommendations

In order to achieve the health-related Millennium Development Goal target of a two thirds reduction in under-five mortality from 1990 to 2015, major reductions will be required in neonatal mortality. Formal education of mothers is critically important to the promotion of child health and disease prevention.

Empowerment of women through education that includes reproductive health education, access to employment opportunities and primary health care would help in reducing neonatal mortality. Formal education programmes should be promoted amongst young women. Enhancing maternal education will help reduce neonatal mortality through positive benefits associated with education.

There is need also to develop effective health policies that incorporate public and private dimensions of investments in child health. Policy measures should aim at strengthening the current Information Education and Communication (IEC) that enhances child survival. Some of the results were contrary to expected occurrence. The study recommends further research on the same by use of primary data and use of qualitative methods.

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