DETERMINANTS OF NEONATAL MORTALITY IN NORTH EASTERN REGION IN KENYA

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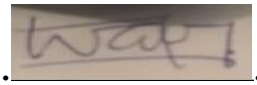
DECLARATION

The project remains my original work and has not been presented for a degree in any other learning institution.

Signature: **…**  **…** Date: **…30/11/2020……**

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DEDICATION

This project is dedicated to all people of goodwill, to my mother (Annah M. Ng'elu) for her desire, vision and prayers to steer me to the utmost level of education. More so, to my wife (Gloria), and son (Carlos Mwendwa Kaloki), for their support and encouragement throughout this demanding period. May the Almighty God bless you all.

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ABSTRACT

Neonatal mortality in Kenya is high, about 42% of the total under five mortality rates, signifying their importance in the overall mortality rates in Kenya. Majority of the neonatal mortalities are in the marginalized areas of Northern Kenya and pastoral communities. Kenya has an average of 22 deaths per 1000 live births with the three counties in the North Eastern region of Kenya having 24 deaths per 1000 live births. The main objective of the study was to identify the factors influencing neonatal mortality in North Eastern Kenya. Specific objectives included to establish whether maternal demographic variables, socioeconomic variables and newborn bio-demographic variables had an influence on neonatal mortality. The study used the 2014 KDHS data collected in the region of North Eastern Kenya. Neonatal mortality was analyzed using SPSS through Cox regression. Cox regression was used as the events (neonatal deaths) were few, countable and involved censored data. The findings were that maternal demographic factor influencing neonatal mortality was age at the delivery, with neonates born to women aged 35 years and above being 24.8 times likely to die within their first 28 days of life. Socioeconomic factors were not significant predictors of neonatal mortality. For child bio-demographic variables, size of child at birth was significant predictor of neonatal mortality, with neonates reportedly born average and large having 99.3% and 99.6% respectively reduced risk to death within the first 28 of life. In conclusion, age of the mother at birth, and the size of child at birth were significant predictors of neonatal mortality in North Eastern. Recommendations include designing and implementing sexual health and reproduction programs targeting women; policies to tackle right nutrition and health seeking behaviors; and advocacy messages on fertility targeting mothers on ages of giving birth, birth spacing, and seeking ante-natal care services. Future studies can be done to establish whether there are changes on the major predictors of neonatal mortality based on the successive KDHS data, and evaluate whether the region is on course towards achieving WHO "*Every Newborn Action Plan"* goal of neonatal mortality rate of below 10 deaths per 1,000 live births by 2035.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS AND ACRONYMS

ANC	Ante-natal Care
ASALs	Arid and semi-arid areas
CHW	Community Health Workers
KDHS	Kenya Demographic Health Survey
LBW	Low Birth Weight
MDGs	Millennium Development Goals
NER	North Eastern Region
NM	Neonatal Mortality
NMR	Neonatal Mortality Rate
PNC	Post-natal Care
SDGs	Sustainable Development Goals
SEA	South Eastern Asia
SPSS	Statistical Package for Social Scientists
SSA	Sub-Saharan Africa
TFR	Total Fertility Rate
U5MR	Under Five Mortality Rate
UN	United Nations
UNICEF	United Nations Children's Fund

CHAPTER ONE: INTRODUCTION

1.1 Background to the Study

This chapter introduces the topic on neonatal mortality in Kenya, narrowing down to the three counties of Garissa, Mandera and Wajir, which form the North Eastern region. The discussion on the neonatal mortality situation is described in the background to the study, as well as other sections in chapter one including the statement of the problem, objectives, justification, research questions, and lastly the scope of the study.

Neonatal mortality problem has been captured under the Sustainable Development Goals (SDGs) as they were not achieved in the previous MDGs (Millennium Development Goals) (Muriithi, & Muriithi, 2015). The 2015 SDGs were adopted by United Nations (UN) to spearhead development across all sectors for all countries by 2030. SDG Goal Three target 3.2 aims at preventing newborn deaths and reducing U5MR to 25/1000 live births or less by the end of SDGs in 2030. The SDG Goal Three, target 3.2 is also linked to Target 3.1 which purposes to reduce the worldwide maternal mortality to below 78 deaths in 100,000 live births. Out of over 160 countries singed to UN (United Nations), about 47 are not expected to meet the proposed SDGs goal 3. Of the 130 million infants born each year, four million die within their first 28 days of their lives. Neonatal mortality across the world accounts for 40% of all the under-five mortality rates (U5MR). Kenya has relatively similar statistics with neonatal mortality rate amounting to 60% of the overall infant mortality. In addition, little focus has been given to neonatal mortality as compared to child mortality and infant mortality (Yego, 2013).

The global trend in neonatal mortality rate reduced by 51% from 36.6 in 1990 to 18.0 deaths for every 1000 live births in 2017, showing a half-reduction in NMR (Hug, Alexander and You *et al*,

2019). During the same period, neonatal deaths decreased from 5.0 million to about 2.5 million. The Millennium Development Goal (MDG) was to reduce neonatal mortality by 2/3 between 1990 and 2015 (Kulei, 2016). Across the world, about 2.7 million newborns lose their lives annually during the first twenty-eight days of their lives with more than half of deaths happening in the first 24 hours after birth. Additionally, about 75 percent of these deaths are registered in the first week of life. Yego (2013) noted that NMR showed a downward trend from 89/1000 in 1990 to 60/1000 live births in 2009, leading to a 28 percent reduction in NMR. The global change had not been reflected in South East Asia (SEA) and sub-Saharan Africa (SSA). Following the set MDG targets, neonatal mortality reduced from 5.1 million in 1990 to about 2.7 million by 2015. It was observed that the decline in neonatal mortality was also slower than the general U5MR in the fifteen-year period covering MDGs.

Africa has also experienced a decline in NMR, but not meeting the previously set and lapsed MGDs. East Africa registered 41 percent as compared to 42 percent of NMR leading to the overall U5MR in Africa. Some African countries like Niger record a higher NMR percentage of the overall U5MR. Some countries have 60 percent of NMR contributing to the overall U5MR. Africa has about 45 deaths in every 1000 live births in terms of neonatal mortality (NM), making it the highest in the world. In Africa, neonatal deaths in the first week (7 days) after birth were 76 deaths in a thousand live births. Consequently, 34 countries in Sub-Saharan Africa (SSA) might not meet the newly set Sustainable Development Goals (SDGs) of achieving 25 deaths in a thousand live births and below by 2030 if the existing trends persist. The SDGs were adopted by the UN to replace the expired MDGs that were not achieved in terms of reducing child mortality (Akinyemi, 2015). Over 41 percent of the estimated 9.7 million children under five dying annually come from sub-Saharan Africa (SSA) (Rutherford, Mulholland & Hill, 2010). The deaths are associated with factors like

adequate access to healthcare and food security that have direct effect on child mortality (Oganda, 2014).

In Kenya, the major causes of neonatal mortality included birth trauma and asphyxia (31.6 percent), prematurity at 4.6 percent, sepsis at 15.8 percent, and congenital anomalies at 13.8 percent (Kulei, 2016). The other minor causes of neonatal mortality included acute respiratory infections at 6.7 percent, injuries at 1.1-percent and tetanus at 0.9 percent while the other varied causes of infant mortality contributed to 4.8 percent (Holtz, 2017). Among the category of other causes of diseases contributing to 4.8 percent were diarrheal diseases at 0.3 percent, pertussis at 0.2 percent, and HIV/AIDS at 0.1 percent respectively (KDHS County Level Fact Sheet, 2014).

Kenya, as well as other countries in SSA, has worked to reduce its NMR to the set SDGs by 2030. There has been a decline in overall childhood mortality as reported in the 2014 KDHS (Kenya Demographic Health Survey). Neonatal Mortality rate has not reduced as expected, only reducing to 22 deaths per 1000 live births. NMR makes about 60 percent of the total under five mortality deaths in Kenya (KDHS 2008-2009).

North Eastern region of Kenya has three counties of Garissa, Mandera and Wajir. The socioeconomic conditions and cultural background have shown to influence fertility and childhood mortality rates. The focus on North Eastern region is based on the three counties' Neonatal Mortality Rate (NMR) of 24 neonate deaths per 1000 live births, when compared to the country's neonatal mortality (NMR) rates of 22 neonate deaths in every thousand live births. The three regions are inhabited by the Cushitic nomadic people, mostly ethnic Somalis and other minor tribes like Oromo, Rendille, and Gabra. The nomadic way of life, involving moving from one region to

another in search of pasture and food has compromised access to health services along with making it hard for expectant mothers to deliver health babies.

The Kenyan North Eastern pastoralists are a marginalized group in terms of access and consumption of healthcare services. Most of pastoral communities are located in the arid and semi-arid areas (ASALs) that are known for poor rains and high cases of food insecurity, a precursor to poor maternal health among the women. Access to healthcare is limited among majority of Sub-Saharan African (including Kenya) communities with the most of women having had only visited ante-natal clinics fewer than three times as compared to the recommended four times during the course of pregnancy (Rutherford, Mulholland & Hill, 2010). Due to lack of adequate health facilities, with the available ones far spread apart, women are not motivated to go for check-ups, a condition that further complicates the pregnancy status of women (Ogada, 2014). The poor access to healthcare is also associated with the number of delivering women at healthcare facilities. Delivery at a health facility improves the survival chances of babies and improves the health of mothers.

High TFR (Total fertility rates) of 5.2 has been associated with increased neonatal and infant deaths (Gashawbeza, 2014). When the TFR is high, mothers are not likely to adequately feed and care for all their children (Ogada, 2014). Food insecurity in the three counties is rampant and is associated with poor health outcomes like malnutrition, deficiency diseases, vicious cycle of diseases, and long-term effects like stunting that leads to mothers producing children who are likely to be stunted. Stunted mothers were likely to be associated with poor birth outcomes, including low weight births and having complicated deliveries.

The other problem associated with increased neonatal mortality among the reproductive women in the three counties is marginalization. Ole Tankoi, Asito, and Adoka (2016) on a study on child survival and the fertility among the refugees found excess mortality among the neonates and infant children among the marginalized and displaced populations. The three counties in the North Eastern region are often associated with insecurity emanating from terrorists who scare away humanitarian organizations supporting mothers at the grassroots. Marginalization in terms of resource allocation, equal distribution of health resources by the county governments and spread of the NGOs and other humanitarian groups have also led to disparities in access to healthcare services as well as maternal and child medical services, further compromising the wellbeing of neonates and increasing their likelihood of dying during their first 28 days of their lives.

1.2 Problem Statement

The literature review had contradicting conclusions on how the maternal demographic factors influenced neonatal mortality across different regions. Different studies found age at delivery significantly influencing neonatal mortality while other studies found it as a non-significant predictor (Verwimp & van Bavel, 2012; Wintz, 2013). Area of residence has been described by majority studies reviewed as non-significant predictor of neonatal mortality, especially in the advent of healthcare to the grassroots (Kerber, 2015; Ansari *et al*., 2015). There were also contradictory findings especially on socioeconomic factors of household wealth where the poor had less likelihood of experiencing neonatal mortality as compared to affluent households. Further from the differing findings on predictors of neonatal mortality, little focus has been given to neonatal mortality in Kenya as compared to child mortality and infant mortality (Yego, 2013; Ogada, 2014). Through the reviewed literature, recent studies on neonatal mortality in Kenya

focused on the Western region by Kaguthi *et al* (2018); Yego (2013) in Eldoret's Moi Teaching and Referral Hospital (MTRH); and Ikamari (2013) on regional variations on neonatal and post-neonatal mortality. No recent and published demographic study had been done on predictors of neonatal mortality in North Eastern Kenya, necessitating this study. The contradicting findings from the reviewed literature; and the gap in having any recent demographic study on predictors of neonatal mortality in NE region led to this research.

1.3 Research Questions

The overall research question for the study was;

What factors influence neonatal mortality in the North Eastern Region of Kenya?

1.4 Objectives

The main objective of the study was to establish the factors associated with neonatal mortality in North Eastern Region in Kenya.

The specific objectives of the study were;

1. To establish the demographic determinants of neonatal mortality in the North Eastern Region of Kenya
2. To establish the socioeconomic determinants of neonatal mortality in the North Eastern Region of Kenya
3. To establish the influence of newborn bio-demographic variables on neonatal mortality in the North Eastern Region of Kenya

1.5 Justification of Study

The World Health Organization (WHO), through *Every Newborn Action Plan* program, has a goal of dropping and attaining neonatal mortality rate of below 10 deaths per 1,000 live births by 2035

(KDHS, 2014, p.115; World Health Organization, 2014). Kenya, which has ratified to the UN SDGs, collaborates with other countries to ensure neonatal mortality is reduced based on SDG Target 3.1 and 3.2. The three counties in the Northern Region of Kenya have a combined neonatal mortality of 24, which is slightly higher than the national rate of 22 neonate deaths per 1000 live births. Conducting this study gave the significant factors that would need addressing to contribute to reducing neonatal mortality, a component captured under SDG Target 3.1 on reducing preventable newborn deaths.

The first 28 days of live for a newborn are critical for survival as the period determines the stability of the baby to feed well and adopt to the new environment. The new baby's characteristics, like birth weight, are likely to influence whether the baby survives or not. A brief by UNICEF on multi-sectoral approaches to nutrition pointed that the first 1000 days, from pregnancy to the second birthday of the child are critical as they are likely to cause life-long and equally irreversible damage to the child, to the community and also at the national levels. The study thus seeks to establish the neonatal mortality status among the children born to reproductive women in the three counties of North Eastern Kenya. Poor nutritional status of women is associated with low birth weight and consequently increasing the risks of deaths. The facilitation of medical services to pregnant women, and especially the ante-natal care (ANC) improves the chances of women giving birth normally and to healthy babies (Verwimp & van Bavel, 2012).

The study findings are likely to benefit scholars through adding academic literature on reproductive health of mothers in the three counties in North Eastern Kenya in terms of losing their neonates and infants. Through highlighting the major factors associated with neonatal mortality, concerned county governments, the national government and the local NGOs would be able to intervene and implement projects that can alleviate the plight of high neonatal mortality. The study

findings also benefit the ministries of health both at the national and at the county government in implementing health measures to improve the survival of neonates. The value of undertaking the study is penned on the findings and recommendation that are likely to inform actions from concerned national county governments and NGOs to implement programs targeting reproductive women in North Eastern.

1.6 Scope of Study and Limitations

The study focused on North Eastern Region of Kenya. Study topic was neonatal mortality among the selected productive mothers and infants as sampled in the 2014 KDHS (Kenya Demographic Health Survey). Units of analysis were the neonates born to reproductive mothers aged 15-49 years in three counties, all collectively classified under North Eastern region.

Limitation on the data was that, being a secondary data set, there were missing variables like counties and ethnicity. Since the two were not well-captured in the data set used, they were assumed not to be significant factors influencing neonatal mortality in the mostly ethnic Somali inhabited region. To further solve the data limitation, analysis was not segregated based on the counties, but on the whole North Eastern region. Another limitation for using this kind of secondary data was data heaping where respondents tend to round off their ages to the nearest 0 or 5. This could have affected the frequencies of respondents during variable categorization, consequently presenting biased results.

The second limitation was in relation to the procedures used to prepare the data. There were missing values for some variables which could have influenced the quality of data and output. To handle the limitation, the missing values were excluded from the analysis through recoding the variables.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter focuses on the literature review, both empirical and theoretical that is related to the study variables. The other sections included empirical literature focusing on the key predictor (independent) and response (dependent) variables, previous research done on the effects of the independent variables on the status of neonatal mortality.

2.2 Theoretical Literature

The theoretical literature focuses on the Mosley and Chen analytical framework, which expounds on the determinants of child survival in unindustrialized and developing countries. It (the framework) incorporates biological and social predictors most likely to determine child survival.

Mosley and Chen framework has not conclusively captured variables supporting neonatal mortality as the most proximate predictors act as secondary influencers to the survival of neonate. The Mosley and Chen framework seeks to establish correlations between socioeconomic characteristics and mortality. For instance, household income, maternal education, as well as mothers' health status determine child's mortality. In the medical science approach of studying the socioeconomic determinants of child mortality, aspects like environmental contamination/dietary intake had a direct influence on occurrences of diseases, infections and maternal demographic factors that influence mortality. As per social science approach of Mosley and Chen framework, socioeconomic determinants influence a proximate determinant which then influences mortality.

Mosley and Chen (1984) indicated that sickness was the direct cause of most deaths as influenced by maternal factors, and breastfeeding among other variables that relate to nutritional status, that then has an effect on mortality. The authors pointed out that the dependent variable in most of the

studies is morbidity (the manifestation of disease among the survivors) that is usually calculated in terms of prevalence or incidence of the disease among the population. The authors also indicated that the socioeconomic determinants (which mostly translate to independent predictors), mostly operate by acting on the basic proximate determinants, which in turn dictate the threats of sicknesses occurrence, and their outcomes.

2.3 Empirical Literature

2.3.1 Maternal Demographic Factors

Neonatal mortality is categorized into two, initial (early) neonatal period lasting for the first seven days and the late neonatal period lasting for the other 21 days up to the 28^{th} day of life. Maternal and neonatal characteristics contribute the largest percent of neonatal mortality. Maternal variables captured include mother's age where mothers below eighteen (18) years are likely to have higher neonatal mortalities as compared to mothers age 18 and above. Residence of the mother and the baby, urban versus rural, previously had a significant influence but the urban advantage has been erased with the children in rural areas having better chances of surviving (Kerber, 2015).

The Age of the mother is a crucial determinant in neonatal mortality as experienced mothers are likely to notice any unusual signs and take their children to the hospital. Experienced mothers are also likely to seek ANC services improving the chances of survival for the babies. A study by Wintz (2013) in India noted that teenagers who were 20 years and below experienced higher incidences of neonatal mortality when compared to mothers above age twenty (20) years. The study identified risk factors like low birth weight babies (LBWB) which further increased the likelihood of neonatal mortality. The study also pointed out mothers who were above 30 years also had higher neonatal mortality rates due to complications like congenital malformations. It was therefore indicated that the age of the mother during delivery was a significant factor in influencing

whether a baby survives the first 28 days of life. The Kenya country profile brief by UNICEF (2016b) indicated that NMR for younger mothers (>20 years) was 1.3 times higher at 27/1000 live births when compared to NMR for mothers aged 20-29 years at 21/1000 live births.

Mothers' age was also associated with experience in handling previous births and children, thus increasing the likelihood of improving baby care. Antenatal and post-natal clinics for the previous births for the elder mothers improved their knowledge on baby diseases, complications and having education interventions were regarded as benefits elder and non-first mothers were likely to benefit from, increasing their neonatal survival (Verwimp & van Bavel, 2012). Apart from the first-time mothers above 30 years who had high likelihood of developing delivery complications, mothers between 20 and 30 years had lower risks of neonatal mortality. The study by Engman (2011) indicated that the age of the mother was also associated with community support where older mothers were likely to seek help as compared to teenage mothers starting motherhood.

Marital status of the mother was also associated with significant changes in neonatal mortality. Married mothers are likely to have support from their partners in caring for the neonates. Support from partners was recognized in the form of taking medical care for the baby, moral and spiritual support that strengthens the mother improving the survival of the neonate (Engman, 2011; Ansari *et al*., 2015). Mothers with partners are also likely to be supported financially and through provision of basic goods like food and shelter which give the mother humble time to focus on caring the baby.

Wintz (2013) study on spiritual and cultural values indicated that single mothers' experienced lack of moral and spiritual support from partners in addition to financial worries. The author also pointed that single mothers were more exposed to engaging in multiple sexual relations to earn

and improve their survival. The engagement of multiple sexual partners also increased their chances of contracting STDs, including HIV, thus compromising the health of their babies. Wintz (2013) therefore associated married mothers with increased neonatal survival.

Education of the mother is positively linked with increased survival chances of neonates. Mustafa (2012) indicated that mothers' education is a significant factor of neonatal mortality in Bagdad found that mothers with formal education preferred health facility delivery as opposed to those without formal education who preferred home delivery with support of local midwives. The mothers without formal education had increased chances of dying from birth complications occurring due to lack of attendance by trained midwives as well as lacking of resuscitation machines in case of health failure. Mustafa (2012) therefore associated having formal education with increased chances of neonatal survival. Babies born to women having at least secondary education presented a 32 percent decreased risk of neonatal deaths when compared to mothers with no education (Mekonnen *et al.,* 2013). It was also observed that primary education for the mothers played no significant difference in reducing neonatal deaths.

Higher education in Kenya was associated with increased neonatal mortality (UNICEF, 2016b). The source pointed that newborns to highly educated mothers had 1.2 times (25/1000 live births) likely chances of dying within their first month when compared to newborns of mothers without education (21/1000 live births). The higher likelihood of newborns of highly educated mothers dying was associated with beliefs like breastfeeding is likely to distort their body shapes and their focus on employment was more likely to divide the attention of the baby leading to increased baby negative outcomes.

Patel *et al.* (2011) study in India's Gujarat Province on the low socioeconomic class and education on mortality found that women with formal education were more concerned with seeking information from health care workers on how best to improve their baby caring skills. Another study done by Walter (2013) indicated that more of educated mothers had formal employment assuring them of income as they catered for their children. Education enlightened mothers on caring practices, seeking opportunities to learn more on child care and practicing good qualities of motherhood. Education was identified by both Patel *et al.* (2011) and Walter (2013) as significant influencers of child survival. Education level was related to contraceptive use as those with low education were less likely to embrace modern contraceptives further having risks of many babies compromising the health of the children.

The options presented often for the residence of the mother is either urban or rural. The 2014 KDHS brief indicated that more infant deaths were witnessed in metropolitan regions compared to countryside (rural) regions. The UNICEF (2016b) brief on neonatal mortality rates in Kenya pointed out that NMR in urban was higher at 26 in a thousand live births as compared to 21 in a thousand live births in rural areas in Kenya. The urban advantage in Kenya seems to be significantly reduced since the demand for the family planning services for urban stands at 76.6 percent as compared to rural NMR of 66.7 percent, a difference of 10 percent. There were high percentages of caesarean section deliveries among urban mothers at 14.7 percent compared to about 5.3 percent experienced in rural areas. Mekonnen et al (2013) also pointed out that the urban advantage in Ethiopia has waned, but the effect of region was significant with the Tigray, Amhara and Benishangul Gumuz regions having a significantly higher risk of neonatal deaths when compared to the capital, Addis Ababa.

Herlily (2013) study on the cultural belief and neonatal mortality pointed out that cultural beliefs were less practiced in cosmopolitan urban areas leading to potential positive changes in child survival. The lack of trust in health facilities by the urban mothers and presence of varied medical opinions in urban areas contributed to the slightly higher neonatal mortality in Kenya's urban mothers. The high incidences of NMR in urban regions could be as a result of inadequacy of healthcare supplies, limited access to preventive healthcare, and relatively low numbers of qualified healthcare personnel (Mabonga, 2013).

Akinyemi (2015) study in the Russia village of Nigeria found out that females with more children had low chances of having neonatal mortalities as compared to those getting their first babies. Birth spacing had an advantage of baby surviving as the spacing moved towards 36 months. Birth spacing was also associated with chronic malnutrition in the case of closely spaced births. Squeezed births (spacing less than three years) was associated with increased neonatal deaths. Education was also associated with increased baby spacing due to available information on the benefits of spaced births. Education was also associated with increased employment for women, thus making them busy for caring new babies, and consequently increasing baby spacing (Winter, 2013).

Parity of the mother also influences the survival of the baby. Kiage (1999) found that mothers with higher parities above 7 children increased their chances of neonatal deaths when compared to mothers with lower parities. Kiage noted that mothers aged 40 years and above had the highest neonatal deaths as they were also associated with high maternal mortality. Mothers with parity 7 and above and their associated high threats of maternal mortality had effects on the survival of the left children after death of parent, further increasing the chances of infant dying.

2.3.2 Socioeconomic Factors

The socioeconomic predictors linked to neonatal mortality in this study include household wealth, employment, delivery at a health facility, and attendance to antenatal and postnatal clinics. Delivering at birth facilities improves survival of the newborn. In Mandera County, 36 percent (one out of three) of mothers deliver in health facilities as compared to 61 percent across Kenya. North Eastern region had the lowest institutional delivery with 29.2 percent of mothers as compared to 61.2 percent for the national estimate. About 32.4 percent of mothers in North Eastern assessed skilled personnel during their delivery as compared to 61.8 percent of mothers nationwide who accessed skilled healthcare attendance.

Mekonnen*et al* (2013) in Ethiopia concluded that no significant relation between the place of birth and increased risk of death of the neonates. Mothers who delivered at home with assistance from community midwives had no significant difference in their baby's neonatal mortality when compared to mothers delivering at health facilities. Instead, the study established that contrary to the expectations of higher survival probability when delivered in government hospitals, there was high neonatal mortality for babies born in government facilities. One reason given for this finding was that government facilities tended to be overcrowded with few health personnel and sometimes arrogant and not humane enough to handle concerns from the mothers. Mekonnen *et al* (2013) thus found out that newborns delivered in government health centers and hospitals had 2.1 and 2.3 times respectively increased risks of dying within the neonatal period when compared to home deliveries. The authors cautioned that the findings could be biased especially from the data collection point of view.

The attendance of mothers to ANC (ante-natal care) was associated with increased survival of children as reported by Envuladu (2013) and Ahmad *et al*. (2019). The study was of the opinion

that mothers who visited clinics had higher chances of their babies surviving when compared to the babies of mothers who had less than four ANC visits. Envuladu (2013) further associated the ANC with diagnostic services on the mothers that were able to identify potential complications before they developed into serious concerns for mothers. Mothers who visited healthcare centers for healthcare services were also likely to deliver at health centers and improve baby survival. The findings were also supported by Ravi (2013) study in India that pointed that mothers who had previous visits were also likely to receive education on handling neonates in terms of feeding, cleaning and overall management of their wellbeing thus improving their survival chances.

Ogada (2014) established that mother's time for ANC visits as well as attendance of well-baby clinic was associated with teaching on breastfeeding, washing clothes, food preparation, sickness care and bathing of the child ensured high quality care for the baby. The study thus pointed that attendance to prenatal and postnatal clinics was associated with increased survival of infants associated with informed mothers.

UNICEF report (2016b) concluded that neonatal mortality rates among the richest was high at 26/1000 live births as compared to the NMR for the poorest households at 20/1000 live births. The report indicated that the gains of higher income households have been erased with the poor gaining access to quality healthcare. Employment presents baby caring challenges that include reduced attention to the baby, increased job insecurity due to fears of losing job or clients, and increasing the chances of returning to work before the baby grows further compromise the health status increasing the likelihood of neonatal deaths. Ogada (2014) opined that low socioeconomic mothers are likely to expose their infants to neglect of care and possibly poor care leading to increased morbidity rates.

Nilima(2017) research in Bangladesh found that households of low socioeconomic status possessed a slightly higher threat of neonatal deaths due to poor or minimal child care. Income was thus associated with significant changes in neonatal morbidity and consequently mortality. Ravi (2013) quoted a study done in Sierra Leone that established high maternal and child mortality due to associated factors like high poverty, reduced family planning and teenage pregnancies. Ravi (2013) identified newborn risk factors that included low birth weight as well as complications connected to the mode of delivery.

2.3.3 Newborn Demographic Variables

The neonatal characteristics associated with neonatal mortality in this study include child sex, gestational age at birth, birth weight of the baby, nature of delivery and complications arising from delivery. Headstromet al. (2014) research on clinical characteristics of neonatal mortality in Uganda covering 2237 women pointed out that there was high neonatal mortality at 27/1000 live births in the eastern part of the country. Using risk ration (RR), it was established that the eastern areas combining three districts of Kamuli, Pallisa and Kibuku had relatively high neonatal mortality at 34 in every thousand live births higher than the national mean. The research was also supported by findings from Kananura et al. (2016) who also studied neonatal mortality and the associated predictors among the eastern Uganda communities.

Headstrom et al (2014) pointed that boy child had slightly higher chances of dying when compared to baby girls in their study of demographics and neonatal mortality. The study was also done in Uganda and tried to show clinical characteristics of pregnant mothers and neonatal outcomes where baby sex was identified as a major determinant of neonatal mortality. Reviewed literature studies therefore associated baby sex with significant neonatal mortality.

Gestational age determines whether the baby was born before due date (pre-term) or as required per gestational period of 39 weeks (Apunda, 2016). When the gestational age was lower than expected, the babies had increased risk of dying during the first month of life, especially due to care at the nursery or ICU. The study by Rwashana (2014) pointed out that pre-term babies were likely to be treated at the ICU or at the nursery or subjected to kangaroo method of nursing, which had higher chances of baby not surviving. The study therefore associated pre-term babies with increased neonatal mortality.

Rwashana (2014) research paper on "the application of system thinking on health dynamics of neonatal mortality in Uganda" viewed some processes as influential in determining the gestational age at birth. The study further pointed out that maternal nutrition during pregnancy was associated with the baby's outcomes and influenced factors like morbidity and mortality. The study by Ogada (2014) indicated that mothers' health and nutritional status was critical in influencing the health as well as survival of the child. The education level of mother had an influence on the foods the mother ate and consequently the gestational age of the child. Another critical aspect was the health situation of the mother that influenced the growth of the baby as diabetic and hypertensive mothers had likelihood of delivering high birth weight babies when compared to normal healthy mothers. Ogada (2014) and Rwashana (2014) confirmed that babies born as low birth weight has increased chance of neonatal deaths when compared to babies born with weight above 2.5kg.

Cesarean section and normal delivery are the two common forms of delivery. Complications were likely to develop from cesarean section delivery as opposed to normal deliveries. In Kenya, the overall percent of mothers delivering through C-section was 8.7 percent while North Eastern region had 2.9 percent of mothers delivering through C-section. The C-section deliveries were mostly experienced in urban areas at about 14.7 percent as compared to 5.3 percent in rural areas.

C-section deliveries had increased chances of developing complications and negatively influencing the health of the newborn.

2.4 Conceptual Framework

Mosley-Chen conceptual framework was adopted for the study as it shows the association between the proximate determinants of child survival. Figure 2.1 shows the conceptual framework;

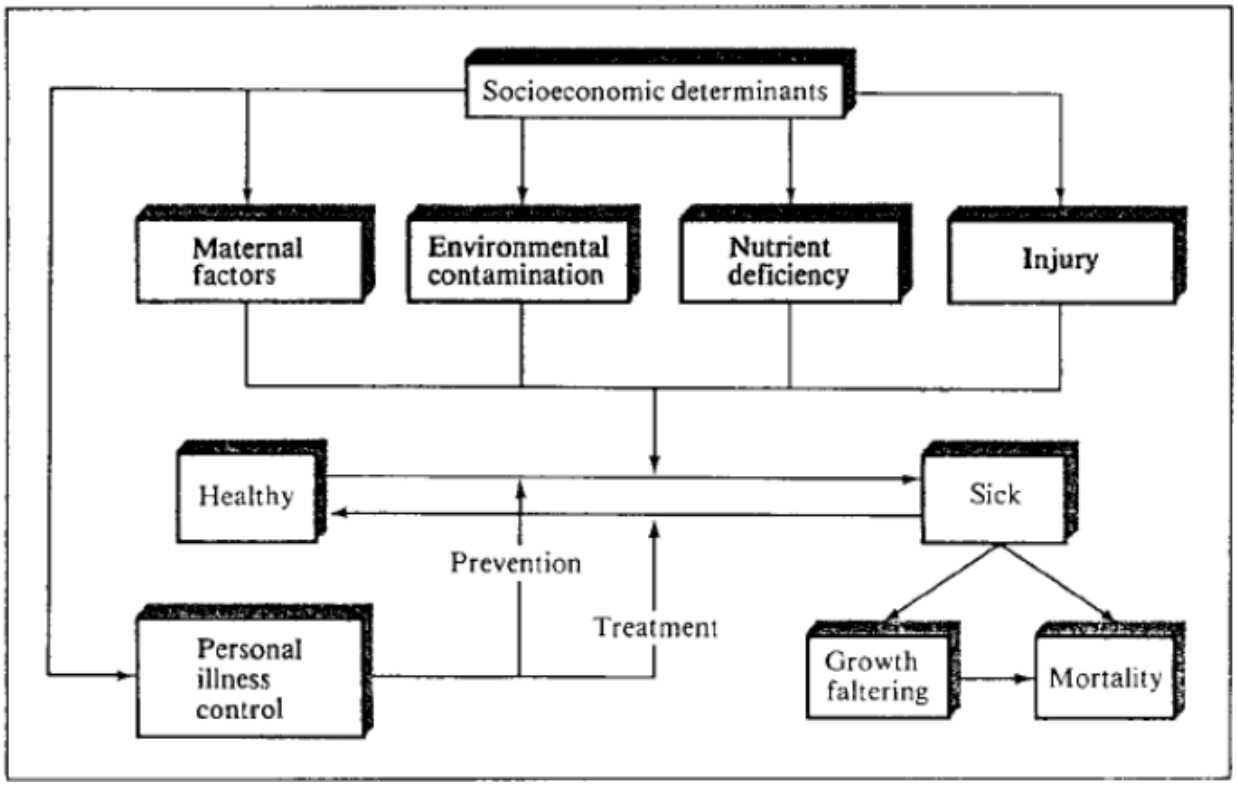

Figure 2.1 Adopted Mosley-Chen Proximate Determinants of Mortality Conceptual Framework

Source: Adopted from the Mosley-Chen conceptual framework (1984)

The conceptual framework shows how the variables are interrelated and how one leads to the other. The adopted conceptual framework shows the socioeconomic determinants of child mortality showing the inter-linkages among the ethnicity/culture to the religion/conceptions, to economy/wealth and the education/skills of the mother (Muriithi, & Muriithi, 2015). The

socioeconomic determinants influence the proximate determinants of mortality that were grouped into five categories including injury controls and management, nutrient deficiency, environmental contamination, maternal factors and personal illness control (Mosley & Chen, 1984). The proximate determinants have a direct effect on either death or survival of the child. Interventions that the author viewed as likely to influence survival of infants were personal illness control, including prevention and treatment of diseases.

2.5 Operational Framework

In the operational framework, the study focused on the proximate determinants of neonatal mortality. Figure 2.2 shows the operational framework adopted and developed from Mosley-Chen conceptual framework

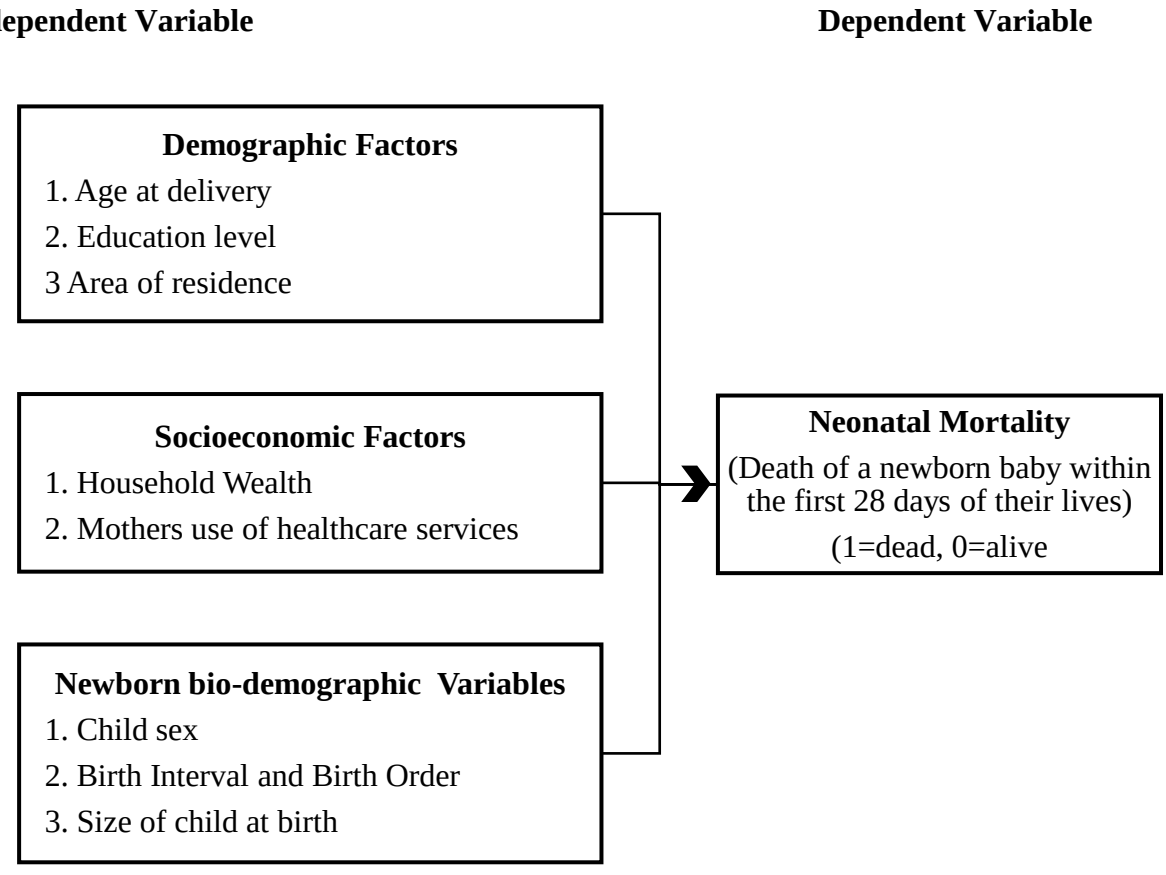

Figure 2.2 Operational Framework, adopted from Mosley-Chen conceptual framework (1984)

Based on the Mosley-Chen (1984) conceptual framework, this study borrows socioeconomic factors, and maternal factors to use in the study. Newborn demographic factors are not well-captured under the conceptual framework; hence they were borrowed from peer reviewed similar studies. For the maternal factors, age, education and residence of the mother were taken and included in the study. Socioeconomic factors included were wealth and use of healthcare services. The use of healthcare services can be conceptualized under the personal illness control in the Mosley-Chen framework, where in this study it was categorized under the general socioeconomic status.

From the operational framework, the independent variables have an effect on the outcome (dependent) variable. The components under maternal demographic factors (education level, residence and age at delivery) influence neonatal mortality. The socioeconomic factors projected to determine neonatal mortality are two; mothers use of healthcare services (ante-natal clinic visits) and household wealth. Neonatal characteristics include child sex, gestational age at birth, size of child at birth, birth interval and birth order were also conceptualized to influence the probability of new born dying within the first 28 days of life.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter focuses on how data for analysis was accessed, analyzed and objectives realized. It comprises of sections on sources and sub-setting of data, data analysis, the location of the study and operational definitions of terms used in the study.

3.2 Source and Sub-setting of Data

The study used secondary data collected under the Kenya Demographic Health Survey (KDHS). The 2014 KDHS was conducted countrywide covering a total of 31,079 women of reproductive age between age 15 and 49 years, as well as 12,819 men aged 15-54 years and 20964 women to represent children born to represent the Kenyan population. The KDHS 2014 data set was filtered to reflect the data set for the North Eastern region data alone. The data set on children, and filled by women formed the main secondary data set used to present the results of the study.

From the KDHS data on children, the 20964 women (representing children) were separated into the North Eastern Region with a total of 1594 children born in North Eastern within the five-year period preceding the data collection process. The next process included recoding variable V024 (Region of residence-former provinces) where 2=1, and else=0 and thus separating the data for North Eastern Region. Once the data was created for North Eastern Region, the variables that were critical for the study were selected while the others not needed discarded leading to the required set of data. The variable on neonatal death was recorded from B6 and B7 and the number of deaths established. Other variables were recorded as explained on the data analysis section before subjecting them to cox regression. Variable B6 was used as the exposure time as it represents the time taken before a child died.

Table 3.1 Characteristics of the study population by study variables

Predictor (variable)	Variable Code	Operational Definition	Role of variable
Child under 28-days dead	B7 Recoded	0 = Alive 1 = Dead	Dependent Variable
Maternal Educ.	V 106	0= No education 1= Primary education & above	Independent variable (Demographic factors)
Wealth Index	V190	1= Poor 2= Rich	Independent variable (Socioeconomic factors)
Maternal Age birth	V013	1= below 24 years 2= between 25 and 34 years 3= above 34 years	Independent variable (Demographic factor)
Use of healthcare services (ANC)	M14	0= No ANC visit at all 1= At least one ANC visit	Independent variable (Socioeconomic variable)
Birth Interval and Birth Order	Recoded BORD and B 11	1= Birth Oder 1 (First Births) 2= BORD 2-3 * Short interval 3=BORD 4+ * Short Interval 4=BORD 2-3 * Long Interval 5=BORD 4+ * Long Interval	Independent variable (Newborn bio-demographic variable)
Sex of the child	B4	1 = Male 2 = Female	Newborn bio-demographic variable
Place of Residence	V025	1= Urban 2=Rural	Independent Variable Maternal factors
Size of the child at birth	M18	1= Large 2= Average 3= Small	Newborn bio-demographic variable

3.3 Data Analysis Method

Analysis was done through cox regression. Cox regression was preferred as it represented the time taken to the event (death of neonate), and the likelihood of the factors contributing to the event.The

model was thus used to present the likelihood of a neonate dying within the exposure time, (first month of life) as influenced by the prevailing socio-economic, demographic and newborn variables. Cox regression was used as the events were few (30 in number) and included censuring of some of the respondents.

Cox regression (or the proportional hazards regression) is best used for investigating effects of several variables upon the time a specified event takes to occur. For this study, the time dependent event was neonatal death, occurring within the first 28 days of life. The selection of Cox model was also based on the nature of data, which was censored and was highly skewed, having countable number of events (deaths) compared to the population in study (neonates). The two challenges (having censored and highly skewed data) led to the selection of Cox regression over other models like logistic regression.

Assumptions for appropriate use of Cox regression model include; independence of survival times between distinct individuals in the population sample; that there is multiplicative relationship between the independent (predictor) variables and the hazard; and that there is a constant hazard ratio over time. The Cox regression model also assumes that the hazards are proportional, that is, hazard ratio between two groups remain constant over time. The hazard ratio reflects the relative risk of an outcome occurring, and can be represented using the following equation;

Let $X_i = \{X_{i1}, \ldots X_i p\}$ be the realized values for the covariates (explanatory variables) for the subject *i*.The hazard function $h(t,X)$is the probability of a neonate dying in a period (t) of 28 days. Then the Cox model was explained as;

$h(t,X_i) = h_0(t) \exp(\beta_1 X_{i1} + \beta_2 X_{i2} \ldots + \beta_p X_{i\,p})$.

The equation gives the hazard function at time *t* for subject *i*, with explanatory variables X_i and β_1 were the coefficients.

The analysis was done per objective as follows;

Objective One:

The demographic variables analyzed included age, level of education and the residence of the mother and the newborn. Age of the mother (coded V013 in KDHS 2014) was recoded into three categories, below 24 years, between 25-34 years and those above 35 years. Level of education (coded V106) was recoded into two categories, no education and primary education and above. Residence of the mother (coded V025) was already dichotomous, having rural and urban categories. The three independent variables were subjected to binomial cox regression (as covariates) with the neonate variable (code B7, recoded as either 0=alive or 1=Dead within one month) as the dependent variable. The output from the binomial regression analysis was then used to interpret the results. The model summary output was used to explain how much neonatal mortality could be explained by the three variables in the model. From the "Variables in the Equation" table, significance (*p-value*) and hazard ratio (Exp(B)) were used to interpret the relationship between the variables. An observed significance (*p-value*) of less than 0.05led to conclusion that there was a significant association between the dependent and the independent variable (Liu, 2014). The explanations for the hazards ratio (HR) is thus when the HR is less than 1, then increasing the values of the independent variable is associated (or corresponds) with decreasing odds of the dependent variable (neonate death). For this study, negative coefficients (β)showed decreased hazard, as well as increased survival times. Positive coefficients (β) showed increased hazard and decreased survival time. Similarly, hazard ratio greater than 1 showed that

increasing values of the independent variable correspond to an increasing likelihood of occurrence, that is, neonatal death.

Objective Two:

The objective was concerned with socioeconomic variables that include wealth index and the use of healthcare services. Wealth index (code V190) was recoded into two, poor and rich while use of healthcare service was measured on whether the mother attended ante-natal clinic or not. The two variables were thus subjected to cox regression against the dependent variable (neonatal death or survival in the first one month). The regression output interpretation was based on the model summary, the coefficients in the hazard ratio (HR) and the significance (p-value) of the independent variables.

Objective Three:

The newborn variables analyzed included sex, size of the child at birth and a computed variable of birth order and birth interval. The sex of the neonate (coded B4) was either male or female while the size of the child at birth was recoded into large, average and small. Birth order and birth interval was computed into a new variable, with five options as shown on table 3.1. The three independent variables were subjected to binomial regression analysis against neonatal survival where hazard ratio (HR) and the p-value (sig.) values were used for the interpretation of cox regression outputs. Results presentation was through cox regression tables. Multivariate cox regression analysis was done where all the variables were subjected to coz regression, and the output interpreted at *p-value* of 0.05 (95% confidence level).

3.4 Location of the Study

The three counties in North Eastern Kenya included Garissa, Mandera, and Wajir. They form the North Eastern region that borders Somalia to the East and Ethiopia to the North (Mandera and Wajir). Garissa County borders Tana River County, Isiolo County, Mandera and Wajir counties. Mandera County shares the western borders with Marsabit County. The three counties have a cumulated population of about 2.31 million as of 2009 census data. The counties had a population of Garissa (623,000), Mandera (1,025,000) and Wajir at 61,900 people. Most of the people are in rural areas at 82.2 percent as compared to 17.8 percent in urban areas. The three counties are home to the most Somali ethnic group who are indicated to have between six and seven children per woman.

3.5 Operational Definitions

Determinants:	The factors or elements influencing the dependent outcome (Neonatal Mortality)
Infant Mortality Rate:	This represents the total number of children dying per 1000 live births before reaching one year.
Infant mortality:	It is the probability of a child dying before reaching their first birthday
Neonatal Mortality Rate:	It is the number of deaths of children before 28 days of life in a thousand (1000) live births
Neonatal mortality:	Indicates the probability of a newborn dying within the first 28 days of life
Under-five mortality:	Represents the probability of a child dying before their fifth birthday

CHAPTER FOUR: FACTORS INFLUENCING NEONATAL MORTALITY IN NORTH EASTERN KENYA

4.1 Introduction

This chapter focuses on the findings from the data and are supported by discussions of the results. The chapter addressed sections like the demographic characteristics, the prevalence of neonatal mortality in the North Eastern region of Kenya, the maternal demographic factors, socioeconomic determinants, socio-cultural determinants and then neonatal characteristics influencing neonatal mortality. The chapter also presents discussions for every variable supporting it with relevant scholarly studies done on the variable.

4.2 Distribution of Neonatal Deaths by Study Variables

Characteristics represent details including age of the respondents, places of residence, highest education level, wealth index, and sex of child. The variables were presented based on those who experienced neonatal mortality, showing the frequencies and the percentage. There were thirty (30) neonatal deaths recorded within the first month, making it 2% of the overall children born in the period of study. The age of the mothers was distributed as follows; below 20 years were 6.6%, 35 years and above were 24.4% and those aged 21-34 years were majority at 69.0%. Further, 50.8% of the children born were female. There were37.5% of the respondents staying in urban centers as shown on table 4.1.

Table 4.1 Distribution of population by study variables

Variable	Options	Frequency	Percent
Neonatal death (up to 28 days)	No	1564	98.1
	Yes (Ref)	30	1.9
	Total	**1594**	**100**
Type of place of residence	Urban	597	37.5
	Rural (Ref)	997	62.5
	Total	**1594**	**100**
Age of the respondent	Below 20 years	105	6.6
	35 years and above	389	24.4
	21-34 years (Ref)	1100	69.0
	Total	**1594**	**100.0**
Sex of child	Male	810	50.8
	Female (Ref)	784	49.2
	Total	**1594**	**100**
At least one Ante-natal visit	No attendance to Ante-natal care	242	15.2
	Attended ANC (Ref)	1352	84.8
	Total	**1594**	**100**
Maternal education	No education	1413	88.6
	Primary education + (Ref)	181	11.4
	Total	**1594**	**100**
Size of child at birth	Large	534	33.5
	Average	178	11.2
	Small (Ref)	54	3.4
	Total	**766**	**48.1**
Wealth Index	Poor	1205	75.6
	Rich (Ref)	389	24.4
	Total	**1594**	**100**
Birth Order and Birth Interval	All other combinations	1335	83.8
	BORD 2-3 and long interval (Ref)	259	16.2
	Total	**1594**	**100**

Source: Computed by author using KDHS 2014 data set

There were 84.8% of mothers who visited healthcare facilities for their ante-natal care in their last births. There were more mothers with no formal education at 88.6% compared to those who had at least primary, secondary and tertiary education being 11.4%. The size of child was distributed as follows, 33.5% were recalled as born large, 11.2% being average size and 3.4% described as small. For wealth index, those who described as poor were 75.6% while the other 24.4% were rich. There were 16.2% of the children who were in the category of birth order two-three and had a long birth of over twenty-four months. The other combinations, which were considered riskier, including the first births, birth order 2-3 and short birth interval, birth order of four and above, all combined were 83.8%.

4.3 Bivariate Cox Regression of Factors Influencing Neonatal Mortality

The section presents the results from bivariate cox regression presenting neonatal deaths as the event (dependent variable), and the independent variables of maternal factors, socioeconomic factors and neonatal bio-demographic factors. Maternal demographic factors included in the study included age of the mother during the delivery, education levels, parity of the mother, and the area of residence. Table 4.2 shows the summary of bivariate cox regression results showing how various variables influenced neonatal mortality.

Table 4.2 Bivariate analysis of various variables on neonatal mortality

	B	SE	Wald	df	Sig.	Exp(B)	95.0% CI for Exp(B)	
							Lower	Upper
Residence of Respondent	-0.189	0.369	0.262	1	0.609	0.828	0.401	1.707
Sex of the child	-0.033	0.369	0.008	1	0.928	0.967	0.47	1.993
Age (21-34 years) (Ref)			0.659	2	0.719			
Below 20 years	0.061	1.069	0.003	1	0.954	1.063	0.131	8.648
35 years and above	0.342	0.434	0.621	1	0.431	1.408	0.601	3.297
Health care Services	0.331	0.49	0.455	1	0.5	1.392	0.532	3.64
Maternal Education	0.304	0.732	0.173	1	0.678	1.356	0.323	5.694
Size child- Small (Ref)			6.961	2	0.031			
Size child- Average	-1.655	0.726	5.204	1	0.023	0.191	0.046	0.792
Size child-Large	-2.103	0.825	6.495	1	0.011	0.122	0.024	0.615
Wealth Index	-0.668	0.375	3.17	1	0.075	0.513	0.246	1.07
Birth order and Birth interval	0.031	0.538	0.003	1	0.954	1.031	0.36	2.959

P<0.05

Source: Computed by author using KDHS 2014 data set

In bivariate analysis, only the size of child at birth was a significant predictor of neonatal mortality. Demographic factors like age at delivery, education level and area of residence were not significant predictors of neonatal mortality. Socioeconomic factors like household wealth and mothers' use

of healthcare services too were not found to significantly predict neonatal mortality. The size of child at birth was found to influence neonatal deaths (*p*-value 0.031, 95 CI).On reference to children reportedly born smaller than normal, those reportedly average or normal size had80.9% lower risk in experiencing neonatal death (p-value of 0.023, 95 CI, 0.191 HR). Children reportedly born large had87.8% reduced risk of experiencing neonatal mortality in relation to the children born small (p-value of 0.011, 95 CI, 0.122 HR). The findings relate with the conclusions by Beser (2010) who found the size of child at birth a significant predictor of neonatal survival among the children born in Nakuru County in Kenya. Further, the findings by Akinyemi (2015) concluded that size of child at birth was a significant predictor of neonatal and infant survival.

4.4 Multivariate Cox Regression of Factors Influencing Neonatal Mortality

The variables were subjected to multivariate cox regression to determine whether there was any change on the influence of neonatal deaths in North Eastern. Most of the variables were not significant predictors of neonatal mortality. To ascertain the significance of the model, goodness of fit was tested as shown on table 4.3.

Table 4.3 Omnibus Tests of Model Coefficients[a]

-2 Log Likelihood	Overall (score)			Change from Previous Step			Change from Previous Block		
	Chi-square	df	Sig.	Chi-square	df	Sig.	Chi-square	df	Sig.
72.866	22.805	10	0.011	20.066	10	0.029	20.066	10	0.029

P<0.05

The model was significant, showing that the predictor variables fitted at 95% confidence levels had a significant p-value of0.011. This showed that the model fit was significant.

To establish whether the independent variables were significant predictors of neonatal death among neonates in North Eastern, the table on "Variables in the Equation" was used for the interpretations. The hazard ratio (Exp(B)) and the significance columns were used. The summary of the results was depicted on table 4.4;

Table 4.4 Multivariate analysis of various variables on neonatal mortality

	B	**SE**	**Wald**	**df**	**Sig.**	**Exp(B)**	**95.0% CI for Exp(B)**	
							Lower	Upper
Residence of Respondent	-0.087	1.175	0.005	1	0.941	0.917	0.092	9.168
Sex of the child	0.894	0.758	1.391	1	0.238	2.446	0.553	10.809
Age (21-34 years) (Ref)			8.392	2	0.015			
Below 20 years	-0.505	1.776	0.081	1	0.776	0.603	0.019	19.592
35 years and above	3.212	1.28	6.296	1	0.012	24.822	2.020	305.036
Healthcare Services	-1.524	0.939	2.633	1	0.105	0.218	0.035	1.373
Maternal Education	-2.704	1.567	2.975	1	0.085	0.067	0.003	1.446
Size child- Small (Ref)			11.416	2	0.003			
Size child- Average	-5.026	1.578	10.139	1	0.001	0.007	0	0.145
Size child-Large	-5.606	1.664	11.349	1	0.001	0.004	0	0.096
Wealth Index	-1.611	1.438	1.256	1	0.262	0.2	0.012	3.341
Birth order and Birth interval	2.128	1.205	3.118	1	0.077	8.399	0.791	89.136

$P<0.05$

Source: Computed by author using KDHS 2014 data set

At multivariate analysis, demographic factor and newborn bio-demographic variables were significant predictors of neonatal mortality. Socioeconomic factors were not significant predictors of neonatal mortality. Age of the mother at last delivery had the largest impact on neonatal mortality for the children born to mothers in North Eastern region of Kenya. Most importantly, age of the mother played the greatest role in influencing neonatal mortality for women aged 35 years and above. Children born to women aged 21-34 years were used as the reference category, assuming that they were not exposed to risks like the teenage mothers (below 20 years) and aged mothers above 35 years. Neonates born to mothers aged 35 years had 24.82 times increased likelihood of dying in their first thirty days compared to the reference category of neonates born to mothers aged 20-34 years (*p*-value of 0.012, 95 CI, 24.822 HR). This meant that age had the greatest influence on neonatal survival among the children born in North Eastern. Neonates born to mothers aged 35 years and above had 24.8 times increased risk of dying within their first 28 days. The study found no significance influence of age 20 and below on survival of neonates (*p*-value of 0.776, 95 CI, 0.603 HR). The study findings reflect similar conclusions by Liu (2014) who established that infants born to mothers age 35 years and above presented higher risks of dying when compared to children born to mothers of age twenty to thirty years. The findings were also reflected the conclusion that age was a significant predictor of neonatal survival (Ikamari, 2013).

Size of child at birth was found to significantly influence survival of children born in North Eastern (*p*-value of 0.003, 95 CI). The reference category was the neonates born smaller size than normal, who were considered high risk. It was found that neonates born normal size (average) had 99.3% reduced risk of dying within their first 28 days of life compared to those born small size (p-value

of 0.001, 95 CI, 0.007 HR-Hazard ratio).Children reportedly born large size had99.6% reduced risk of experiencing neonatal deaths compared to those born smaller size (sig 0.001, 95 CI, 0.004 HR).The size of child at birth was thus a significant predictor of neonatal survival as those born with average (normal) size and large size had 99.3% and 99.6%respectively reduced risk to death when compared to those reportedly born small size. The findings in the study reflected similar conclusions by Kulei (2016) on a study of maternal determinants of neonatal mortality in Nakuru County where babies born underweight and small size were found to have an increased likelihood of experiencing neonatal mortality. The findings were also similar to the conclusions by Beser (2010) who argued that the size of baby at birth was a significant predictor of neonatal survival. Further, the findings are similar to the conclusions by Nilima (2017) in Bangladesh who found that size of child at birth was also a significant predictor of neonatal mortality.

Other newborn bio-demographic variables like child sex and birth interval combined with birth order were not significant predictors of neonatal mortality. Birth order and birth interval were combined to increase the survival likelihood. A combination of birth order and birth interval categorized the children with the highest risk and those with lowest risk. In reference to the low risk group of neonates born of order two-to-three, and with a long birth interval of over 24 months, the other groups were not significantly exposed to high neonatal mortality (p-value of 0.77, 95 CI, 8.399 HR). The place of residence of mothers, whether urban or rural was not significant predictor of neonatal mortality (sig. 0.941, 95 CI) among the children born in North Eastern. Access to ante-natal care was also not a significant predictor of neonatal deaths in North Eastern (sig. 0.105, 90 CI). Maternal education (sig. 0.085, 95 CI) and Wealth index of the mother (sig. 0.262, 95 CI) were not a significant predictor of neonatal death among the children born in North Eastern.

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter focuses on the summary of the study, conclusion and recommendations made from the findings, and entire study. Sections covered include the introduction to the chapter, summary, conclusion and recommendations, both for policy implementation and for future research.

5.2 Summary of the Study

Chapter one presented the introduction to the study, covering background information on neonatal mortalities across the globe, in the region and narrowing into Kenya. The study is based on the SDG Goal Three target 3.2 that aims at preventing newborn deaths and reducing U5MR to 25/1000 live births or less by the end of SDGs in 2030. Further, the study is connected to the World Health Organization's Every Newborn Action Plan program, that has a goal of dropping and attaining neonatal mortality rate of below 10 deaths per 1,000 live births by 2035. Chapter one also presents the research question on the factors influencing neonatal mortality in the North Eastern Region of Kenya. The three objectives were to establish the demographic, socioeconomic and newborn biodemographic determinant of neonatal mortality in North Eastern Region of Kenya. The chapter also explained the limitations of the study, including the challenges associated with secondary data like year heaping and missing values.

Chapter two presented the literature review, focusing on the theoretical literature and empirical reviews of studies done on the study area. The study borrows much from the Mosley-Chen analytical framework of child survival. Chapter two presents in detail studies done on maternal demographic factors, socioeconomic factors, and neonatal demographic variables. An operational framework is also presented, showing the relationship between the independent variables and the dependent variables.

Chapter three explained the research methods and data. KDHS 2014 data was used. The study used cox regression to determine the influence of the independent variables on the survival of neonates in North Eastern region. Chapter four presented the findings, where majority of the children were born to women with no education at 88.6% against 11.4% who had primary level of education and above. In addition, most of the children were born to rural women at 62.5%. There were thirty cases of neonatal deaths observed against a total of 1594 children born, representing a 2% of the total children born in the study period. Maternal demographic factors (age at delivery) were found to have a significant influence on neonatal mortality among the children born to women in North Eastern region of Kenya at the multivariate stage. Age at birth was a significant predictor of neonatal mortality among the children born, with children born to women above age 35 years having 24.8 times likelihood of dying than those born to women aged 21-34 years.

Socioeconomic determinants variable of neonatal mortality including household wealth index and use of healthcare services were found not to be significant predictors of neonatal mortality at both bivariate and multivariate levels. Newborn bio-demographic characteristics including size of child at birth was significant predictors of neonatal mortality while sex of child and the combined birth order and birth interval were not. Newborn variables, especially size of child at birth was a significant predictor of neonatal mortality. In addition, children reportedly born of average and large size 99.3% and 99.6% respectively reduced risks of experiencing neonatal mortality. Chapter five presented the conclusion, summary and the recommendations.

5.3 Conclusion of the Study

Conclusion was based on the three independent variables, maternal demographic variable, socioeconomic variables and newborn bio-demographic variables. The three broad categories of variables were found to significantly influence neonatal survival in North Eastern region. Maternal

demographic variable of age at delivery was a significant predictor of neonatal mortality. Education level and area of residence, whether urban or rural, were not significant predictors of neonatal mortality. Age had the highest impact on neonatal survival as children born to women aged 35 years and above were 24.82 times likely to die within their first 28 days of life.

Socioeconomic determinants were found not to have significant influence on neonatal mortality among children born in North Eastern region. Seeking of ante-natal care services and household wealth were not associated with any advantage of one group over the other in exposure to neonatal deaths.

The effects of neonatal bio-demographic characteristics on neonatal mortality were significant predictors of neonatal mortality. The size at birth was a significant predictor of neonatal mortality with children born large and average having less likelihood of experiencing neonatal mortality. Child sex and combination of birth interval and birth order were found not to significantly influence neonatal mortality among children born to mothers in North Eastern.

5.4 Recommendations

Recommendations made seek to address the effect of age at birth, where neonates born to mothers aged 35 years and above had 24.4 times increased times of dying within their first 28 days of birth. They also seek to address factors related to giving birth to neonates small in size where average and large children had better survival rates compared to those small. From these two variables contributing most to neonatal mortality, the areas to address them would include education, promotion of maternal and child health promotion, and a holistic continuum of health seeking behaviors and sensitization.

Recommendations for Policy Implementation

1. Key fertility messages targeting age of mothers at giving birth, spacing, and birth order are recommended as these factors had the highest influence on neonatal mortality. Key to the messages is discouraging giving birth past age 35 years.
2. The national and the county governments of Wajir, Mandera, and Garissa as well as non-governmental organizations need to design and implement reproduction health programs targeting both men and women of reproductive age on sexual reproductive health.
3. Policies are recommended targeting increased ante-natal care services to mothers on longer birth intervals, right nutrition, and health seeking behaviors among women of reproductive age in North Eastern Region of Kenya. These would be expected to ease challenges associated with size of child at birth, which was a significant predictor of neonatal mortality.

Recommendations for further research

4. Based on the recent data sets like 2019 census data, and future data sets like the expected KDHS 2021, it would be recommended that research be conducted to ascertain whether the factors are still the major determinants of neonatal mortality in North Eastern in Kenya. This will inform change of policies and programs targeting reproductive mothers.
5. Further studies are recommended based on subsequent KDHS data to evaluate whether the region is achieving the WHO goal of below 10 neonatal deaths per 1000 live births by 2035.

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Appendix 1: PLAGIARISM REPORT