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FACTORS DETERMINING NEONATAL MORTALITY IN KENYA

BY

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DECLARATION

The work provided in this project, unless otherwise referenced, is my own work, and has not been submitted elsewhere for any other degree or qualification.

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This Research Project is Submitted for the Award of Master of Science Degree in Population Studies under our Approval as University Supervisors.

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ABSTRACT

Every single region on earth has had an upsurge of the share of under-five deaths arising during the neonatal period. In Kenya, most of the previous studies conducted have largely focused on infant and under-five mortality. For the country to realize a decline of new-born deaths, a clear understanding of factors influencing neonatal mortality to guide in the design of evidence-based resolutions is inevitable.

This study analyzed the 2014 Kenya Demographic and Health Survey data; it examined neonatal deaths that occurred among the 20,964 children born in the last 5 years prior to the survey. Three levels of analysis, namely; univariate, bivariate and multivariate techniques were performed to investigate factors determining neonatal mortality. At multivariate level, logistic regression model was used to assess the simultaneous effects of the variables since the dependent variable is dichotomous (binary) and independent variables are either continuous or categorical.

The study found age of mother at first birth; birth order, interval and size of the neonate; ANC visits; place of delivery; household wealth and region of residence to be significantly associated with neonatal deaths. Interventions aimed at reducing neonatal deaths should address the demographic, healthcare and socioeconomic factors that significantly influence neonatal mortality in Kenya. Reproductive health policies and programs geared towards enlightening women on the neonatal survival should be intensified.

Conduct enhanced data collection in future health related surveys to facilitate capture of critical neonatal proximate determinant variables especially for births whose survival status at the time of survey date were reported as dead.

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LIST OF ACRONYMS

ANC	Antenatal Care
CM	Child Mortality
DHS	Demographic and Health Survey
GOK	Government of Kenya
IMR	Infant Mortality Rate
KDHS	Kenya Demographic and Health Survey
KNBS	Kenya National Bureau of Statistics
LMICs	Low- and Middle-Income Countries
MDG	Millennium Development Goal
MMR	Maternal Mortality Ratio
NASSEP V	National Sample Survey and Evaluation Programme V
NCPD	National Council for Population and Development
NM	Neonatal Mortality
NMR	Neonatal Mortality Rate
NRM	National Road Map
PLOS	Public Library of Science
PNM	Post Neonatal Mortality
SDG	Sustainable Development Goal
SPSS	Statistical Package for the Social Sciences
SSA	Sub Saharan Africa
U5M	Under-five Mortality
U5MR	Under-five Mortality Rate
UN	United Nations
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
UN-IGME	United Nations Inter-Agency Group for Child Mortality Estimation
UNSD	United Nations Statistics Division
WHO	World Health Organization

CHAPTER ONE: INTRODUCTION

1.1 Background

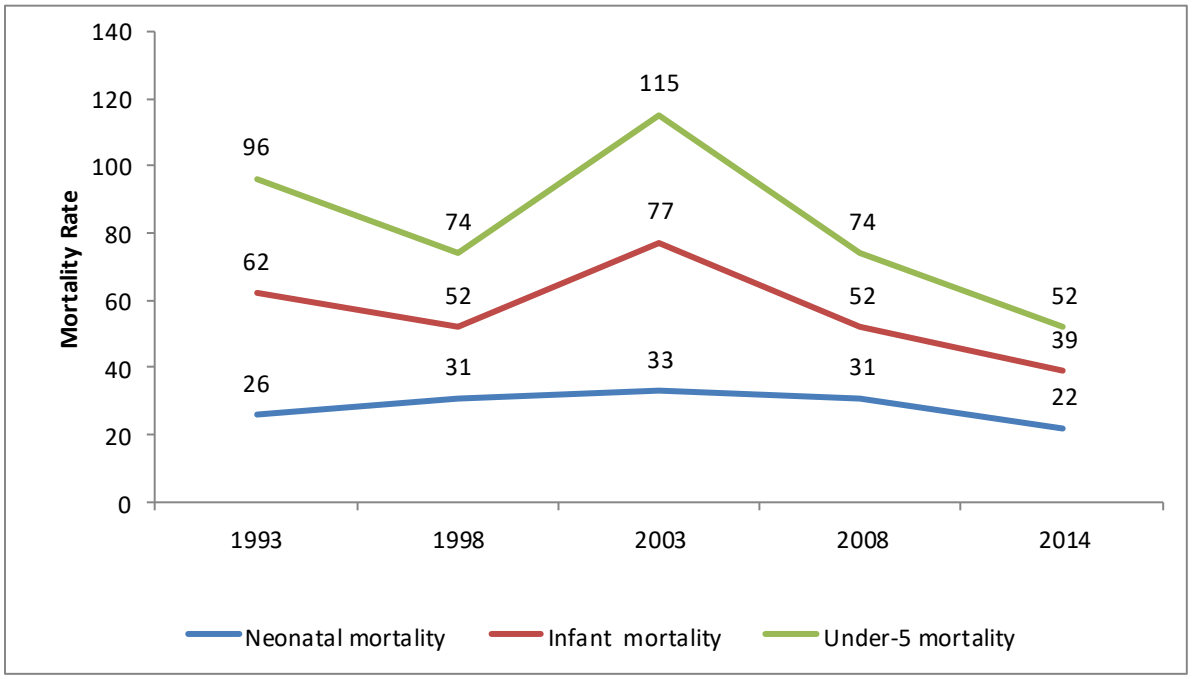
A child's risk of dying is most prominent during the neonatal period, which spans between birth and 28 days (UNICEF *et al*., 2019). Globally, 2.5 million newborns died in 2018 translating to 7,000 deaths per day (WHO, 2019). Although neonatal mortality (NM) declined by 49 per cent from 37 to 19 deaths for every 1,000 live births between 1990 and 2016, it accounted for 46 per cent; an increase from 41 per cent in 2000 representing a higher segment of under-five mortality (U5M). By comparison, mortality of children aged 1-59 months dropped by 62 per cent during the same period. In its 2017 report, the UN Inter-Agency Group for Child Mortality Estimation (UN-IGME) affirms that all regions the world over are experiencing an increase in the share of NM for children under-five.

Despite global decline in NM levels, marked disparities exist in regions and countries. At 28 deaths for every 1,000 live births in 2018, Sub-Saharan Africa (SSA) region recorded the highest neonatal mortality rate (NMR) (UNICEF *et al*., 2019). The agency report reveals that children born in SSA region have a 10 times higher risk of dying in the first month of life compared to those born in a wealth country. A 2019 UNICEF regional estimates report for the death of children below five years indicates that over the last two decades, the region recorded the least progress, with the NMR declining by 34 per cent from 42 deaths in 1998 to 28 deaths in 2018. Although NMR accounted for almost two-fifth and over half of deaths of children under-five and infants respectively. Therefore, MDG 4 did not isolate and monitor the NMR as a distinct indicator from the other forms of childhood mortality. The 2019 UN Inter-

Agency Report asserts that several countries in SSA are likely to miss the NM Sustainable Development Goal (SDG) target of 12 deaths for every 1,000 births. Going by the current trend, it is anticipated that 42 out of 48 countries in the region are likely to miss this target by 2030. It is predicted that if no progress is made in fast-tracking the reduction of NMR, about half of the SSA countries will meet the SDG target after 2050 (UNICEF *et al*., 2019).

Kenya like other developing countries, is facing the challenge of high NM. According to the 2014 Kenya Demographic and Health Survey (KDHS), Kenya had a NMR of 22 deaths and is expected to ensure its reduction to 12 deaths for every 1,000 by 2030 as envisioned in the SDG 3.2. Figure 1.1 presents the trend in childhood mortality from 1993 to 2014 in Kenya. Between 2003 and 2014, U5MR fell by 55 per cent from 115 to 52 deaths for every 1,000 live births (KDHS 1993, 1998, 2003, 2008/9, 2014). Over the same period, IMR declined by 49 per cent from 77 deaths for every 1,000 births to 39 while NMR presented the slowest rate of decline of 33 per cent from 33 to 22 deaths for every 1,000 live births.

Figure 1.1: Trends in Childhood Mortality, 1993 – 2014



In an article extracted from Kenya's case study on the countdown to 2015, Keats *et al*., (2017) affirms that improvement in Reproductive, Maternal, Newborn and Child Health in the country has been at variance in the past 20 years. A report on fast-tracking the country's progress to 2030 maintains that Kenya will require accelerated efforts to attain the SDG target 3.2 aimed at 12 or lower neonatal deaths (Keats *et al*., 2017).

In October 2015, 193 World leaders from the United Nations General Assembly member countries met and unanimously agreed on the sustainable development agenda for 2030. The assembly came up with 17 SDG's and 169 global targets to address future challenges by 2030. Sustainable Development Goal 3 which is aimed at ensuring health living and promoting welfare for all ages was established to address health concerns.

Similarly, a UNICEF report released in 2014 demonstrates that prior to the country attaining the "Every Newborn Action Plan's goal" of a NMR below 10 by 2035, much progress remains to be made (WHO, UNICEF, 2014). Given that improving neonatal

mortality is an essential part of reducing under-five mortality (U5M), a deliberate effort geared towards reducing neonatal deaths will be a strategic way of attaining the SDG 3.2 targeting child mortality.

1.2 Problem Statement

"Committing to Child Survival", a report by UNICEF shows that though the world has experienced an advance in child survival it remains elusive to the newborns and more needs to be done to bring to an end avoidable child deaths. A 2014 UNICEF report shows that over 2.8 million newborn babies died within 28 days of birth in 2013, accounting for 44 per cent of the world's U5 deaths (UNICEF, 2014). In order to improve child survival, an enhanced focus is required to address the growing segment of U5M taking place during the neonatal period (UNICEF *et al*., 2018).

Under SDG target 3.2, member countries committed to aim at reducing NMR to 12 (UNDP_SDGs)**.** Achieving this target calls for a clear understanding of the levels of NM and important factors influencing it. A study published in the open-access journal PLOS Medicine found that the relatively slow pace of reducing NM could stop a number of SSA countries from realizing the SDG target 3.2 by 2030 (Mejía *et al*., 2019). The study findings show that Kenya, Rwanda, Senegal, Tanzania, and Uganda SDG target by 2030. However, it is envisaged that only Rwanda and Tanzania are likely to meet both the NM targets simultaneously. For Kenya to meet the SDG target 3.2.2 of reducing NMR to 12 by 2030, the problem of newborn deaths needs to be investigated in order to understand the underlying and proximate factors influencing NM with the aim of informing reduction strategies (Kayode *et al*., 2016).

Since most of the studies previously conducted have largely focused on IMR and U5MR, there is inadequate research on NM in Kenya. This has been done on the premise that factors contributing to neonatal deaths are similar to those of the older child. However, in the SSA region where almost all global newborn deaths occur, causes of neonatal deaths are not well known due to lack of reliable data (Afolabi, 2017). A UNICEF's SDG briefing note number one, asserts that the amount of data in the LMIC's on neonatal mortality may have grown in recent decades but still suffers from lack of accuracy, reliability and timeliness.

The objective of this study was to determine the key factors contributing to the decline in NMR in Kenya with a view of fast-tracking the achievement of SDG target 3.2. Findings from this study should be considered during the strategic design and interventions aimed at accelerating reduction of NM to achieve SDG target 3.2. In addition, the findings will be valuable to other researchers by providing significant information concerning factors affecting NM in Kenya. Besides, the findings will give insights that can be used in monitoring and evaluation of activities of the national and county Governments; and other concerned agencies aimed at childhood mortality reduction.

1.3 Research Question

This research sought to establish the answers to the question;

"What are neonatal mortality determinants in Kenya?"

1.4 Objectives of the Study

The overall aim of the research was to assess the specific factors determining neonatal mortality in Kenya.

The research specific objectives were:

1. To identify demographic factors influencing Neonatal Mortality
2. To determine healthcare factors influencing Neonatal Mortality
3. To establish socioeconomic factors influencing Neonatal Mortality

1.5 Justification of the Study

Health may be regarded as a mark of social progress and prosperity for a nation and forms the basis for the all-inclusive development and well-being of the people. (WHO Report, 2016). Kenya's aspiration as articulated in the country's Vision 2030 envisages a situation where the citizens will attain high quality of life by 2030. In addition, ending all preventable child deaths by 2030 is the aim set forth by the SDG target 3.2, an aspiration that calls for a clear understanding of exactly where the main gaps remain in improving child survival. This will only be possible if the health concerns of all segments of the population, including under-fives, are fully and comprehensively addressed (NCPD, 2016).

Estimates by the UN-IGME shows that in Kenya, the proportion of NM to IM and U5M has been steadily increasing between 1960 and 2018 only experiencing a decline between 1985 and 1995. The proportion of NM to IM rose from 41 per cent in 1960 to 64 per cent in 2018, an increase of 59 per cent. Over the same period, the proportion of NM to U5M grew by 92 per cent from 25 per cent to 48 per cent.

Going by the present trends, it is predicted that if progress is not enhanced, 42 out of 48 SSA countries are likely to miss the NM SDG target 3.2.2 by 2030 whereas about half of them will achieve the target after 2050 (UNICEF *et al*., 2019). This report emphasizes that fast-tracking progress to attain the SDG target would save 5 million newborn lives between 2018 and 2030. In order for Kenya, with an NMR of 22 deaths to meet the SDG target 3.2.2 of 12 deaths or lower, evidence to guide interventions and action plans is necessary to intensify effective interventions required to realize reduced newborn deaths.

The outcome to be realized will guide in supporting better-quality healthcare services that will empower the country to tackle the high level of neonatal mortality. Moreover, findings from this study will boost the knowledge required to inform policy and planning of health policies and programmes in the Kenya. In addition, the findings will complement others that have been carried out on the factors that influence neonatal.

1.6 Scope and Limitations of the Study

This research used the 2014 KDHS data in which 31,079 out of 32,172 eligible women were interviewed, giving a 97 per cent response rate. The study examined neonatal deaths that occurred among the 20,961 children born in the last 5 years prior to the survey, excluding births in the interview month. Thus, the sampled under five-year-old children who survived or died within 28 days of life is the unit of analysis.

There is concern regarding timing of measurement for some indicators collected in the survey. While it would be expected to assess characteristics during the mother's

pregnancy and birth of the child, certain variables measured during the interview were mothers' education attainment and household characteristics. Further, as the information provided is based on self-reporting, the data collected may be subject to recall bias (Althubaiti, 2016).

Generally, survey data is affected by sampling errors and misreporting, of which the 2014 KDHS was no exception. Data quality may suffer due to exclusion of birth histories of newborns who died immediately after birth. Considering that the survey interviewed surviving women, an underestimation of NMR may have occurred due to an association of newborn with maternal deaths. Occasionally, distinguishing between a neonatal death and still birth may be difficult and misclassification might result to early neonatal deaths being recorded as miscarriages. Sometimes, cases of neonatal deaths within the first hour after birth go unreported (Malqvist, 2010).

The WHO articulates that the most critical neonatal mortality proximate determinants are pre-conception nutrition care; pregnancy care; care during labour, around birth and in the first week of life; and care of the small and sick new-born. However, the 2014 KDHS did not collect information pertaining to variables that can facilitate measuring these factors.

In this study, birth weight, breastfeeding initiation and postnatal care which are very important variable in determining neonatal survival were excluded due to high proportions of missing values. At times, women who deliver at home might have difficulties of knowing their child's exact birth weight. Despite birth size and ANC visits having high proportions of missing values, they were included in this research. Birth size is either reported as very large, larger, average, smaller, or very small as gauged by the mother. Although KDHS approximations of NM may be prone to

sampling and non-sampling errors, it is the only viable source of NMR. Moreover, there is no notable evidence to suggest widespread or severe inaccuracies in the data which is the most appropriate for identifying general trends at household-level analysis of determinants.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter provides a desk review based on previous research done focusing on the causes of childhood deaths. It contains the theoretical perspective and the empirical literature covering demographic, healthcare and socioeconomic factors. The chapter also provides the conceptual and operational framework as well as the operational hypothesis for the study.

2.2 Theoretical Perspective

Different theories have been advanced to address childhood mortality. The epidemiologic transition theory as postulated by Omran (2005) pays attention to the intricate changing patterns of diseases and health. These patterns are connected to demographic and socioeconomic transitions forming a modernization complex. This theory argues that mortality decline is a more recent phenomenon with effects of medical aspects being more direct and more outstanding, expanded by considerable public health programs.

This theory is hinged on the principle that differentials in disease patterns and health are majorly widespread in young women and children. The theory demonstrates that childhood survival is gradually improved as pandemics reduce due to improved nutrition, increased income, and proper sanitation measures. This is boosted by availability of modern public health measures. In spite of these distinct achievements in the survival of children and women, the theory concluded that IM and CM remains exceptionally high mostly in the developing countries.

Mosley and Chen (1984) analytical framework have been adopting by many researchers studying child survival in many developing countries. This framework provides specific and clear concept for studying child mortality and hypothesizes relationship between socio-demographic characteristics, proximate determinants and neonatal mortality. The theory assumed that all the economic and social factors work through a combination of proximate (intermediate) determinants or biological mechanisms to result to mortality. The intermediate determinants affect children's health directly while the underlying determinates do so indirectly through their impact on the intermediate determinants.

2.3 Empirical Literature

This section provides analysis of previous studies undertaken with regard to CM. As demonstrated by Mosley and Chen (1984) conceptual framework, the outcome is affected by socioeconomic factors through the proximate determinants which can broadly be classified into demographic factors, environmental factors, nutritional factors and healthcare factors. In this study, the socioeconomic determinants are grouped into three broad categories namely; individual (mother's education), household (household income) and community level category (residence and region). In the same way, the proximate determinants are demographic factors such as birth order, sex of the child, mother's age at first birth, birth size and also preceding birth interval; and healthcare factors (antenatal care visits, place of delivery). This study excluded environmental contamination factors as they were not presented in the 2014 KDHS in a form in which they have an effect on the neonates. Nutrition deficiency may best be

expressed by way of breastfeeding initiation of newborns. This factor was also excluded from this study due to high proportions of missing values for the indicator.

2.3.1 Demographic Characteristics

The demographic characteristics of mothers and children play an important role in the survival of children. The variables used in this research include gender of the child, mother's age at first birth, birth order, previous birth interval and birth size.

Sex of Child

In their study, Ezeh *et al*. (2014) found that male neonates were at a greater risk of dying in the neonatal period compared to female neonates. This finding is consistent with a study done in Indonesia in 2008 that showed that male newborns were more likely to die compared to female newborns. A similar study conducted in Bangladesh in 2009 reported a lower risk of male-related deaths among female neonates. Recent studies by researchers in the United States have revealed that baby boys are more likely to die within the first year of life compared to baby girls. They assert that death data indicated that boys were more vulnerable compared to girls in the early months of life. Previous studies show that children and specifically male infants are more likely to die compared to female infants (Muriithi, & Muriithi, 2015). This is consistent with the analysis of the 2014 KDHS which show that sex of the newborn influences' infant as well as child mortality.

Age of Mother at Birth

In a study investigating the effect of early age of mothers at birth on NM, Neal *et al.* (2018) emphasized the need to reduce adolescent child bearing among the youngest age group as a way of addressing challenges of NM. Their analysis shows that there is a

rise in the risk of NM to adolescent mothers and is most striking in mothers falling in the youngest age group. The study found that even after adjusting for utilization factors of demographic, healthcare services and socio-economic the risks persisted. An article based on research done in rural Tanzania on neonatal survival with respect to the effect of age of mother and other associated factors where first and second births indicated that delayed maternal age at birth was a significant factor which had an impact on NM. This particular study revealing a higher NMR for infants born to teenage mothers agrees with similar previous studies conducted elsewhere (Selemani *et al*., 2014). Dube, (2012) in his unpublished Masters of Arts Research Paper investigating the relationship of mothers age at first birth and IM in Zimbabwe established that they are highly correlated. From his study, adolescent mothers suffer higher IM compared to mothers who delay childbearing to older ages.

These findings contrast with similar studies done in Ethiopia and India. In a research carried out in Northwest Ethiopia on prevalence and factors associated with NM, Kebede *et al*. (2012) established no association existing between NM and age of mother at birth, child's sex, and ANC visit. Similarly, Hallad *et al*. (2018) in their research paper done to estimate NMR and Infant Mortality Rate (IMR) for rural North Karnataka, India found that education of mother, mother's career and mother's age at birth did not show strong association on IM.

Birth Order

Birth order is an important determinant of childhood mortality. In contrast to someone whose birth order is one or two, an infant whose birth order is five or more has a greater chance of dying within the first five years of age. In comparison, infants with

a birth order of three or four have a smaller chance of dying by the age of five relative to birth orders of one and two. (Kaberuka *et al*., 2017). Analysis carried out elsewhere has found that first-born infants have a greater mortality rate relative to those with a higher birth order. Nazrul *et al*. (2009) found that in Bangladesh, NM and PNM levels are the lowest for children whose birth order is four or higher.

Preceding Birth Interval

An increased risk of morbidity and mortality is associated with children who are born very close to each other. During the 3rd International Conference on African Growth Problems in Nigeria in 2016, a paper entitled "Effect of Birth Spacing on Under-five Mortality in Nigeria: A Proximate Determinant Approach (Birth Spacing and Under-five Mortality", according to Gbolahan and Gbemisola (2016), proximate variables influencing child mortality are socio economic variables such as maternal schooling, age, place of residence, and wealth status. The fact that child mortality varies by the length of the previous birth interval has been established. Studies from the developed and developing countries clearly point to higher mortality for births taking shorter intervals.

A Research undertaken in Ethiopia on the impact of pre-birth periods on CM showed that children with a pre-birth period of less than 18 months were at a greater risk of death compared with those with a pre-birth interval of 60 months or more. Those with a previous birth period between 36 and 47 months had a smaller chance of death than children with a 60-month birth interval. (Tariku, 2016).

Birth Size

Birth weight is considered to be a good measure of child's health status and nutrition. A study conducted in Nigeria investigating the effect of low birth weight on IM showed that, compared to standard weight, children born with low birth weight are at higher risk of dying during the first year of life. This result was achieved regardless of child sex, birth order, pregnancy and delivery care, education and nutritional status of mothers, sanitation and clean water access in the household, and other variables (Uthman, 2007). Similarly, Muriithi M. and Muriithi K. (2015) in their analysis on the determination of IM in Kenya found that newborn size has an effect on IM and CM. They reported that, compared to those who are either average, greater than average or very large in size, there was a relative higher risk of death for babies and children born who are smaller than average in size.

2.3.2 Healthcare Factors

According to UNICEF, an important strategy for reducing maternal morbidity and mortality is to ensure the delivery of all babies with the help of a qualified birth attendant. Maternal health is closely linked to newborn survival since provision of care during pregnancy, a reduction in maternal and neonatal morbidity and mortality is the result of labor and delivery. Twenty-two per cent of global births occurred in 2016 without the help of a qualified birth attendant. Data available shows that coverage of skilled birth attendant at birth rose by 33 per cent between 2000 and 2016 from 60 per cent to 80 per cent. Non-existent or inadequate care all through pregnancy and at the time of delivery contributed to the estimated deaths of slightly more than 300,000 mothers and over 2.7 million newborns in the first month of life in 2015, despite significant progress made in the previous two decades (UNICEF, 2017).

In Kenya, with 362 deaths per 100,000 live births and 22 deaths per 1,000 live births, maternal mortality ratio (MMR) and NMR have remained unacceptably (2014 KDHS). A National Road Map (NRM) established in 2010 to address maternal and newborn health is aimed at reducing maternal, morbidity and mortality of newborns by enhancing the affordability, accessibility, acceptability and use of eligible birth attendance during pregnancy, infant birth and postpartum at all levels of Kenya's health care system (GOK, NRM, 2010). Health factors included by this analysis include antenatal care appointments and place of birth.

Antenatal Care Visits

Antenatal treatment (ANC) is an internationally recommended practice that is crucial in minimizing NM. When ANC is pursued early during the pregnancy and continually sustained until delivery, it helps in the identification of any adverse pregnancy outcome. A recent randomized control trial involving several countries and spearheaded by WHO disclosed that necessary health interventions can be provided during the four or more ANC visits with definite time intervals (Lincetto *et al*., 2012). The report further notes that it is important to identify underlying conditions early enough. Therefore, the first ANC visit should be made early enough into the pregnancy, preferably the first trimester (between 1 and 12 weeks). The first ANC diagnosis is to differentiate between pregnant women who need routine treatment and those who need special consideration.

Findings from the 2014 KDHS show that the quality of ANC given to expectant mothers during their visits is determined by the services received and the kind of information provided (2014 KDHS). According to a recent UNICEF report, easy, cost-effective treatments that can be delivered during pregnancy and delivery can easily

avoid most infant deaths. For any birth, the WHO suggests that women make at least four ANC visits. A study commissioned in India to investigate the frequency, timing and impact of ANC visits on the timing of the initial ANC visit during the first trimester (the first three months of pregnancy) and NM were strongly associated with NMR. The study suggested that in order to obtain better health of newborns, the first ANC visit in the first trimester should be done by pregnant mothers (Gupta & Talukdar, 2017).

Tekelab *et al*. (2019) established in a systematic review that focused on the influence of ANC on NM in SSA that expectant mothers who obtained one ANC from a qualified provider had a lower chance of experiencing NM relative to those who did not. The study further showed that there was statistical significance of at least one ANC on NMR. A study in Kenya aiming at establishing the efficacy of ANC services in minimizing NM was shown to be associated with the risk of NMR in the absence of controls for complications during breastfeeding, insufficient ANC visits and professional ANC provision. (Arunda *et al*., 2017).

Place of Delivery

Delivery in a health facility is considered essential in promoting maternal and newborn survival due to the presence and assistance of healthcare professionals. During delivery, professional care in a health facility is considered to be essential in reducing maternal mortality and NM. A study by Machio (2018) shows that NM and U5M are highly associated with skilled delivery care. These findings suggest that efforts should be made to ensure access of skilled delivery care services by as many women as possible would accelerate reduction in NM and U5M. Professional assistance guarantees that work continues well through gestation with sufficient testing to detect

any anomalies and other complications that can place the baby and mother at risk. These tests detect possible complications such as fetal distress allowing for appropriate interventions and referrals to be made.

No substantial variation in the probability of neonatal mortality was found in another study on NM and its determinants in Eastern Uganda between women who delivered in a health facility and those who delivered at home (Kananura *et al*., 2016). This was compatible with two other findings in Tanzania that showed no substantial difference between deliveries done in the hospital and those at home. In Tanzania, in comparison to the predicted neonatal survival benefits from institutional delivery, a study examining whether place of delivery or multiple health care problems found no data to conclude that delivery in health facilities is protective for newborns (Nathan and Mwanyangala, 2012). Findings arising from these studies suggest that this may be attributed to the low quality of health services attributable to lack of vital equipment and low staff level in the rural areas.

In comparison, Ajaari *et al*. (2012) noted in a study in rural Tanzania on the effect of place of delivery on NM that a delivery outside a health facility is more likely than a delivery in a health facility to lead to neonatal death. This research concludes that deliveries to health facilities attended by trained medical workers decrease maternal and NM morbidity relative to home deliveries. The conclusion is consistent with a 2005 WHO survey claiming that, relative to home delivery, delivery in a health center (and not generally a hospital) staffed by trained health professionals is better.

2.3.3 Socioeconomic Factors

The socioeconomic factors considered in this study were the level of mother's education, household wealth, residence, and region.

Mother's Education

Education of a mother is an important characteristic in determining survival status of children. Results from a World Bank systematic review of impact evaluation evidence avers that investing in female education has a bearing in the reduction of NM. This report shows that well educated women effectively safeguard the health of their children by providing better nutrition, observing hygienic practices, and promoting health seeking behavior. A study done in Madagascar on mother's education with respect to increased child survival demonstrated that education of the mother has an effect on their offspring's' survival. This study shows each additional year of schooling reduces the probability of losing a child by 1.0 per cent. When compared to uneducated mothers, those who completed primary school have a 5.0 per cent chance less to have a child loss (Badji, 2016).

In a seminar article focusing on SSA, Caldwell (1979) highlights that there is a robust relationship between maternal education and lower CM in Nigeria. He advocates that an educated mother is more conscious about illness and has a high likelihood of seeking healthcare. He further observes that education increases the knowledge and enhances the ability to handle new ideas and introduce different cultures. The article notes that the educated mother is able to relate with the present world, and is likely to consider the amenities around her as a right, and is likely to cooperate with medical personnel. In addition, the woman may have better bargaining power with the husband

and/or family members. Education exposes parents to other cultures that are largely influenced by the western world and helps them ease ties with their traditional beliefs. In such situations, the parents can make decisions concerning their health and child care without reference to their elders.

Household Wealth

The household wealth index is constructed by using household data based on household assets, services, and amenities, and households are ranked according to their level of wealth. Household's wealth is important in determining living standards which increases the chances of child survival (Ikamari, 2013). Comparable research in Ghana found that a household's income has an important influence on the survival of children (Lartey *et al*., 2016). An infant from a family with high wealth status was found to be more likely to thrive compared to one with low wealth status.

A study in India investigating the association between household income and child survival showed that an increasingly relevant indicator of CM is household wealth. The correlation between household income and CM was found to be greater in rural areas, meaning that households are largely responsible for deciding child survival in these areas. (Chalasani, 2010).

Place of Residence

Parents place of residence is considered to have an effect on the survival status of children in developing countries. However, Poudel (2013) in his unpublished Master's Thesis in Public health on Neonatal Mortality Predictors in Nepal found no association between NM and place of residence. A further research on NM and PNM in a developed world also found no major mortality correlation with socio-economic

variables such as faith, exposure of mothers to mass media, place of residence and mother's working status (Uddin *et al*., 2008).

On the contrary, studies done elsewhere have shown a significant relationship between place of residence and child health. A study done in Brazil found that CM rates in urban areas, relative to rural areas, they were smaller; while a similar study in Ghana found place of residence to be an important factor influencing child survival (Quansah, 2016). In his article on trends in childhood mortality in Kenya Kimani-Murage (2014) states that the advantage of child survival in urban areas has now been erased. The article notes that there was significant decline in CM in rural areas compared to urban ones.

Region of Residence

Widespread regional variation of IM in Kenya has been the main challenge facing effective implementation of child survival programmes in the country (Akuma, 2009). Nairobi, Central, Eastern, Coast, North Eastern, Rift Valley, Nyanza and Western are the eight regions/provinces in Kenya. Ikamari, (2013) found that children born to women from less developed regions have higher NM and PNM mortality risks compared to their counterparts in more developed regions. Mortality rates were found to be persistently higher in Nyanza region compared to Nairobi region. Clearly, the findings show that region of residence is a significant factor determining NM and PNM in Kenya. This may be attributed to variations in the socio-economic and environmental factors of the environment.

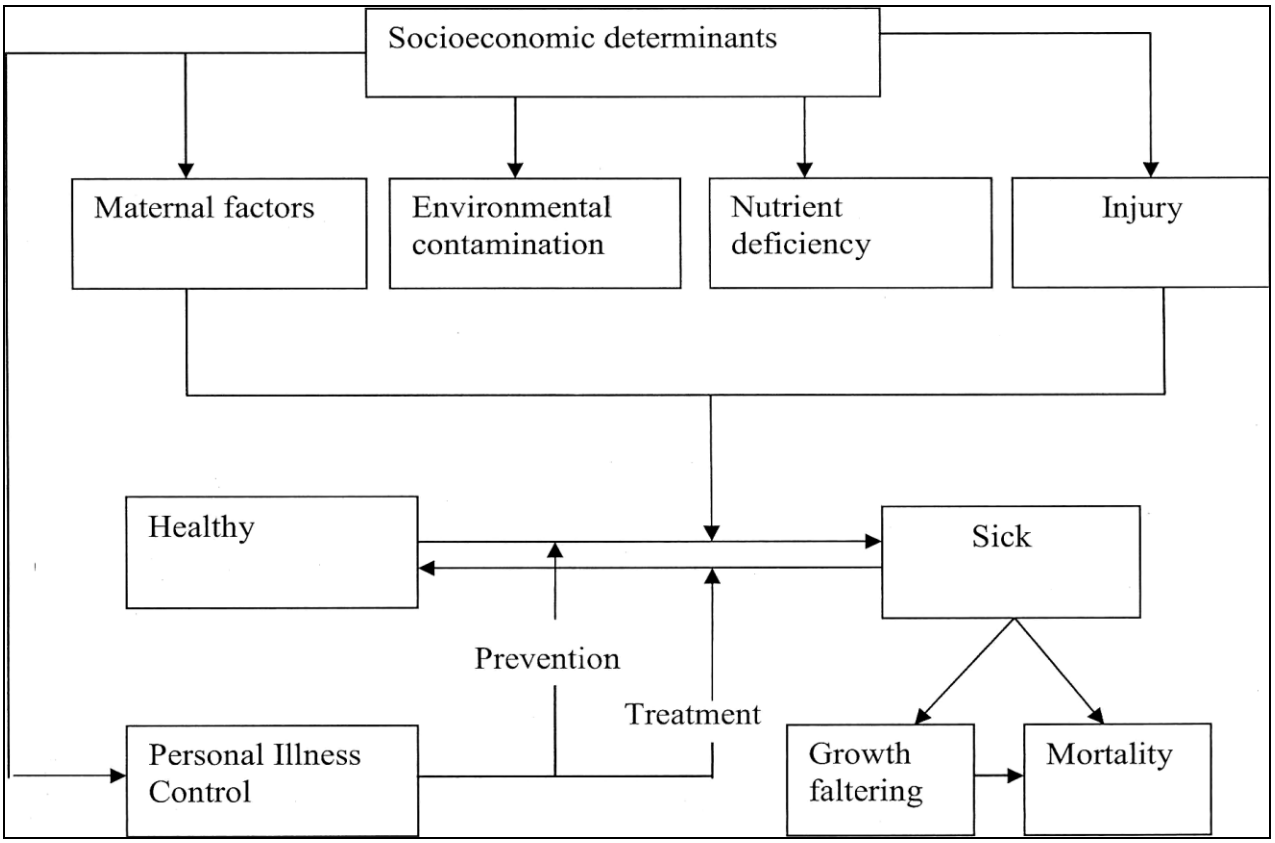
2.4 Conceptual Framework

Figure 2.1 illustrates the Mosley and Chen's conceptual framework for the survival of children in developing countries. It shows pathways by which socioeconomic determinants impact on child survival through proximate determinants resulting to morbidity or mortality. Any effort to reduce neonatal illness and deaths must operate through these events. If these are addressed, the risk of neonatal mortality ought to decline.

The system has divided proximate morbidity and mortality determinants into variables of parental, water pollution, food deprivation, disability and personal disease management. Determinants falling under the initial four classes have a bearing on the rate at which children transition from good to ill, while variables affect both this rate (through prevention) and the recovery rate in the last group (through treatment) (Hill, 2003). These factors affect child mortality and portray presence of interrelationships among different determinants.

Parity, age, and birth interval are the maternal or demographic factors identified, and environmental pollution factors, on the other hand are quality of air, food, water, and others. Injury, personal preventive measures, and nutrition deficiency are among the determinants of child mortality identified.

Figure 2.1: Conceptual Model



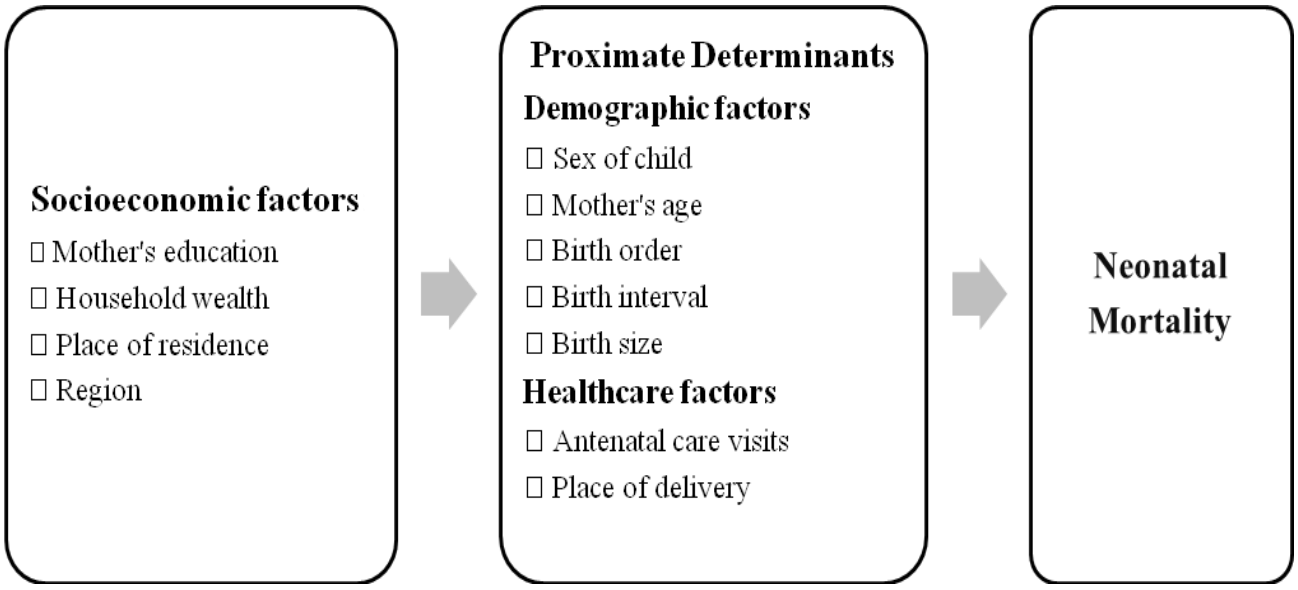
Source: Mosley, W. and L. Chen. (1984) "An Analytical Framework for the Study of Child Survival in Developing Countries

2.5 Operational Framework

The operational framework used in this study is illustrated in Figure 2.2. This framework as modified from Mosley and Chen (1984) conceptual framework was developed to guide the investigation into the factors influencing NM in Kenya. The framework shows how the conceptual model is applied on the selected variables in the study. The dependent variable is survival or death of the neonate while the independent variables are mothers' education, household wealth, place of residence, region of

residence, neonate's sex, age of mother, birth order, preceding birth interval, birth size, Antenatal care visits and place of delivery

Figure 2.2: Operational Framework



Source: *Modified from Mosley and Chen (1984) Conceptual Model*

2.6 Operational Definitions of Variables

This section gives a concise definition of variables and their measurement as used in this study. Child survival status within 28 days is the dependent variable whereas the predicator variables are grouped into demographic factors (sex of neonate, mother's age, birth order, birth interval, birth size), healthcare factors (antenatal care, place of delivery) and socioeconomic (mother's education, place of residence, wealth index, region) as shown in Table 2.1.

Mother's age at first birth: This is the age of the mother when she gave birth to her first child.

Birth order: This refers to the order a child is born in their family.

Preceding birth interval: This is the difference in months between the date of birth of child and birth date of birth of preceding child. It is a variable that measures the duration of the interval preceding the birth. The “first child” category refers to first born child.

Birth size: This is a variable based on the mother’s perception with respect to the size of the child at birth. Categorized as large, average, and small, the variable is used since some mothers studied do not know the birth weight of their newborns.

Antenatal care (ANC): It is the care given by skilled healthcare professionals to pregnant women from the time of conception to the onset of labour, to safeguard the health conditions for both mother and the unborn baby.

Place of delivery: This is the place where the baby was born.

Household wealth index: This is a composite measure based on an index of the number and types of ownership of selected assets, such as televisions and bicycles and housing characteristics of the household, and then divided into quintiles of the de jure population.

Table 2.1: Variable definitions

Variables	Categories of variables
DEPENDENT VARIABLE	
Survival status	0 = Alive 1 = Dead
INDEPENDENT VARIABLES	
Demographic factors	
Sex	Sex of child; 1 = Male 2 = Female
Mother's age	Age of mother's at first birth; 1 = < 20 2 = 20 - 29 3 = ≥ 30
Birth order	Birth rank of child; 1 = 1 - 2 2 = 3 - 4 3 = ≥ 5
Birth interval	Preceding birth interval (in months); 1 = < 24 2 = 24 - 36 2 = > 36
Birth size	Size of child at birth as gauged by the mother; 1 = Large 2 = Average 3 = Small
Healthcare factors	
Antenatal care	Number of Antenatal care visits; 0 = None 1 = 1 - 3 2 = ≥ 4
Place of delivery	Place of delivery of child; 1 = Home 2 = Health facility
Socioeconomic factors	
Mother's education	Mother's level of education; 1 = No education 2 = Primary 3 = Secondary+
Residence	Place of residence; 1 = Urban 2 = Rural
Wealth index	Household wealth index; 1 = Poor 2 = Middle 3 = Rich
Region	Region/Province; 1 = Coast 2 = North Eastern 3 = Eastern 4 = Central 5 = Rift Valley 6 = Western 7 = Nyanza 8 = Nairobi

2.7 Operational Hypotheses

These hypotheses have been formulated to give expected direction of the influence of the predictor variables on the dependent variable.

1. Higher maternal education reduces neonatal mortality in Kenya.

2. A woman living in the rural area is more likely to experience a neonatal death compared to the one living in an urban area.
3. Region of residence in Kenya influences neonatal mortality.
4. Adolescent mothers as well as older mothers aged over 30 years have a higher likelihood of experiencing neonatal death in Kenya.
5. Increased Antenatal care visits reduce neonatal mortality.

CHAPTER THREE: DATA AND METHODS

3.1 Introduction

This chapter presents the research methodology adopted in this study so as to meet the set objectives and answer the research question. It gives a comprehensive discussion on the data source, techniques used in data analysis and ethical concerns.

3.2 Data Source

This study used the 2014 KDHS which was the sixth cross-sectional survey conducted in Kenya as part of the DHS programme. KDHS was intended to provide population and health indicators at the national level, regional (formerly provinces) level, urban and rural areas, and for selected county level indicators.

The 2014 KDHS dataset has seven common types of recode data files associated with the core questionnaires consisting of household, man's and woman's questionnaires. The datasets which are available in the standard recode file formats are: Births recode (BR); Couples recode (CR); Household recode (HR); Individual recode (IR); Children's recode (KR); Men's recode (MR); and Household member recode (PR). This study used the children's' recode (KR) dataset which has one record for every child of interviewed women, born in the five years preceding the survey. The unit of analysis in this file is the children of women born in the last 5 years (0-59 months) before the interview. The data which is publicly available can be accessed by making a request to the DHS program or KNBS website on Kenya National Data Archive (KENADA) data sharing platform.

Out of the 32,172 eligible women age 15-49 identified for the woman's questionnaire 31,079 were interviewed, giving a 97 per cent response rate. Women who had given birth were asked to indicate whether or not each of the babies born during the last 5 years survived the first 28 days of life. Thus, the analysis is based on a total of 20,964 children born in the last 5 years prior to the survey excluding children born during the month of interview; out of this 443 died within 28 days of birth.

i) Dependent Variable

The NM defined as any death occurring during the first 28 days of life, is the dependent variable in the study. Neonatal death was recoded as a binary variable with '**0**' indicating that the child survived for more than 28 days and '**1**' otherwise, i.e., death of the child within 28 days.

ii) Independent Variables

The independent (also known as explanatory or predictor) variables of this study are grouped into three categories namely, demographic factors, healthcare factors and socioeconomic characteristics.

Demographic variables include; sex of the neonate, mother's age at first birth, birth order, preceding birth interval and birth size. The healthcare factors are ANC visits and place of delivery while socio-economic variables comprise of; mother's education, place of residence, household wealth and region of residence.

3.3 Ethical Considerations

Consent to use the 2014 KDHS data was obtained from the KNBS. This data which is free can be acquired through a formal request on the KNBS website (www.knbs.or.ke). Thus, no ethical approval was required.

3.4 Data Analysis

This study used three levels of analysis, namely; univariate, bivariate and multivariate techniques to investigate factors influencing neonatal mortality in Kenya. Data analysis was done using SPSS 22.0.

3.4.1 Univariate Analysis

The univariate analysis provides summary statistics for only one variable. This analysis describes the data and patterns that exist within it. Frequencies and percentages illustrate the distribution of neonatal mortality for the independent variables.

3.4.2 Bivariate Analysis

The correlation of each indicator and the dependent variable is shown by bivariate analysis. The frequency of the relationship between two variables and the test hypothesis of interactions between two nominal or ordinal level variables are also tested.

Cross-tabulation has been used to achieve the ties between two variables. This is a descriptive statistical test indicating whether there are significant variations between groups to suggest some kind of relation between variables. Cross-tabs, though, are not enough to evaluate a theory between two variables and to explain the strength of the

relationship between an independent and dependent variable. To gain more details about the relationship, chi-square statistics were used to assess whether or not neonatal mortality was correlated with the predictor variables considered in the analysis.

The p-value or significance value must be the same size or less than the significance amount to decide if the chi-square statistic is high enough (statistically significant) to validate a relationship. A p-value is a measure of the strength of proof given against the null hypothesis by the sample results. All variables with a p-value <0.05 would be considered.

3.4.3 Multivariate Analysis

Chi-square statistics does not provide information on the direction of the relationship (positive or negative) between the two variables. Multivariate analysis was performed to understand interactions between different variables in the dataset.

A logistic regression analysis was used to assess the simultaneous effects of socioeconomic, demographic and health seeking behaviour variables. This is the appropriate regression analysis to conduct when the dependent variable is dichotomous (binary). It describes the relationship between a dichotomous response variable and one or more nominal, ordinal, interval or ratio-level explanatory variables. The logistic model (also known as logit model) is a special case of generalized linear model where the assumptions of normality and constant variance of residuals are not satisfied. It predicts the odds associated with the presence or absence of the dependent variable/outcome where results are presented as odds ratio (OR).

The logistic regression model is expressed as:

$P = \frac{1}{1+e^{-z}}$, where ***P*** is the probability of death of a child within the first four weeks of birth and ***z*** is the regular linear regression equation: $Z = \alpha + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_n x_n$

Where, ***α*** and ***β*** are the parameters of the model and **x's** are the independent variables

Thus, the general multivariate logistic regression model can be expressed as;

Logit (p) = Log $\left(\frac{p}{1-p}\right) = \alpha + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_n x_n$

Which expresses the log odds [Log $\left(\frac{p}{1-p}\right) = \log(odds)]$ of the outcome variable as a linear function of the independent variables. SPSS version 23 software was used to analyze the data.

To find factors associated with neonatal mortality, socioeconomic determinants and proximate determinants were added in a stepwise process in the logistic regression model. At first levels socioeconomic variables (Model-1a) were added to demographic factors while in the second case socioeconomic variables (Model-1b) were added to health factors. In the second level (Model 2) all the proximate factors were added to socioeconomic determinants in the logistic regression analysis. The results were reported as odds ratio (95% CI). *P* value less than 0.05 was considered to be statistically significant.

CHAPTER FOUR: FACTORS DETERMINING NEONATAL MORTALITY

4.1 Introduction

This section presents the results of the study. The socioeconomic factors at community, household, individual levels and proximate characteristics were compared between the children alive and the children dead within 28 days after birth. Section 4.2 gives the background characteristics of the study population whereas section 4.3 provides the relationship between the background characteristics and child survival status. Section 4.4 presents the study's multivariate analysis findings showing the effects of selected factors on neonatal mortality.

4.2 Background Characteristics

A total of 20,964 live births occurred in the last five years prior to the survey with 443 neonatal deaths reported. This translates to a neonatal mortality rate of 21 deaths per 1,000 births. This is arrived at by considering the 443 neonatal deaths as the numerator divided by 20,964 live births as the denominator expressed per 1,000 live births. From the births reported, 2.0 per cent neonatal deaths (443 neonatal deaths) occurred within 28 days as shown in Table 4.1 below. The results show that a majority of the children (58.0%) were born to adolescent mothers below 20 years of age. Distribution of children by birth order shows that a greater proportion (43.8%) were in the birth order 1 and 2 with the proportion declining with the increase in the birth order. Fewer children (19.2%) were born with a preceding birth interval of less than 24

months. The distribution of children whose mother perceived them to be of small birth size were 17 per cent while almost 1 in 4 were of large birth size.

A higher proportion of mothers (54.5%) made four or more ANC visits. Majority of mother's (54.5%) delivered in a health facility compared to forty-six percent who delivered at home. Further, the results show that over fifty-two percent of children were born to mothers who had primary level of education with those with no education being 22 per cent. Majority (55.0%) of children were born to mothers who are poor. Two-thirds of the children were born to mothers who reside in rural areas. The results show that one in three children were born in Rift Valley region followed by Nyanza and Eastern regions at 14 per cent each; Nairobi region had the least number of births (2.5%).

It is possible that participants giving 'don't know' response could have biased the analysis of the proximate determinants of neonatal mortality. However, there may be no way of estimating the magnitude and direction of this effect in the absence of proxies for don't know responses.

Table 4.1: Percentage Distribution of Background Variables, KDHS 2014

Variable	Category	Frequency (n=20,964)	Percent
Child Survival Status	Alive	20,521	97.9
	Dead	443	2.1
Sex	Male	10,633	50.7
	Female	10,331	49.3
Mother's Age	< 20	12,161	58.0
	20 - 29	8,557	40.8
	≥ 30	246	1.2
Birth Order	1 - 2	9,192	43.8
	3 - 4	6,145	29.3
	≥ 5	5,627	26.8
Preceeding Birth Interval	< 24	3,089	19.2
	24 - 36	5,719	35.5
	≥ 37	7,301	45.3
Birth Size	Large	2,372	23.9
	Average	5,896	59.4
	Small	1,660	16.7
Antenatal Care Visits	None	924	6.2
	1 - 3	5,881	39.3
	≥ 4	8,144	54.5
Place of Delivery	Home	9,411	45.5
	Health facility	11,250	54.5
Mother’s Education	No education	4,585	21.9
	Primary	11,055	52.7
	Secondary+	5,324	25.4
Wealth Index	Poor	11,526	55.0
	Average	3,497	16.7
	Rich	5,941	28.3
Place of Residence	Urban	6,828	32.6
	Rural	14,136	67.4
Region of Residence	Coast	2,650	12.6
	North Eastern	1,594	7.6
	Eastern	3,015	14.4
	Central	1,420	6.8
	Rift Valley	6,850	32.7
	Western	1,977	9.4
	Nyanza	2,926	14.0
	Nairobi	532	2.5

4.3 Relationship between Background Characteristics and Child Survival Status

The results showing the relationship between neonatal mortality and background characteristics are presented in Table 4.2. These findings indicate that mother's age, birth order, preceding birth interval, birth size, ANC visits and place of delivery are significantly associated with NM at 5.0 per cent level of significance. On the contrary, mother's education, place of residence, wealth index, region and sex were not significantly influencing neonatal mortality at 5.0 per cent level of significance.

Neonatal deaths observed among teenage mothers (below 20 years) was below 2.0 per cent while mothers aged 20 to 29 years experienced slightly over 2.0 per cent neonate deaths. Mothers with a birth order 5 and above experienced a higher neonatal mortality (2.6%) compared to mothers of lower birth order. The highest proportion (3.4%) was neonatal deaths among mothers with a previous birth period of less than 24 months. Four per cent neonatal deaths occurred among mother's who reported to have given birth to children with small birth size compared to 1.0 per cent among mothers who reported to have given birth to children with average birth size. Less than 2.0 per cent neonatal deaths were experienced among mother's who reported to have given birth to children of average birth size.

The results also show that the number of ANC visits and place of delivery strongly influenced neonatal mortality in Kenya. Neonatal deaths were highest (3.7%) for women who had no ANC visit with 34 deaths out of 890 births. Interestingly, an equal proportion of neonatal deaths (2.0%) was observed among mothers who delivered at home in comparison to a health facility.

Table 4.2: Relationship between Independent Variables and Child Survival, KDHS 2014

Variable	Category	Child Survival Status			X^2	df	*p* -value
		Alive (20521)	Dead (443)	Percent			
Sex	Male	10,390	243	2.3	3.093	1	0.079
	Female	10,131	200	1.9			
Mother's Age	< 20	11,931	230	1.9	6.89	2	0.032
	20 - 29	8,350	207	2.4			
	≥ 30	240	6	2.4			
Birth Order	1 - 2	9,007	185	2.0	7.84	2	0.020
	3 - 4	6,031	114	1.9			
	≥ 5	5,483	144	2.6			
Preceeding Birth Interval	< 24	2,983	106	3.4	36.84	3	0.000
	24 - 36	5,631	88	1.5			
	≥ 36	7,161	140	1.9			
Birth Size	Large	2,318	54	2.3	50.06	3	0.000
	Average	5,820	76	1.3			
	Small	1,593	67	4.0			
Antenatal Care Visits	None	890	34	3.7	132.2	3	0.000
	1 - 3	5,797	84	1.4			
	≥ 4	8,044	100	1.2			
Place of Delivery	Home	9,223	188	2.0	56.05	2	0.000
	Health facility	11,020	230	2.0			
Mother's Education	No education	4,486	99	2.2	3.865	2	0.145
	Primary	10,806	249	2.3			
	Secondary+	5,229	95	1.8			
Wealth Index	Poor	11,295	231	2.0	4.349	2	0.114
	Middle	3,407	90	2.6			
	Rich	5,819	122	2.1			
Place of Residence	Urban	6,675	153	2.2	0.797	1	0.372
	Rural	13,846	290	2.1			
Region	Coast	2,587	63	2.4	12.48	7	0.086
	North Eastern	1,565	29	1.8			
	Eastern	2,952	63	2.1			
	Central	1,379	41	2.9			
	Rift Valley	6,718	132	1.9			
	Western	1,943	34	1.7			
	Nyanza	2,863	63	2.2			
	Nairobi	514	18	3.4			

4.4 Effects of Selected Factors on Neonatal Mortality

Multivariate level analysis using logistics regression analysis where predictor variables were included in three models is presented in Table 4.3a-c. Although mothers' education, place of residence, wealth index, region and sex were found not to be significant at bivariate level, they have been included at this level. The common practice is to include in multivariate analysis only those variables that are statistically significant in univariate/bivariate analysis. Researchers have realized that univariate and bivariate analysis alone may not be sufficient, especially for complex data sets (Lo et al., 1995). Some variables not significant in univariate analysis may become significant in multivariate analysis. This may arise due to the influence of missing data, a scenario found in this study.

The first model had socioeconomic factors and demographic factors included in the model (Model 1a). After controlling for other variables, mother's education was found to be a determinant of neonatal mortality in Kenya. In additional, the results show that birth order, preceding birth interval and birth size were significantly associated with neonatal mortality. The relationships were significant at 5.0 per cent level. In the second model (Model 1b), socioeconomic factors and health factors were included in the logistics analysis. The results show that ANC visits and place of delivery were significant determinant of neonatal mortality in Kenya. The second level model (Model 2) has all the proximate and socioeconomic factors included in the logistic regression analysis. This model shows that sex of child, birth order, preceding birth interval, birth size, ANC visits and place of delivery are significant determinants of neonatal mortality in Kenya. The relationships were significant at 5.0 per cent level.

Results obtained in model 1a shows that mother's education was a significant determinant of neonatal. The odds of dying for a neonate born to mothers with secondary level of education was 1.411 times higher compared to mothers with no education. Model 1a and 2 shows that birth order is a significant determinant of neonatal mortality in Kenya. Compared to children of birth order 1 or 2 neonates of birth order 3 or 4 were 35 per cent (Model 1a) and 40 per cent (Model 2) less likely to die. Neonates born with previous birth intervals of 24 months to 36 moths are about 1.5 times more likely to survive compared to those born with shorter previous birth intervals of less than 24 months. These results are similar to those established in a study by VanSoest (2018) in Bangladesh on the relationships between infant mortality, birth spacing and fertility which found that mortality risk falls with birth interval length. Otherwise, newborns, whose birth size according to the mother was large, the odds of dying were 0.547 (45%) times lower than the odds for average-sized babies.

The results show that neonates whose mothers had four or more ANC visits were associated with lower odds of neonatal deaths compared with those who had none. Mothers who attended at least four ANC visits or more were 66 per cent less likely to lose their newborn compared to those who had no ANC visit (OR 0.337 Cl: 0.220, 0.515). This result is supported by a study done in Ethiopia on factors affecting NM in the general population using the 2016 Ethiopian Demographic and Health Survey. The study found that being born to a mother with no ANC visit increase the odds of neonatal death compared to mothers with four or more ANC visits.

Place of delivery was another important predictor for neonatal mortality. Compared to neonates born at home, the odds of dying were significantly higher for

neonates born in a healthcare facility (OR 3.634, 95% CI: 2.317, 5.699). Model 2 results show that sex is a significant determinant of neonatal mortality. The odds of dying for a male neonate is 1.22 times higher compared to a female neonate.

Based on the 95 per cent confidence interval there is no statistically significant difference within variable measurements among wealth index, place of residence, mother's age and region.

Table 4.3a. Logistic Regression Analysis Results of Neonatal Mortality, KDHS 2014

Model 1a

Variable	Measurement	B	Sig.	Exp(B)	95% C.I.for EXP(B)	
					Lower	Upper
Mother's Education	No education (RC)		0.033			
	Primary	0.400	0.032	1.493	1.034	2.154
	Secondary	0.345	0.012	1.411	1.080	1.845
Region	Coast (RC)		0.030			
	North Eastern	-0.471	0.101	0.624	0.356	1.097
	Eastern	-1.011	0.003	0.364	0.188	0.703
	Central	-0.573	0.046	0.564	0.321	0.991
	Rift Valley	-0.217	0.465	0.805	0.449	1.442
	Western	-0.640	0.019	0.528	0.309	0.901
	Nyanza	-0.770	0.014	0.463	0.251	0.855
	Nairobi	-0.484	0.094	0.617	0.350	1.086
Residence	Rural (RC)					
	Urban	0.103	0.389	1.109	0.877	1.402
Wealth Index	Poor (RC)		0.056			
	Middle	-0.011	0.938	0.989	0.740	1.321
	Rich	0.289	0.063	1.335	0.985	1.811
Sex	Female (RC)					
	Male	0.185	0.057	1.203	0.995	1.455
Mother's Age	<20 (RC)		0.009			
	20 - 29	-0.353	0.408	0.703	0.305	1.621
	30+	-0.039	0.926	0.961	0.420	2.203
Birth Order	1 - 2 (RC)		0.005			
	3 - 4	-0.437	0.003	0.646	0.482	0.866
	5+	-0.327	0.012	0.721	0.560	0.929
Preceding Birth Interval	< 24 months (RC)		0.000			
	24 - 36 months	0.630	0.000	1.877	1.443	2.441
	> 36 months	0.343	0.037	1.410	1.021	1.946
Birth Size	Average (RC)		0.000			
	Large	-0.581	0.000	0.559	0.423	0.739
	Small	-0.562	0.003	0.570	0.394	0.825
	Constant	-2.752	0.000	0.064		

RC - Reference Category

Table 4.3b: Logistic Regression Analysis Results of Neonatal Mortality, KDHS 2014

Model 1b

Variable	Measurement	B	Sig.	Exp(B)	95% C.I.for EXP(B)	
					Lower	Upper
Mother's Education	No education (RC)		0.281			
	Primary	0.220	0.237	1.246	0.865	1.796
	Secondary	0.208	0.116	1.232	0.950	1.597
Region	Coast (RC)		0.006			
	North Eastern	-0.416	0.148	0.660	0.375	1.160
	Eastern	-1.000	0.003	0.368	0.190	0.710
	Central	-0.515	0.074	0.598	0.340	1.052
	Rift Valley	-0.130	0.664	0.878	0.489	1.578
	Western	-0.681	0.013	0.506	0.296	0.866
	Nyanza	-0.796	0.011	0.451	0.244	0.833
	Nairobi	-0.573	0.047	0.564	0.320	0.992
Residence	Rural (RC)					
	Urban	0.107	0.376	1.113	0.878	1.412
Wealth Index	Poor (RC)		0.025			
	Middle	-0.129	0.393	0.879	0.653	1.182
	Rich	0.241	0.123	1.273	0.937	1.728
ANC Visits	1 - 3 (RC)		0.000			
	4+	-1.166	0.000	0.312	0.204	0.475
	None	-0.128	0.510	0.880	0.602	1.287
Place of Delvery	Home (RC)		0.000			
	Health facility	1.288	0.000	3.624	2.329	5.638
	Constant	-2.641	0.000	0.071		

RC - Reference Category

Table 4.3c: Logistic Regression Analysis Results of Neonatal Mortality, KDHS 2014 ***Model 2***

Variable	Measurement	B	Sig.	Exp(B)	95% C.I.for EXP(B)	
					Lower	Upper
Sex	Female (RC)					
	Male	0.199	0.042	1.220	1.007	1.478
Mother's Age	1<20 (RC)		0.003			
	20 - 29	-0.385	0.371	0.680	0.293	1.581
	30+	-0.039	0.927	0.961	0.416	2.220
Birth Order	1 - 2 (RC)		0.002			
	3 - 4	-0.511	0.001	0.600	0.446	0.807
	5+	-0.329	0.012	0.720	0.557	0.930
Preceding Birth Interval	< 24 months (RC)		0.000			
	24 - 36 months	0.462	0.001	1.587	1.215	2.073
	> 36 months	0.189	0.254	1.208	0.873	1.673
Birth Size	Average (RC)		0.000			
	Large	-0.603	0.000	0.547	0.413	0.725
	Small	-0.509	0.007	0.601	0.414	0.873
ANC Visit	1 - 3 (RC)		0.000			
	4+	-1.089	0.000	0.337	0.220	0.515
	None	-0.039	0.842	0.962	0.654	1.413
Place of Delivery	Home (RC)		0.000			
	Health facility	1.290	0.000	3.634	2.317	5.699
Mother's education	No education (RC)		0.224			
	Primary	0.187	0.330	1.206	0.828	1.756
	Secondary	0.238	0.085	1.269	0.968	1.663
Residence	Rural (RC)					
	Urban	0.115	0.348	1.121	0.883	1.424
Wealth Index	Poor (RC)		0.036			
	Middle	-0.119	0.437	0.888	0.658	1.198
	Rich	0.233	0.139	1.262	0.927	1.718
Region	Coast (RC)		0.004			
	North Eastern	-0.430	0.138	0.651	0.368	1.149
	Eastern	-1.161	0.001	0.313	0.161	0.609
	Central	-0.507	0.081	0.602	0.341	1.064
	Rift Valley	-0.191	0.525	0.826	0.458	1.490
	Western	-0.671	0.015	0.511	0.298	0.877
	Nyanza	-0.791	0.012	0.453	0.244	0.841
	Nairobi	-0.550	0.059	0.577	0.326	1.021
	Constant	-1.701	0.002	0.183		

RC - Reference Category

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This section presents the summary, conclusions and recommendations of the study of factors influencing neonatal mortality in Kenya. The focus of the study was to analyze factors determining neonatal mortality and the association of the selected variables including mother's education, region, type of residence, age of mother at first birth, birth size, birth order, preceding birth interval, ANC visits and place of delivery.

5.2 Summary of Findings

This study aimed to identify factors influencing neonatal mortality in Kenya using the 2014 KDHS data. Specifically, the study aimed to identify demographic, healthcare and socioeconomic factors that influence neonatal mortality in Kenya. Demographic characteristics examined in this study includes sex of child, mother's age at birth, birth order, preceding birth interval, and birth size; while healthcare factors are ANC visits and place of delivery. The socioeconomic factors considered in this study were level of mother's education, household wealth, residence and region.

In this study, univariate, bivariate and multivariate techniques were used for data analysis. The univariate analysis was used to illustrate the distribution of neonatal mortality for selected independent variables. At the bivariate level, cross-tabulation was used to test the relationship between background characteristics and child survival status while chi-square test was applied to show the strength of this relationship**.** The

results obtained showed that mother's age, birth order, preceding birth interval, birth size, ANC visits and place of delivery were significantly associated with NM.

Multivariate analysis was applied using binary logistic regression to assess the simultaneous effects of demographic, healthcare and socioeconomic variables on neonatal mortality. The results obtained show that the mother's education, sex of child, birth order, preceding birth interval, birth size, ANC visits and place of delivery, were significantly associated with neonatal mortality, while mother's age, place of residence, household wealth and region of residence were not significantly associated with NM.

5.3 Conclusion

This study examined demographic, healthcare and socioeconomic determinants influencing NM in Kenya. The results obtained have shown that demographic factors were the key predictors of NM. All the demographic factors of child bearing age, birth order, preceding birth interval, and size of neonate at birth significantly determined the risk of neonatal death. The number of ANC visits as a healthcare factor was also significantly associated with higher risks of neonatal mortality.

5.4 Recommendations

5.4.1 Recommendations for policy

Implementation of consistent intervention programs focusing on the risk factors identified in this study will enhance reduction of neonatal mortality in Kenya.

More emphasis should be made on the importance of adhering to the WHO recommended four or more ANC visits. Reproductive health programs should be

enhanced to encourage mothers to make at least four antenatal care visits to a health facility during their pregnancy.

5.4.2 Recommendations for Further Research

Conduct enhanced data collection in future health related surveys to facilitate capture of critical neonatal proximate determinant variables especially for births whose survival status at the time of survey date were reported as dead. This will guide the country achieve the SDG goal 3.2 of 12 or lower neonatal deaths by 2030. A comprehensive study is required to help understand why there is no significance difference between home and health facility deliveries.

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