DETERMINANTS OF NEONATAL MORTALITY AMONG A NATIONALLY REPRESENTATIVE SAMPLE OF MOTHERS IN NIGERIA

BY

QUADRI GBENGA IBRAHIM

MATRIC NO: 173402

B.Sc MICROBIOLOGY

A PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF DEGREE OF MASTER OF SCIENCE IN EPIDEMIOLOGY

UNIVERSITY OF IBADAN

DEPARTMENT OF EPIDEMIOLOGY AND MEDICAL STATISTICS,

FACULTY OF PUBLIC HEALTH

COLLEGE OF MEDICINE

UNIVERSITY OF IBADAN

JANUARY, 2015

CERTIFICATION

We certify that this research ' **Determinants of neonatal mortality among a Nationally Representative Sample of mothers in Nigeria'** was carried out by Quadri Gbenga Ibrahim, of the Department of Epidemiology and Medical Statistics, Faculty of Public Health, University of Ibadan.

.....

Dr. ADEOYE I.A

(Supervisor)

30/4/2015

.....

Dr. FAGBAMIGBE

(Co-supervisor)

Department of Epidemiology and Medical Statistics,

Faculty of Public Health

College of Medicine

University of Ibadan

DEDICATION

This work is dedicated to Almighty God and to my loving mother Oluwakemi Musilimatu Quadri (1964-2014)

ACKNOWLEDGEMENT

I give all glory and honor to the Almighty God for His unfailing provision and for being my source of strength and inspirations. Also, I sincerely acknowledge my supervisors, firstly, Dr Ike Adeoye., for the superb and unequalled supervision during the course of this research work. Sir, you moved from being a teacher, a supervisor to a sister and mother for painstakingly reading through the research work and making the necessary correction(s). It is a rare privilege to be under your supervision ma. Also, unequalled thanks go to my co-supervisor Dr Fagbamigbe, for his immense contributions to this research work. God bless you sir.

I specially appreciate all my lecturers in the Department of Epidemiology and Medical Statistics for their encouragement and support throughout this Masters. Equally, I appreciate the Head of Department, Dr I.O Fawole. May God bless you all. I cannot forget Dr Akinyemi for his goodwill. Sir you are more than just my lecturer, you are a father and a great mentor. Thank you so much sir

Special thanks to my parents, Mr. Quadri olalekan and Mrs. Quadri Adekemi (of blessed memory) for their immense care and support morally, spiritually and financially since birth to present whose desire for a better living helped me to realize my dreams to this moment. Sir and ma, I am highly indebted to you and it's my prayer that you will reap the fruit of your labour in good health. To my brothers and sister, Mariam Quadri, Gbeminiyi Quadri, Gbemisayo Quadri,and Gbemisola I really appreciate you all for your support at all times.

Lastly, I appreciate all my course mates in the Department of Epidemiology and Medical Statistics, especially, Orobosa Kennedy, Ojo keji, Raimi Olatunde Enadegeh, Aminu Oladimeji, Gbolade Ogunsanya, Fadumila Johnson, Omosefe, Dolapo and Daniel Afolayan for their contribution and support. I appreciate you all and God bless you all and that special someone that continues to encourage me, Taiwo Oladele i say a very big thank you to you.

ABSTRACT

Neonatal mortality is a global challenge and Nigeria continues to bear the greatest burden in Africa. Therefore identification of individual and community determinants associated with neonatal mortality are important for targeted interventions. However in most developing countries, including Nigeria this problem has not been adequately investigated particularly the effect of proximate and community factors. Therefore this study seeks to investigate the effects of proximate and community level factors on neonatal mortality.

This is a secondary data analysis of 31428 women of reproductive age(15-49yrs) who had child birth 5years prior to the Nigeria Demographic and Health Survey (2008-2013) The 2013 NDHS was a three-stage cluster sample survey of 40,680 households from 36 states of the federation and the federal capital. The outcome variable was neonatal mortality as reported by their mothers, frequency tables were generated to summarize variables of interest and neonatal mortality rates by individual and community level factors were determined. A Kaplan- meier curve was used to describe the probability of neonatal survival and death. Sampling weights were applied to correct for sampling variability during the study design using *STATA 12 svy* command. Chi-square test was used to determine the association of social, economic and demographic characteristics of mothers and neonatal death. Logistic regression was used to estimate the independent effect of factors on neonatal mortality. Level of significance was at 5%

The mean age of the mothers was 29±7years, 56.1% were educated, 95.3% married while 70.6% were unemployed. Neonatal mortality was 37/1000 live births, across geopolitical zone the North West had highest NMR(45.5) while South South had the lowest NMR(30.5) Residing in a rural areas(OR=1.29, CI=1.10-1.52), Neonates delivered through cesarean section(OR=1.81 CI=1.13-2.74) and delivered by unskilled birth attendants were significantly associated with neonatal death. However, breastfed babies(OR=0.39,CI 0.33-045),adequately spaced infants(OR=0.56, CI 0.33-045) of a higher birth order(OR=0.61 CI=0.46-0.82) had a higher odds of survival compared to male neonates not breastfed

Both individual and community characteristics showed a significant effect on neonatal survival. Implementation of community-based interventions targeting basic education, poverty

alleviation, women empowerment and an increased focus on the continuum-of-care approach in health care service will improve neonatal survival.

Keywords: Neonatal mortality, Individual factors, Community factors, Multivariate analysis, Nigeria.

Word count:342

TABLE OF CONTENTS

CHAPTER THREE: METHODOLOGY

CHAPTER FOUR: RESULT

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

HF	Health facility
NMR	Neonatal mortality rates
NDHS	Nigeria demographic and health survey

CHAPTER ONE

INTRODUCTION

1.0 BACKGROUND

Neonatal mortality has emerged as an important global public health problem, with an estimated 4million deaths occurring in the first 4weeks of life out of the 130million babies born yearly. (WHO,2006). Neonatal mortality can be defined as the death of a newborn within the first 28days after birth

More than one-third of the neonatal deaths in the world occur in South Asian countries and among all these countries, India has the largest number of neonatal deaths consequence of large number of births (Lawn et al., 2005, UNICEF,2004). Worldwide Nigeria is second to India with the highest number of neonatal deaths, and the highest reported figure in Africa (Akinyemi J.O 2011; Osita k, 2014). Every year in Nigeria, more than 250,000 neonates die, which translates to approximately 700 neonates every day. Consequently neonatal mortality remains alarmingly high in Nigeria, despite the significant decline in most parts of the developing world, including some sub-Sahara African countries, such as Ghana and Uganda. A recent United Nations (UN)report on childhood mortality reported that over the last 2 decades, the Nigerian neonatal mortality rate (NMR) dropped by only 20.4%, from 49 deaths per1000live births in 1990 to 39 deaths per 1000 live births in 2011. This is in tandem with the NDHS report of a 20% reduction of neonatal death form 1999-2013(NDHS 2013). It can be interpreted as approximately one in every 25neonates born in Nigeria died in the first month of life (NDHS 2013;Osita KE.,2014). Mortality rates were higher among males neonates than female neonates as it had always been in previous NDHS survey

The high rate of the neonatal death is one of the reasons why the Millennium Development Goal (MDG-4) which aims at reducing under-five mortality by two thirds by the year 2015 may not be achieved. Unfortunately, most of the data and interventions to achieve MDG-4 are derived from the developed countries where the incidence of under-five mortality is low. Data on the epidemiology of neonatal mortality were scarce in societies with higher neonatal mortalities and there is inadequate access to cost-effective interventions to prevent them (Gbenga AK., et al 2014). Despite the fact that neonatal mortality is responsible for 40% of all under-five mortality and more than half of total infant mortality, it is not directly targeted by

MDGs (child health special report, 1999) Tackling neonatal mortality is of utmost priority in order to reduce child mortality and achieve the MDG-4 target.

Neonatal mortality contributes 40% to the overall under-five mortality and approximately 50% of infant mortality in Nigeria(WHO, 2009). Neonatal mortality is indirectly caused by maternal factors, health-system factors and delivery factors. This is because the health of the mother and the newborn are intricately linked (Babalola and Fatusi 2011, Adeoye *et.al* 2013,UNICEF). The main direct causes of neonatal deaths are preterm birth (28%), severe infections (26%), asphyxia (23%) and neonatal tetanus (7%) (Lawn et al., 2005, UNICEF,2004) Among the four million neo-natal deaths across the world; 3 million of these deaths occur in the early neonatal period i.e., in the first week of life. One in three of these neonatal death occurs during delivery and could largely be prevented (WHO, 2006). They also occur mostly in places of residence of these mothers i.e. home delivery, where there is usually absence of skilled birth attendant (Ayede A.I 2012;Ostia k., etal 2010).

Although under-5 mortality might be declining at the rate of 2.9% per year,(Child Health Research Project, 1999) it is alarming that the reduction rate of neonatal mortality is 2.1% per year, lagging behind the rate of reduction among older aged children. A major barrier to intervention is the perceived complexity of reducing neonatal deaths which is not necessarily so, action to reduce neonatal deaths belong in two health-system programmes, maternal-health programmes covering pregnancy, childbirth, and early neonatal care and child-health programmes, which move on through infancy into childhood. Addressing neonatal mortality requires a continuity between these elements of care, which is lacking in many settings with care for the neonate often receiving little attention in either maternal or child-health programmes. The greatest gap in care often occurs during the critical first week of life when most neonatal and maternal deaths occur, often at home and with no contact with the formal health-care system. In addition, behaviors such as breastfeeding, which influence survival after the neonatal period, are started in the first days of life, yet most women fail to utilize post-natal care services during this period.(Joy E,2004)

There are various reasons why the health of the newborn has been neglected in sub-Saharan Africa despite the huge number of deaths. Most neonatal deaths are unnoticed and undocumented. In developed countries childbirth is accompanied by a fanfare, but in many

poorer countries childbirth is accompanied by uneasiness for the mother and baby who may remain hidden at home with limited access to care. Often times the baby is unnamed until 1 or even 6 weeks has passed, reflecting apprehension and cultural acceptance of high mortality in Africa. Unfortunately, neonatal deaths also have low visibility on the global agenda, many global agencies do not mention any cause of neonatal death on their lists of major risk factor of child death. Understanding the factors associated with neonatal mortality is important for the effective focus of public health efforts on the prevention of neonatal mortality. In addition, the availability of substantial epidemiological information at the country level will be an important determinant of success in meeting and in measuring progress toward the MDGs for child survival. The causes of neonatal mortality vary between and within countries. There is a scarcity of information about the direct causes of neonatal deaths in low-income communities, population-based information in these settings is largely dependent on verbal reports of autopsies of variable quality(world bank survey 2001). Therefore these study aims to explore the individual and community level factors affecting neonatal mortality using a nationally representative data.

1.1 STATEMENT OF PROBLEM

Under-five mortality is a useful index for evaluation of the quality of health care available in a community (Park k, 2002). Childhood deaths have been reported to be concentrated in poor resource settings such as Africa and Asia, where poverty, ignorance and social instability have provided a platform on which malnutrition and infection-related diseases have resulted in childhood deaths. (WHO, 2012; Enviromental and child health survival 2011) Statistics has shown that rates still remain unacceptably high in sub-Saharan African countries as approximately half of childhood deaths take place in sub-Saharan Africa despite the region having only one fifth of the world's children population (Smith, 2010).

For instance, in sub-Saharan Africa, 1 child in 8 dies before age five- nearly 20 times the average of 1 in 167 in developed parts of the world (Ojikutu, 2008). Similarly, UNICEF (2010) in the State of the World's children Report noted that 8.1 million children across the world who died in 2009 before their fifth birthday lived in developing countries and died from a disease or a combination of diseases that could easily have been prevented or treated. It also noted that, half of these deaths occurred in just five countries namely, India, Nigeria, the Democratic Republic of

Congo, Pakistan and China with India and Nigeria both contributing to one third of the total number of under five deaths worldwide. The report describes the declining rate as disturbing and grossly insufficient to achieve the MDG goal by 2015 as only 9 out of the 64 countries with high child mortality rate areon track to meet the MDG goal.

Researchers have noted that "as the 2015 deadline for achieving the Millennium Development Goals (MDGs) approaches, there is a growing sense of urgency to accelerate progress, especially for reducing child and maternal deaths" efforts at attaining the MDG4 has only succeeded in reducing under5 mortality but neonatal mortality remains relatively stagnant (Joy E *et,al* 2012). The most recent Countdown Report by UNICEF suggests that, at the present rate of progress, 23 (31%) of 75 countries are on track to achieve the MDG 4 target for child survival, whereas only nine (12%) are projected to reach the MDG 5 target for maternal mortality. Other estimates from the Institute of Health Metrics and Evaluation (Lozano R *et al* ,2011) suggest that only nine and four of the 75 countries are expected to reach the MDG 4 and MDG 5 targets, respectively by 2015.

In Nigeria, neonatal mortality is of public health importance; 37 per 1000live births are dying within the first 28 days of life (NDHS 2013). There is a problem of diverse and insufficient knowledge of neonatal mortality in developing countries, In order to measure up with the MDG 4 Which plans to reduce child mortality by 2/3 in 2015, neonatal mortality which accounts for more than 50% of infant and under 5 mortality has to be reduced drastically. Till date most studies mainly examined factors influencing under 5 and infant mortality only few studies have specifically identified determinants associated with neonatal mortality in Nigeria (Edmond KM, et al 2008).Recent studies on neonatal deaths have majorly been hospital and community based studies(Anthony O A *et,al* 2012;Gary L D2008.)

Furthermore, in most developing countries such as; Cote' d voir, Ghana, Senegal and Nigeria. Neonatal, maternal and health service factors were reported to have independent association with neonatal mortality (Titaley CR et al, 2008; Engmann C et al, 2009) also neonatal mortality have been frequently associated with severe infections(including sepsis/pneumonia, tetanus and diarrhea), preterm birth and complications of asphyxia (Lawn, cousens and zupan 2005) which all consequently lead to death of the neonate. But most of these studies were hospital based case control and experimental studies (Adetola AO., et al

2011;Onayade AA., et al 2006; Fawole AO., et al 2011) which are subjected to various limitations some of which are; neonates delivered at home were not taken into consideration, control groups were not population based and these studies may not be generalizable to the wider Nigerian populace.

Association between individual level factors were the focus of previous studies gave little attention to the influence of proximate and community level determinants on neonatal mortality and inherent differences even when they analyzed population based data with stratified nature, thereby not taking into cognizance the importance of socioeconomic and proximate determinants which is a core aspect of social epidemiology, which consolidates its observation on the fact that people residing in the same environment tend to have the same health outcomes than those living in different areas(Gbenga, 2013). Therefore community factors were not taken into account either at the design or analytical stage which is essential in understanding the wellbeing of an individual in a population.

1.2 JUSTIFICATION

Neonatal mortality has not been giving enough attention around the world resulting in insignificant development over the past decades. Earlier studies have also verified this limited development despite major improvements in overall under-five survival, neonatal mortality still persists(Osita et, al 2007, Gbenga A.K 2014). It is estimated that 34 out of every 1000 babies born in developing countries die before they reach one month of age. Of the 130million babies born every year, about four million die in the first four weeks of life (WHO 2006). 75% of neonatal death occur in the first week of life (WHO 2006). It is reported that every hour 450 newborns die (Lawn, Cousens and Zupan 2005). Most of these deaths occur in low and middle income countries such as Nigeria.

In light of the above this study presents population-based data on risk factors associated with neonatal mortality in Nigeria. Hence, This study is offering a model for the investigation of factors for improved neonatal survival. Such factors can be found in communities as well as in patterns of behavior at an individual level. Stimulating development requires the acquisition of reliable data as well as a proper understanding of socio-economic and proximate determinants of

neonatal death in Nigeria. Therefore study being nationally representative will add value to the field of epidemiology on child mortality in general and neonate death in particular. It will also serve as a point of reference for future researchers who wish to conduct further research work in this area of research. it will also explore the various ways individual factors interact in order to bring to the fore, the various reasons of neonatal mortality in Nigeria.

The wide dearth of knowledge as a result of little work done on this phenomenon will be bridged and members of the public and health professionals will be informed on the dangers that are inherent in neglecting neonatal care. And the findings will aid national and international policy makers to better understand the phenomenon and undertake a policy reform supportive of maternal and neonatal care.

The challenges frequently identified in policy analysis is the slow progress in reducing global neonatal mortality. Child survival programmes in the Nigeria have tended to focus on pneumonia, diarrhea, malaria, and vaccine-preventable conditions, which are important causes of death after the first month of life. Therefore to meet MDG-4, a substantial reduction in NMRs in high-mortality countries such as Nigeria is needed, and reducing deaths in the first week of life will be essential to facilitate the progress. Findings from this study would be useful to public health researchers and policymakers in reviewing and designing new community based intervention strategies aimed at reducing neonatal mortality in Nigeria.

1.3 OBJECTIVES

1.3.1 BROAD OBJECTIVES

The objectives of this study is to determine factors associated with neonatal mortality in Nigeria using the 2013 NDHS.

1.3.2 SPECIFIC OBJECTIVES

1. To estimate the neonatal mortality rate for Nigeria using NDHS 2013 data

2. To determine neonatal mortality rates disaggregated by proximate and community factors

3. To describe the survival function of neonates in the first 28 days.

4. To investigate the association between neonatal mortality, proximate and community factors

5. To determine the independent effects of proximate and community factors on neonatal Mortality.

1.4 HYPOTHESIS

NULL-HYPOTHESIS: There is no association between Socio-economic determinants of mothers and the survival of the neonates.

ALTERNATIVE HYPOTHESIS: Thereis an association between socioeconomic determinants of mothers and survival of the neonates.

CHAPTER TWO

LITERATURE REVIEW

Neonate originated from the Latin word neonatus and it refers to an infant in the first 28days after birth the term encompasses premature infants, post-mature infants and full term infants.(merriam webster, 2007.) Neonatal mortality is therefore the death of a newborn within the first 28days of life, death of the baby after breathing within these 28days is regarded as neonatal death and these first 28 days are the most critical period for an infant to survive . There are two stages which are: Very early neonatal mortality rate which is the number of deaths during the first 24 hours of life per 1000 live births in a given year. and Early neonatal mortality rate which is the number of deaths during the first 7 days of life per 1000 live births in a given year .

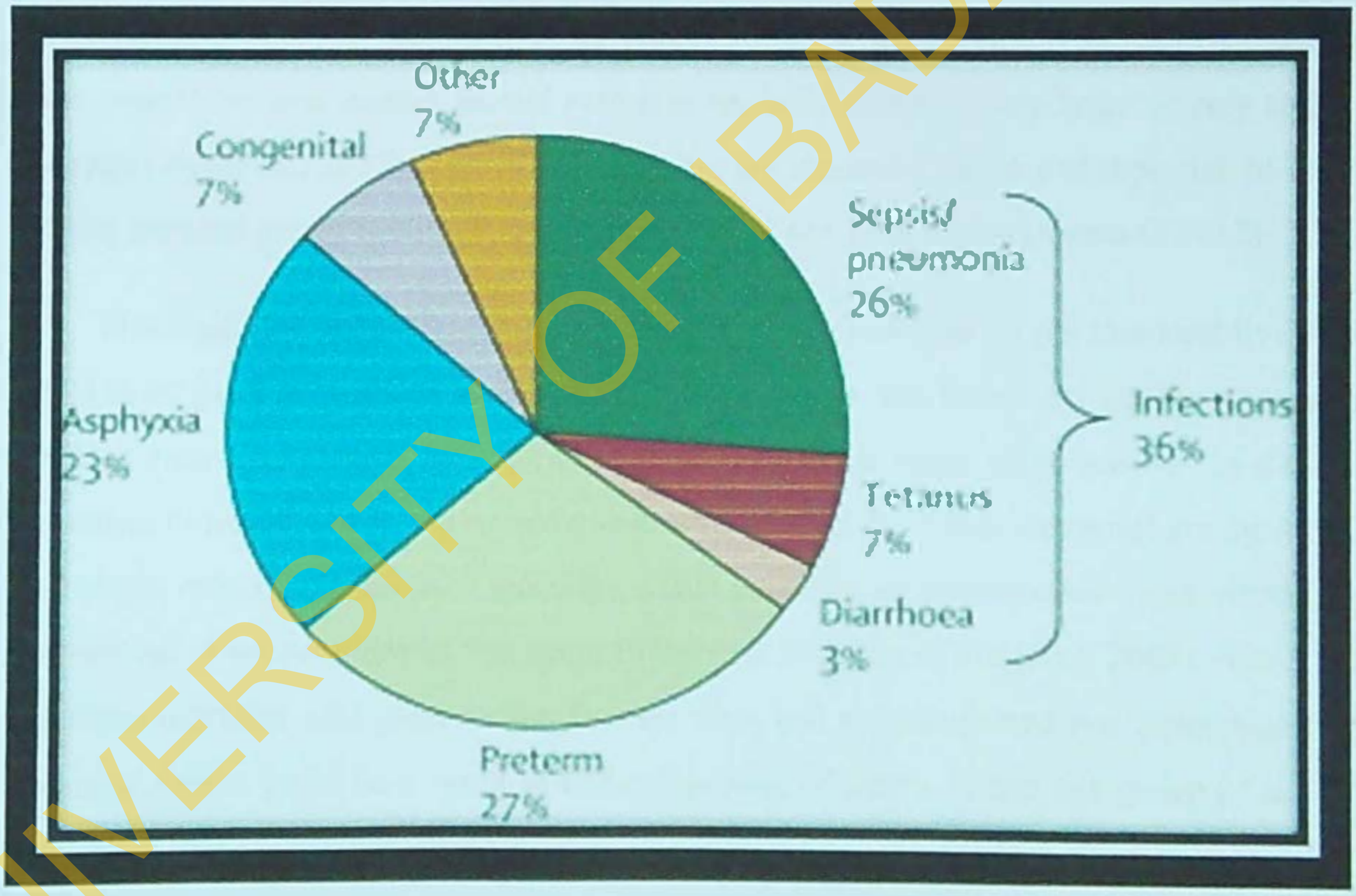


FIGURE1: Estimated distribution of direct causes of neonatal mortality based on vital registration data for 45 countries and modeled estimates for 147 countries(Lawn, Cousens, Wilczynska and the CHERG neonatal group, 2007).

In sub-Saharan Africa only 68% of women received any antenatal care (WHO/UNICEF, 2004), and only 53% have their babies delivered by a skilled attendant (UNICEF, 2001) In Africa most of the progress in reducing child mortality has been the result of global initiatives and vertical programmes, which fail to meet the needs of infants in the first month of life (Bhutta, 2000). Worldwide male mortality has generally been higher than female because in the very first month after birth, males are biologically weaker than females female mortality is 14% lower than their male counter parts during this period (Pandey et al 1998) Another possible reason for the low rate of neonatal deaths among girls may be because of the development of early fetal lung maturity in the first week of life (Joy E.L 2009,Rajora p 2013),resulting in a lower incidence of respiratory diseases in female neonates compared with male neonates.

A large proportion of births in Africa occur at home and it is usually difficult to obtain the exact birth weights of these babies. Questions used in NDHS were, was the baby very large, large, medium, small or very small at the time of the birth. This is clearly far from the concept of birth weight because mother herself evaluates her baby as being very large or very small than average (Ayede A.I 2012). Babies born very big are abnormal babies and their risk of mortality during neonatal period is also higher than the normal size born babies (meena G 2012).

Worldwide, on an average infant mortality rate dropped from 95 per thousand live births in 1993 to 60 per thousand live births in 1995 (WHO 2006). The father and mother's education as well as their work status each have independent effects upon child survival in developing countries (Amtzen 2000). As neonatal deaths in the first day (early-neonatal) are most difficult to reduce, reduction in neonatal mortality would normally be accompanied by an increase in the percentage of neonatal deaths that occur in the first 24 hours of life (Hall, 2005). About 70% of neonatal mortality take place in the first six days and an unexpected low proportion of early neonatal deaths could be a result of under-reporting of deaths in this age group (Curtis, 1995 Saojeet A 2012).

Low birth weight (LBW) is an important pointer of reproductive health and general health status of population. WHO estimated that about 25 million low birth weight babies are born each year, nearly 95% of them in developing countries? globally, neonatal mortality is 20

times more likely for LBW babies compared to heavier babies (≤ 2.5 kg) Low birth weight has been shown to be a result of preterm birth, intrauterine growth restriction, or a combination of both conditions. There are numerous factors contributing to LBW both maternal and fetal. Weight at birth is directly influenced by general level of health status of the mother Maternal environment is the most important determinant of birth weight, and factors that prevent normal circulation across the placenta cause poor nutrient and oxygen supply to the fetus, restricting growth. The maternal risk factors are biologically and socially interrelated; most are, however, modifiable. Krammer has identified 43 potential factors for low birth weight. Not that all the factors, should be present in a given area. The factors vary from one area to another, depending upon geographic, socioeconomic and cultural factors (Deshpande J et al, 2011).

The mortality of low birth weight can be reduced if the maternal risk factors are detected early and managed by obstetric care. Thus it is necessary to identify factors prevailing in a particular area responsible for low birth weight. Maternal environment is the most important determinant of birth weight and factors that prevent normal circulation across the placenta to cause poor nutrient and oxygen supply to the fetus, restricting growth.(Joseph N, 2012) The maternal risk factors are biologically and socially interrelated; most are, however, modifiable. In Madana's study of determinants of neonatal mortality in 2012 , infant mortality rate was 9% and the two leading causes of death were neonatal infections and asphyxia during childbirth (Madana z, et al 2012.) half of the causes of death in the neonatal period were due to low birth weight, prematurity, respiratory problems, hereditary abnormalities, and infections. Other important factors that raise the risk of neonatal mortality include maternal infections during pregnancy, maternal age (less than 16 and more than 35 years), maternal drug addiction, social and economic poverty, unmarried mothers, caesarean method of birth e t c. So many factors are involved in the infant mortality rate that identification of these factors can consequently be effective in reducing neonatal mortality, majority of previous studies just indicated prevalence of infant mortality rate and didn't report about cause of this death and details about its related factors

2.1 Traditional misconception and neonatal mortality

In African countries despite the fact that major childhood diseases have been identified and modern technology to combat them developed, multitudes of children in these nation continue to die in large number from the attacks of these diseases. The major reason is deeply rooted in people's beliefs and attitudes concerning childcare and behavioral practices into health strategies (Parry, 1984; Uboma Jaswa , 1988; Feyisetan, 1988; 1990, Feyisetan and Adeokun, 1989). The Nigerian Health Policy recognizes the need to reduce the current high childhood morbidity and mortality rates, but people's belief and behavioral practices have not been adequately integrated into the health intervention programmes. The non-disease specific beliefs among the Yoruba's, is the existence of "Abiku" (children from the spirit world who can die at will). The Yoruba belief that some children are from the spirit world and they will eventually return to the spirit world after a short period of time on earth unless certain rituals are performed. Abikus are described as spirit children whose mercurial treatment, even rejection, of their parents (mothers especially) leave the mothers in most pitiable state (Soyinka, 1981; Okri, 1995 and 2Ogunyemi, 1996). Abiku children inflict a lot of pain and agony on their mothers. The pain suffered by the mothers of abiku and the efforts made by abiku mothers to placate their obviously mischievous, pain-causing offspring were succinctly displayed in Soyinka's (1981), Achebe's (1986) and Okri's (1993) works. The Igbo of Southeast Nigeria call the living icon 'Ogbaje' (Achebe, 1958 and Achebe, 1986). The ogbanje child also emerges as a frequent traveler between the world of the living and the place of the friendly dead (Achebe, 1958, Quayson, 1997). The notion of abiku or ogbanje is a common phenomenon in West African countries. Recognizing the implication of this belief for child health and its survival and upon the recognition of the fact that children under-five and neonates constitute an important segment of the Nigerian population.

2.2 Birth registration and neonatal mortality.

In May this year, the World Health Assembly WHA endorsed the Every Newborn Action Plan—the first global plan to end preventable deaths in newborn babies and stillbirths Melinda Gates assured the delegates at the Assembly that the Bill & Melinda Gates Foundation is committed to the "triple investment" of preventing maternal and newborn deaths and stillbirths, These initiatives should be seen in the context of the efforts to achieve the Millennium Development Goal, during which child mortality (<5 years of age) has been halved but neonatal mortality reduced by only a third. Neonatal mortality now accounts for 2·9 million (44%) childhood deaths. Of the neonatal deaths about a third are caused by infection. Deriving the number of serious bacterial infections in infants younger than 1 month is complex. Many countries do not register all births and deaths, making it difficult to establish the denominator (live-births). Neonatal sepsis is difficult to diagnose: the signs can be subtle and non-specific, and in settings where little or no laboratory support exists and clinical care is basic, the diagnosis is especially hard (Janni k, 2005). Clinical diagnostic algorithms are biased towards sensitivity rather than specificity, because neonates can deteriorate with alarming speed (WHA 2010).

Findings from a study of neonatal care in tertiary hospitals in India showed a large discrepancy between knowledge (e.g. 78% for resuscitation) and skill (24%). Training needs to be effective, facility-based and monitored, and should have ongoing supervision. All of this takes political commitment—but, as shown in The Lancet's Every Newborn Series, only a very small proportion of donor funds is specifically for neonatal babies. Neonatal sepsis has been a major cause of neonatal mortality but there is no global estimates of the burden but the deaths which they cause. Anna Seale and colleagues present findings from a systematic review and meta-analysis to estimate the burden of bacterial infections and deaths in male and female neonates in sub-Saharan Africa, South Asia, and Latin America. The study group provided data from a further 18 secondary analyses and unpublished studies. Despite differences in study design, diagnostic criteria, and follow-up, their estimates are fairly robust. They concluded that in 2012, there were 6·9 million cases (uncertainty range 5·5 million–8·3 million) of possible severe bacterial infection in neonates of 32 weeks of gestation or more or weighing 1500 g or more at birth, of whom 680 000 died (0·46 million–0·92 million). The overall incidence was 7·6% (95% CI 6·1–9·2) and case-fatality was 9·8% (7·4–12·2). Latin America had the highest incidence

(9·2%) but lowest death rate (7·4%), and sub-Saharan Africa had the lowest incidence (6·2%) and highest case-fatality rate (12·2%). To reduce this burden in Africa several interventions were proposed such as; maternal immunization against tetanus, group B streptococcus prophylaxis, prevention of prematurity, subsequent increased risk of late neonatal sepsis, and prevention of HIV transmission. furthermore, deliveries should be clean, safe, and attended by a skilled assistant, cord cleansing with chlorhexidine should be done (findings from a meta-analysis of three randomized community-based cluster trials done in south Asia between 2002 and 2010, including 54,624 newborn babies, showed that such care led to a 23% reduction in all-cause neonatal mortality: deaths from omphalitis fell by 56%; and frequent hand washing by all involved in assisting the delivery and handling the baby. Third, there should be early and exclusive breastfeeding, babies should be kept warm, and danger signs (e.g, abnormal temperature, poor feeding, difficulty breathing, little spontaneous movement, and convulsions) should be identified early, with rapid access to appropriate treatment. None of these interventions are new or costly. Hence it will be economically laudable for health institutions involved in maternal care to adopt these practices despite dwindling allocations from government.

2.3 Neonatal mortality and social inequalities.

A study in the U.K by (Sarah, 2008). presented data on maternal and perinatal mortality and social inequalities to explore the extent to which women of certain social groups or circumstances are at greater risk of maternal and perinatal death .Maternal mortality data were provided by the CEMACH Saving Mothers' Lives enquiry into maternal deaths in the UK in 2003-05. For perinatal mortality, ONS data for England and Wales were supplemented by CEMACH perinatal mortality data to provide further analysis by social-factors. Social factors were examined for correlations with maternal and perinatal deaths, these included marital and birth registration status, social-class, deprivation, ethnicity, residency status, language, maternal age, smoking, maternal-obesity, psychiatric problems(including substance abuse), and domestic abuse. Additionally, aspects of the maternity services which may have affected disadvantage vulnerable groups were discussed, these included poor access to care and substandard clinical care (Sarka, *et al* 2010). Though this study failed to determine systematically how many of the social factors associated with higher mortality rates were confounders or the extent to which

these factors have a cumulative effect upon health-out comes. However, known exposure to multiple social risk factors were explored to illustrate how some women are highly disadvantaged in terms of maternal and perinatal mortality.

Sarah Fisher found in this study that, women with a partner who was unemployed or in an unclassified occupation had the highest maternal mortality rate and were over seven times more likely to die than women with partners in employment. Perinatal mortality was considerably higher for babies with fathers in 'routine' occupations than for babies with fathers working for 'large employers and in higher managerial occupations. Perinatal mortality was highest for solely registered births, followed by births registered jointly by unmarried parents and lowest for births registered by married parents. For births registered jointly by unmarried parents perinatal mortality was lower when parents lived at the same address. Black African women had the highest maternal mortality rate of all ethnic groups. The high proportion of refugees and asylum seekers in this group contributed to this. Women born in the West African country group had the highest perinatal mortality rate; over twice the rate for UK-born women.

The incidence of preterm birth and very low birth weight is high amongst babies of African ethnicity. Mothers living in the most deprived area quintile were about five times more likely to die than those in the least deprived quintile. Babies born to mothers living in the most deprived areas quintile were 1.8 times more likely to die still born or in the first week of life than those in the least deprived quintile. Perinatal mortality was higher for babies of teenage mothers and for those born to women aged 40 and over. Women from socially disadvantaged groups were more likely to have complex needs yet were less likely to access and receive the care they required. 17% of all direct or indirect deaths were of women who booked late, were irregular attendees for care, or did not seek care at all.

2.4 Child spacing and other determinants of neonatal mortality.

Shea Rutstein, in analysis of the Demographic Health Surveys from 18 countries, reported that the risk of neonatal mortality was highest in women with very short and very long intervals between pregnancies. Women with less than 15 months between pregnancies or more than 39 months, had a 43% greater chance of experiencing a neonatal death than women who

spaced their pregnancies between 16 and 38 months. Women who waited 15–26 months between pregnancies had only an 11% risk of losing their child. Further, the risk of a neonatal death was highest in women with no previous children, and in women in the extremes of their reproductive years (<18 and >35–years of age) (Shea R, 2010).

Education also affected neonatal mortality rates—women with secondary and above education had fewer fetal deaths than women with no formal education or one limited only to primary school. The risk of neonatal mortality was significantly higher in women with less than a 24 month birth interval, and women with no previous children. Again, the risk of neonatal mortality was highest in women at the extremes of their reproductive years. Boys had a 26% higher risk of dying than girls, and either sex of child was 22% more likely to die in the first month of life if his or her mother received no prenatal care. Importantly, antenatal tetanus vaccinations reduced the chance of neonatal death by almost 50%.

(Rajora p, et al 2013) also carried out a record based retrospective study to determine the association between gender and susceptibility towards perinatal deaths in the obstetric and gynecological unit of Gobind sing medical college. Where a standardized case definition was developed and the male and female births were compared for socio-demographic, maternal, fetal and early neonatal risk factor. For perinatal mortality, deliveries with gestational age less than 28 weeks and weight less than 500gm were excluded. A total of 151 perinatal deaths and 52 early neonatal deaths analyzed, perinatal mortality contributed 76.16% and early neonatal death of 23.84% with the males taking 58.28% of the burden and 41.72% for females. Male gender loss was at 60% as compared to 40% in females and it was more in the mothers of age group 25-29yrs. socioeconomic status illiteracy, inadequate antenatal care and susceptibility of male to preterm delivery were factors responsible according to the study also male overweight, diabetics and hypertension during pregnancy were found to have a high correlation with male child mortality as cord accidents were also more in males than females.

Rajora therefore concluded that the male gender is at higher risk than the female gender and in the future male chromosome might be non-existent. Though not in agreement with a study done by (Mandana zafari et al,2012) which was a hospital based study employing cross-sectional descriptive, analytical and retrospective method, that included all infants hospitalized in Neonatal unit of Sari bu Ali Hospital, India. Of the 1302 infants studied 60 died in the hospital

(40% male and 60% female) as opposed to numerous studies, there was a correlation between gestational age, cause of death, maternal age with infant mortality but no significant association was established between type of delivery, gender, birth-weight and infant death. From studies of similar design done in Nigeria, Saudi Arabia, India (Adeyokunnu, 1980, SAJCH, 2007, Saoji A, et al 2011, Amosun A.M 2014) slight differences were noticed in the mortality rates which causes were invariably attributed to cardiac arrest and hyaline membrane diseases.

2.5 Maternal age and parity

A study by Michael Koenig in Bangladesh presented an analysis of all live births from 1974 to 1990 in both the health intervention and comparison areas, in which there were 57,435 births in 24,032 sibling associations ; parity (number of children born) ranged from 1 to 11 children. The relationship between high parity and infant mortality is one of the most enduring relationships that have been studied. Yet to begin his presentation, Dr. Koenig suggested that the relationship is not causal, as had long been assumed, but rather that women who experienced high levels of infant death subjected themselves to higher parities. the death of one infant was experienced by only 12.5% of mothers with two births, and no mothers in that birthing category experienced the death of both of their children. By comparison, almost half of women with seven or more births had experienced the death of an infant, and 34% of them had two or more infant deaths examining interrelationship between siblings, he found that the risk of neonatal mortality actually decreases with the increasing number of sibling relationships within a single family His analysis also established that a higher risk for neonatal mortality is related with prior child loss

Maternal age and neonatal mortality are interrelated with young women having a higher risk of infant mortality. Worldwide, approximately 14million adolescents aged 15–19 years give birth annually. 16% of young adults reside in sub-Saharan Africa with a fertility rate of 112.84/1000 in comparison to 40.50/1000 in older women (Fatusi A *et.al* 2009; Gant L *et.al*., 2009) Fifty percent of births in sub-Saharan Africa are to mothers <20years of age . Mothers <15 16_17 years and18_19years have a 55%, 19% and 6% higher risk of neonatal mortality respectively in comparison to mothers ≥20years (MangiaterraV, 2008) A systematic review conducted by Astha Ramaiya and her colleagues to determine the relationship between neonatal mortality and maternal age in sub-Saharan Africa focusing on indicators of socio-economic

deprivation and lack of access to obstetric care shows that younger mothers in Africa have increased social and biological risk factors associated with neonatal mortality. Although, this analyses was limited by the heterogeneity of the study contexts, and some quality issues, this was the first analysis to pool studies and consider risk by maternal age. Moreover, given the diversity of included studies, it has found a remarkable consistency in data highlighting significant vulnerabilities of adolescent mothers.

2.6 Prematurity and intrauterine growth retardation

Almost 16% of all developing world children are born with low birth weight (LBW), or weighing less than 2,500 grams, with the highest regional rates found in Africa. Two-thirds of all low birth weight is due to intrauterine growth retardation (IUGR), and the remaining 33% is due to preterm birth—some of whom also have IUGR.(Arifeen,2005.) The term "small for gestational age" (SGA) is generally used as a measure for IUGR, and is defined as birth weight under the 10th percentile for that gestational age and gender. Shams El Arifeen explained the relationship of birth weight to the relative risk for mortality in selected developing countries. Remarkable consistency of birth-weight specific relative risks have been reported across populations and a large range of years.

One of the biggest single cause of child mortality is preterm birth, and illness during pregnancy has been found to be an imperative risk factor for it(Bolanle, F 2012). Patrick Walker and colleagues used mathematical modeling to estimate the burden of low birth-weight (due to either preterm birth or intrauterine growth restriction) caused by malaria in Africa. They calculated that, without adequate protection during pregnancy, a woman in Africa has a roughly 50-50 chance of being exposed to malaria infection during pregnancy, and a one in five chance of developing placental infection. This figure relates to 900,000 entirely preventable low birth-weight deliveries per year. Since most transmission occurs before or early in pregnancy, Walker and colleagues recommend synergy between malaria prevention programmes and antenatal and family planning programmes and rightly call for protection of pregnant women from malaria to be made a public-health priority.

2.7 Multi-country Study of infections in early infancy

Pneumonia, sepsis, and meningitis are estimated to cause over 1 million infant deaths per year, and yet, very little data exist on the relative importance of the organisms that cause these diseases. Kim Mulholland reported on the results of a WHO-supported multicenter study designed to identify the bacterial and viral agents responsible for serious infections in infants under 90 days of age in developing countries, and to identify the simple clinical signs that best predict serious infection in infants under 90 days of age.

Over 4,500 sick infants under 90 days of age were studied in Papua New Guinea, The Gambia, Philippines, and Ethiopia. Ten percent of the 4,500 neonates died, and death was associated with a blood or cerebrospinal fluid culture that tested positive for one of several bacterial agents. The most common gram-positive organisms noted in the sick neonates were Streptococcus pneumoniae (33 cases), Staphylococcus aureus (34 cases), and group-A streptococcus (29 cases). E. coli and Salmonella spp were the most common gram-negative organisms causing illness. The most common viruses noted were respiratory syncytial virus (RSV), influenza A, para-influenza, and influenza B.

Dr. Mulholland concluded by noting that efforts to improve early infant mortality should focus on preventing bacterial infections, as well as on early detection and prompt referral of suspected cases. Further, this study has shown that clinical signs can reliably identify those neonates who are most ill. Shannon. D who has understudied the streptococcus as a causative organism of meningitis has emphasized on the numerous prophylactic practices that have been adopted to decrease the morbidity and mortality associated with infections in newborn babies caused by group B streptococcus, regardless of continual efforts, the bacterium remains a leading cause of bloodstream infections and meningitis worldwide. Group B streptococcus typically affects babies younger than 7 days (early-onset) or infants up to 3 months of age (late-onset).

The primary prevention strategy used is prophylactic antibiotic treatment of women during childbirth. In the USA, intra-partum antibiotic prophylaxis contributed to a 65% reduction of early-onset disease, but had no effect on late-onset disease. Other studies have reported similar trends. However, a report by (Shannon D, et. al) in the Netherlands shows the opposite trend in

the past 25 years, where the incidence of both early-onset and late-onset group B streptococcus infection has significantly increased despite the adoption of intra-partum antibiotic prophylaxis. The incidence of early-onset disease has increased from 0·11 to 0·19 cases per 1000 live-births ($p<0·0001$), and the incidence of late-onset disease increased from 0·03 to 0·13 per 1000 live-births ($p=0·004$). These data therefore suggest that intra-partum antibiotic prophylaxis has not affected the disease burden in this population.

An analysis of multi-locus sequence typing data has shown that phylo-genetic lineage are associated with disease in infants. Strains belonging to clonal complex 17, are common in several countries, and might be hyper virulent. for instance Shannon recovered significantly more clonal complex 17 strains from ill babies than from asymptomatic pregnant women and identified an association between clonal complex 17 infections and meningitis. Although he reported no changes in the distribution of clonal complexes over time but Bekker noted an increase in early-onset disease caused by clonal complex 17 strains after the adoption of intra-partum antibiotic prophylaxis practices. strains of clonal complex 17 therefore might either be more resistant or more tolerant to antibiotics than strains of other genotypes. In either case, these strains would be selected for during intra-partum antibiotic prophylaxis, which would increase the likelihood of vertical transmission and risk of disease in infants. Because antibiotic use varies by location, we are not surprised to see differences between studies in the distribution of clonal complexes at a given point in time. it was shown that clonal complex 17 strains were significantly more likely to persist in women compared with other clonal complexes.

It was also noted that giving intra-partum antibiotic prophylaxis, particularly with penicillin, was a predictor of persistent maternal group B streptococcus colonization, thereby supporting findings from an early study of the failure of penicillin to eradicate group B streptococcus during childbirth. Intra-partum antibiotic prophylaxis prevents the maternal transmission of group B streptococcus to babies; however, additional evidence was provided by Bekker for the hypothesis that intra-partum antibiotic prophylaxis variably affects group B streptococcus strains with distinct genetic backgrounds. Thus, intra-partum antibiotic prophylaxis is probably not sufficient to eradicate colonization with clonal complex 17 strains from the female genitourinary tract, a key risk factor for both early-onset and late-onset infections. The findings of Bekker confirmed that group B streptococcus disease in babies

remains a global public health concern and show the importance of continuous surveillance in different geographic locations.

Also in agreement is a study by Ane-Fiske and her colleagues observational study in Guinea-Bissau. In their Article, they described a decrease in measles vaccine coverage by 12 months of age after the introduction of pentavalent vaccine (diphtheria, tetanus, pertussis, Haemophilus- influenzae type B, and hepatitis B). What went wrong? The answer probably lies in a concurrent decision to introduce a stricter wastage policy and to focus on vaccination by 12 months of age. These policies, which were instigated in response to GAVI guidance but which were not in themselves proposed by GAVI, seem to have resulted in vaccinators not opening any ten-dose vials of measles vaccine unless at least six children were present. Some children's vaccinations thus seem to have been delayed until they passed 12 months, after which they no longer became a priority age group. which was caused by the incessant attempt by health worker to economize measles vaccine by delaying the administration of vaccines till the number of children reaches at least six influenced by GAVI guidance, a practice which eventually jeopardizes the whole vaccination process and consequently results in neonatal mortality.

2.8 Complications of Pregnancy and Delivery

Carine Ronsmans discussed the role of childbirth complications in neonatal death. Citing data from, Bangladesh, from 1987 to 1993, exploring the rates for stillbirths, and early and late neonatal deaths separately, she showed that in Mat-lab, mal-presentation caused the highest stillbirth rate (359/1,000), with prolonged labor (156/1,000), and eclampsia (128/1,000) also being important causes.

On the other hand, the early neonatal death rate was the highest for eclampsia (205/1,000), and intra-partum bleeding (28/1,000) was associated with the highest mortality in the late neonatal period. Looking at prevalence of risk factors for perinatal mortality, and attributable risks within the same population, she showed that complications during delivery accounted for the largest attributable risk. Prematurity caused a similar proportion (28%) of perinatal deaths. In conclusion, Dr. Ronsmans said that the current program emphasis of safe motherhood programs on management of conditions that arise during labor and delivery will help to further

reduce neonatal mortality. However, prematurity remains one of the single most important contributors to neonatal deaths, and understanding its causes and possible solutions remains one of the priorities in research on neonatal mortality.

2.9 Intervention against toxic exposure as a risk of neonatal death

The effects of toxic exposures (tobacco, social drugs, lead, and pesticides) on perinatal and neonatal mortality were explored by Iain Atiken. He began by stating that the issue of toxic exposures is an intricate one due to the number of substances that people are exposed to and because exposures may occur simultaneously. The main impact of tobacco smoking on pregnancy is low birth weight, usually via intrauterine growth retardation. An estimate of the relative risk for LBW is approximately 2.4 (Joseph N, 2012.) The effect of tobacco substances is usually to reduce the birth weight by about 200 grams. It is estimated that 20% of women in the industrialized world are smokers, which leads to an attributable risk of about 22% for LBW. In developing countries about 7% of women smoke, giving an attributable risk of 9%, but there is wide variation among regions.

Another issue is the effect of environmental tobacco smoke. In studies that have not done formal measurement of exposures, there is a reported relative risk for low birth-weight of about one-half of that involved in direct smoking, yielding a relative risk of passive smoking of 1.2. These studies suggest that passive smoking reduces birth weight by 100 grams. If we assume that the husband is a smoker and the wife is not, and that about 40% of husbands smoke, the attributable risk of passive smoking for low birth weight is about 7%. Studies which have investigated timing of exposure during pregnancy have made it quite clear that the main effect is during the third trimester. With social drugs, WHO estimates that worldwide about 15 million people risk their own health due to use of psychoactive substances. There is currently a rapid increase in use of opiates, cocaine and psychotropic drugs in many developing countries. There is also widespread use of marijuana, particularly among poorer groups. Marijuana is used by about 3% of pregnant women in the United States. It is suggested that its use is associated with smaller babies, but this evidence comes from studies that have not controlled for other confounders such as poor antenatal care and weight loss or failure to gain weight during

pregnancy. The most common birth defects is from alcohol, Fetal alcohol syndrome (FAS) is associated with heavy, chronic drinking, and evidence is mounting that binge drinking is also a risk factor. Incidence of FAS in the United States is estimated to be between 1/300 and 1/2000. FAS is associated with underdevelopment of the face, lower growth during pregnancy, lower growth rates after birth, and in extreme cases, a variety of CNS abnormalities. If the prevalence of this drinking pattern is 2–3 % of women, the attributable risk of alcohol-related birth defects is approximately 2%. There is also growing evidence that women who drink 2–3 drinks a day may be at risk for having an infant with low birth weight, with an odds ratio of 1.8.

2.10 Nutritional intervention against neonatal mortality.

Maternal malnutrition before or during pregnancy can lead to spontaneous abortion, stillbirth, small for gestational age babies, preterm delivery, or increased risk of perinatal and neonatal death.(Caulfield LE et al,.2006.) Also, certain forms of maternal malnutrition limit neurologic development in the fetus. Furthermore, maternal malnutrition may increase the risk of maternal infection, and impair development of the fetal immune system. An example of the effects of protein/calorie malnutrition on the fetus can be found by examining statistics from the World War II Dutch famine. (Meena G, 2012) At this time, there was a dramatic drop in energy intake from about 1700 kcal to about 700 kcal/day. When this timing of severe energy restriction occurred in the pre-conceptual period, there was reduced fertility and an increase in neural tube defects. When severe caloric restriction occurred during the first trimester, there was a twofold increase in stillbirth rate, increase in preterm delivery rates, and an increase in early neonatal death. The babies that did survive were born at an average birth weight of 3200 g. When the energy restriction occurred during the third trimester, babies were born at significantly lower weights. Also, data from Baltimore illustrated the effects of maternal body-mass index (BMI) entering pregnancy and weight gains during pregnancy on the probability of delivering a small baby or a relatively large baby. (Rashim A et al, 2012.)Very thin women (BMI <20) had an increased risk of having a small-for-gestational-age infant (when compared to normal BMI women) unless they gained a recommended amount of weight (10 kg) during pregnancy

There is evidence to suggest that we can enhance infant outcomes by increasing maternal nutritional status.(Meena G, 2012) In 1997, Prentice and colleagues supplemented Gambian women with an extra 900 calories per day, with most of the calories coming from fat in a ground nut-based biscuit. The supplement also provided calcium and iron. The researchers noted that there was an increase in birth weight of about 136 grams. Head circumference was increased by about 3 mm. LBW was reduced by 35%, and stillbirths by 55%. Overall there was a 49% reduction in perinatal deaths and 40% reduction in early neonatal deaths but no effect on post-neonatal deaths. These women also received prenatal care, including iron and folate supplements, tetanus toxoid if needed, and chloroquine in malaria season. conclusively it has been shown that although efficacy studies seem to show an improvement of neonatal and perinatal outcomes with improved maternal nutrition, there are no programs in operation to implement these results. Clearly, studies have shown that the potential is there for a mortality reduction impact for the baby and perhaps even the mother. Finally, Dr Caulfield said that the scientific community needs to stop emphasizing on women having bigger babies but rather on them having healthier babies.

2.11 Malaria prophylaxis against neonatal mortality

10 years ago, 45 million pregnant women were living in malaria endemic areas, with over 23 million in Sub-Saharan Africa alone. Although the effect of malaria on perinatal and neonatal mortality depends on the rate of transmission, malaria may cause up to 30% of the preventable low birth weight, and 3–5% of neonatal mortality in highly endemic regions. according to Dr rick steketee, Malaria is also associated with an increased risk of spontaneous abortions and stillbirths. Although WHO recommends antimalarials for prevention of malaria in pregnant women in endemic areas, many African countries lack control programs because of low effectiveness and inaccessibility of drug regimens, and competing program priorities. According to Dr Steketee, chloroquinine is safe and the drug of choice to combat *Plasmodium falciparumin* the few areas where it is still effective, while quinine may be effective for complicated malaria. Mefloquine or a combination of mefloquine and artemisinin can be used in multidrug resistant areas, although there is some evidence that it may increase the rate of stillbirths—an issue that requires further study. Pyrimethamine is a folic acid antagonist but is not associated with

congenital abnormalities in humans, even in the first trimester. Proguanil is safe, and clindamycin is also safe, but there is a possibility of build up in the fetal liver. The medications that should be most avoided when treating pregnant women are tetracyclines, which cause abnormalities in skeletal and muscular growth, tooth development, and in the lens and cornea. Primaquine can also cause haemolysis in G6PD-deficient infants. The Mangochi trial in Malawi found that two doses of Fansidar in the second and third trimesters is effective in clearing parasites and increasing birth-weight,(Steketee RW, et al.,1996.) and Malawi has since instituted a policy of monthly Fansidar to all women attending antenatal clinics; however, issues of mounting clotrimoxazole resistance with the use of Fansidar should be well thought-out.

2.12 Immunizations in pregnant women and neonates

The significance of maternal immunization to prevent tetanus, pertussis, group-B streptococcus, haemophilus, pneumococcus, meningococcus, influenza, rotavirus, and respiratory syncytial virus in neonates and infants were discussed by mark Steinhoff. With maternal immunization, maternal antibodies are transferred to the unborn infant via active transport thus preventing many of the infections that occur in very early life. Antibody levels in an infant born to an immunized mother may exceed levels in the mother, and last from three to six months in the baby (Steinhoff MC et al.,2001). Vaccination of pregnant women or women likely to become pregnant also increases breast milk antibody levels and protects the mother herself. A study in Bangladesh showed a reduction in infant mortality when pregnant women were given tetanus toxoid vaccinations. With two doses of tetanus toxoid, there was a reduction in deaths from day 4 to day 14 of life (the age at which most neonatal tetanus deaths occur) from 30/1,000 to less than 10/1,000. Also, there was a substantial reduction in deaths for the three years after vaccination. (Black RE et al, 2005.). WHO currently recommends maternal immunization for neonatal tetanus in the second and third trimesters, but estimates that only 47% of women receive it during routine antenatal care visits. Public policy in the United States recommends that pregnant women receive tetanus and diphtheria toxoid vaccine if the woman never had primary immunization, or if a booster is needed. Influenza vaccination is also recommended for pregnant women after the first trimester but is received by very few women. If maternal immunization programs are to expand, further research is needed to remove the barriers

to progress, which include concerns about safety and liability. Neonatal vaccine priorities include early delivery of rotavirus, influenza, and meningococcal, and pneumococcal, vaccines, a number of these vaccines are in development and testing.

2.13 Resuscitation of the newborn

Undersized infant, congenital malformation or prolonged labor predisposes a newborn to asphyxia and can lead to stillbirth, early neonatal death or brain damage if immediate resuscitation is not implemented after birth. In developing countries, there are approximately 4-9 million cases of birth asphyxia each year, but only 1-2 million newborns are resuscitated correctly(world health report, 2007). Almost 1 million annual neonatal deaths are due to birth asphyxia. Jelka Zupan said that the most crucial barrier to delivering proper care in developing countries is that 60% of births occur in the home and skilled attendants are not always available (WHO, 2013). Institutions in Africa also frequently lack equipment and skills for this life-saving procedure. Generally, if a baby is not breathing at birth, resuscitation should be initiated immediately.

Standard resuscitation guides recommend a range of interventions for newborn resuscitation, including ventilation by bag and mask, intubation, support of the circulation with chest compressions, drugs, and intensive care. However, a study from Sweden found that almost 80% of newborns who required resuscitation only needed the bag and mask intervention (Ugbomma A 2012). and more complex interventions such as intubation, chest compression, or drugs were rarely needed. Another recent study showed that most newborns could be successfully resuscitated with room air and that pure oxygen was unnecessary (Ayede, 2012).

Lack of neonatal revival in the developing world is largely due to shortage of resources and lack of or poor quality and maintenance of necessary equipment. Occasionally, it is also due to barriers such as absence of necessary skilled personnel during resuscitation. in some countries only a physician is allowed to deliver resuscitation techniques. Dr. Zupan concluded by calling for safe motherhood programs to increase women's access to skilled birth attendants through midwifery programs and to give midwives and others good resuscitation skills with ongoing tutoring to sustain them.

2.14 Thermal control of the newborn

Warmth and food are the two basic needs of a newborn (WHO 2010). newborn covering after delivery may seem like a regular procedure, but a study in Africa concluded that most infants were not wiped and covered adequately, even if the attendant at their birth was trained to do so. often times only the face was wiped, and this consequently leads to loss of heat through evaporation of fluids that remained on the skin (Pradhan YV 2012). partial warming can cause hypothermia in the neonate. In the same African study, 50% of the babies had hypothermia at time of discharge. These results also pointed to the growing concern of separation of newborn and mother(meena G, 2012) In a randomized trial, the differences in body temperatures were analyzed among babies kept skin to skin with their mother and those that were assigned to the nursery within minutes of delivery, and it was found that there was a significantly reduced risk of hypothermia with neonates kept with their mothers. In addition, blood glucose levels at 90 minutes were higher than in the nursery neonates. In another trial that investigated re-warming of infants, 90% of babies who were kept skin to skin with their mothers reached normal temperatures, while only 60% of the babies in incubators were able to reach the same state. Thermal protection of neonates is not only important in the period immediately after birth, but there are a small number of infants who will need it longer(Bergman et.al., 2006). For example, in desert areas, with large daily variations in temperature, it should be stressed that infants need to be protected against heat loss during the cold nights as well.

2.15 kangaroo care method for the newborn

Kangaroo method was developed in 1978 in Colombia by rey and martinez in order to cope with overcrowding, nosocomial infection and scarcity of resources. Current management of preterm babies in Nigeria is mainly incubator based. The problems with incubators are that most are imported, so they are expensive and in short supply and therefore must be shared. Sharing of incubators increases the risk of infection, The incubators are rarely cleaned, electricity supplies are sometimes sporadic, and parts are often not available for repair (Ibe OE, 2005). In the Kangaroo Care method, a preterm infant, wearing only a diaper is placed between the mother's breasts in skin-to-skin contact, instead of being placed in an incubator. This method has been shown to have many benefits. The safety, effectiveness, and improved survival of preterm babies cared for in this manner has been demonstrated in Zimbabwe by (Bergman, 1994) and (Kambarami, 1998) and also shown to have better survival rates in Mozambique. The improvement in survival has been documented between 20-60%. The bigger the baby, the better the survival. Potentially fatal apnea was also reduced. In a study examining the benefits of Kangaroo Care for very low birth weight infants (<1500 grams), Dr. Kambarami found that the infants allocated to Kangaroo Care had better health outcomes than infants placed in a standard incubator setting (kambarami, 1998). The Kangaroo Care babies grew faster. Their median weight and hospital discharge weight was higher, frequency of illness and median duration of hospital stay was less, there was a more rapid increase in weight, and survival rates were better. There was a statistically significant difference in growth rates, with the intervention group growing faster, and the frequency of illness was less but not statistically significant.

2.16 Breastfeeding and nutritional support for the newborn

The importance of the timing and type of breastfeeding on neonatal mortality, the evidence for this effect, and implications for breastfeeding promotion programs was defined by Dr Ukegbu. Late neonatal deaths (from 8 to 28 days) are more likely to be prevented by breast feeding than are earlier deaths, which are principally related to the infant's status at birth and delivery. However, there is some evidence that in the first week of life, breastfeeding can help prevent hypothermia and hypoglycemia in newborns, which are contributory causes of death (Megha S, 2012). Suckling increases body temperature, and the nearness to the mother that breastfeeding provides is beneficial in reducing hypothermia. Since fasting is associated with a fall in blood glucose, practices that restrict the early initiation of breastfeeding are likely to increase the incidence of hypoglycemia.

Breastfeeding especially protects against late neonatal deaths that are primarily due to infections such as sepsis, pneumonia, meningitis, umbilical infection (omphalitis), and diarrhea. In studies in Nigeria, there were major protective effects of breastfeeding for infants 0-1 months of age. The relative risks for mortality were much higher in infants who were not breastfed While the major difference in relative risk is due to a lack of breastfeeding, the addition of supplements to breastfeeding in the first month of life is damaging (Agho, 2011). As shown in Nigeria there were substantial benefits of exclusive breastfeeding over partial breastfeeding. The relative risk of death found to be 24.7 for infants not breastfed, and 3.1 for infants partially breastfed, compared to 1 for those exclusively breastfed

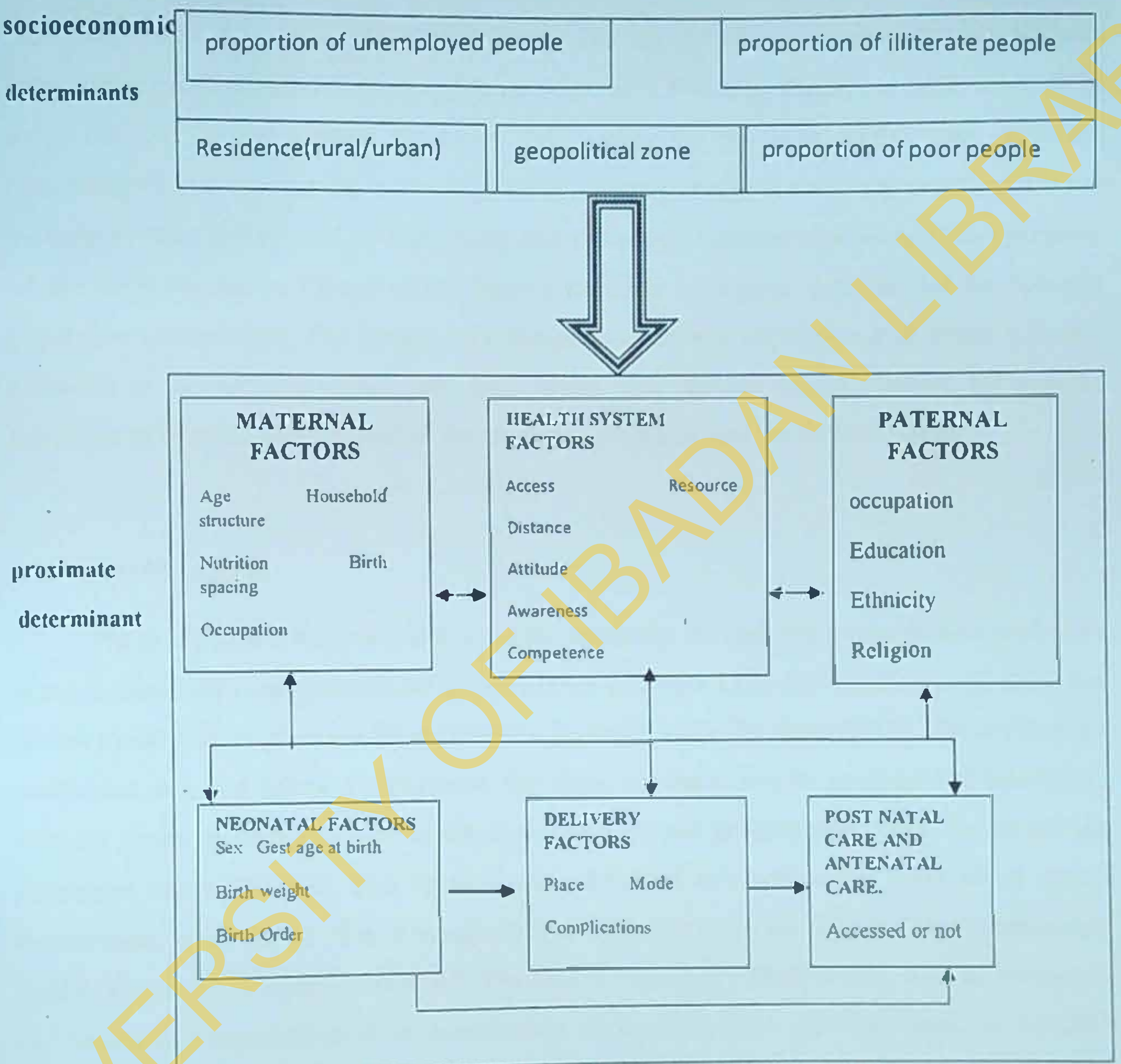
Therefore, it is recommended that infants should be put to breast within one hour after birth and should not go without breastfeeding for more than three hours between feeds (WHO 2007). However, The rate of early breastfeeding was low among mothers in Nigeria, and the factors identified that may influence its practice have important implications for breastfeeding intervention programmes. Activities to promote early breastfeeding should be focused on specific groups of women and locations in which it is poorly practiced In addition, support to the mothers is necessary.

2.17 Conceptual framework of socioeconomic and proximate determinant of neonatal mortality adapted from Mosley and Chen.

The conceptual framework used below was adapted from Henry Mosley and Lincon chan it was developed for the study of the determinants of child survival in developing countries. The approach incorporates both social and biological variables, it also integrates exploratory methods employed by social and medical scientists and provides for the measurement of morbidity and mortality in a single variable.

The framework is based on the principle that all social and economic determinants of child mortality necessarily operate through a common set of biological mechanism, or proximate to exert an impact on mortality. the framework is intended to advance research on social policy and medical intervention to improve child survival. In this study not all variables in the framework could be utilized due to the limited information available in the NDHS data.

Figure 2 : Conceptual framework of socioeconomic and proximate determinant of neonatal mortality adapted from Mosely and Chen.



CHAPTER THREE

METHODOLOGY

3.1 STUDY DESIGN

This study used data from the NDHS 2013. The survey was conducted by the National Population Commission(NPC) in conjunction with the ICF macro, Calverton, MD, USA, in 36 states and the Federal Capital Territory. The sample for the 2013 NDHS was nationally representative and covered the entire population residing in non-institutional dwelling units in the country. The survey used as a sampling frame the list of enumeration areas (EAs) prepared for the 2006 Population Census of the Federal Republic of Nigeria, provided by the National Population Commission. The sample was designed to provide population and health indicator estimates at the national, zonal, and state levels. The sample design allowed for specific indicators to be calculated for each of the six zones, 36 states, and the Federal Capital.

3.2 STUDY AREA

The study area is Nigeria and it is administratively divided into states. In turn, each state is subdivided into local government areas (LGAs) and each LGA into smaller (secondary and tertiary) localities. Nigeria has 36 states and a Federal Capital Territory (FCT). These states are subdivided into 774 LGAs. Furthermore, the states are regrouped by geographical location to form six zones, In addition to these administrative units and geographical zones, during the last population census in 2006, each locality was subdivided into convenient areas called census enumeration areas (EAs). The average number of households per EA in the corresponding locality frame was assigned to each EA. The EAs in Nigeria are small in size, with an average of 211 inhabitants (equivalent to 48 households). Since these EAs were too small to be DHS clusters, the 2013 NDHS included several EAs per DHS cluster (with a preferred minimum cluster size of 80 households

3.3 STUDY POPULATION

The study population are Neonates whose data were obtained from a total of 39,902 women age 15-49 who were identified as eligible for individual interviews, and 98 percent of them were successfully interviewed. Among men, 18,229 were identified as eligible for interviews, and 95 percent were successfully interviewed. Thereby having a total of 58,131 respondents, though response rates were slightly lower in urban areas than in rural areas as expected.

For this particular study, the study population used was 31,428 women whom were sampled from both urban and rural areas in Nigeria and have experienced child birth 5years preceding the survey which was extracted from the kids recode data, variable *b6* from the NDHS.

3.4 SAMPLE SIZE

The sample size allocation features an equal sized allocation with small adjustments. Lagos and Kano were assigned the largest sample size, with 40 clusters each; the remaining states had either 23 or 24 clusters each. Among the 904 clusters, 372 were in urban areas and 532 were in rural areas. The total number of households sampled was 40,680, 16,740 from urban areas and 23,940 from rural areas. The calculations were based on the results of the 2008 NDHS.

3.5 SAMPLING TECHNIQUE

The sample for the 2013 NDHS was a stratified sample, selected independently in three stages from the sampling frame. Stratification was achieved by separating each state into urban and rural areas. In the first stage, 893 localities were selected with probability proportional to size and with independent selection in each sampling stratum. In the second stage, one EA was randomly selected from most of the selected localities with an equal probability selection. In a few larger localities, more than one EA was selected. In total, 904 EAs were selected. After the selection of the EAs and before the main survey, a household listing operation was carried out in all of the selected EAs. The household listing consisted of visiting each of the 904 selected EAs, drawing a location map and a detailed sketch map, and recording on the household listing forms

all occupied residential households found in the EA with the address and the name of the head of the household. If a selected EA included less than 80 households, a neighboring EA from the selected locality was added to the cluster and listed completely. The resulting list of households served as the sampling frame for the selection of households in the third stage. In the third stage of selection, a fixed number of 45 households were selected in every urban and rural cluster through equal probability systematic sampling based on the newly updated household listing.

3.6 DATA COLLECTION METHOD AND TOOLS

The questionnaire used for this study is the Woman's Questionnaire, The content of this questionnaire was based on model questionnaires developed by the MEASURE DHS programme. The model questionnaires were modified according to the country's requirements, in consultation with a broad spectrum of government ministries and agencies, non-governmental organizations, and international donors, to reflect relevant issues such as family planning, domestic violence, HIV/AIDS, and maternal and child health. A stakeholders' meeting organized by NPC in Abuja on March 26, 2012, provided a platform for experts to discuss the questionnaire extensively, and the input from this was used to finalize the survey questionnaire. The questionnaires were then translated into three major Nigerian languages—Hausa, Igbo, and Yoruba—and were pretested, refined, and finalized for the survey.

The data file "kids recode" *NGKR6ADT.ZIP* obtained from the women's questionnaire was used for this study. It was downloaded from the national population commission website ;*www.population.gov.ng*. the data from the NDHS was weighted before using, by making use of the *svy* command provided by the Stata software. The data had to be weighted due to the sampling variability during the survey as more respondents were sampled in the rural areas than those in the urban areas, hence unequal sampling.

3.7 VARIABLES

3.7.1 OUTCOME VARIABLE:

Neonatal mortality is the outcome variable as reported by the mothers who participated in the study which was defined during the data collection as the probability of dying within the first month of life. The variable utilized after weighting was *b6* defined as age at death as reported by the mothers that were interviewed which was recorded from those that reported death of child on the day of birth to those that died on 4years later.

The variable *b6* was recoded to a dichotomous variable *bn7* where death from day 1 to the 28th day was recoded to 1 "success" and those that survived after the 28th day to 4years was recoded to 0 "failure".

3.7.2 EXPLANATORY VARIABLES:

The explanatory variables included socio-demographic, Proximate and socioeconomic variables. These variables were derived from the child survival framework designed by mosley and chen in 1984,these variables were diagnosed for possible association with neonatal mortality. Information available in the NDHS 2013 was taken into account in the development of this framework.

INDIVIDUAL LEVEL DETERMINANTS

These are variables related to the woman and her baby, they include factors were categorized into six groups: maternal, neonatal, paternal, antenatal, delivery, and postnatal factors. Maternal factors consisted , maternal age(*v013*), parity(*v201*), maternal occupation(*v717*), maternal education(*v149*), breast feeding(*m4*) and preceding birth interval(b11) sex of child(b4), birth order(bord), multiple pregnancy(b0) and birth weight(m19) was examined to assess the effects of neonatal factors while paternal factors entailed paternal occupation(v705) and education(v701), ethnic group(v131) and husband's age(v730).

Maternal up take of antenatal(m14), delivery(m15) and postnatal health care services(m71) were assessed by considering maternal health seeking behavior. Maternal health

seeking behavior was accessed by combining maternal characteristics such as having a healthcare card, having received tetanus toxoid, having received antenatal care, having delivered in a health facility and having heard about family planning. To evaluate the wealth index of the households an asset based approach was applied by NDHS. Household properties such as radio, car, and other features within the house such as water source, toilet facility and roof/floor type will be used to evaluate the wealth index of the house hold using principal component analysis PCA. Asset-based methods have previously been applied by the World Bank and other studies to estimate wealth status.

SOCIO-ECONOMIC DETERMINANTS

The socioeconomic determinants included in this study was assessed by considering the status of economically disadvantaged community in which the participants were dwelling. it was operationalised by utilizing four factors; place of residence*(v025)*,proportion of illiteracy*(v155)*, literacy*(v155)* and region of the country*(v101)* which they live was applied to generate socioeconomic disadvantage and privileged categories and subsequently classified into low, moderate and high deprivation categories.

3.8. DATA PROCESSING

The data analysis was done using STATA 12.0 statistical software package. The first stage of the analysis involved weighting The NDHS data which is a complex data, meaning that the sampling done during the execution of this survey was not evenly distributed i e the rural areas were oversampled while the urban areas where under-sampled hence to correct for this anomaly the kids recode data had to be weighted before further analysis

The STATA 12.0 was used to used to declare the data as a survey data by using the *svyset* command

Procedure

1. **Weight**: specify your weight variable was specified= v005/1000000

2. **Cluster:** primary sampling unit or enumeration area: v001

3. **Strata:** strata variable was created by using the region variable = v022

STATA command: *svyset [pw=weight], psu(v001) strata(v022)*

Some variables were further categorized into categories that would make analysis and interpretation of the results more meaningful. That is, some variables were re-categorized by merging groups which were similar but had very small numbers of observations within them. For instance mother's education which initially had 4 categories (1 No education, 2 Primary, 3 Secondary, 4 Higher) was recoded into 3 categories (1 No education, 2 Primary, 3 Secondary or more). The same procedure was applied to the Religion variable where 'Catholic and other Christian' was merged into a single 'Christian' group; for the Birth size variable, birth sizes from 0.7kg to 2.4kg were coded as 1, while those weighing between 2.5kg to 4kg were coded as 2 and those who weighed larger 4kg were coded as 3 for the Place of delivery variable, 'Government hospital, health center and health post' were merged into 'Government Health Facility' and for Delivery Assistants variable, 'Nurse/Midwife, Auxiliary Nurse and doctor were merged into one group(professional) while traditional birth attendant, relatives, friends and other where merged into a single group (unprofessional). Continuous variables like maternal age at birth were also categorized into 3 groups; less than 20 years, 20 to less than 34 years and 35 years or more

3.9 DATA ANALYSIS

There were three stages in the analysis of this data. These include descriptive statistics, bi-variate analysis, and multiple logistic regression.

These stages are described below:

3.9.1 : Descriptive statistics to examine the distribution of the study participants in terms of socio-demographic variables of interest in this study. Frequency tables were used to summarize the study participants' characteristics and proportion of neonatal deaths across selected variable categories.

3.9.2 : Chi-square was used to examine the relationship between each variable of interest and the outcome variable –neonatal mortality (coded as zero if child survived the neonatal period

and one if child died within this period). A p-value of 0.05 was considered statistically significant at 95% confidence level.

The next stage involved the use of multivariate logistic regression, this approach is useful in assessing the effect of our explanatory factors (socio-economic and proximate factors) on neonatal mortality, having controlled for the significant socioeconomic and maternal factors as well as important proximate determinant.

3.9.3 Multivariate logistic regression model.

The third stage of the analysis is the running of the multivariate logistic regression test. At this point all the independent demographic, socio-economic and individual variables are looked at together in relation to the dependent variable, neonatal mortality. This is done to determine the extent to which all the variables that have an impact on neonatal mortality are dependent on each other's presence. This method tests for confounding. The logistic regression using The *STAT(version 12.0)* statistical package will be utilized to reports odds ratios, which explain the nature of the relationship between each independent variable and the dependent variable in the presence of the other independent variables. Both the bivariate and multivariate logistic regression tests are run at 5% significance levels and the p-values and confidence intervals are analyzed for statistical significance for each independent variable.

The model of the multivariate logistic regression is: $Y = B0 + B1X1 + B2X2 + B3X3 ..... + E$ (Bender and Grouven, 1997)

Y= Dependent/Outcome variable

Bo= Intercept

B (1/2/3/....) = Regression Coefficient

X (1/2/3/....) = Independent Variable

E=Error

Table 3.10: Description of variables used in the analysis

Variables	Description and categorization
Community level factors	
Type of residence	1=rural 2=urban
Region	1=north central 2= north-east 3=north-west 4=south-east 5= south-west 6=south-south.
Literacy	1=illiterate 2=literate
Wealth index	1=poor 2=average 3=rich
Proximate factors	
Maternal age	1=15-24 2=25-34 3=35-49
Age at first birth	1=<20 2=20-29 3=30-39 4= >40
Maternal education	1= no education 2=primary 3=secondary 4=higher
Working status	1=not working 2=working 3=missing
Marital status	1=married 2=not married
Parity	1=single-parous 2= no of birth btw 2-4 3=no of births >=5
Birth interval	1=<24 months 2=24-35months 3= >35months
Breast feeding	1=yes 2=no
Health seeking	1=visited health facility in the last 2 months 2= no visits
Desire for child	1= wanted then 2= wanted later 3=wanted no more 4=missing
Paternal age	1=16-27 2=28-45 3=46-60 4=60-99
Paternal occupation	1=unemployed 2=white collar(service & managerial) 3= farming(self employed and employee) 4=manual
Paternal education	1=no education 2=primary 3=secondary 4=higher
Ethnicity	1=Hausa (Fulani and Kanuri) 2=Yoruba 3=Igbo 4=others
Sex of child	1=male 2=female
Birth order	1=1st child 2=2nd-3rdchild 3=4th-6thchild 4=>7th child
Birth weight in kg	1=<2.5kg 2=2.5-4000kg 3=4000kg 4=not weight 5=missing
Twin birth	1=single birth 2=multiple births
Place of delivery	1=home delivery 2=health facility 3=missing

Placed on chest after delivery	1=yes 2=no 3= missing
Mode of delivery	1=caesarean section 2=vaginal delivery
Delivery assistant	1=nurses and doctors 2=home and non professional attendant
Antenatal care	1= attended antenatal 2=did not attend

CHAPTER FOUR

Results

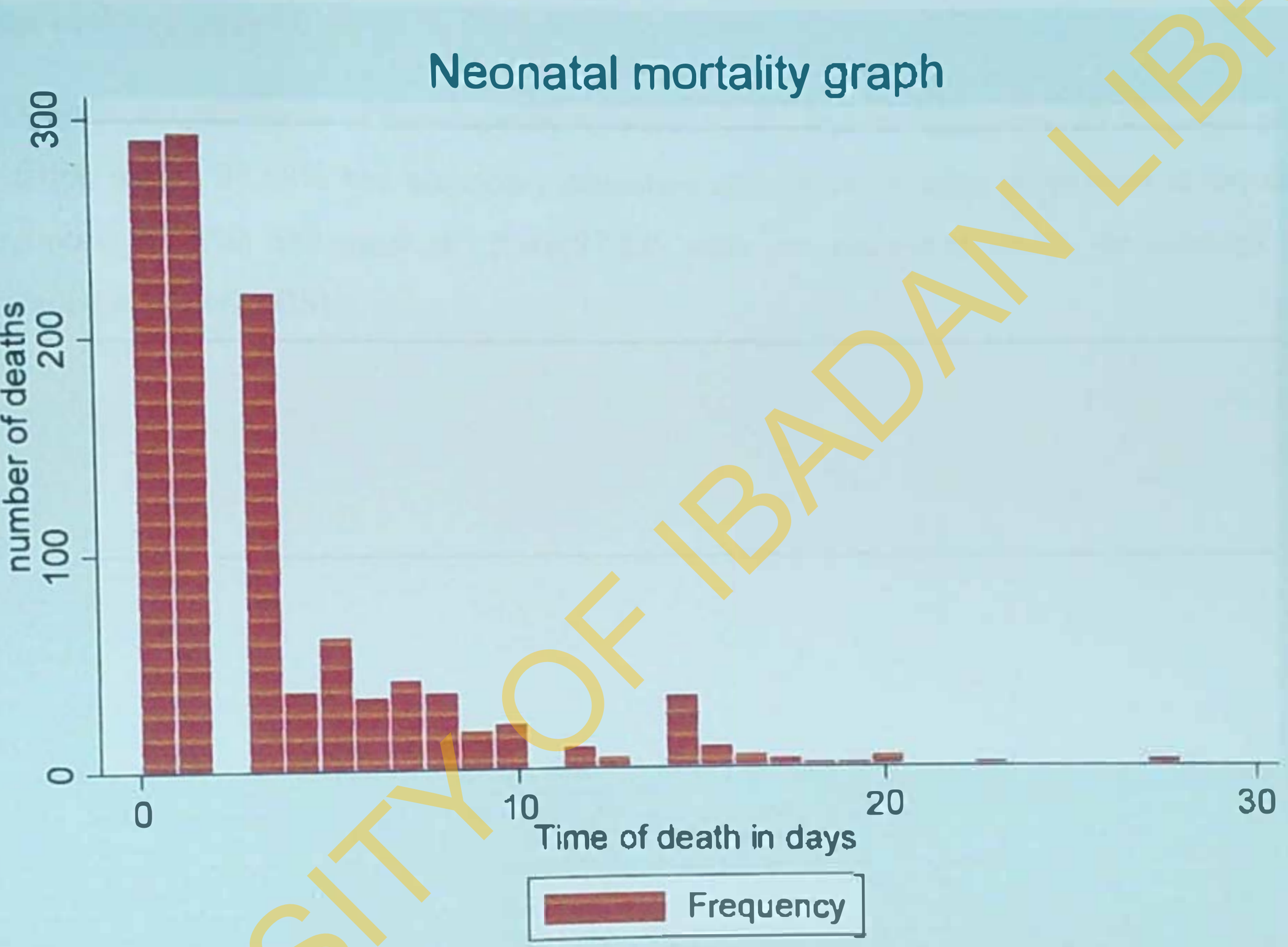
4.1: Neonatal mortality rate for Nigeria using the NDHS 2013 data

The inclusion of variables in this study was partly guided by the Mosley and Chen conceptual framework previously used in similar studies (Mosley 1984). A total of 31482 women who have ever given birth in the five years prior to this survey participated in this study, they had a mean age of 29±7years and reported 1189 neonatal deaths representing a neonatal mortality rate of 37/1000(35.7-40.0) in Nigeria, based on the report of the DHS statistics.

4.2 Frequency distribution of children that died during the neonatal period

The graph(figure 3) below shows the distribution of neonatal death, the day of death of the newborn. The highest mortality occurred on the early days of birth as over 500 of the 1189 deaths occurred on the day of birth and 24hours after birth(day0-1). There was a gradual decline in the number of death as the day progressed.

Figure 3: FREQUENCY DISTRIBUTION OF CHILDREN THAT DIED DURING THE NEONATAL PERIOD.



4.3: FREQUENCY DISTRIBUTION OF WOMEN BY SELECTED SOCIO-DEMOGRAPHIC VARIABLE.

The table 4.1 below shows the distribution of women who had delivery within the last five years prior to the survey by selected socio-demographic characteristics . Their mean age was 29±7years as majority (74%) were below the age of 35years,95.26% were married and 70.61% were employed. 67% of the women were rural dwellers and 31.47% are from the north western region of the country.

The educational status of the respondents were; 46.9% had no education, 20.43% had primary education while 32.68% had secondary education and above. A large proportion of the women were poor(45.94%) and most of them(97.92) were not registered under the national health insurance scheme(NHIS).

Table 4.3 frequency distribution of women by selected socio-demographic variables

Variable	Frequency	Percentage
Mothers age		
15-24	7614	24.19
25-34	15698	49.86
35-49	8170	25.59
Education		
No education	14 762	46.89
Primary education	6432	20.43
Secondary or higher	10288	32.68
Marital status		
Married	29990	95.26
Unmarried	1492	4.74
Religion		
Christian	12 654	40.19
Muslim	18 354	58.30
Traditional	474	1.51
Residence		
Rural	21131	67.12
Urban	10351	32.88
Geopolitical zone		
North central	4614	14.66
North east	6517	20.70
North west	9906	31.47
South east	2816	8.94
South south	3747	11.90
South west	3882	12.33
Wealth index		
Poor	14462	45.94
Average	6272	19.92
Rich	10748	34.14
Employment status		
Employed	22229	70.61
Unemployed	9253	29.39
Polygamous union		
Yes	9953	33.19
No	20037	66.81
Covered by NHIS		
Yes	536	1.70
No	30826	97.92
Missing	120	0.38

4.4 Neonatal mortality rates by socioeconomic characteristics of the mothers.

Table 4.2.1 below shows the neonatal mortality rates by socioeconomic status of the mother. Neonatal mortality rates were high in rural areas 41.1(38.5-43.9) compared to those in urban region 30.8(27.5-34.3). According to geopolitical zone the north western zone had the highest mortality rates 45.5(41.3-50.0) of all the six geopolitical zones and the lowest was from south-south 30.42(25.1-36.4). Mortality rates was high among the poor mothers 42.9(39.6-46.4) compared to the rich mothers 31.7(29.2-35.9).

Table 4.4 : Neonatal mortality rates by socioeconomic variables

Socioeconomic variable.	Total live birth=31428	Neonatal mortality=1189	NMR (95%CI)
Community level			
Place of residence			
Urban	10351	319(26.83)	30.8(27.5
Rural	21131	870(73.17)	41.1(38.5
Geopolitical zone			
North central	4614	156(13.12)	33.8(28.7-39.4)
North east	6517	253(21.28)	38.8(34.2-43.7)
North west	9096	414(34.82)	45.5(41.3-50.0)
South east	2816	112(9.42)	39.8(32.9-47.6)
South south	3747	114(9.59)	30.42(25.1-36.4)
South west	3882	140(11.77)	36.1(30.4-42.4)
Wealth index			
Poor	14462	621(52.23)	42.9(39.6
Average	6272	227(19.09)	36.2(31.7
Rich	10748	341(28.68	31.7(28.5
Literacy			
Literate	20328	827(69.55)	40.7(38.0
Illiterate	11154	362(30.45)	32.5(29.2

4.5 NEONATAL MORTALITY RATES BY INDIVIDUAL LEVEL FACTORS

4.5.1 Neonatal mortality rates by maternal factors

The NMR for neonates born to mothers between the ages of 15-24 was higher 47.9(2.5-53.1) compared to mothers who were in older age groups(35-49), 40.5(2.1-45.0). Women who had their first birth at an older age(30-39) had a NMR of 40.2(27.6-56.2) as compared to younger women 20-29 who had a NMR of 36.0(32.7-39.50)

Women who had only primary education recorded a higher NMR than women who attained university educational level (NMR:42.6vs31.3). Neonates whose mothers were not working had a slightly higher NMR than those who were who were working(NMR:38.5vs37.3). There was a significant difference in the NMR of those registered under the national health insurance scheme and those who did not (38.1 vs 22.4). Women who had given birth to more than five children had a higher NMR (41.5)than those who had just one birth (37.1). Women that had a birth interval less than 24 months had a higher NMR compared to those who had birth interval between 24-35 months(30.9).Neonates who not breastfed experienced a higher NMR than those who were breast fed by their mothers(NMR:38.3vs21.7), mothers who had a low health seeking behavior recorded a greater NMR 40.5 than those who had a high health seeking behavior(31.7)

TABLE 4.5.1 NEONATAL MORTALITY RATES BY MATERNAL FACTORS

Maternal factors	Total live births=31428	Neonatal mortality 1189	NMR(95%CI)
Maternal age			
15-24	7614	342(28.76)	47.9(2.5-53.1)
25-34	15698	516(43.40)	32.9(1.4-35.7)
35-49	8170	331(27.84)	40.5(2.1-45.0)
Age at first birth			
<20	18665	725(60.98)	38.8(36.1
20-29	12009	432(36.33)	36.0(32.7
30-39	797	32(2.69)	40.2(27.6
>40	11	0(0.00)	38.8(36.1
Education			
No education	14762	593(49.87)	40.2(37.1
Primary	6432	274(23.04)	42.6(37.8
Secondary or higher	10288	322(27.08)	31.3(1.7
Working status			
Not working	9099	350(28.12)	38.5(34.6-42.6)
Working	22229	830(69.81))	37.3(34.9-39.9)
Missing	154	9(8.34)	
Religion			
Christian	12654	460(38.69)	36.4(33.2-39.8)
Islam	18354	710(59.71)	38.7(35.9-41.60
Traditionalist	474	19(1.59)	40.1(24.3-61.9)
Polygamous union			
Yes	9953	387(34.71)	38.9(35.2
No	20037	728(65.29	36.3(33.7
NHIS coverage			
Yes	536	12(1.01)	22.4(11.6-38.8)
No	30826	1176(98.91)	38.1(36.3-40.3)
Missing	12	1(0.08)	
medical autonomy			
Yes	10874	753(67.53)	69.2(64.5-74.2)
No	19116	362(32.47)	18.9(17.1-3.0)
Marital status			
Married	29990	1115(93.78)	37.2(35.1-42.1)
Not married	1492	74(6.22)	49.6(39.1-45.3)
Parity			
1	3624	135(11.35)	37.1(31.2
2-4	14966	519(43.65)	34.7(31.8
>or =5	12892	535(45.00)	41.5(38.1
Birth interval			
<24	5817	314(26.41)	54(48.3
24-35	9868	305(25.65)	30.9(27.6
>35	15797	570(47.94)	36.1(33.2
Breastfeeding			
Yes	30086	654(55.00)	21.7(20.1-23.4)
No	1396	535(45.00)	38.3(357.6-409.3)
Health seeking			
High	9765	310(26.07)	31.7(28.3
Low	21560	873(73.42)	40.5(37.9
missing	157	6(0.50)	
Desire for child			
Wanted then	9663	531(44.66)	2.3(50.5
Wanted later	16870	516(43.40)	30.5(28.0
Wanted no more	4778	138(1161)	28.9(24.1
Missing	171	4(0.34)	

4.5.2 Neonatal mortality rates by paternal factors

In this study it was found that neonates born to younger fathers(16-27) had higher NMR compared to matured fathers (60-99), (NMR:48.4vs33.7) women who were married to uneducated men reported a higher NMR than those who were married to men with university education(NMR:42.1vs27.9).Neonates who were born to Hausa fathers had a higher NMR compared to those married to Yoruba's (NMR:39.7:35.5).

Table 4.5.2 Neonatal mortality rates of paternal factors

Characteristics	Total live births=31428	Neonatal mortality 1189	NMR (95%CI)
paternal factors			
Age			
16-27	2150	104(9.33)	48.4(39.7-58.3)
28-45	20639	731(65.56)	35.4(32.9-38.0)
46-60	6104	243(21.79)	39.8(35.0-45.0)
60-99	1097	37(3.32)	33.7(23.8-46.2)
Occupation			
unemployed	464	13(1.12)	28.0(15.0-47.4)
white collar	9761	341(29.42)	34.9(31.3-38.8)
farming	11286	464(40.03)	23.3(20.7-26.4)
manual	9367	341(29.42)	36.4(32.7-40.4)
Education			
No education	11903	501(43.23)	42.1(38.6-45.9)
Primary	5985	242(20.88)	40.4(35.6-45.7)
Secondary	9009	305(26.3)	33.9(30.2-37.8)
Higher	3981	111(9.58)	27.9(23.0-33.5)
Ethnicity			
Hausa	13935	553(3,77)	39.7(36.5-43.1)
Yoruba	12947	459(3.55)	35.5(32.3-38.8)
Igbo	3414	130(3.81)	38.1(32.1-45.1)
Others	1186	47(3.96)	45.3(34.1-28.0)

4.5.3 Neonatal mortality rates by delivery factors

Women who delivered at home had a higher neonatal mortality rate than those who gave birth in a health facility(NMR:36.9vs35.4) also women who placed their neonates on their chest recorded lower NMR (23.4) compared to women who did not place the neonate close their chest(37.9).Neonates delivered by cesarean section had a higher NMR than those born vaginally(NMR:72.8vs21.3)

Table4.5.3: Neonatal mortality and delivery factors

Characteristics	Total live births=31428	Neonatal mortality 1189	NMR(95%CI)
Delivery factors			
Place of delivery			
Home	19619	725	36.9(34.4-39.7)
Health facility	11553	409	35.4(32.1-38.9)
Placed on chest			
Yes	1370	32	23.4(16.0-32.8)
No	29759	1129	37.9(35.8-40.2)
Mode of delivery			
Caesarean section	659	48	72.8(54.2-95.4)
Normal delivery	30823	1141	21.3(19.7-23.1)
Delivery assistant			
Professional	3054	136	44.5(37.5-52.5)
Non professional	28428	1053	37.0(34.9-39.3)

4.5.4: Neonatal mortality rates by health system factors

Mothers who were aware and well informed about health issues experienced a lower neonatal rate 33.1(29.7-37.0) than women had no awareness about maternal issues92.9(87.1-98.9) also women who had limited resources experienced slightly higher neonatal mortality rate38.5(35.5-41.8) than women who had resources37.2(34.4-40.2).Mothers who were knowledgeable about maternal health reported slightly lesser NMR 25.6(22.5-29.1) than mothers with no knowledge 27.8(23.0-33.2).

Table 4.5.4: Neonatal mortality rates of health system factors.

Characteristics	Total Live birth= 31428	Neonatal mortality Yes=1189	NMR (95%CI)
Health system factor			
Awareness			
Yes	9429	313(26.32)	33.1(29.7-37.0)
No	9429	876(73.68)	92.9(87.1-98.9)
Missing	19	0(0.00)	
Resources available			
Yes	16881	628(52.82)	37.2(34.4-40.2)
No	14449	557(46.85)	38.5(35.5-41.8)
Missing	152	4(0.34)	36.1(32.5-39.9)
Distance to HF			
far	10063	363(30.53)	36.1(32.5-40.0)
near	21295	819(68.88)	38.5(35.9-41.1)
missing	124	7(0.59)	
Attitude o f hx staff			
Professional	26258	992(83.41)	37.8(35.5-40.2)
Unprofessional	5071	190(15.98)	37.5(32.4-43.1)
Missing	153	7(0.48)	
Knowledge			
Yes	9211	236(2.56)	
No	4180	116(2.78)	25.6(22.5-29.1)
Missing	139	4064(97.22)	27.8(23.0-33.2)

4.5.5 Neonatal mortality rates by neonatal factors

In this study the NMR for male neonates was greater than the female neonates(NMR 42.4vs32.6)it was observed that neonates who were in the 7th birth order had a greater NMR (47.7) compared to neonates in the 4th-6th birth order that recorded a NMR of (32.8).Babies who their mothers perceived them to be small in size had a NMR of 99.1(6.8-11.3) compared to the larger neonates 27.8(1.4-30.7). Mothers who had multiple birth had a higher NMR(33.1) compared to those who has singleton births(16.5).

Table4.5.5: Neonatal mortality rates of neonatal factors

Characteristics	Total Live birth= 31428	Neonatal mortality Yes=1189	NMR (95%CI)
Neonatal factors			
Sex of child			
Male	15965	683(57.44)	42.7(39.7-46.0)
Female	15517	506(42.56)	32.6(29.9-35.5)
Birth order			
1	6109	286(24.05)	46.8(41.7-52.4)
2-3	10074	322(27.08)	42.0(28.6-35.6)
4-6	9971	327(27.50)	32.8(29.4-36.5)
>7	5328	254(21.36)	47.7(42.1-53.7)
Size of child			
Large	13589	378(31.79)	27.8(1.4-30.7)
Average	15976	621(52.23)	38.9(1.5-41.9)
Small	1917	190(15.98)	99.1(6.8-11.3)
Child is twin			
Yes	30384	1007(84.69)	33.1(31.2-35.2)
No	1098	182(15.31)	16.5(144.2-189.1)

4.5.6: Neonatal mortality by antenatal care factors

Mothers who did not utilize antenatal care services had greater neonatal mortality rates46.3(43.3-49.5) compared to mothers who attended 26.4(2.8-29.3)similarly mothers who did not visit any health facility after birth had a higher NMR 43.4(41.0-46.0) compared to those who attended health care after birth 12.3(1.4-15.5).

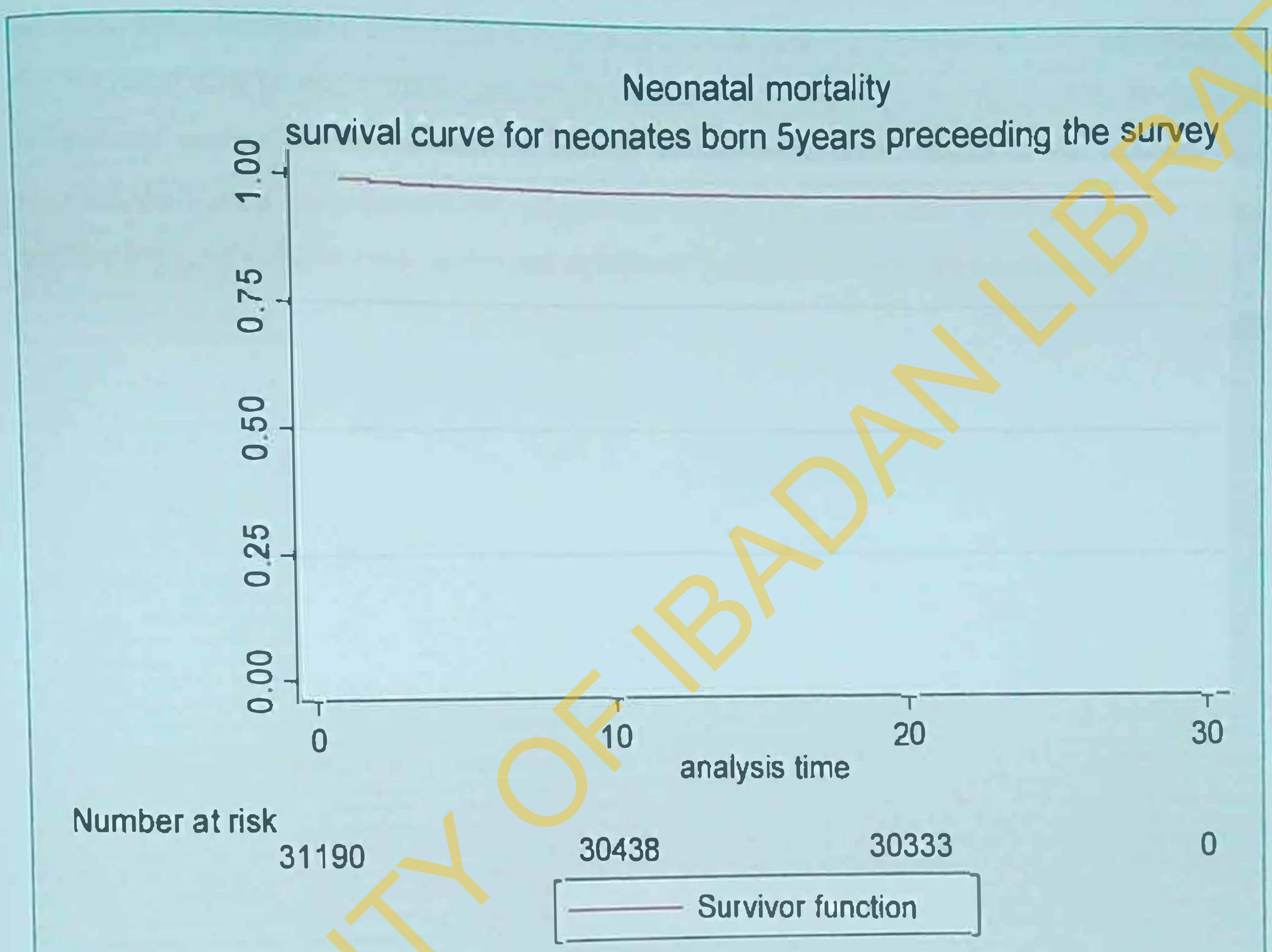
Table 4.5.6 : Neonatal mortality rates by antenatal care factors

Characteristics	Total	Neonatal mortality Yes=1189	NMR (95%CI)
Antenatal care			
Yes	13530	357(30.03)	26.4(23.8-29.3)
No	17952	832(69.97)	46.3(43.3-49.5)
Postnatal care			
yes	5754	71(5.97)	12.3(1.4-15.5)
No	25728	1118(94.03)	43.4(41.0-46.0)

4.6 Kaplan-Meier survival curve for children before their 28th birthday (neonates) in Nigeria,2013.

The graph(figure 4) below shows the probability of a neonatal death within the first 28days of life. The graph slopes slowly from day1 with a probability of dyeing at 0.95 to 0.90 on day 10 and 0.85 by day 20.

Figure 4: Kaplan-Meier survival curve for children before their 28th birthday (neonates) in Nigeria,2013.



4.7: Association between neonatal mortality and community level determinants.

Table 4.5 below shows that there is a significant association between residence and neonatal death , it is observed that women in the rural areas experienced 73.2% of the total neonatal death compared to women living in urban residence(26.8%) which was significant at <0.001.According to geopolitical zone women in the north west reported the highest percentage of neonatal deaths(34.8%) compare to women in the south south region of the country that reported the lowest percentage(9.6%) which was statistically significant at 0.025. Wealth index and literacy levels also showed statistical significant relationship with neonatal mortality

Table 4.7: Association between community level factors and neonatal mortality.

Community level factors	Total= 31428	Neonatal mortality Yes=1189	No=30293	X^2	p-value
Place of residence					
Urban	10351	319(26.8)	10032(33.1)		
Rural	21131	870(73.2	20261(66.9)	20.4933	<0.001
Geopolitical zone					
North central	4614	156(13.1)	4458(14.7)		
North east	6517	253(21.3)	6264(20.7)		
North west	9096	414(34.8)	9492(31.3)		
South east	2816	112(9.2)	2704(8.9)		
South south	3747	114(9.6)	3633(12.0)		
South west	3882	140(11.8)	3742(12.4)	12.79	0.025
Wealth index					
Poor	14462	621(52.2)	13841(45.7)		
Average	6272	227(19.1)	6045(20.0)		
Rich	10748	341(28.7)	10407(34.4)	21.87	<0.001
Literacy					
Illiterate	20328	827(69.5)	n19501(64.4)		
Literate	11154	362(30.4)	10792(35.6)	16.25	<0.001

4.8 Association between proximate determinant and neonatal mortality

4.8.1: Association between maternal factors and neonatal mortality

Among the 31428 women that have ever experienced child birth 5years prior to this study, a significant relationship was observed between their age range and neonate death(<0.001) as it is shown that women between the age 25-34 reported higher mortality(60.81%) compared to those in the older age group 35-49(0.50%). A significant inverse association was observed between the educated mothers and neonate death as mothers with no education reported the highest mortality (49.87%) compared to mothers who. attained higher education(3.95%). A direct relationship was noted between the number of births a woman has had neonate death as the percentage of neonatal mortality markedly increased among women who reported more than five births(45%) compare to the single-parous mothers (11.35%) which was significant at <0.001.Birth interval and breast feeding were observed to have a strong association with neonatal death (<0.001) as those with preceding birth greater than 35months experienced 47.94% of the total neonate death while those less than 24months reported 26.41%.similarly women who reported breastfeeding their babies had 55% mortality and those who dint breast feed their babies also reported markedly high neonatal death(45%).

Women categorized as having a high health seeking behavior reported less neonate death (26.07%) compared to those who have a low health seeking behavior 73.42% significant at <0.001

Table 4.8.1 Association between maternal factors and neonatal mortality

Maternal factors variable	Total=31428	Neonatal mortality		X^2	p-value
		Yes=1189	No=30293		
Maternal age					
15-24	7614	342(28.7)	7272(24.0)		
25-34	15698	516(43.4)	15182(50.1)		
35-49	8170	331(27.8)	7839(25.9)		
Age at first birth				22.765	<0.001
<20	18665	725(60.9)	17940(53.0)		
20-29	12009	432(36.3)	11577(38.2)		
30-39	797	32(2.6)	765(2.5)		
>40	11	0(0.0)	11(0.0)		
Education				2.384	0.503
No education	14762	593(49.9)	14169(46.8)		
Primary	6432	274(23.0)	6158(20.3)		
Secondary or higher	10288	322(27.1)	9966(32.9)		
Working status				21.385	<0.001
Not working	9099	350(28.1)	8749(29.40)		
Working	22229	830(69.8)	21399(70.6)		
Missing	154	9(8.3)	145(2.4)		
Religion				2.046	0.360
Christian	12654	460(38.69)	12194(40.3)		
Islam	18354	710(59.71)	17644(58.2)		
Traditionalist	474	19(1.59)	289(1.0)		
Polygamous union				1.392	0.707
Yes	9953	387(34.71)	9566(33.1)		
No	20037	728(65.29	19309(66.9)		
NHIS coverage				1.208	0.272
Yes	536	12(1.01)	542(1.7)		
No	30826	1176(98.91)	29650(97.9)		
Missing	12	1(0.08)	119(0.4)		
medical autonomy				6.473	0.039
Yes	10874	753(67.53)	183363(63.6)		
No	19116	362(32.47)	10512(36.4)		
Marital status				7.206	0.007
Married	29990	1115(93.78)	28875(95.3)		
Not married	1492	74(6.22)	1418(4.7)		
Parity				6.031	0.014
1	3624	135(11.35)	3489(11.50)		
2-4	14966	519(43.65)	14447(47.7)		
>or =5	12892	535(45.00)	12357(40.8)		
Birth interval				8.894	0.012
<24	5817	314(26.41)	5503(18.2)		
24-35	9868	305(25.65)	9563(31.6)		
>35	15797	570(47.94)	15227(50.3)		
Breastfeeding				52.948	<0.001
Yes	30086	654(55.00)	29432(97.2)		
No	1396	535(45.00)	861(2.80		
Health seeking				4.8e+3	<0.001
High	9765	310(26.07)	9455(31.20		
Low	21560	873(73.42)	20687(68.3)		
missing	157	6(0.50)	151(0.5)		
Des Irefor child				14.15	<0.001
Wanted then	9663	531(44.66)	9132(30.2)		
Wanted later	16870	516(43.40)	16354(54.0)		
Wanted no more	4778	138(11.61)	4640(15.3)		
Missing	171	4(0.34)	167(0.6)	113.252	<0.001

4.8.2: Association between paternal factors and neonatal mortality.

Educational status of the fathers of the neonates showed a statistically significant relationship with neonatal death(<0.001), women who were married to men with no education had higher proportion of neonatal mortality(43.23%) compared to women who were married to educated men(9.58%).

Table 4.8.2: Association between paternal factors and neonatal mortality.

Characteristics	Total	Neonatal mortality		X^2	p-value
		Yes=1189	No=30293		
paternal factors					
Age					
16-27	2150	104(9.3)	2046(7.1)		
28-45	20639	731(65.6)	19908(69.0)		
46-60	6104	243(21.8)	5861(20.3)		
60-99	1097	37(3.2)	1060(3.7)	7.763	0.051
Occupation					
unemployed	464	13(1.12)	451(1.5)		
white collar	9761	341(29.4)	9420(31.7)		
farming	11286	464(40.0)	10822(36.4)		
manual	9367	341(29.4)	9026(30.4)	7.342	0.062
Education					
No education	11903	501(43.2)	11402(38.4)		
Primary	5985	242(20.9)	5743(19.3)		
Secondary	9009	305(26.3)	8704(29.3)		
Higher	3981	111(9.6)	3870(13.0)	21.874	<0.001
Ethnicity					
Hausa	13935	553(56.2)	13382(96.0)		
Yoruba	12947	459(3.6)	12488(96.5)		
Igbo	3414	130(3.8)	3284(96.2)		
Others	1186	47(4.0)	1139(96.0)	3.441	<0.329

4.8.3: Association between neonatal factors and neonatal mortality.

Table 4.6.2 below showed a significant relationship between gender of the baby and mortality(<0.001) as male neonates were observed to die more (57.4%) than the females (42.56%). There was a significant increase in neonatal death as the birth order of the children increases, first born's showed reduced neonate death(24%) compared to children born after the second birth (27.08%) at <0.001 significance level. High neonatal mortality was observed among women that had twin births(84.69%) compared to those with single births(15.31%) which was significant at $p<0.001$.

Table 4.8.3 Association between neonatal factors and neonatal mortality

Characteristics	Total	Neonatal Mortality yes=1189	No=30293	χ^2	pvalue
Neonatal factors					
Sex of child					
Male	15965	683(57.44)	15282(50.45)		
Female	15517	506(42.56)	15011(49.55)	22.403	<0.001
Birth order					
1	6109	286(24.05)	5823(19.22		
2-3	10074	322(27.08)	9752(32.19)		
4-6	9971	327(27.50)	9644(31.48)		
>7	5328	254(21.36)	5074(16.75)	44.27	<0.001
Size of child					
Large	13589	378(31.79)	13211(43.61)		
Average	15976	621(52.23)	15355(50.69)		
Small	1917	190(15.98)	1727(5.70)	236.08	<0.001
Child is twin					
Yes	30384	1007(84.69)	29377(96.98)		
No	1098	182(15.31)	916(3.02)	512.82	<0.001

4.8.4: Association between delivery factors neonatal mortality

A strong association(<0.001) was noted between neonate death and delivery factors, as neonates delivered at home recorded high mortality (60.98%) compared to those birthed in health facility (34.40%). Similarly an inverse relationship was observed between those placed close to their mothers after birth compared to those who were not as 94.95% of children not placed on their mothers chest during delivery died compared to 2.69% of those placed on the mothers chest. Babies delivered through caesarean section showed higher mortality (4.04%) compared to those delivered normally which was statistically significant at <0.001. this observation is in tandem with those who were not delivered by professional assistance as they recorded a higher mortality (88.56%) compared to those who seek professional assistance (11.44%),p<0.001

Table4.8.4: Association between delivery factors neonatal mortality

Characteristics	Total=31428	Neonatal-mortality Yes=1189	No=30293	X^2	p-value
Delivery factors					
Place of delivery					
Home	19619	725(61.0)	18894(62.4		
Health facility	11553	409(34.4)	1144(36.8)		
Missing	310	55(4.6)	255(0.8)	168.50	<0.001
Placed on chest					
Yes	1370	32(2.7)	1338(4.4)		
No	29759	1129(95.0)	28630(94.5)		
Missing	353	28(2.4)	325(1.1)	24.623	<0.001
Mode of delivery					
Caesarean section	659	48(4.0)	611(2.0)		
Normal delivery	30823	1141(96.0)	29682(98.0)	22.78	<0.001
Delivery assistant					
Professional	3054	136(11.4)	2918(9.6)		
Non professional	28428	1053(88.6)	27375(90.5)	132.641	<0.001

4.8.5: Association between health-system factors and neonatal mortal.

A marked association was observed between women who were aware about health risks and neonatal death, it was observed that as high as 73.68% of women who had no awareness reported higher neonatal death compared to those who were aware (26.32%), which was statistically significant at $p<0.001$. Resources, distance to health facility, attitude of health staff were not statistically significant but had an inverse relationship with neonatal mortality.

Table 4.8.5: Association between health-system factors and neonatal mortal.

Characteristics	Total	Neonatal-mortality		X^2	p-value
		Yes=1189	No=30293		
Health system factor					
Awareness					
Yes	9429	313(26.3)	9116(30.1)		
No	9429	876(73.7)	21158(69.8)		
Missing	19	0(0.0)	19(0.1)	8.569	0.014
Resources available					
Yes	16881	628(52.8)	16253(53.7)		
No	14449	557(46.9)	13892(45.9)		
Missing	152	4(0.4)	148(0.5)	0.940	0.625
Distance to HF					
far	10063	363(30.5)	9700(32.0)		
near	21295	819(68.9)	20476(67.6)		
missing	124	7(0.6)	117(0.4)	2.267	0.322
Attitude of HF staff					
Professional	26258	992(83.4)	25266(83.4)		
Unprofessional	5071	190(16.0)	4881(16.1)	0.2810	0.869
Missing	153	7(0.5)	146(0.6)		
Knowledge					
Yes	9211	236(2.6)	8975(97.4)		
No	4180	116(2.8)	4064(97.2)	0.13	0.102
Missing	139	5(3.6)	134(96.4)		

4.8.6 Association between antenatal care and neonatal mortality.

Women that attended antenatal care were observed to experience low mortality(3.03%) compared to women who did not (69.97%)significant at p<0.001,similarly there was a marked increase in mortality among those that did not attend postnatal care(94.03%) compared to those that did not seek post natal care after birth(4.04%) significant at p<0.001

Table 4.8.6 Association between antenatal care factors and neonatal mortality.

Characteristics	Total	Neonatal mortality Yes=1189	No=30293	X^2	p-value
Antenatal care					
Yes	13530	357(3.0)	13173(43.0)		
No	17952	832(70.0)	17120(56.7)	84.58	<0.001
Postnatal care					
Yes	5754	71(5.97)	5683(18.8)		
NO	25728	1118(94.03)	24610(81.2)	128.358	<0.001

4.9 Community level determinants of neonatal mortality.

To examine the individual effects of place of residence, region and other selected community factors on neonatal mortality, a multiple logistic regression of neonatal deaths was run over each variable of interest while controlling for the other. The results are shown in Table 3.5. geopolitical zone, wealth index and literacy were not significantly associated with deaths. The factor that was found to be significantly associated with increased risk of neonatal death include those residing in rural areas whom were 1.29 times more likely to experience neonatal death than the urban dwellers ($P<0.001$).

Table 4.9 : community level determinants of neonatal mortality.

Variable	Odds ratio	Confidence interval	p-value
Community level			
Place of residence			
Urban*			
Rural	1.294	1.099-1.524	0.002
Geopolitical zone			
North central *			
North east	1.062	0.861-1312	0.573
North west	1.131	0.927-1378	0.223
South east	1.361	1.054-1757	0.018
South south	0.944	0.736-1.212	0.656
South west	1.253	0.984-1.596	0.067
Wealth index			
Poor*			
Average	0.914	0.771-1.083	0.299
Rich	0.888	0.728-1.084	0.244
Literacy			
Literate*			
Illiterate	0.899	0.766-1.055	0.192

*=Reference category

4.10 Individual level determinants of neonatal mortality

Long birth spacing and breastfeeding had a protective effect on the babies survival during the neonatal stage, In this study it was found that mothers who has an interval 24-35 months (OR=0.61 p<0.001) and greater than 35 months(OR=0.55 p<0.001) between births were respectively 39% and 45% less likely to experience neonatal death children who were breastfed(OR=0.39 p<0.001) were 61% less likely to die during neonatal period than those who were not breastfed similarly female babies(OR=0.74 p<0.001) were 23% less likely to die before their 28th day compared to the males. There was a significantly lesser risk of neonates of higher birth order 4-6 (OR=0.69 p=0.045) and 2-3(OR=0.61 P=0.001) as they were 31% and 39% less likely to die during their neonatal period. Neonates who were within the weights 2.5-4.0kg(OR=0.45 p<0.001) and >4.0kg(OR=0.41 P=0.025) were 55% and 59% less likely to die compared to babies who weighed less than 2.5kg it was noticed that infants of multiple gestation were 6times more likely to die before they attain the age of one month(OR=5.91 p<0.001)

Women who had resources at their disposal(OR=0.97, P<0.027) where 1.03 times less likely to loose their child during neonatal period while those in distant proximity from a health facility(OR=1.22, P=0.021) were 1.2 times more likely to experience neonate death In addition women who delivered at home (OR=1.10,P=0.08) were 1.1 times more likely to lose their child before the 28th day compared to those who delivered in a health facility similarly babies delivered by caesarean section(OR=1.8, p=0.054) were twice more likely to die in the neonatal period compared to those birthed by normal delivery, consequently women whose delivery were not taken by a professional assistant were 1.4times more likely to experience neonatal death compared to those attended to by skilled birth attendant(OR=1.4, P=0.013) the utilization of post natal care services by women reduced the likelihood of reducing their babies during neonatal life compared to those who failed to seek post-natal care(OR= 0.59, p= 0.02)(OR=0.39 p=0.03)(OR=0.212 P<0.001) see table (4.8.1-4.8.6)

Table 4.10 Individual level predictors of neonatal mortality.

Variables	Odds ratio	Confidence interval	P-value
Maternal factors			
Maternal age			
15-24*			
25-34	0.736	0.586-0.926	0.009
35-49	0.758	0.543-1.058	0.103
Age at first birth			
<20*			
20-29	1.110	0.931	0.244
30-39	1.234	0.747	0.412
>40	1		
Education			
No education*			
Primary	1.253	1.024	0.029
Secondary or higher	1.039	0.818	0.752
Working status			
Not working*			
Working	1.037	0.890-1.21	0.639
Parity			
1*			
2-4	1.038	0.757	0.818
>or=5	1.072	0.686	0.755
Birth interval			
<24*			
24-35	0.611	0.508-0.734	<0.001
>35	0.555	0.456-0.675	<0.001
Breastfeeding			
No*			
Yes	0.387	0.331-0.453	<0.001
Health seeking			
Low*	0.893		
High	0.940	0.331-0.453	<0.001
Desire for child			
Wanted then*			
Wanted later	0.524	0.453	0.130
Wanted no more	0.530	0.417	0.010
paternal factors			
Age			
16-27*			
28-45	0.926	0.705	0.584
46-60	0.898	0.648	0.518
60-99	0.648	0.401	0.076

Individual level predictors continued			
Occupation			
Unemployed*			
white collar	0.926	0.705	0.362
Farming	0.897	0.648	0.425
Manual	0.648	0.401	0.269
Education			
No education*			
Primary	0.971	0.793	0.778
Secondary	0.843	0.670	0.122
Higher	0.769	0.563	0.095
Ethnicity			
Hausa*			
Yoruba	0.674	0.453	0.031
Igbo	0.543	0.652	0.345
Others	1.232	0.44	0.442
Neonatal factors			
Sex of child			
Male*			
Female	0.736	0.642-0.842	<0.001
Birth order			
1*			
2-3	0.614	0.463	0.001
4-6	0.686	0.464	0.045
>7	0.910	0.623	0.997
Size of child			
Large *			
Average	1.27	0.968	0.002
Small	1.94	0.248	<0.001
Child is twin			
No*			
Yes	5.92	4.746-7.386	<0.001
Health system factor			
Awareness			
No*			
Yes	0.997	0.012-0.769	0.975
Resources available			
No*			
Yes	0.971	0.012-0.769	0.027
Distance to HF			
Near*			
Far	1.22	1.031-1.453	0.021
Attitude of HF staff			
Professional*			
Unprofessional	0.936	0.769-1.139	0.590

Individual level predictors continued			
Delivery factors			
Place of delivery			
Home*			
Health facility	1.102	1.071-1.139	0.008
Placed on chest			
Yes*			
No	0.794	0.531-1.187	0.054
Mode of delivery			
Normal delivery*			
Caesarean section	1.807	0.992-2.715	0.005
Delivery assistant			
Professional*			
Non professional	1.396	1.072-1.817	0.013
Antenatal care			
Yes*			
No	1.075	0.899-1.285	0.427
Postnatal care			
Yes*			
No	1.798	1.181-2.72	0.006

*=Reference category

CHAPTER 5

DISCUSSION CONCLUSION AND RECOMMENDATIONS

5.1 DISCUSSION

The study examined the influence of community(socio-economic), proximate(individual) and demographic characteristics of mothers on neonatal mortality in Nigeria. A secondary analysis of women who had child birth five years prior to the time of survey was conducted using the 2013 Nigeria Demographic and Health Survey (NDHS) data. The explanatory variables derived from the conceptual framework of child survival by Mosley and Chen (Year!). The first publication that examined neonatal mortality in Nigeria using a nationally representative sample NDHS 2008 was by Osita et al (2014). The neonatal mortality rate in Nigeria is 37/1000 with most of the deaths occurring in the first 24 – 48 hours of life. This is agreement scientific literature (Osita K.E *et al*,2014) (Gbenga A.K *et al*,2014) (Quanrul H *et al* 2010). However, this has implications for policy formulation and the most critical period for targeting the health interventions necessary for improving neonatal survival. Regional variations were also observed in the distribution of neonatal mortality rates across the country with the north western region recording the highest mortality rates in the country, similar studies in that region also confirmed the observation (Mohammed B S, 2014). The lowest were recorded in the south south zone (Joshua O.A 2010)

This study showed several factors that were significantly associated with neonatal mortality after adjusting for confounding factors. Mother's age was a significant determinant of neonatal mortality in this study. Women in the older age category (25-34) were 30% less likely to experience neonatal death compared to those in the lower age category(15-24) which is in agreement with what was reported by , (Zwane E.2007) (Ajaari J 2012) (Mohammed BS 2014) have reported an association between younger maternal age and neonatal death. Astha Ramaiya and her colleagues study in their study on maternal age and neonatal mortality in sub-Saharan Africa (Ashat R et al 2001) corroborated our findings in which high rate of neonatal death was reported among young mothers in Africa. She explained that young mothers in Africa have increased social and biological risk factors associated with neonatal mortality. Another study in

Zimbabwe found that mothers who were less than 20 years of age experienced greater infant mortality, (Huang, 2008) though another study reported that there is an increased risk of infant mortality for mothers over the age of 35 (Mturi and Curtis ,1995) . This phenomenon might also be attributed to the density of this age group of women in the population and not necessarily the age of the women being a risk factor for neonatal death.

The association of sex and child survival is well reported in the literature. It is confirmed in this study that female babies have 30% less likely to die during the neonatal period compared to the inales. Previous studies have also confirmed the high risk associated with being a male neonate though with diverse odds (Titaley CR *et al* 2007:Alonso v et al 2006) contributing factors to this are late fetal lung development in males compared to females, higher prevalence of respiratory diseases in males, immuno-deficiency and congenital malformation.(Airokiasamus 2008; Janni 2005).

Lack of education of mothers was observed to be significantly associated with higher neonatal mortality rates when compared with educated women. This observation is in consonance with other studies (Yared M *et al* 2011) (Deepak Paudel, *et al* 2013) which showed that education is one of the strongest influences on women's knowledge, attitudes, and behavior in child health practices. The mothers education plays an important role in the survival of the child, it was observed in this study that mothers who attained secondary educational level or higher reported less neonate death compared to those with no education which corroborates a study done by(Yared .M *et al* 2014) in Ethiopia that reported a strong association between neonatal survival and maternal education. A trend which might be due to the good health seeking behavior possessed by educated mothers such as taking tetanus toxiod immunization during pregnancy, and receiving skilled antenatal, delivery and postnatal care. Unmarried, women which may imply a lack of spousal support experienced a higher NMR compared to those who had a partners, this difference might be due to lack of financial and emotional support during child birth (Anthony O *et al* 2010).

Neonates born to a mother who practiced traditional religion was found have a significantly higher NMR compared to those who were either Muslims or Christians. The

peculiarity of those who practice traditional religion may be found in the beliefs and myths they may have concerning child birth and survival. Women who were multiparous had higher mortality rates than women who had given birth to just a child, this observation is in agreement with a study done by Ayede in Ibadan and Micheal Koenig in Banglaesh . Both researchers have extensively described the inverse relationship between multiparity and neonate death. In addition, neonates born to young fathers between the ages of 16-27 recorded higher mortality than neonates born to more matured fathers, this observation might be due to inexperience and lack of awareness of the fathers on childbirth and related issues which might lead to making uninformed and ill advised decisions about the health of the mother and newborn. Consequently, resulting in an increased morbidity or mortality of the neonate. The educational level the father also showed similar pattern, as fathers with a higher level of education i.e. secondary and above had the lowest mortality rates. Few studies have investigated association between paternal factors and neonatal mortality.(Gbenga A.K *et al*, 2014).

Studies in Nigeria have not sufficiently investigated the association between community-level factors and neonatal mortality at a national level even though community-level factors have been shown to be associated with neonatal mortality and morbidity (Ngianga et al 2014) and(Mandana Zafari, 2012). The community level factors examined in this study were geopolitical zone, wealth-index, place of residence and literacy. However, in the multivariate analysis only place of residence had a significant association with neonatal mortality as women living in rural communities had a 30% risk of experiencing neonatal death compared to urban dwelling women.

There are numerous likely explanations for this association as dwelling in a rural community where illiteracy and poverty coexist will influence neonatal survival via multiple channels. People living in the same community with socioeconomic deprivation tend to be similar in terms of health outcomes because of the shared community characteristics which may mediate its impact through poor access to health care services, inability to afford health care costs, poor personal and environmental hygiene, poor nutrition, ignorance of the importance of health care services and more (Deshpande J et al,2012). Community factors will exact their effect on the health outcome (neonatal-mortality) through the individual-level factors(Ellen V D *et al* 2009) It is expected that the community one lives plays a paramount role in determining

access to health institution. (Buor,2004) explained that rural areas were always experiencing a poorer health status and the greater need for health services which cannot be found in their vicinity.

Place of residence has been observed as important factors that will influence the use of the health facilities in Nigeria. Most of those in the rural areas may not have access to the health care facilities. It was also observed that there is an unequal distribution of these health facilities between urban and rural areas in the country. In a study done in Ondo State Nigeria, (Iyun *et. al.* 2002) observed that there is disparities in the distribution of both hospitals and the lower health facilities. Some LGAs have an excess share of the health facilities relative to their population. The spatial variation in the allocation of health facilities is also reflected in the provision of hospital beds, nurses and doctors, despite the substantial increase in man power resources in the country. WHO (2006) explained that, one of the problems affecting the health sector is the unbalanced distribution of health professionals to the benefit of urban centers. Also, some categories of health manpower are in short supply in the rural areas. There exists an uncomfortable mix of under-utilization and over-utilization of the skills of health professionals depending on the geographic location as it was observed in this study that 88% of the mothers were attended to by unprofessional and unskilled birth attendant.

The poorest household wealth index quintile was identified as a risk factor for neonatal mortality in this study. Similar to this finding, a secondary analysis of Sudan DHS has also found lower household wealth index as a risk factor for neonatal mortality (Bashir A.O 2010). House hold poverty has been reported to increase neonatal mortality either by increasing the prevalence of risk factors like maternal infections or through reducing access to effective care.

It was observed in this study that 95% of the women reported breastfeeding their neonates Consequently, it was protective against neonatal mortality while babies who were not breastfed had a 70% chance of neonatal death, an observation supported by a study in sub Saharan Africa (Astha R. 2014). It was found in this study that women who had longer birth interval (>24months) had lower risk of experiencing neonatal death and reported a lower NMR (30 9) compared to those whose birth spacing was less than 24 months. This might be attributed

to the fact that women who allowed more time before another birth gives opportunity for the full recovery of their body nutrient before going into childbirth.(Amosu A.M, 2014).

After controlling for several confounders it was observed that babies of multiple gestation were five times more likely not to survive during neonatal period compared to singleton births as previously reported in studies from sub Saharan Africa (Jahn, 2006; Diallo, 2011. The plausible explanation for this association is that multiple births have a higher risk of prematurity and being too small for gestational age. These conditions will put the babies at risk of medical complications which might not be adequately managed in rural settings.

Distance of the mothers residence to a health facility was also found to be significant as mother who resided far from a health facility were 1.2 times more likely to experience neonatal death. Studies which were mainly community based have reported this association (Deshpande J 2011). Contrary to public belief however, increased neonatal mortality risk was associated with deliveries in health facilities compared with home deliveries. Similar findings have been reported in other countries.(Titaley, 2012; Hatt, 2009) (Yared M 2013). An explanation for this could be the referral of pregnant women who already have complications to these health facilities. Moreover, the excess mortality in health facilities is alarming and raises concern about the quality and preparedness of the emergency obstetric and newborn care services.(Mohammed BS, Olugbenga AM 2014).

In support of similar studies (Osita K.E 2014; Zwane E M 2007) this study shows that neonates delivered by caesarean section had 80% risk of dying during birth with a NMR of 72.8, compare to those delivered vaginally. This result contradicts previous report which indicated a statistically insignificant relationship between mode of delivery and neonatal death (seedhom AM, 2008). The significantly high risk of neonatal mortality in this study might be due to low knowledge, negative perception and aversion to the risk of caesarian section among Nigerian women (Sunday A, and Kalu A, 2011). This corroborates a recent study on Caesarean section on maternal request in north-eastern part of Nigeria which found that most neonatal deaths was experienced by mothers who delivered through emergency caesarian sections. It was

also found that unavailability of skilled birth attendant puts the baby at a greater risk (1.23 times) of death before the age of one month.

A multi-country study by (Francesca C *et al*, 2013) also confirmed that countries in sub-Saharan Africa generally have few skilled workers able to perform surgery including caesarean sections and most of qualified doctors live in urban areas. The study also noted that, caesarean delivery rates were extremely low among both the richer and poorer women who lived in rural areas, where structural and workforce constraints may be the most important barriers to access. A woman's ability to pay for the surgery is thought to be an important determinant of caesarean deliveries as the cost of emergency caesarean sections can be tragic for households. Although user fee exemptions have been one of the key strategies to increase access to delivery care in sub-Saharan Africa but it has not been fully operationalized.

Mothers that possessed good health seeking behavior such as having tetanus toxoid during pregnancy; and received skilled antenatal, delivery and postnatal care have been shown to reduce the chances of neonatal death among their siblings (Titaley C. *et al* 2008; Feng X, 2011). The impact of birth spacing, breastfeeding and utilization of antenatal, delivery and postnatal services have clearly demonstrated the possible impact of the continuum of care approach (Joy E et al 2005) from antenatal to postnatal life on the survival and well-being of newborns. Mothers with good health seeking behavior will have a better uptake of the components of this approach from antenatal to postnatal care, as they will be more likely to receive tetanus toxoid, breastfeeding counseling, birth preparedness, blood supplements, skilled delivery, birth spacing, immediate neonatal care for the betterment of their lives and that of their babies.

Utilization of postnatal services were inversely related to neonatal mortality. Neonates of mothers that utilized these health services were found to have 50% lesser risk of losing their babies as the health of a neonate deteriorates considerably faster than the health of an adult. However, neonates also recover very fast if appropriate intervention is received as early as possible. Thus, it is important that mothers seek health intervention promptly in case of illness to save the lives of their infants. Most of the maternal health indicators that were operationalized to generate maternal health seeking behavior have been shown to have a similar influence on neonatal mortality though not significant in this study.

5.2 STRENGTH AND LIMITATION OF THIS STUDY

The major strengths of this study is the fact that it is based on nationally representative data which could easily be generalized to the entire country. It is one of the few attempts at assessing the progress in determinants and effects on childhood mortality in Nigeria. But before interpreting this study, Some limitations needs to be taken into consideration. Firstly, the analyses were based on cross-sectional data, therefore causal effect between the factors analyzed and childhood mortality could not be measured. Furthermore, only surviving mothers were interviewed which could have led to gross underreporting of neonatal death for instance mothers that died during labor due to obstetric complications would have been omitted in this current analysis implying that the burden of neonatal mortality especially early neonatal death could be larger than expected.

5.3 CONCLUSION

This study examined nationally representative data on neonatal mortality over half a decade by analyzing a dataset of the 2013 Nigerian demographic and health surveys. The outcomes of this study shows that both community and individual (neonatal, maternal, antenatal, delivery and postnatal) level factors to be significantly associated with infant survival within the first 28 days of life Analysis has shown that factors such as home delivery, unskilled delivery assistance, multiple gestation, overweight, high birth order, lack of breastfeeding, inadequate education, unavailability of financial resources, improper delivery practices, cesarean mode of delivery are risk factors contributing to neonatal death while factors such as higher educational status, professional delivery, vaginal delivery and breastfeeding were shown to reduce chances of neonatal mortality

5.4 RECOMMENDATIONS

The findings in this study have important policy implications to achieve optimum neonatal care within the constraints of the economic situation of the country reduction of neonatal mortality could be achieved in Nigeria by Starting' with family-community care with a substantial improvement in female education, environmental health and birth practices. Many of these factors are at the core of the MDG , in which Nigeria is rated as having not made sufficient progress.

Birth spacing needs to be widely promoted in the country while quality maternal and child health services should also be made affordable and available to curb the risks associated with multiple births and other complications. public awareness campaigns by the Nigerian Health Ministry and other relevant agencies may be useful in educating rural dwellers, especially those into traditional religion, on some basic issues in maternal and child health including gender equality.

Finally the disparity in neonatal deaths between rural and urban areas should suggest to the Nigerian government that more needs to been done to attain socioeconomic equality in the rural areas particularly in the area of quality, affordable and accessible neonatal and child health facilities. Although reducing neonatal mortality is only one aspect in the drive to reduce childhood mortality by two thirds in 2015 in line with the MDG, it will be an essential step which must be taken if sustainable progress is to be made as regards child health.

REFRENCES

Am J Public Health1998 Aug;88(8):1168-74

Antai, D. 2008. Individual and contextual -level determinants of social inequalities in under-five mortality in Nigeria: differentials by religious affiliation of the mother. World Health & Population 10.4: 39-52.

Antai, D., and Antai, J. 2008. Individual- and contextual-level determinants of social inequities in under-five mortality in Nigeria: differentials by religious affiliation of the mother. World Health and Population 10.4: 38-52

Bhattacharya, B., Singh, K.K. and Singh, U. (1995) Proximate determinants of fertility in Eastern Uttar Pradesh. Human Biology, 67, 867–886

Caldwell, J. C. 1979. Education as a factor in mortality decline: an examination of Nigerian data. Population Studies 33.3.395-413.

Caulfield LE, Stoltzfus RJ, Witter FR Implications of the Institute of Medicine weight gain recommendations for preventing adverse pregnancy outcomes in black and white women.

Cecilia S Acuin, Geok Lin Khor, Tippawan Liabsuetrakul, Endang L Achadi, Thein Thein Htay, Rebecca Firestone, Zulfi qar A Bhutta. Maternal, neonatal, and child health in southeast Asia; towards greater regional collaboration; Lancet 2011: 377; 516–25.

Chowdhury, A.R. (1988) The infant mortality–fertility debate: some international evidence, Southern Economic Journal, 54, 666–74

David R Marsh, Gary L. Darmstadt, MS Judith Moore Pat Daly, David Oot, Anne Tinker. Advancing Newborn Health and Survival in Developing Countries: A Conceptual Framework: JournalofPerinatology2002;22:572–576

Folasade Iyun (1988) Inequalities in health care in Ondo State, Nigeria Health Policy and Planning, 3(2): 159-163

Gbenga A Kayode, Evelyn Ansah, Irene Akua Agye pong Mary Amoakoh-Coleman Diede rick E Grobbee and Kerstin K lipstein- Grobusch. Individual and community determinants of neonatal mortality in Ghana: a multi level analysis BMC Pregnancy and Childbirth 2014, 14:165.

Iyewumi Titilope Adeyele, Donald Ikenna Ofoegbu,, Infant and Child Mortality in Nigeria: An Impact Analysis, International Journal of Economic Practices and Theories, Vol. 3, No 2, 2013 (April), e-ISSN 2247–7225

Joy E. Lawna, Anne CC Leeb, Mary Kinneya, Lynn Sibleyc, Wally A Carlod, Vinod K Paule, Robert Pattinson f, Gary L Darmstadt : Two million intrapartum-related still births and neonatal deaths: Where, why, and what can be done: International Journal of Gynecology and Obstetrics107(2009)S5–S19

krammer MS. intrauterine uterine growth and gestational duration determinants. paediatrics,1987;vol.(80):502-506.

Merriam- webster dictionary 2007.

Mesike, Chukwunwike Godson, Mojekwu, Joseph Nnamdi: Environmental Determinants of Child Mortality in Nigeria, Journal of Sustainable Development, vol. 5, No. 1; January 2012.

Mohammed Zakir and Phanindra V. Wunnava; Factors affecting infant mortality rates: evidence from cross-sectional data; Applied Economics Letters, 1999, 6, 271–273.

Mosley, W., and Chen, L. C. 1984. An analytical framework for the study of child survival in developing countries. Population and Development Review 10.suppl: 25-45

Mulholland K. Serious infections in young infants in developing countries.Vaccine 1998;16:1360-2

Narayanan I, Prakash K, Murthy NS, Gujral VV. Randomized controlled trial of effect of raw and holder pasteurized human milk and of formula supplements on incidence of neonatal infection.Lancet1984 Nov 17;2(8412):1111-3

National and State Population Housing Tables: Priority Tables Volume I. . 2006 Population and Housing Census of the Federal Republic of Nigeria. Abuja: National

National Population Commission [Nigeria]. 2000. Nigeria Demographic and Health Survey 1999. Calverton, Maryland: National Population Commission and ORC Macro International.

Nigeria Demographic and Health Survey 2003. National Population Commission and ORC Macro International, Calverton MD.

Osita K.E, Kingsley E.A, Michael J.D, John H and Andrew N. Determinants of neonatal mortality in Nigeria: evidence from the 2008 demographic and health survey BMC Public Health 2014, 14:521

Quamrul Hasan Chowdhury, Rafiqul Islam* and Kamal Hossain: Socio-economic determinants of neonatal, post neonatal, infant and child mortality. International Journal of Sociology and Anthropology Vol. 2(6), pp. 118-125, June 2010

Rudolf Knippenberg, Joy E Lawn, Gary L Darmstadt, Genevieve Begkoyian, Helga Fogstad, Netsanet Waelign, Vinod K Paul, for the Lancet Neonatal Survival Steering Team,

Systematic scaling up of neonatal care in countries; Published online March 3,2005 http://image.thelancet.com/ extras/05art1164web.pdf

Rutstein, S. 2005. Effects of preceding birth intervals on neonatal, infant and under-five years mortality and nutritional status in developing countries: evidence from the demographic and health surveys. International Journal of Gynecology & Obstetrics 89: 7-24

Susser M, Stein Z. Timing in prenatal nutrition: a reprise of the Dutch Famine Study. Nutr Rev1994 Mar;52(3):84-94

Taha TE, Dallabetta GA, Canner JK, Chiphangwi JD, Liomba G, Hoover DR, Miotti PG. The effect of human immunodeficiency virus infection on birth-weight, and infant and child mortality in urban Malawi. Int J Epidemiol1995 Oct;24(5):1022-9ss

Tinuade A. Ogunlesi (2005): The Pattern Of Utilization Of Prenatal And Delivery Services In Ilesa, Nigeria. The Internet Journal of Epidemiology. Volume 2 Number 2

Titaley CR, Dibley MJ, AghoK, Roberts C L ,Hall J :Determinants of neonatal mortality in Indonesia .BMC Public Health 2008,8:232.

United Nations Development Programme(UNDP):United Nations Human Development Report2011: Sustainability and Equity :A Better Future for All. New York; 2011.

United nations: The Millennium Development Goals Report 2012. NewYork; 2012

Uthman OA, Moradi T, Lawoko S: The independent contribution of individual-,neighbourhood-,and country-level socioeconomic position on attitudes towards intimate partner violence against women in sub-Saharan Africa: a multilevel model of direct and moderating effects. SocSciMed2009,68(10):1801–1809

WHO 2004. Maternal Mortality in 2000 Estimates developed by WHO, UNICEF and UNFPA, Geneva.

Worldbank. (2012). Education Statistics: Nigeria. Education MDG monitor Retrieved 24/07/2012, from http://go.worldbank.org/KHYE9TME80.

YV Pradhan, Shyam Raj Upreti, Naresh Pratap KC, Ashish KC, Neena Khadka, Uzma Syed, MaryVKinney, Ramesh Kant Adhikari, Parashu Ram Shrestha, Kusum Thapa, Amit Bhandari, KristinaGrear, Tanya Guenther and Stephen N Wall for the Nepal Newborn Change and Future Analysis Group,2012.

SECTION 2. REPRODUCTION

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
201	Now I would like to ask about all the births you have had during your life. Have you ever given birth?	YES ..... 1 NO 2	→ 206
202	Do you have any sons or daughters to whom you have given birth who are now living with you?	YES ..... 1 NO 2	→ 204
203	How many sons live with you? And how many daughters live with you? IF NONE, RECORD '00'.	SONS AT HOME ..... DAUGHTERS AT HOME	
204	Do you have any sons or daughters to whom you have given birth who are alive but do not live with you?	YES ..... 1 NO 2	→ 206
205	How many sons are alive but do not live with you? And how many daughters are alive but do not live with you? IF NONE, RECORD '00'.	SONS ELSEWHERE ..... DAUGHTERS ELSEWHERE	
206	Have you ever given birth to a boy or girl who was born alive but later died? IF NO, PROBE: Any baby who cried or showed signs of life but did not survive?	YES ..... 1 NO 2	→ 208
207	How many boys have died? And how many girls have died? IF NONE, RECORD '00'.	BOYS DEAD ..... GIRLS DEAD	
208	SUM ANSWERS TO 203, 205, AND 207, AND ENTER TOTAL. IF NONE, RECORD '00'.	TOTAL	
209	CHECK 208: Just to make sure that I have this right: you have had in TOTAL _____ births during your life. Is that correct? YES → NO → PROBE AND CORRECT 201-208 AS NECESSARY.		
210	CHECK 208: ONE OR MORE BIRTHS → NO BIRTHS →		→ 226

211 Now I would like to record the names of all your births, whether still alive or not, starting with the first one you had.
RECORD NAMES OF ALL THE BIRTHS IN 212. RECORD TWINS AND TRIPLETS ON SEPARATE LINES.
(IF THERE ARE MORE THAN 12 BIRTHS, USE AN ADDITIONAL QUESTIONNAIRE, STARTING WITH THE SECOND ROW).

212 What name was given to your (first/next) baby? RECORD NAME BIRTH HISTORY NUMBER	213 Is (NAME) a boy or a girl?	214 Were any of these births twins?	215 In what month and year was (NAME) born? PROBE: What is his/her birthday?	216 Is (NAME) still alive?	217 IF ALIVE: How old was (NAME) at his/her last birthday? RECORD AGE IN COM-PLETED YEARS.	218 IF ALIVE: Is (NAME) living with you?	219 IF ALIVE: RECORD HOUSE-HOLD LINE NUMBER OF CHILD (RECORD '00' IF CHILD NOT LISTED IN HOUSE-HOLD).	220 IF DEAD: How old was (NAME) when he/she died? IF '1 YR', PROBE: How many months old was (NAME)? RECORD DAYS IF LESS THAN 1 MONTH, MONTHS IF LESS THAN TWO YEARS; OR YEARS.	220A In what month and year did (NAME) die?	221 Were there any other live births between (NAME OF PREVIOUS BIRTH) and (NAME), including any children who died after birth?
01	BOY 1 GIRL 2	SING 1 MULT 2	MONTH .. YEAR	YES . . 1 NO . . . 2 → 220	AGE IN YEARS	YES . . . 1 NO 2	HOUSEHOLD LINE NUMBER (NEXT BIRTH)	DAYS . . . 1 MONTHS 2 YEARS . . 3	MONTH YEAR	
02	BOY 1 GIRL 2	SING 1 MULT 2	MONTH YEAR	YES . . 1 NO . . . 2 → 220	AGE IN YEARS	YES . . . 1 NO 2	HOUSEHOLD LINE NUMBER (GO TO 221)	DAYS . . . 1 MONTHS 2 YEARS . . 3	MONTH YEAR	YES . . . . 1 ADD BIRTH NO . . . . . 2 NEXT BIRTH
03	BOY 1 GIRL 2	SING 1 MULT 2	MONTH YEAR	YES . . 1 NO . . . 2 → 220	AGE IN YEARS	YES . . . 1 NO 2	HOUSEHOLD LINE NUMBER (GO TO 221)	DAYS . . . 1 MONTHS 2 YEARS . . 3	MONTH YEAR	YES . . . . 1 ADD BIRTH NO . . . . . 2 NEXT BIRTH
04	BOY 1 GIRL 2	SING 1 MULT 2	MONTH YEAR	YES . . 1 NO . . . 2 → 220	AGE IN YEARS	YES . . . 1 NO 2	HOUSEHOLD LINE NUMBER (GO TO 221)	DAYS . . . 1 MONTHS 2 YEARS . . 3	MONTH YEAR	YES . . . . 1 ADD BIRTH NO . . . . . 2 NEXT BIRTH
05	BOY 1 GIRL 2	SING 1 MULT 2	MONTH YEAR	YES . . 1 NO . . . 2 → 220	AGE IN YEARS	YES . . . 1 NO 2	HOUSEHOLD LINE NUMBER (GO TO 221)	DAYS . . . 1 MONTHS 2 YEARS . . 3	MONTH YEAR	YES . . . . 1 ADD BIRTH NO . . . . . 2 NEXT BIRTH
06	BOY 1 GIRL 2	SING 1 MULT 2	MONTH YEAR	YES . . 1 NO . . . 2 → 220	AGE IN YEARS	YES . . . 1 NO 2	HOUSEHOLD LINE NUMBER (GO TO 221)	DAYS . . . 1 MONTHS 2 YEARS . . 3	MONTH YEAR	YES . . . . 1 ADD BIRTH NO . . . . . 2 NEXT BIRTH
07	BOY 1 GIRL 2	SING 1 MULT 2	MONTH YEAR	YES . . 1 NO . . . 2 → 220	AGE IN YEARS	YES . . . 1 NO 2	HOUSEHOLD LINE NUMBER (GO TO 221)	DAYS . . . 1 MONTHS 2 YEARS . . 3	MONTH YEAR	YES . . . . 1 ADD BIRTH NO . . . . . 2 NEXT BIRTH

212	213	214	215	216	217	218	219	220	220A	221
What name was given to your next baby? RECORD NAME BIRTH HISTORY NUMBER	Is (NAME) a boy or a girl?	Were any of these births twins?	In what month and year was (NAME) born? PROBE: What is his/her birthday?	Is (NAME) still alive?	IF ALIVE: How old was (NAME) at his/her last birthday? RECORD AGE IN COMPLETED YEARS	IF ALIVE: Is (NAME) living with you?	IF ALIVE: RECORD HOUSEHOLD LINE NUMBER OF CHILD (RECORD '00' IF CHILD NOT LISTED IN HOUSEHOLD).	IF DEAD: How old was (NAME) when he/she died? IF '1 YR', PROBE: How many months old was (NAME)? RECORD DAYS IF LESS THAN 1 MONTH, MONTHS IF LESS THAN TWO YEARS, OR YEARS.	In what month and year did (NAME) die?	Were there any other live births between (NAME OF PREVIOUS BIRTH) and (NAME), including any children who died after birth?
08	BOY 1 GIRL 2	SING 1 MULT 2	MONTH ☐☐ YEAR ☐☐☐☐	YES . . 1 NO . . . 2 → 220	AGE IN YEARS ☐☐	YES . . . 1 NO 2	HOUSEHOLD LINE NUMBER ☐☐ → (GO TO 221)	DAYS . . . 1 MONTHS 2 YEARS . . 3 ☐☐	MONTH ☐☐ YEAR ☐☐☐☐	YES . . . . 1 ADD BIRTH NO . . . . . 2 NEXT BIRTH
09	BOY 1 GIRL 2	SING 1 MULT 2	MONTH ☐☐ YEAR ☐☐☐☐	YES . . 1 NO . . . 2 → 220	AGE IN YEARS ☐☐	YES . . . 1 NO 2	HOUSEHOLD LINE NUMBER ☐☐ → (GO TO 221)	DAYS . . . 1 MONTHS 2 YEARS . . 3 ☐☐	MONTH ☐☐ YEAR ☐☐☐☐	YES . . . . 1 ADD BIRTH NO . . . . . 2 NEXT BIRTH
10	BOY 1 GIRL 2	SING 1 MULT 2	MONTH ☐☐ YEAR ☐☐☐☐	YES . . 1 NO . . . 2 → 220	AGE IN YEARS ☐☐	YES . . . 1 NO 2	HOUSEHOLD LINE NUMBER ☐☐ → (GO TO 221)	DAYS . . . 1 MONTHS 2 YEARS . . 3 ☐☐	MONTH ☐☐ YEAR ☐☐☐☐	YES . . . . 1 ADD BIRTH NO . . . . . 2 NEXT BIRTH
11	BOY 1 GIRL 2	SING 1 MULT 2	MONTH ☐☐ YEAR ☐☐☐☐	YES . . 1 NO . . . 2 → 220	AGE IN YEARS ☐☐	YES . . . 1 NO 2	HOUSEHOLD LINE NUMBER ☐☐ → (GO TO 221)	DAYS . . . 1 MONTHS 2 YEARS . . 3 ☐☐	MONTH ☐☐ YEAR ☐☐☐☐	YES . . . . 1 ADD BIRTH NO . . . . . 2 NEXT BIRTH
12	BOY 1 GIRL 2	SING 1 MULT 2	MONTH ☐☐ YEAR ☐☐☐☐	YES . . 1 NO . . . 2 → 220	AGE IN YEARS ☐☐	YES . . . 1 NO 2	HOUSEHOLD LINE NUMBER ☐☐ → (GO TO 221)	DAYS . . . 1 MONTHS 2 YEARS . . 3 ☐☐	MONTH ☐☐ YEAR ☐☐☐☐	YES . . . . 1 ADD BIRTH NO . . . . . 2 NEXT BIRTH

222	Have you had any live births since the birth of (NAME OF LAST BIRTH)? IF YES, RECORD BIRTH(S) IN TABLE.	YES . . . . . 1 NO 2
223	COMPARE 208 WITH NUMBER OF BIRTHS IN HISTORY ABOVE AND MARK: NUMBERS ARE SAME ☐ → NUMBERS ARE DIFFERENT ☐ (PROBE AND RECONCILE)	
223A	CHECK 220A: ANY DEATHS IN JANUARY 2009 OR LATER? YES ☐ → NO ☐ SKIP TO 224	
223B	CHECK 220: ENTER THE NUMBER OF DEATHS THAT HAPPENED IN DAYS, MONTHS AND 2-4 YEARS. IF NONE, RECORD '0'.	☐
224	CHECK 215: ENTER THE NUMBER OF BIRTHS IN 2008 OR LATER.	NUMBER OF BIRTHS . . . . . ☐ NONE . . . . . 0 → 226