SHORT-TERM OUTCOMES OF ASPHYXIA IN PRETERM NEONATES RECEIVING CARE AT NEWBORN UNIT, KENYATTA NATIONAL HOSPITAL

CALEB WILLIAM MADARA

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A RESEARCH THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE CONFERMENT OF MASTER OF SCIENCE (PEDIATRIC NURSING) DEGREE IN THE SCHOOL OF NURSING OF THE UNIVERSITY OF NAIROBI

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DECLARATION

I Caleb William Madara hereby declare that this project is my original work and has not been submitted for award of degree in any university or forum.

Signature …… Date ……

CERTIFICATE OF APPROVAL

We, the undersigned certify that this proposal has been submitted for the degree in Masters of Science in Nursing (Pediatric Nursing) of the University of Nairobi with our approval as internal supervisors.

Dr. Abednego Alibiri Ongeso.

PhD, MScN, BScN

Lecturer, School of Nursing Sciences,

University of Nairobi

Sign_____ Date_____

Prof. Grace Omoni

PhD, MSc, BScN

Associate Professor, School of Nursing Sciences,

University of Nairobi

Sign_____ Date_____

DEDICATION

This thesis is dedicated to my beloved parents Aggrey and Carren Madara.

Wife (Jackie) and our three bundles of joy; Victoria, Alvin and Nevine.

To my eldest brother Victor, thank you for inspiring me to always aim for the star!

To the rest of my sibling Jackline, Kennedy, Collins and Sarah - I cherish you people more than you ever imagine.

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I would like to thank God Almighty for sustenance, grace and sound health.

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Last but not least, I cannot fail to thank my adorable wife Jacky, our lovely kids Victoria, Alvin and Nevine by whose love, patience and relentless prayer this project was accomplished.

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ABBREVIATIONS AND ACRONYMS

AAP	American Academy of Pediatrics
AHA	American Heart Association
ALARM	Advances in Labor and Risk Management
ANC	Antenatal Clinic
APA	American Pediatric Association
EmonC	Emergency Obstetric and Newborn Care
ETAT	Emergency Triage Assessment and Treatment of serious illness
HBB	Helping Babies Breath
HIE	Hypoxic Ischemic Encephalopathy
ILCOR	International Liaison Committee on Resuscitation
KDHS	Kenya Demographic Health Survey
KNBS	Kenya National Bureau of Statistics
KNH	Kenyatta National Hospital
NBU	Newborn Unit
NICU	Neonatal Intensive Care Unit
NRP	Neonatal Resuscitation Program
PALS	Pediatrics Advance Life Support
SPSS	Statistical Package for Social Science
WHO	World Health Organization

OPERATIONAL DEFINITION OF TERMS

APGAR score:

A system of grading newborn's physiologic characteristics by way of inspection and auscultation to determine response to environmental stimuli against a score of 0-10 performed at the first and fifth minute after birth.

Birth asphyxia:

Failure of a neonate to initiate and sustain breathing at time of birth with an APGAR score of less than 7 at 5^{th} minute of birth. This study will take into account preterm neonates diagnosed with birth asphyxia from maternity ward and elsewhere

Co-comorbid:

Any chronic or acute medical condition occurring prior to or alongside current diagnosis of birth asphyxia.

Neonatal death:

Death of an infant that occurs within the first twenty-eight days of life.

Pre-term neonate:

A baby born before 37 complete weeks of gestation and weighing more than 400gm.

Resuscitation:

Medical intervention performed at the time of birth to enable infant to initiate and maintain circulation by way of stimulation or through the use of bagging, chest compression and ventilation.

Short-term outcome:

Clinical improvement leading to hospital discharge, presence of neurodevelopmental signs or death within the first 7 days following resuscitation to correct birth asphyxia.

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ABSTRACT:

Background: Neonatal resuscitation plays a major role in preventing neonatal death due to asphyxia. Globally, it is estimated that out of 2.5 million neonatal deaths that occur annually, 28% of which is attributed to preterm delivery and 24% result from perinatal asphyxia. However, despite Kenyatta National Hospital being a teaching and referral hospital providing specialty neonatal care, there is paucity of data on short term outcomes of asphyxia in pre-term neonates hence the need this study.

Objective: This study aimed at determining short-term outcomes of birth asphyxia in preterm neonates receiving care at Kenyatta National Hospital Newborn Unit.

Methods: A hospital-based descriptive cross-sectional study was conducted between the month of June and July 2019 involving mother-infant pair of preterm neonates with asphyxia (n=36) selected purposively and Nurses working in the newborn unit (n=52) selected via systematic random technique. Maternal socio-demographic characteristics and nurses' characteristics were collected using semi-structured questionnaire and a separate checklist used to capture daily neurological assessment for infant in the first seven days of life. Data collected were analyzed using STATA version 14, descriptive and inferential statistics calculated using Odds Ratio with bivariate and multinomial logistic regression applied to independent variables with level of significance set at 95% Confidence Interval and p value = ≤ 0.05.

Results: Out of 34 infant mothers that took part in the study, advanced maternal age (AOR =3.3, 95% CI [-1571.4-1577.9]), distance from medical facility (AOR = -32, 95% CI [-20829.8-20765.5]), low income status (AOR = -23, 95% CI [-25.8-21,4]) and anemia in pregnancy (AOR=12.8, 95% CI[-18048.2-18073.7]) was shown to increase the risk for adverse neonatal outcome. By the end of day seven of life, 55.8% of neonates (n=19) had recovered and got discharged, 35.2 % (n=12) continued treatment and 9% (n=3) had expired. Neonatal characteristics such as decreased birth weight (AOR= 0.17, 95% CI [-1054957-1054958]), low APGAR score (AOR= -91.01, 95% CI [0.23-8.1]) and poor monitoring of vital signs (AOR= -1.17, 95% CI [-8.04-8.0]) in neonates was found to influence neonatal outcome. There was no significant statistical association between knowledge of nurses on preterm asphyxia and its management in relation to neonatal outcome (p=0.635). Similarly, no significant statistical association was found to exist between nurses' practice regarding immediate care of asphyxiated neonate and neonatal outcome (p=0.512).

Conclusion: In Kenyatta National Hospital, the mortality rate of asphyxia in preterm neonates was found to be 9 % with morbidity rate of 35% on day seven of life and this was largely determined by maternal and neonatal risk factors rather nurse's knowledge and practice on management of asphyxia.

Recommendations*:* There is need to strengthen prevention of anemia in pregnancy and identification of risk factors associated with preterm asphyxia. Nurses should practice strict observation of vital signs in high risk neonates to improve outcome. Prompt treatment of hypoglycemia and sepsis in preterm neonate can help prevent neonatal morbidity and mortality in early neonatal period.

CHAPTER ONE: INTRODUCTION

1.0 Introduction

This chapter discusses background of the study, problem statement, study significance, justification and objectives as used in the study. It also highlights assumptions and limitation of the study including theoretical framework and conceptual model at tail end of the chapter.

1.1 Background of the study

Birth asphyxia, which is defined by World Health Organization (WHO) as failure to initiate and sustain breathing at the time of birth is a major health concern responsible for nearly 2.5 million neonatal death annually (World Health Organization., 2018).

Current demographic estimates by WHO state that close to 30% of neonates born in the developing countries are at risk of suffering from short and long-term effect associated with birth asphyxia. Astonishingly, another 1.3 million neonates die from complications of prematurity which is largely dependent on resuscitation as a means of survival (Ibrahim, Muhye and Abdulie, 2018).

At global level, incidence rate of asphyxia in the developed countries remains as low as 0.1% in the United States, whereas in developing countries the rate is estimated to be much higher with less accurate documented findings. For instance, epidemiologic studies across a few selected African countries have revealed a quantum variation in the incidence rates of neonatal asphyxia among infants with Cape town and Niger reporting 4.6/1000 and 26/1000 live births respectively (Amritanshu *et al.*, 2014; Wayessa, Belachew, & Joseph, 2017).

Sub-Saharan Africa, according to Wayessa et al. (2017) accounted for 38% of global neonatal deaths, with newborn death rate estimated to be 34 deaths per 1,000 live birth by 2017. Report by Kenya National Bureau of Statistics (2014) stated that national neonatal mortality rate stood at

22 deaths per 1,000 live births against a perinatal mortality rate of 29 deaths per 1,000 pregnancies. This represented a marked decline of 24% in neonatal mortality rate from the previous 37 per 1,000 live birth in 2009.

Health demographic statistics by Every Preemie Scale, an Organization that provides practical catalytic intervention in low birth weights and preterm infants in 25 selected USAID priority countries, suggested that 193,00 babies are born in Kenya prematurely and another 13,300 under five children die annually from complications of prematurity (Every preemie scale, 2018). This is consistent with reports by national government on population demographics (Ministry of Health, 2016). However, this figure is far from the set target of 12 deaths per 1,000 live birth as envisioned by Sustainable Development Goal 3 (World Health Organization., 2018).

At birth when a fetus is unable to initiate spontaneous breathing, some form of resuscitation either basic or advanced may be applied to enable it adapt to extra uterine life, without which the neonate may die or suffer short or long-term brain impairment (Jneid *et al.*, 2017). When this happens, a nurse present will attempt to prevent hypoxic-ischemic process from settling in, by way of ensuring prompt establishment of spontaneous circulation and independent breathing within the first few minutes of newborn's life. This is done through provision of warmth, stimulation by drying, bag-valve-mask bagging, sucking noticeable secretion, chest compression and use of adrenaline with normal saline in very severe cases of asphyxia (Bansal et al., 2014; Bruckmann and Velaphi, 2015).

Some very common complications associated with asphyxia include Hypoxic Ischemic Encephalopathy (HIE), mental retardation (MR), cerebral palsy (CP), functional disabilities, deafness among others and vary with severity (Were, 2004; Namusoke, Nannyonga, Ssebunya, Nakibuuka, & Mworozi, 2018).

Clinical treatment with therapeutic hypothermia, administration of oxygen by continuous positive airway pressure (CPAP) mode, parenteral nutrition, electroencephalogram (EEG) monitoring and use of anticonvulsants have registered better outcome in neonates managed for moderate to severe hypoxic ischemic encephalopathy (Polderman, 2015; Namusoke et al., 2018).

Met analysis of studies in developing countries on care of asphyxia in preterm neonate has shown that additional training among nurses may decrease neonatal death significantly by performance of intervention such as drying, warming and stimulation for complete revival (Shikuku *et al.*, 2017).

1.2 Problem statement

Globally, 24% of the 2.5 million neonatal death that occur annually is attributed to birth asphyxia (World Health Organization., 2018). Several measures have been taken to reduce this trend one of which is to equip health workers with resuscitation skills for asphyxiated babies (Kattwinkel *et al.,* 2010).

Reports from Kenyatta National Health Record department reported neonatal mortality rate of 21 deaths per 1000 deaths which is higher than the required universal target of less than 12 deaths per 1,000 live births as per Sustainable Developmental Goal 3 (SDGs) (World Health Organization., 2018). Furthermore, there exist limited documented findings on short term outcome of asphyxia among preterm neonates in Kenyatta National Hospital.

A study by (Maalim, 2011) found a perinatal asphyxia rate of 31.1% and 6.7% morbidity rate in term infants admitted at Kenyatta National Hospital by day seven of life. Another study in Tanzania by (Moshiro *et al.*, 2018) found out that lack of team work, poor organizational skills, non-caring attitude and lack of joint decision-making approach was found to be a major hindrance to successful resuscitation of asphyxiated neonates.

The study therefore, aimed at determining short-term outcomes of asphyxia in preterm neonates receiving care at Kenyatta National Hospital Newborn Unit.

1.3 Justification

Death from birth asphyxia and prematurity is a health concern in the neonatal period both globally and locally. Sound knowledge on risk factors and preventive measures can help alleviate mortality and morbidity related to asphyxia and prematurity in the early neonatal period. A number of studies done previously have only focused on asphyxia in term neonates nursed in Kenyatta National Hospital (Kagwire, 2005). A study by Moshiro et al. (2018) found out that number of antenatal visits, educational background and place of birth was significant in determining adverse outcome in term neonates with birth asphyxia. Likewise, Alwar (2010) concluded that despite knowledge of newborn resuscitation being low among Kenyatta National Hospital nurses working in theatre and labor ward, they performed generally well in provision of warmth and ventilation of newborn using bag-mask-valve.

Other related studies have shown that having good knowledge on newborn resuscitation does not have significant impact on outcome of neonatal asphyxia (Otido, 2013; Kamau, 2018)

Therefore, this study topic was specifically chosen to determine short-term outcomes of asphyxia in preterm neonates receiving care at Kenyatta National Hospital Newborn unit which is a teaching and referral hospital with large volume of clientele. Data from this study will help broaden awareness among nurses on care of preterm neonates with asphyxia and form basis for policy agenda in improvement of maternal and neonatal care.

1.4 Study objectives

1.4.1 Broad Objectives

To assess determinants of short-term outcomes of asphyxia in preterm neonates receiving care in at Newborn Unit Kenyatta National Hospital.

1.4.2 Specific objectives

1. To assess maternal socio-demographic influence on outcome of birth asphyxia in preterm neonates receiving care at KNH NBU.
2. To establish neonatal factor, influence on short-term outcome of birth asphyxia in preterm neonates receiving care at KNH NBU.
3. To describe effect of nurses' knowledge and practice on short-term outcome of asphyxia in preterm neonates receiving care at KNH NBU.
4. To establish the infant co-morbidity factor, influence on pre-term neonates with diagnosis of birth asphyxia receiving care at NBU KNH.

1.5 Research Questions

1. What is the maternal socio-demographic influence on short-term outcomes of birth asphyxia in preterm neonates receiving care at KNH NBU?
2. What is the neonatal factor influence on short-term outcomes of birth asphyxia in preterm neonate receiving care at KNH NBU?
3. What is the relationship between nurses' knowledge and practice on short-term outcomes of birth asphyxia in preterm neonates receiving care at KNH NBU?
4. What is the relationship between neonatal co-morbidity and short-term outcomes of birth asphyxia in preterm neonates receiving care at KNH NBU?

1.6 Assumption

This researcher believed that the choice of hospital set-up was conducive and convenient for the collection of data for this particular study.

1.7 Limitation to the study

This was a cross-sectional descriptive hospital study to assess short-term outcome of asphyxia in preterm neonates receiving care at KNH NBU; a public teaching and referral hospital which had excluded other private, faith-based and public hospitals and therefore findings from this study could have had limited applicability to other health institutions offering emergency neonatal care besides Kenyatta National Hospital.

1.8 Significance of the Study

This study aimed at establishing most important risk factors to target and implement during admission of pre-term neonates with birth asphyxia. It also highlighted frequency and sequence of outcome of birth asphyxia in preterm neonates within the first seven days of hospital admission thus creating awareness and capacity building among nurses on post-resuscitation care of asphyxiated neonates. It also enabled stakeholders to identify efficient and cost-effective modalities that eased burden of care faced by mothers with asphyxiated babies through resource mobilization and communal participation. Knowledge generated from this study helped in providing scholarly benefit to nursing researchers in the field of neonatal care.

1.9 Theoretical Framework

The Donabedian model is a conceptual design that was adopted in this study since it could provide a framework for assessing and determining how certain actions affect a given outcome (Donabedian, 2015). When applied conceptually, it can be used to demonstrate fundamental interaction in selected variables that may lead to a particular outcome either good or bad (Sardasht *et al.*, 2013).

The model which was developed by Avedis Donabedian in the year 1966 and has since remained significant in the world of human and social science in assessing quality of health

care offered, despite others such as Health Behavior Model (Rosenstock, 1960), Bamako Initiative (Ebrahim, 1993), Theory of Planned Behavior which relates to process and outcome (Netemeyer and Ryn, 1991).

According to this model, Structure were described in the context in which care is delivered and incorporated elements such as staffing organization in the ward, availability of resuscitation equipment and hospital bed capacity; whereas the Process was defined as the way in which systems works to deliver a desired outcome such specific roles played by individual health care worker to achieve a pre-planned goal such as reduction of neonatal mortality and morbidity.

The outcome element was taken to reflect the impact of care on the patient as demonstrated by end product of given intervention such as resuscitation, provision of quality care and whether this was done in accordance to the planned objective. In the context of neonatal care, were mothers satisfied with care rendered or is the outcome poor leading to increased socioeconomic burden to patient's family, community and nation at large.

In this study the broad objective was to determine the short-term outcomes of asphyxia in preterm neonates receiving care at Kenyatta National Hospital New Born Unit. By adopting Donabedian approach, the researcher was able to explore factors that contributed to short-term outcomes of asphyxia in preterm neonates and further identified gaps that was to form basis for policy formulation.

The main weakness of this model despite its adoption into the was its inability to fully depict association existing between processes and outcome (Rubin, Pronovost and Diette, 2001). The researcher appreciated that other models and theories could have suited this study but Donabedian model was chosen out of personal preference and ease of applicability.

1.10 Conceptual Framework

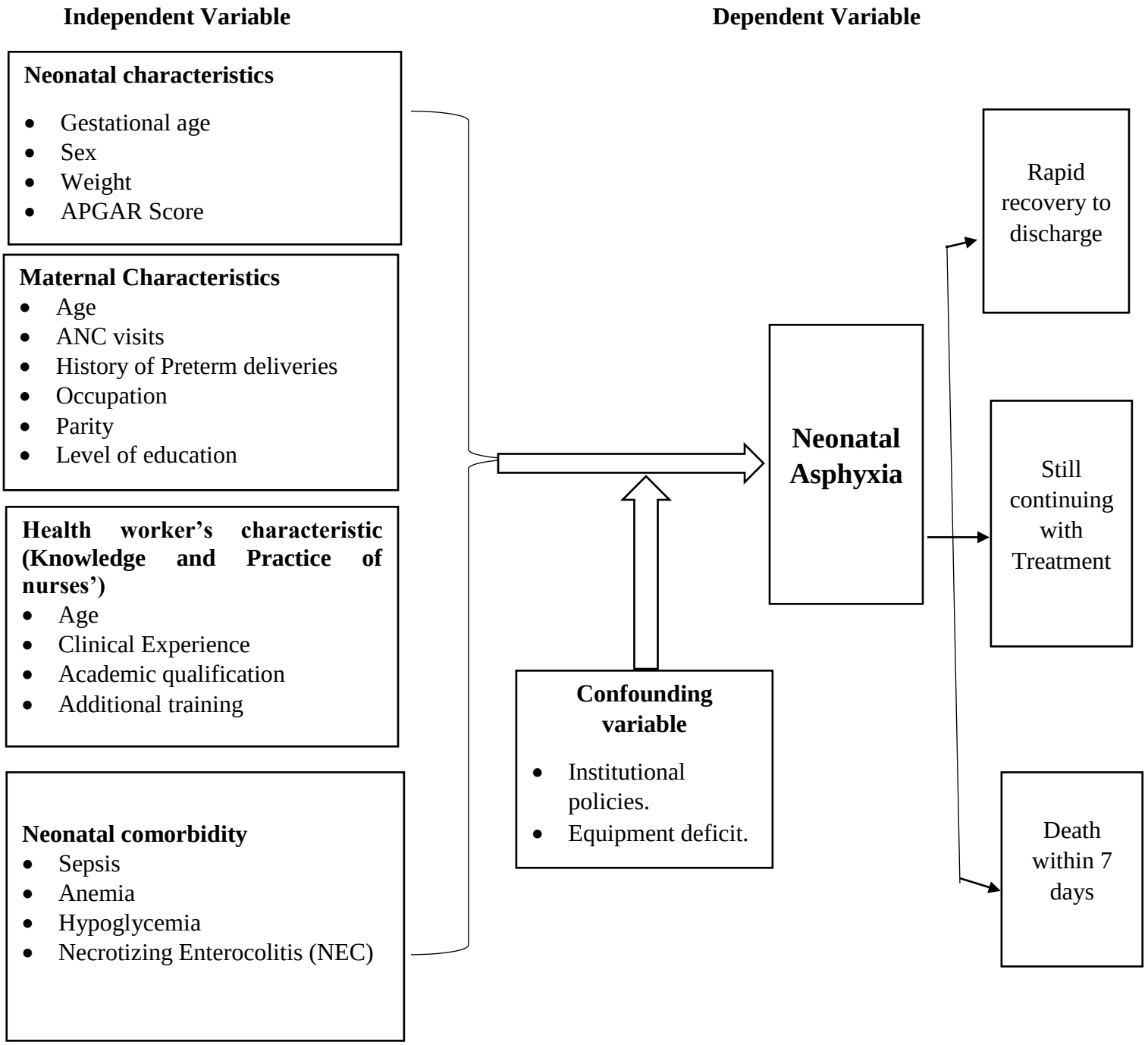

Figure 1:1: Conceptual Framework

1.10.1 Definition of conceptual variables

Any variable that when adjusted or manipulated causes an effect on dependent variable is termed as independent variable (Kothari, 2004). Neonatal characteristics, Maternal Socio-demographic characteristic, Nurse's knowledge and practice and presence of Neonatal Comorbidity were all representative of independent variable. Furthermore, these variables were captured through self-administer questionnaire to nurses, researcher-assisted questionnaire to infant's mother and infant's bio data form used to capture infant's characteristics.

Dependent was the variable that was being tested and measured and it was mostly affected by independent variable. In this study, dependent variable was taken as asphyxia outcome in preterm neonates and was categorized in three deferent levels i.e. rapid recovery to discharge, continuing treatment or death within first seven days of life. The researcher and his assistant used Daily Neonatal Neurologic Assessment Tool to check and tick observations noted up to the seventh day and provided a summary of the outcome. The data was then uploaded into the computer for analysis.

Neonatal characteristic included; gestational age, sex, birth weight, APGAR score as recorded on Infant Medical record. Maternal Characteristics included; Age, ANC visits, occupation, education level. Nurses' characteristic included; age, years of experience, academic qualifications etc. whereas neonatal comorbidity entailed presence of any medical condition at birth such as Anemia, Sepsis, and Hypoglycemia etc.

Confounding variable were those variables that appeared to influence both dependent and independent variable in a manner that would either mask or demonstrate an association that did not exist. In this study administrative policies such as admission criteria, equipment deficit and staff shortage were thought to represent presence of confounding variable in the study.

CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

This chapter explores statistics and findings relating to short-term outcome of preterm asphyxia as derived from sources such as PubMed, Hindawi, Medscape, Cochrane, University of Nairobi repository, Hinari, Google scholar, among others including unpublished thesis. The chapter also gives a broad definition of asphyxia, how it affects preterm neonates, its management and goes further to highlight factors that lead to poor outcome.

2.1 Introduction to birth asphyxia in preterm neonates

Asphyxia, which is defined by WHO as inability to initiate and sustain breathing at time of birth is a significant contributor to neonatal mortality and morbidity (WHO, 2018). According to (Tasew *et al.*, 2018), birth asphyxia can also be defined by the presence of 3 parameters namely; umbilical blood PH less than 7, APGAR score of between 4-6 and metabolic academia. APGAR score between 1-5 is significant in diagnosing asphyxia and the lower the value the higher the risk of developing neurologic disability (Dalili *et al.*, 2015a).

Multiple series of maternal, obstetric and fetal factors have been shown to cause asphyxia in the neonatal period accounting for 24% of neonatal deaths thus making it the second largest cause of neonatal mortality (Amritanshu *et al.*, 2014).

Improvement of primary health care delivery system in high-income countries such as United States have led to significant drop in the incidence rate of perinatal asphyxia to less 0.1% among newborn as compared to about 30% in developing countries (Amsterdam *et al.*, 2014). In Kenya, resource inequality and poor access of essential neonatal care is the primary cause of neonatal mortality and morbidity (Ministry of Health, 2016).

Studies have also shown that factors such as; inadequate resuscitation skills, lack of therapeutic hypothermia, shortage of Pediatric Intensive Care Unit (PICU) nurses, being unable to recognize very sick neonates, resource limitation, inefficient transport and referral system have all been implicated to cause adverse outcomes in preterm asphyxia especially in low income countries (Ibrahim et al., 2018; Jose and K, 2018).

In many instances, neonates that survive asphyxia tend to develop complications in the immediate postnatal period, which include convulsions, refusal to feed, blunted neurologic reflex and hypoxic ischemic encephalopathy (HIE) whose incidence is about 1-8% in high-income countries. Currently, incidence rate of HIE in middle and low-income countries vary from one country to another as data on this remains relatively scanty and inconclusive.

Clinical treatment with therapeutic hypothermia and low supplemental oxygen administration of 21% and not 100% have registered better outcome in management of HEI associated with asphyxia in preterm neonates (Dempsey *et al.*, 2015; Charles, Hunt, Murthy, Harris, & Greenough, 2018).

WHO guideline for pediatric resuscitation describes what action is to be taken in the event that a neonate is born with very minimal chance of survival or in situation that guarantee poor clinical outcome, although this remains controversial across different clinical spectrum (Weir, Evans and Coughlin, 2011; Hazinski et al., 2015).

It is worth noting that sometimes the decision not to initiate resuscitation in a severely compromised neonate may pose an ethical dilemma to both the parent and healthcare provider, especially where the outcome remains unclear (Weir et al., 2011; WHO, 2012). In such situation, Polderman (2015) opines that parental desire should be respected and supported by healthcare team no matter the consequence.

2.2 Maternal factors contributing to Asphyxia

There are myriad causes of asphyxia during childbirth which can either maternal or fetal in origin. However, most studies have shown that close to eighty percent of perinatal asphyxia occur during intrapartum period with about 20% of all cases occurring either during post-natal or in antenatal period (Taylor, Sawyer, 2017 ; Namusoke et al., 2018).

Risk factors associated with maternal causes may include; maternal age, early rapture of membrane, multiple pregnancies, poor attendance of antenatal visit, low maternal hemoglobin, non-judicious use of oxytocin during labor and deliveries among others (Ugwu, Abedi and Ugwu, 2012; Namusoke *et al.*, 2018).

Quite often though, perinatal asphyxia have been linked with events that include; hemodynamic collapse, fluid embolism, hemorrhage, placental abruption, uterine raptures, nuchal cord, cord prolapse, and maternal fever during intrapartum period (Kapaya *et al.*, 2018).

Various maternal socio-demographic factors such as level of education, number of antenatal clinic attendance, previous deliveries, place of birth et cetera have been shown to affect the general outcome of asphyxia among newborns (Gichogo, 2004; Were, 2004; Alwar, 2010; Maalim, 2011).

A study by (Otido, 2013) found that about 25% of newborn deaths that occurred in rural part of Kenya was mostly associated with asphyxia. This can generally be attributed to poor access to basic obstetric care or failure to seek early newborn care by mothers of such infants. Early preparation and timely recognition of babies in dire need of resuscitation is paramount in such group of mothers.

American Heart Association and other pediatric protocol highly advocates for the presence of a trained health personnel in pediatric emergency to optimize resuscitation outcome in asphyxiated neonates (Bansal *et al.*, 2014; Hazinski *et al.*, 2015).

2.3 Prevalence of Birth asphyxia in neonates

Studies show that neonatal asphyxia is the fifth leading cause of under 5 mortality after neonatal infections (Zeretzke-bien, 2018). Globally, asphyxia is estimated to cause 24% out of the total 2.5 million deaths that occur annually (Bansal *et al.*, 2014).

In majority of high in-come countries such as US, the incidence rate of perinatal asphyxia is estimated to be 2 per every 1000 live births representing nearly 0.1% of total neonatal death that occur annually. With incidence rate of low-income countries estimated to be five to ten times higher, two selected country namely Cape town and Nigeria registered 4-6 and 7-26 per 1000 live births according to an Ethiopian study. Similar statistics were found to occur in countries such as Cameroon which reported 8.5%, Pakistan 28%, Kenya 30.1%, India 6.6% and Thailand 7.3% this was according to a study by (Wayessa, Belachew and Joseph, 2017).

World Health Organization report estimates that about 7,000 newborns develop birth asphyxia daily. Studies have also revealed that among the many infants affected, 15-20% die in the neonatal period, and up to 25% of the survivors are left with permanent neurologic impairment such as epilepsy, cerebral palsy, mental retardation and neurodevelopmental delay (Were, 2004).

Currently, the extent to which infectious diseases impacts on perinatal brain injury associated with birth asphyxia has not been fully understood which makes it paramount for a study of such nature be conducted in the same area (Lee *et al.*, 2013).

Wayessa, Belachew and Joseph (2017) found prevalence rate of birth asphyxia to be 32.9% and 12.5% in the first and fifth minute respectively of Apgar scoring for term infants. Maalim (2011)

found a perinatal asphyxia rate of 31.1% at fifth minute among term infants admitted at KNH NBU and this finding were consistent the with Ethiopian study.

Furthermore, a Nigerian study by Ugwu, Abedi and Ugwu (2012) found that prevalence rate of asphyxia to be 28 per 1000 live birth and this was largely attributed to lack of health education among health care workers due to influence of unsubstantiated religious beliefs among native residents towards conventional medicine.

Regional epidemiological indices point to the fact that rate of birth asphyxia in Sub-Saharan Africa has never dropped below 10% due to myriad of factors such as poor access to skilled obstetric care, lack of adequate antenatal visit, poor socio-economic status, shortage of clinical guidelines among others (Lee *et al.*, 2013).

Essentially during parturition, as the fetus navigates the birth canal it utilizes both circulatory and non-circulatory adaptive mechanism necessary for survival. Some of which allows it to cope with period of oxygen debts while maintaining optimal function of vital organs such as heart, adrenal glands, kidney and the brain.

However, due to intrinsic or extrinsic causes, these mechanisms may sometimes be compromised if the degree of oxygen deprivation is severe resulting into decreased cerebral perfusion that may lead to cell death and tissue necrosis (Rainaldi and Perlman, 2016).

Failure to correct this anomaly in good time may result into conditions such as neurodevelopmental delays, mental retardation, epilepsy, attention deficit disorders among others which confer long-term debilitating effect to the infant (Schmölzer *et al.*, 2013; Kamau Pauline Thirimu, 2018).

2.4 Knowledge and Practices of nurses on management of Asphyxia

Multiple studies have shown that neonatal resuscitation program has been found to be an effective intervention at reducing complication associated with asphyxia during neonatal period (World Health Organization, 2012; Kamau, 2018). As a result, majority of nurses working in specialty units such like pediatric intensive care unit (PICU) are expected to undertake a post-basic training in a field of nursing to become proficient in delivery of quality health services (Alwar, 2010; Nanychama, 2017; Kamau, 2018).

Some common refresher in-service courses offered on new-born resuscitation program include; Emergency Triage Assessment and Treatment Plus (ETAT+), Pediatric Advanced Life Support (PALS), Emergency Obstetric and Newborn Care (Emonc), Helping Babies Breath (HBB), Advances in Labor and Risk Management (ALARM), Neonatal Resuscitation Program (NRP), Pediatric Immediate Life Support (PILS) among others (Sawyer, Umoren and Gray, 2016; Shikuku *et al.*, 2017).

Normally, such courses are taught with an aim of equipping nurses with adequate skills and knowledge necessary to combat obstetric and neonatal complications as they arise during daily care of infants. EmonC is one of such courses that offers signal functions on new-born resuscitation and nurses trained on it have shown exemplary performance in delivery of newborn emergency care pertaining to asphyxia (Otido, 2013; Berhe, Tinsae and Gebreegziabher, 2017; Moshiro *et al.*, 2018).

Most recently, programs such Help Babies Breath (HBB) that was introduced in 2010 by American Academy of Pediatrics (AAP) to offer practical cost-effective solution in limited-resource setting on prevention of asphyxia in newborns has gained considerable momentum in many African countries. For instance, a country like Tanzania which had embraced Help Babies

Breath program in 2012 registered a 47% decline in neonatal deaths and a further 24% reduction in fresh still births following its implementation by nurses (Antonucci, Porcella and Pilloni, 2014).

Kamau (2018) found out that nurses and other health worker in Uasin Gishu County had poor skills on basic newborn resuscitation despite majority of them having acquired minimum level of competence-based knowledge. Likewise, (Alwar, 2010) found out that despite nurses in Kenyatta National Hospital having demonstrated decreased knowledge of newborn resuscitation, it was however observed that they performed well in provision of warmth and ventilation of newborn using bag-mask-valve.

Consequently, Opiyo *et al.* (2008) concluded that repeated exposure of newborn resuscitation training among health care workers could amount to improved neonatal outcome. However, it has also been observed that mere possession of knowledge of newborn resuscitation in the absence of practical skills may necessarily not guarantee a better outcome in care of neonate with asphyxia.

2.5 Effect of infant co-morbidity on Asphyxia

Comorbidity which refers to the presence of additional condition besides primary defect or infirmity can occur in preterm infants born with asphyxia. According to a study by Black *et al.* (2015) preterm births were found to be associated with comorbidities that reflected increased cost of healthcare and was negatively correlated with gestational age. Some of the most common preterm comorbidity include Respiratory Distress Syndrome (RDS), anemia requiring transfusion, Bronchopulmonary dysplasia (BPD), Sepsis, Necrotizing Enterocolitis (NEC), Intra-ventricular hemorrhage, Periventricular leukomalacia among others (Black *et al.*, 2015).

A preterm infant usually presents with complications such as low birth weight, congenital malformations, pulmonary hypoplasia, sepsis due to underdeveloped immune system among others. Due to prematurity, these babies tend to develop both long and short-term health problem for which asphyxia is significantly implicated. Empirical data indicate that very low infant's weight characteristic of preterm deliveries, have about 5-10 times post-neonatal mortality as compared to term deliveries (Opiyo *et al.*, 2008; Antonucci, Porcella and Pilloni, 2014).

Asphyxia can often lead to multiple organ failure, especially when ventilation appears to be grossly compromised like in the case of severe hypoxic ischemic encephalopathy (HIE), during which time the body will have exhausted all its adoptive mechanism necessary to maintain normal functionality (Antonucci, Porcella and Pilloni, 2014).

Renal injury that does not result from trauma in preterm infants with birth asphyxia is a potential consequence of adaptive mechanism and it carries a 40% fatality rate (Ibrahim, Muhye and Abdulie, 2018). However, oliguria which presents commonly in neonates diagnosed with asphyxia does not impact adversely on the general outcome following hospital admission in neonatal period (Alaro, 2013).

Severe prematurity may also be considered to be an infant comorbidity since it carries increased risk of mortality and morbidity, meaning that the lower the gestational age the higher the mortality rate. Perinatal studies have shown that less than 28 weeks' gestation has about 30-50% risk of neonates expiring. Equally so, extremely low birth weight of less than 1000 grams remains a high risk factor for death and disability at 20-50% among survivors who may later develop learning and motor disability (Ziino, Davies and Davis, 2003).

Routine administration of antenatal steroids to infant's mother have remarkably increased preterm survival rate. However, current administration of exogenous surfactant, introduction of

continuous Positive Airway Pressure (CPAP) and use of mechanical ventilation has further improved preterm asphyxia survival outcomes. Apnea of prematurity (AOP) has been shown to respond well to administration of caffeine citrate (Chen *et al.*, 2019).

Necrotizing Enterocolitis (NEC) which is a form of gastrointestinal complication in extremely preterm infants with unknown etiology affects one in every ten infants. It presents as an acute inflammation and necrosis of the large bowel causing increased morbidity and mortality among preterm admitted in newborn unit (NBU). Prematurity, immature gastrointestinal barrier, abnormal bacterial colonization of gastrointestinal tract (GIT) and impaired intestinal blood flow have been associated with NEC. A study by (Nair, Longendyke and Lakshminrusimha, 2018) have linked presence of severe asphyxia, maternal use of cocaine and polycythemia as risk factor that predispose to necrotizing enterocolitis.

Treatment of necrotizing enterocolitis may include withholding oral feed for a few days, surgical intervention in severe necrotic cases, use of probiotic therapy and liberal use of exclusive human breast milk. Research has also found out that suppression of acid lowering medication and short course administration of antibiotic could remarkably lower the chances of developing necrotizing enterocolitis.

An Indian study by (Jadcherla *et al.*, 2010) found out that environmental and nociceptive stimuli affect development of digestive tract among preterm with cardiorespiratory involvement thereby delaying achievement of independent milestone as per required age. This therefore shows that prematurity could affect feeding tendencies such as sucking reflex in a preterm neonate hence result in poor prognosis in the presence of asphyxia.

Retinopathy of prematurity (ROP) may also occur as a co-morbidity to asphyxia due prematurity leading to blindness. Most case of ROP has been linked to excessive oxygen administration

which inhibits both vascular endothelial growth factor (VEGF) and vascular growth. Blindness is as a result of continued scaring, retinal detachment and obliteration of vision. Paradoxical administration of low oxygen concentration in saturation less than 85-89% have been linked to increased risk of mortality (Wheatley *et al.*, 2002).

Bronchopulmonary dysplasia which is one of the most serious comorbidities affecting preterm infants with history of frequent hospital admission in the first year of life has been shown to predispose to disease such as airway hyperactivity, decreased lung function and chronic lung disease (CLD). Use of caffeine citrate as a remedial therapy within the first 48 hours has yielded better outcome when combined with Vitamin A and corticosteroids (Chen, Jin and Chen, 2018).

Hyperglycemia may also present as preterm comorbidity especially if an infant is born to a diabetic mother (Mohamed, 2016). In such a situation, routine monitoring of random blood glucose at birth may avert complications related to hypoglycemia such us diabetic coma. Use of potassium infusion in combination with normal saline and dextrose from day two of life as prescribed in pediatric protocol has proved effective in restoring electrolyte imbalance among this vulnerable group (Ministry of Health, 2016).

Infections by bacteria such as Staphylococcus aureus, Escherichia coli, and Candida albicans have been shown to be rampant among preterm neonates with very low birth weights. Most notable infections occurring within the first 72 hours have been attributed to Escherichia coli and Group B streptococcus both of which have high fatalities, followed by Candida albicans and Pseudomonas (Chen, Jin and Chen, 2018).

CHAPTER THREE: METHODOLOGY

3.0 Introduction

This chapter describes the materials and methods that were employed in this study. It also gives a highlight of the study design, the study site, inclusion and exclusion criteria and the study population. In addition, it provides a description of data collection procedure and ethical considerations among others things.

3.1 Study design

This was a descriptive cross-sectional study where quantitative data on short-term outcome of birth asphyxia in a preterm neonate was collected at Kenyatta National Hospital Newborn Unit between June and July, 2019.

3.2 Study area

The study was conducted at the Newborn unit of Kenyatta National Hospital, which is the largest Teaching and Referral public health institution for the college of health sciences, University of Nairobi. It is located in Kenya's Capital city about 1.5 kilometers from central business district, in Upper hill area along hospital road, off-Ngong road. The Newborn unit admits an average of 300 neonates per month and is located in the third floor of the hospital tower block (Kenyatta National Hospital, 2018). This unit houses newborn intensive care unit and has about sixty nurses stationed in the ward and thirty more on attachment basis.

3.3 Study population

The study had targeted mother and infant pairs admitted with birth asphyxia together alongside healthcare providers (nurses) working in NBU during the study period. Generally, the unit is known to admits about 300 babies in a month majority of whom come from labor ward, and as referrals through Pediatric Emergency Unit (PEU). Out of the 300 neonates admitted to the ward,

approximately 40 preterm neonates were observed to present with birth asphyxia on monthly basis.

3.4 Eligibility criteria

Inclusion for Neonates- (Mother-Infant pair)

All preterm neonates who had diagnosis of asphyxia, aged between 0-24 hours on initial assessment, had failed to initiate breathing by their own effort at the time of birth with an APGAR score of 7 and below at 5^{th} minute with or without resuscitation were included into the study. Infant mothers had to give consent to be enrolled into the study as well.

Exclusion for Neonates (Mother-Infant pair)

Absence of infant's mother and severely sick neonates requiring emergency attention were excluded from the study.

Inclusion for Nurses

Nurses who had worked in pediatric ward for more than three month period and had provided consent.

Exclusion for Nurses

Nurses who were on leave or off-duty during the period of study together with trainee nurses on clinical rotation.

3.5 Sample size determination

Prevalence rate of asphyxia among term infants in KNH has be shown to be 20% of weekly hospital admission. Since no data was found from MOH guidelines, KDHS report or KNH Information department regarding prevalence rate of asphyxia in preterm neonates in Kenya, the

researcher therefore assumed a 50% probability in single population. Cochrane's formula was then used to calculate sample size as shown below (Kothari, 2004).

Mother-infant pair was estimated as follows:

$$n = \frac{Z^2 Pq}{d^2}$$

Whereby;

n = represented sample sized population greater than 10,000

z = level of confidence according to the standard normal distribution. Sample interval at 95% confidence, limit becomes 1.96.

p = the proportion of pre-term babies with birth asphyxia at birth. This will be taken to be 50% since population of preterm infants with asphyxia known, hence **p=** 0.5

q = the proportion of the population without characteristic of interest (Preterm babies without birth asphyxia). **q** is equal to **1-p**

d = is the tolerable margin of error at 95% confident limit =0.05

Therefore, by substituting these values in the formula;

$$n = \frac{1.96^2 \text{ x } 0.5\text{x } 0.5}{0.05\text{x } 0.05}$$

n =384

Since the proportion of the preterm infants with birth asphyxia is approximately 40 per month, Fisher's correlation formulae were applied to a get a more finite population since 40 neonates were less than 10,000 population as shown;

$$\boldsymbol{nf = \frac{n}{1+\frac{n}{N}}}$$

Where:

$\boldsymbol{nf}$ = intended sample size when the target population is <10000

N= total target population of 40 preterm neonates with asphyxia

n = the desired sample size where population is more than 10,000

Therefore, substituting values in the formula we get:

$$\boldsymbol{nf} = \frac{\mathbf{384}}{\mathbf{1}+\frac{\mathbf{384}}{\mathbf{40}}}$$

$\boldsymbol{nf}$ = 36.0

= **36**

The required sample size for the neonates and their mothers was thirty-six (36) study participants.

Nurses sample size calculation

Since the number of nurses caring for the preterm infants with birth asphyxia in KNH was less than 10,000 i.e. 60 nurses stationed in new-born unit. The Fisher's correction formula was again used to get a finite population as follows:

$$\boldsymbol{nf} = \frac{\mathbf{384}}{\mathbf{1}+\frac{\mathbf{384}}{\mathbf{60}}}$$

$\boldsymbol{nf}$ = 51.892

= **52**

The required sample size for nurses was found to be fifty-two (52) study respondents

3.6 Research Tool

Two questionnaires were used in collection of quantitative data in the study. One questionnaire addressed to 52 nurses had contained series of 25 multiple choices questions on general knowledge of resuscitation and care of neonate with birth asphyxia. Another questionnaire with a set of 15 questions was used to target mothers-infant pairs who had met inclusion criteria as described. A separate Neonatal Bio data form was to be completed by research assistant to capture infant's characteristic prior to admission into the study. To fill the form mentioned above, data was generated from infant's medical record (patient's file). Clarification for missing data was sort from mother and primary health care giver in cases of referral. Assessment of clinical outcome of asphyxia in preterm neonates was done using Daily Neurological Assessment tool attached at the back of patient's file. Diligent care was taken to ensure protection of participant's identity.

3.7 Pretesting of Study Instrument

The Study pretest was conducted at Kenyatta National Hospital maternity labor ward to assess for reliability of the questionnaire. Six questionnaires were given to nurses working in maternity and semi-structured questionnaires advanced to mothers with asphyxiated baby. This helped to clarify abbreviation pediatric courses listed on the questionnaire that were not well understood by the nurses and identify sensitive issues regarding use of any invasive procedure in the study that had to be clarified before enrolling into the study.

3.8 Validity

Validity of the research instrument was determined using a semi structured questionnaire that had been customized from other previous studies and guidelines so as to yield consistent results with a Cronbach's alpha value of 0.89 for measure internal consistency.

3.9 Reliability

This was ensured through competitive selection and training of research assistant who took part in pretest exercise and data collection process. Reliability of neonatal checklist was confirmed by equivalent fraction method with correction of 0.8.

3.10 Training of Research Assistant

One research assistant who was a registered bachelor of science nurse with diploma in neonatology was selected to assist in collection process. Her strong academic background in neonatal care and passion in caring for neonates made her choice of becoming research assistance inevitable.

3.11 Sampling Procedure

The sampling frame included all nurses caring for preterm infants with asphyxia in newborn unit plus mother-infant pairs. Systematic sampling technique was used to select nurses taking part in the study whereas mothers of infants with asphyxia were selected vis a simple random method. A list of all nurses working at the unit was obtained from the Nursing Service Manager indicating names and respective qualifications. To select participants in the study, the researcher had to use a computer-generated list that had the name of nurses that has met inclusion criteria. Those to be included in the study were approached based on chance and availability.

For the mother-infant pairs, purposive sampling technique was used whereby the researcher had to make 40 small papers of which **36** were written ‘yes’ and **4** written ‘no’. The papers were folded into small pieces, then mixed and put in a bowl from where eligible mother were supposed to pick a paper each at a time. Those mothers who picked ‘yes’ were enrolled into the study and those with ‘no’ were automatically excluded. Unique numbers for each neonate whose

mothers had already participated in the selection procedure were generated and tabulated separately in a concealed register to avoid duplication of selection.

3.12 Data Collection Procedure

Preterm neonates admitted to newborn unit Kenyatta National Hospital with APGAR score less than 7 at 5^{th} minute and having a diagnosis of birth asphyxia were recruited into the study. Most of neonates that took part in the study had been resuscitated from maternity ward and sent to Newborn unit after stabilization had been achieved. Also, those who had come as referral from neighboring facilities with history of birth asphyxia and met inclusion criteria were enrolled into the study.

Nurses stationed in the unit were selected using systemic random sampling method were asked to complete a self-administered questionnaire after providing consent.

Mother-infant pair that had purposively been selected and has met inclusion criteria were also included in the study.

3.12a Recruitment Procedure

Each prospective participant was approached and taken through what the study entailed (see Appendix 8 & 9). After providing consent, mother was directed to a separate room within the ward where questionnaire was completed by way of writing and ticking. Researcher-assisted questionnaire was used to collect data from mothers of infants participating who did not understand questions well. In such a situation, the researcher and his assistant were always present to provide assistance in interpretation and clarification of questions asked. Those that were unable to understand both Kiswahili and English were explained to in their native dialect. This process took a maximum of fifteen minutes.

Self-administered questionnaires were used to collect data among nurses that had enrolled in the study (See Appendix 7). Each nurse was allowed 10 minutes to fill in the questionnaire in a place of their convenience within the ward after issuing consent.

A neonatal checklist was used to collect data from the infant's medical record. The Principal investigator took value of APGAR score as indicated on the infant's medical record as the true absolute value since neither him nor his assistance could not have been present at the time of delivery to verify the score. KNH provides for attending midwife or doctor present at time of birth to complete and document APGAR score and this was automatically reflected in the delivery notes. The same logic was applied for all the preterm neonates with birth asphyxia that had come in as referral.

3.12b Consenting procedure

The researcher introduced himself to the ward in-charge and produced evidence of approval to collect data. Upon contact with the neonate's mother, either the researcher or his assistant had to introduce him and present an invitation request into the study. Information pertaining to the study were then issued to respective participants in-order to seek informed consent (Appendix 4). Consent was then signed using agreement form as shown in (Appendix 7. 8 & 9).

3.12c Interview procedure for quantitative data collection

Each mother that was enrolled into the study was approached and explained about the study (Appendix 8). After the mother had given consent she was directed to a separate room within the ward where she was taken through filling of the questionnaire. The researcher asked the mother questions per the questionnaire (Appendix 5). Those that understood how to read and write were allowed to complete their questionnaire unaided. Those mothers who had problems understanding the questions were provided with an interpreter.

3.12d Health Record Reviews

Neonatal Bio data Checklist was completed using information extracted from infant's medical record (Child welfare booklet and patient's file) once consent had been obtained from the mother. Other missing data were generated retrospectively from maternal ANC booklet besides verbal inquiry from the mother.

3.12e Study flow chart

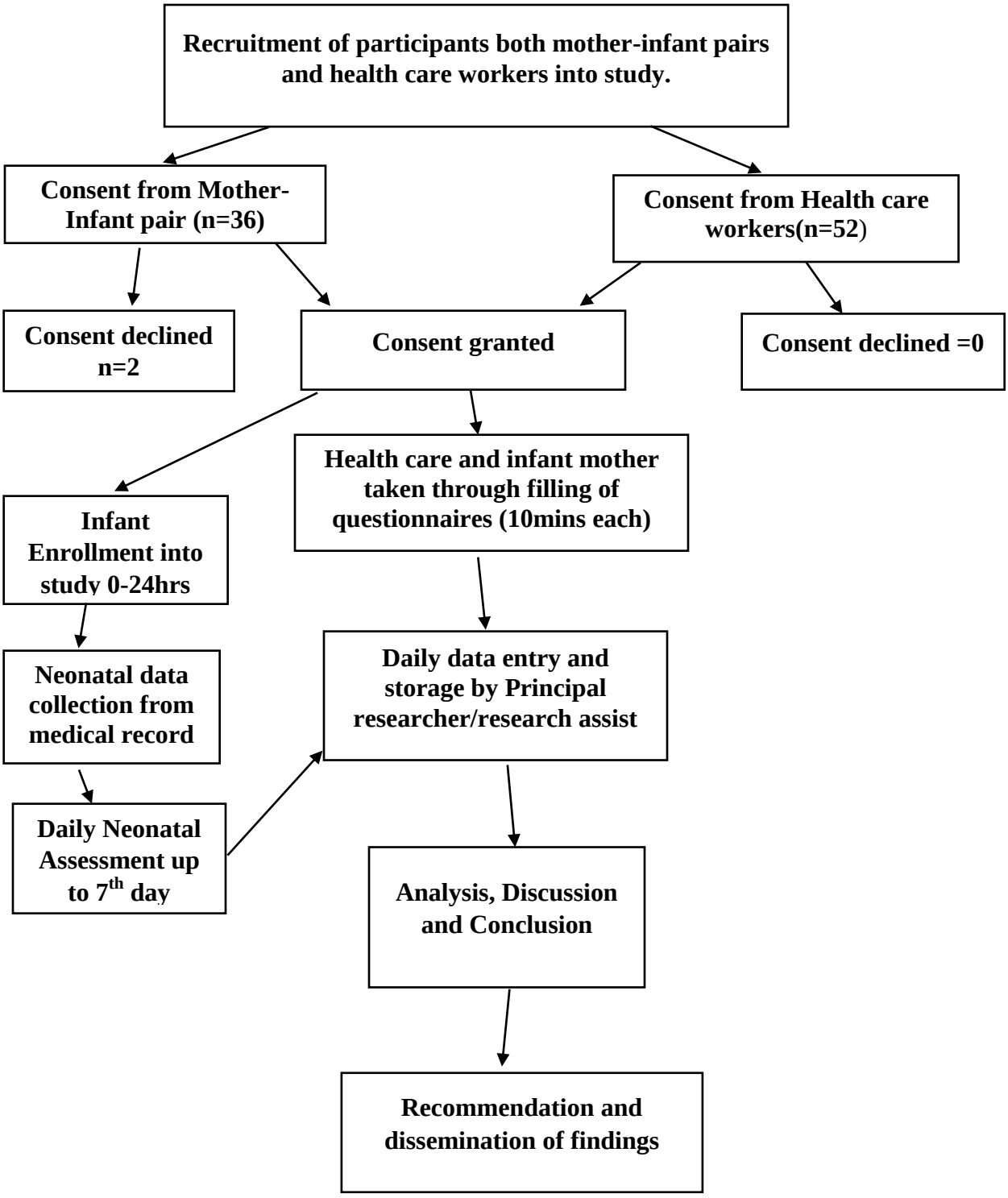

Figure 3.2: Study Flow Chart

3.13 Data management and analysis

Collected data were stored under lock and key, in a secure cabinet which was only accessible to the principal researcher, his assistant and supervisors upon request. Participant's identity was concealed by use of unique number allocated to each respondent.

Data collected were cleaned, coded, checked for normality and completeness. Each questionnaire was entered against into Microsoft excel program which was then imported to STATA version 14 for analysis. Categorical data were then presented as frequency listing and percentages.is was performed to determine factor influencing outcome of neonatal asphyxia.

3.14 Data presentation

Analyzed data was presented using graphs, pie charts, tables and narrative explanation accompanying each given form of presentation.

3.14 Data Dissemination procedure

Result from the study were presented to the University of Nairobi College of Health Sciences, Medical Library and another copy issued to the management of KNH for future reference. The result of the study was published in scientific peer review nursing journal for public access and the abstract presented in scientific conference.

3.15 Ethical consideration

Approval to conduct research was sought from Ethics and Research Committee (ERC) of UON and KNH Administration. Permission to collect data was granted by the KNH authorities.

The health care provider and Infant mothers were issued with informed consent which entailed the following: Introduction into the research, with a brief explanation of the importance and benefits of the study to participants.

A written informed consent was issued to the mother whose infants had met inclusion criteria. Clear explanation about the study was shared to the mother and health care provider prior to seeking consent. Personal identification of respondents was concealed by use of unique number to maintain confidentiality of data collected.

It was emphasized that participation into the study was voluntary in nature with no monetary gains to be expected, and that the results obtained would be shared with other relevant stakeholders including health care giver and infant's parents.

Infant Protection Measures

Non-invasive procedure was used during data collection process of infant's characteristic by way of assessment of respiratory rate, heart rate, presence or absence of suck reflex, seizure and degree of muscle tone. Findings from each assessment was then recorded on daily neonatal checklist.

The infant's details were kept concealed and no information pertaining to their identity was released to the public to maintain confidentiality.

The researcher only recruited those neonates whose mothers were available during data collection period and had provided consent. Furthermore, clearance was sort from ward in-charge and/or team leader to ascertain that neonates were of sound health and capable of taking

part in the study. Emergency neonatal care was given priority over any other activity and no preferential treatment was accorded to those participating in the study.

Education to the mother

This study was meant to help mothers obtain knowledge on what to do when she happens to experience premature delivery and enumerated the importance of seeking quick medical intervention to prevent birth asphyxia.

3.16 Study limitations

Recall bias by mother of infants regarding their health status while pregnant would have affected the quality of findings on maternal demographics. The fact that this study excluded surgical cases and very extreme preterm infants that required urgent treatment could have made parents of eligible infants feel discriminated against and lower statistical power. Single-point of data collection, short duration of study and a fairly small sample population could have affected generalizability.

Since APGAR scoring was done by someone else, this could have led to either underscoring/over scoring of a neonate at birth leading to misreporting of secondary data.

3.17 Mitigation of study limitations

Infant's mothers were given ample time to try and remember the exact details surrounding their pregnancy. The use of maternal booklet aided in restoring maternal recollection and verification of what had been said. Only three out the all eligible infants were excluded on the basis of having anatomic malformation for which clear and thorough explanation was provided as to why these babies could not have been allowed to take part in the study. Besides, application of purposive random selection techniques ensured research bias was avoided.

CHAPTER FOUR: RESULTS

4.0 Introduction

Findings of the study were presented in this chapter systematically following objectives as stated. The results were based on maternal characteristics, Neonatal characteristics and health workers knowledge and practice influence on neonatal outcome. Neonatal comorbidity influence on asphyxia was also included in the results.

4.1 Response rate

The research was carried out to determine short-term outcomes of asphyxia in preterm neonates receiving care at Kenyatta National Hospital, Newborn Unit. The research included two questionnaires for both mother-infant pair and nurses and a daily neurological checklist for Neonatal analysis. A total of 52 questionnaires for nurses were returned which highlighted a 100% response rate while 34 questionnaires on neonates were returned after 2 participants withdrew from the study indicating a 94% response rate. Nonresponse rate of more than 25% may potentially bias the sample according to (Silvo *et al.*, 2016). Therefore, 94% response rate was found to be statistically permissible in a descriptive study since it could not impact much on validity of the study inference.

4.2 Demographics

4.2.1 Maternal factors

The infant mother demographics were analyzed and presented as shown in table 4.1. The average age of infant's mothers was 29.65 years. The analysis showed that most 22 (64.7%) were married. Half of the infant's mothers 17 (50%) had secondary school education, majority 33 (97.1%) were Christians, and less than half 15 (44.1%) were self-employed. The findings identified that three out of four 26 (76.5%) of mothers delivered through spontaneous vaginal

delivery. The analysis also highlighted that the average number of children was two. Majority 31 (91.2%) of mothers had never experienced a miscarriage prior to the last pregnancy whereas most 19 (65.5%) had developed anemia during pregnancy. Half of the respondents 18 (52.9%) lived between 0.5 to 1 Km from a medical facility.

Table 4.1: Socio-demographic characteristics of infant's mothers

	Frequency (%)
Age	Mean = 29.65
Marital status	
Married	22 (64.7)
Single	11 (32.4)
Divorced/Separated	1 (2.9)
Level of education	
Primary	3 (8.8)
Secondary	17 (50.0)
College	14 (41.2)
Religion	
Christian	33(97.1)
Muslim	1(2.9)
Occupation	
Student	8 (23.5)
Self employed	15 (44.1)
Formal employment	1 (2.9)
Housewife	10 (29.4)
Monthly income	
Ksh. 1000 - 5000	6 (17.6)
Ksh.6000 - 10000	8 (23.5)
Ksh.11000 - 24000	9 (26.5)
Ksh. 25000 and above	11 (32.4)
Type of delivery	
SVD	26 (76.5)
Caesarian section	6 (17.6)
Breech	2 (5.9)
How many children do you have	Mean =2
Have you ever had a miscarriage?	
Yes	3(8.8)
No	31(91.2)
Do you have any history of multiple pregnancies?	
Yes	12(35.3)
No	22(64.7)
Have you suffered from the following conditions while you were pregnant?	
Anemia	19 (65.5)
High blood pressure	8 (27.6)
Malpresentation	2 (6.9)
How far do you stay from the nearest medical facility?	
0.5 - 1Km	18 (52.9)
5 - 10Km	13 (38.2)
More than 10Km	3 (8.8)

4.2.2 Maternal socio-demographic factor influence on outcome of birth asphyxia in preterm neonates receiving care at KNH NBU

A multinomial regression analysis was conducted to determine maternal factors that influence on outcome of birth asphyxia in preterm neonates receiving care at KNH NBU. An increase in maternal age by one year was 3.38 times likely to increase the likelihood of a neonate to die than recover. An increase in monthly income results in 23.6 likelihood of neonatal recovery occurring than death. A neonate born through SVD was 29.7 times more likely to recover fully than die. A baby born to a mother who had suffered anemia in pregnancy was 12.75 times more likely to experience neonatal death than recovery. A mother residing closer to a healthcare facility is 32.1 times less likely to suffer neonatal death as compared to recovery. This is shown in table 4.2.1

Table 4.2.1: Multinomial logistic regression output on Maternal factors on neonatal outcome

Variables	**Odds Ratio**	**Std. Err.**	**Z**	**P-value**	**[95% Conf. Interval]** Lower	Upper
Recovered ~y						
Age	3.28	803.43	0	0.997	-1571.4	1577.97
Monthly Income	**-23.58**	**1.12**	**-21**	**0.560**	**-25.78**	**-21.38**
Type of delivery	29.72	9190.53	0	0.997	-17983.4	18042.83
Disease during pregnancy	12.75	9214.9	0	0.999	-18048.2	18073.7
Distance from medical facility	-32.11	10611.2	0	0.998	-20829.8	20765.6
_Cons	1.063	4.78	0.22	0.82	-8.3	10.42
Continuing ~t						
Age	3.38	803.43	0	0.997	-1571.4	1577.97
Monthly Income	-24.1	UD	UD	UD	UD	UD
Type of delivery	32.03	9190.5	0	0.997	-17981	18045.14
Disease during pregnancy	12.54	9214.9	0	0.997	-18048.4	18073.5
Distance from medical facility	-28.56	10611.2	0	0.998	-20826.2	20769.1
_Cons	-8.63	UD	UD	UD	UD	UD
Died	*Base outcome*					
****Significant at p ≤0.05,***		***UD-Undefined***		***95% CI,***		

4.2.2 Neonatal demographics

The Neonatal demographics were assessed and presented as shown in the table 4.2 The average birth weight was 1850 grams with a minimum 620grams and maximum 2850 grams. The analysis determined that majority of the neonates 21 (61.8%) were female and that the most common underlying disease was sepsis at 8 (72.7%). The Apgar score was assessed at 1 minute and 5th minute. The average Apgar score at 1 was 3.24 with a range of between 1 and 6. The Apgar score at 5th Minute was average 5.03 with a range of between 3 and 7.

Table 4.2.2: Neonatal demographics

Factors	**Frequency (%)**
Birth weight (in grams)	Mean =1850
Sex	
Male	13(38.2)
Female	21(61.8)
Underlying disease	
Sepsis	8 (72.7)
Anemia	2 (18.2)
Hypoglycemia	1 (9.1)
Apgar score at 1 Min	M=3.24
Apgar score at 5 Min	M=5.03

4.2.3 Neonatal neurologic analysis

Daily neonatal neurologic assessment was conducted for the first seven days where the progress of neonates was assessed based on seven status scores which included conscious level, suck reflex, respiration rate, presence of seizure, apex beat, Moro reflex and muscle tone as shown in table 4.2.3 bellow.

On the first day of assessment majority of the neonates had an apex beat above one hundred standing at 26 (76.5%) and respiration tachypnea was present among 25 (73.5%). On day 2, majority of the neonates from a sample of 31respondents had an Apex beat above one hundred 26 (90.3%), Seizures absent 21 (67.7%) and respiration tachypnea present 20 (64.5%). On day 3

there were 18 neonates who were assessed from the initial 32. Majority of the neonates had Apex beat above one hundred 28 (94.4%), Seizures absent in 21 (66.7%). On day 4 there were 17 neonates available. Majority of the neonates had Apex beat above one hundred 17 (88.2%) and seizures absent 12 (64.7%).

Table 4.2.3: Summary of daily neonatal assessment using modified Sarnat and Sarnat chart

Status	***Day 1 (32)***	***Day 2 (31)***	***Day 3 (18)***	***Day 4 (17)***	***Day 5 (5)***	***Day 6 (4)***
Conscious (Irritable-Yes)	47.1% (16)	32.4% (11)	44.4% (8)	41.2% (7)	60% (3)	25% (1)
Suck Reflex (Hyper -Yes)	44.1% (15)	22.6% (17)	50% (9)	23.5% (4)	60% (3)	50% (2)
Respiration (Tachypnea-Yes)	73.5% (25)	64.5% (20)	55.6% (10)	23.5% (4)	60% (3)	25% (1)
Seizure (Absent -Yes)	44.1% (15)	67.7% (21)	66.7 (12)	64.7% (11)	60% (3)	75% (3)
Apex Beat (Above 100 -Yes)	76.5% (26)	90.3% (28)	94.4% (17)	88.2% (15)	100% (5)	100% (1)
Moro Reflex (Exaggerated -Yes)	17.6% (6)	25.8% (8)	11.1% (2)	23.5% (4)	100% (5)	100% (1)
Tone (Increased-Yes)	14.7% (5)	6.5% (2)	11.1% (2)	5.9% (1)	20% (1)	100% (1)

4.3 Neonatal factors influence on birth asphyxia

The neonate's factors were analyzed to understand the different distribution of the findings based on frequencies and percentages.

4.3.1 The color of liquor at birth

Most neonates 16 (46.7%) had meconium stained liquor while 15 (43.3%) had clear liquor as presented in figure 4.3

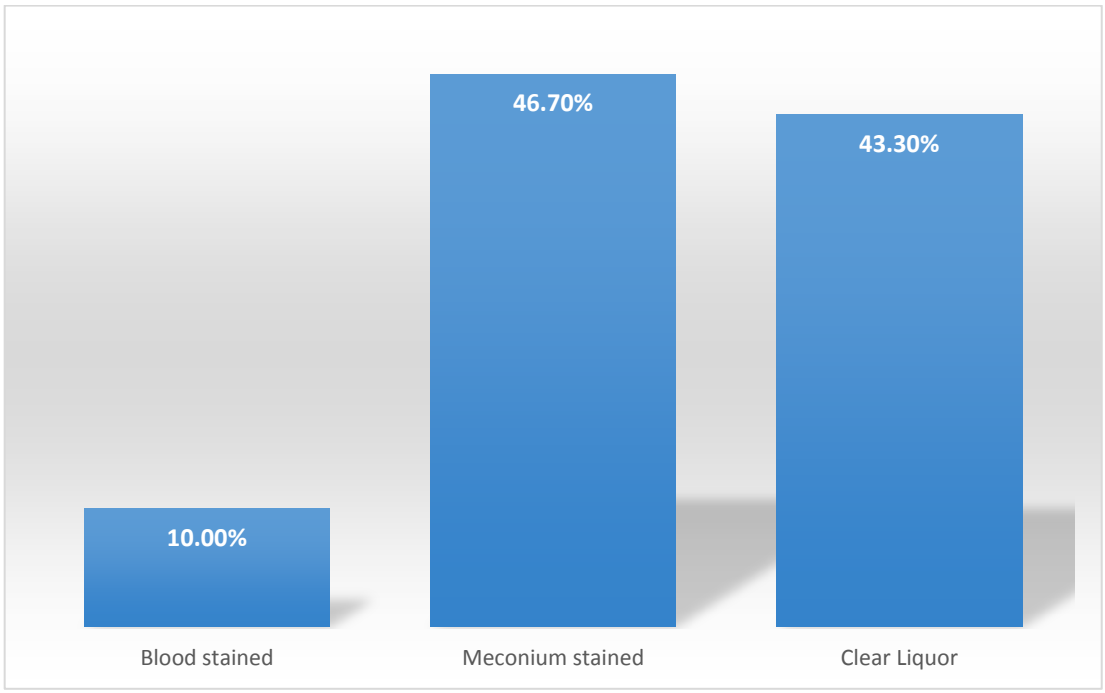

Figure 4.3: The neonate color of liquor at birth

4.3.2 Baby cry at birth

The analysis showed that majority of the neonates 24 (70%) did not cry at birth as presented in figure 4.2

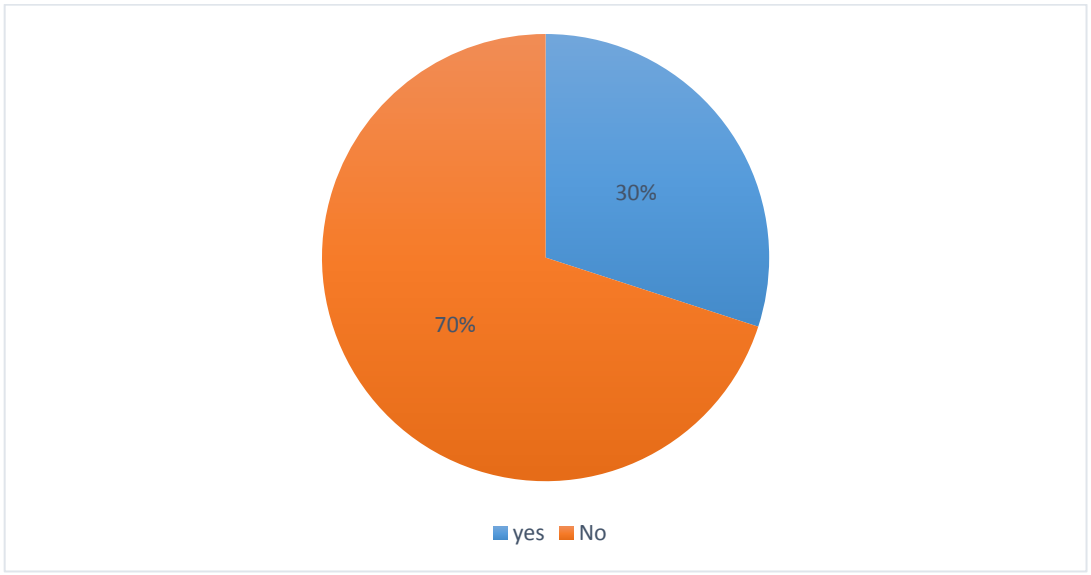

Figure 4.4: Proportion of neonates that cried at birth

4.3.3 Resuscitation done with a Bag-Valve-Mask

The analysis showed that resuscitation with a bag-valve mask was used on majority 25 (73%) of the neonates. This is shown in figure 4.5 below.

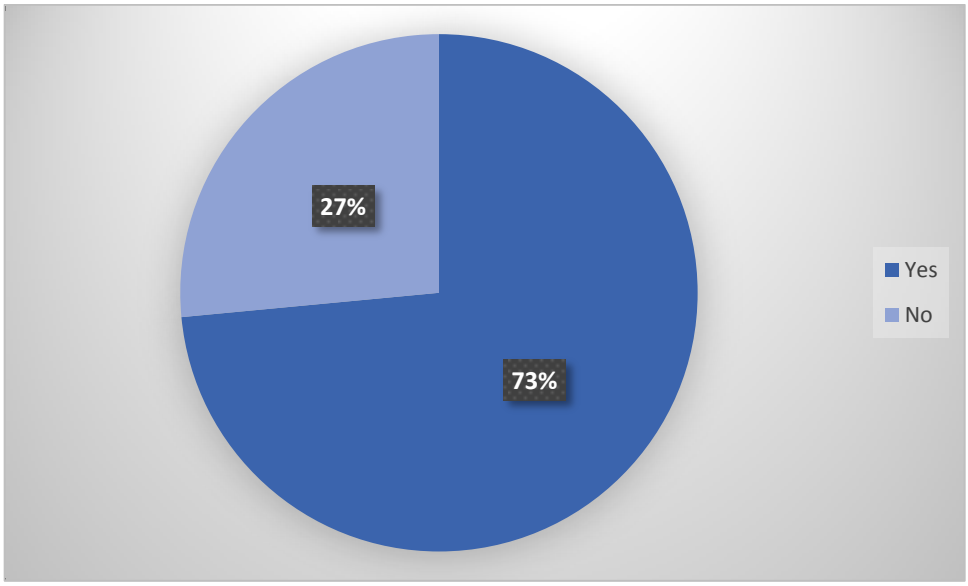

Figure 4.5: Proportion of infant's resuscitated with bag-mask-valve

4.3.4 Neonatal factors assessment

Additional neonatal factors were assessed to understand different procedures that were undertaken on the neonates to optimize their survival chances. From the study, majority of the neonates 22 (64.7%) did not have blood glucose test done on admission. It was noted from the analysis that 27 (79.4%) of the neonates had oxygen saturation measurement taken on admission with majority of neonates presenting with peripheral cyanosis at 23 (79.3%). The analysis also showed that 15 (45.5%) of the neonates had yellow coloration of skin as shown in the table 4.3.4 below.

Table 4.3.4: Neonatal factor assessment

Factor	Frequency (%)
Was blood glucose test done	
Yes	8(23.5)
No	22(64.7)
If yes what was the value	7M=.29
Was Oxygen saturation taken on admission	
Yes	27(79.4)
No	4(11.8)
What was the degree of cyanosis?	
Central	6(20.7)
Peripheral	23(79.3)
Any presence of yellow coloration (Jaundice)	
Yes	15(45.5)
No	18(54.5)
How frequent were vital signs monitored	M=6.36
Was there any infection	
Yes	11(36.7)
No	19(63.3)
If Yes, specify	
Conjunctivitis	1 (2.9)
Fever	4 (11.8)
Neonatal sepsis	2 (5.9)
Body odor due to PROM	1(2.9)
Pustule	1 (2.9)
UTI	1 (2.9)
Did the baby feed in the first 24 hours after delivery?	
Yes	24(70.6)
No	10(29.4)
What type of feed was neonate given?	
EBM	8(23.5)
IVF	25(73.5)
Formula Feed	1(3)
Did the infant tolerate oral feeds?	
Yes	21(65.6)
No	11(34.4)

4.4 Neonatal outcome

Neonatal outcomes were assessed where 19 neonates recovered fully, 12 were continuing with treatment and 3 neonates died as shown in figure 4.6 below.

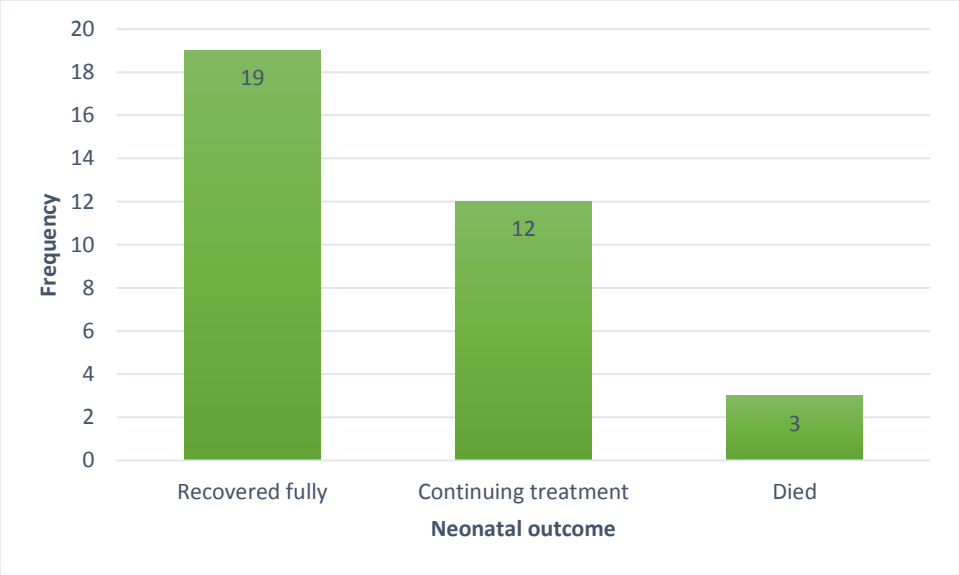

Figure 4.6: Neonatal outcome of asphyxia

4.5 Neonatal factor influences on short-term outcome of birth asphyxia in preterm neonates receiving care at KNH NBU

Multinomial logistic regression was conducted to determine neonatal factors that influence short-term outcome of birth asphyxia in preterm neonates receiving care at KNH NBU. The findings showed that an increase in one unit in birth weight decreased the chances of death by 0.17 times compared to recovery. A neonate with sepsis as the underlying disease was 72.2 times likely to die than recover while a patient with hypoglycemia was 72.2 times highly likely to recover than die when all factors were held constant. Male neonates were 35.2 times likely to die than recover compared to female neonates. A reduction in Apgar score at 1 minute was 91 times more likely to result into death than recovery of a neonate. A reduction in monitoring the vital signs by one unit was more likely to result in death than recovery.

The analysis also determined that a neonate with higher birth weight was 0.26 times less likely to die than to continue treatment. A neonate with sepsis as the underlying disease was 2.8 times likely to die than continue with treatment while a neonate with anemia as the underlying disease was 2.8 times less likely to die than continue with treatment compared to a neonate with sepsis as shown in table 4.5

Table 4.5: Neonatal factor influence Multinomial logistic regression output

Variables	**Odds Ratio**	**Std. Err.**	**Z**	**P-value**	**[95% Conf. Interval]** Lower	Upper
Recovered						
Birth weight	0.17	538253.5	0	1	-1054957	1054958
Underlying disease	72.2	UD	UD	UD	UD	UD
Sex	-35.21	UD	UD	UD	UD	UD
Apgar Score at 1 min	-91.0061	UD	UD	UD	UD	UD
Apgar score at 5 min	0	(Omitted)	0.34	0.73	0.23	8.1
Frequency in monitoring vital signs	-1.17	4.10E+07	0	1	-8.04E+07	8.00E+07
Baby fed	0	(Omitted)	UD	UD	UD	UD
Infant tolerating oral feeds	0	(Omitted)	UD	UD	UD	UD
Died	Base Outcome					
***Significant at p≤0.05. Odd ratio;**	**95% CI**	**UD-Undefined**				

4.6 Newborn Unit Nurses analysis

4.6.1 Nurses socio- demographic characteristics

The analysis of demographic factors of the nurses who participated in the study was conducted and represented as shown in table 4.6.1. The findings from the analysis showed that majority of the nurses that had participated in the study were female 44(84.6%) and 27(51.9%) were diploma holders with a mean age of 33 years. The findings showed that most of the nurses had been practicing for an average of 8.16 years. Half of the respondents, 26(50%) had served in the unit between 1 -9 years. The respondents were also asked whether they had ever attended any professional course in their career, for which 41(78.8%) affirmed to have attended at least one

professional course. Majority of the respondents, 25(62.5%) attended Emergency Triage Assessment Treatment plus (ETAT+) professional course.

Table 4.6.1: Nurses demographics

Factor	**Frequency (%)**
Sex	
Male	8(15.4)
Female	44 (84.6)
Age	Mean =33.61
Highest Level of education	
Diploma	27 (51.9)
Higher diploma	11 (21.2)
Bachelor's degree	13 (25.0)
Master's degree	1 (1.9)
How long have you been practicing (Years)	Mean =8.16
How long Have you served in this unit?	
0 -12 Months	18 (34.6)
1 - 9 years	26 (50.0)
More than 10 Years	8 (15.4)
Have you attended any professional course?	
Yes	41 (78.8)
No	11 (21.2)
Courses attended	
Emonc	7 (17.5)
PALS	5 (12.5)
ETAT +	25 (62.5)
HBB	1 (2.5)
NRP	1 (2.5)
ALL	1 (2.5)

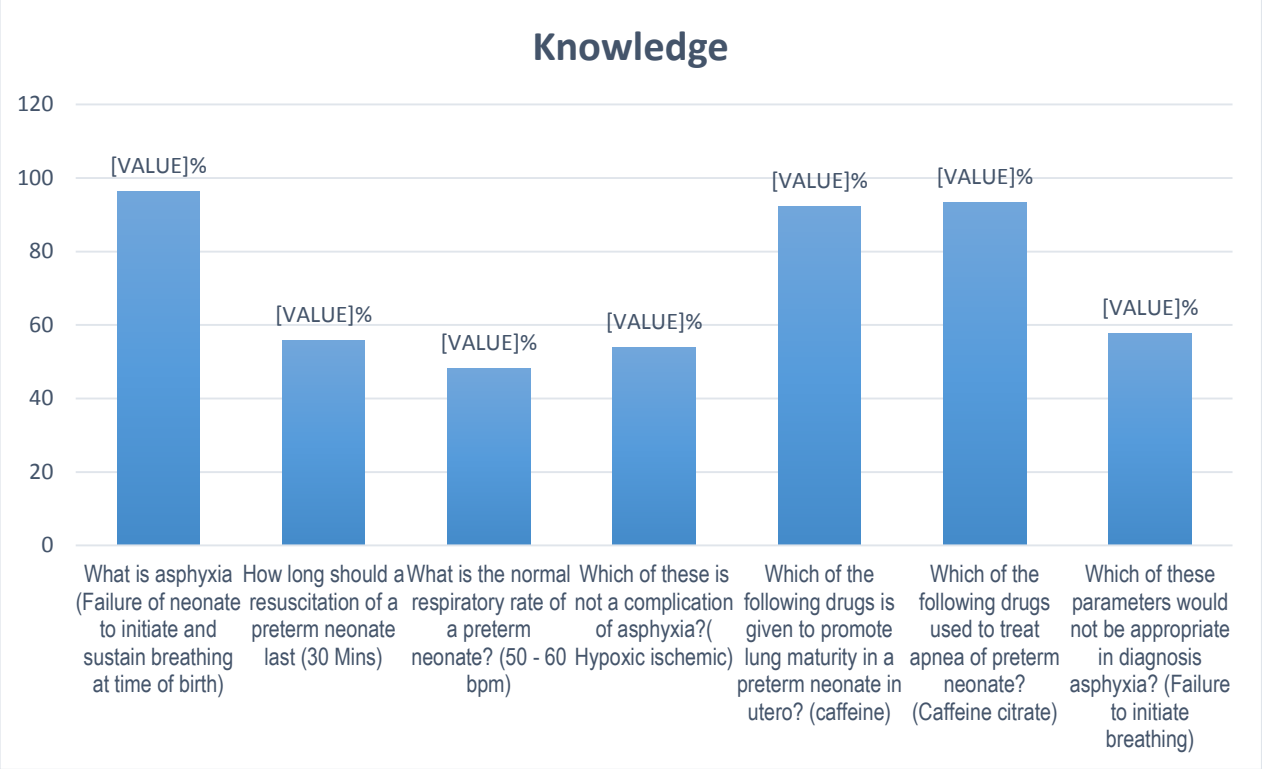

Figure 4.7.2: Knowledge of Newborn Unit Nurses on immediate care of asphyxiated neonates

The study focused on determining the level of knowledge among nurses on asphyxia as presented in Table 4.6.2 Nurses were asked to define asphyxia, 50 (96.2%) defined asphyxia as failure of neonate to initiate and sustain breathing at time of birth. The analysis also sought to determine the time taken to resuscitate a preterm neonate, 29 (55.8%) stated that it should take 30 minutes. The analysis also determined that 25(48.1%) of the nurses highlighted that the normal respiratory rate of a preterm neonate to be between 50 and 60 beats per minute.

The nurses were also asked to identify a short complication that is related to asphyxia, 53.8% of them identified hypoxic ischemic as not to be a complication of asphyxia, 34.6% selected epilepsy. Drugs given to promote lung maturity in a preterm neonate in utero were also evaluated where 48(92.3%) of the nurses identified dexamethasone while 2(3.8%) picked caffeine citrate. The analysis also assessed if nurses knew which drugs was used to treat apnea in preterm neonate, 48(92.3%) mentioned caffeine citrate as the appropriate drug. The researcher had also sought to evaluate if nurses knew which parameters was not used in diagnosing asphyxia and

30(57.7%) identified birth weight <2500 grams while 10(19.2%) mentioned Umbilical blood PH<7.

4.6.3 Knowledge of newborn unit's nurses on neonatal outcome

A test for association was conducted to determine relationship between nurse's knowledge and neonatal outcome. The findings showed that there was no statistically significant association between knowledge and neonatal outcome (P>0.05) as shown in Table 4.1.4.

Table 4.1.4: Association between health worker's knowledge and neonatal outcome

		23. Neonatal outcome			
		Recovered fully	*Continuing treatment*	*Died*	*p-value*
What is asphyxia	Failure of neonate to initiate and sustain breathing at time of birth	13 (41.9%)	15 (48.4%)	3(9.7%)	0.635
	None of the above	1(100%)			

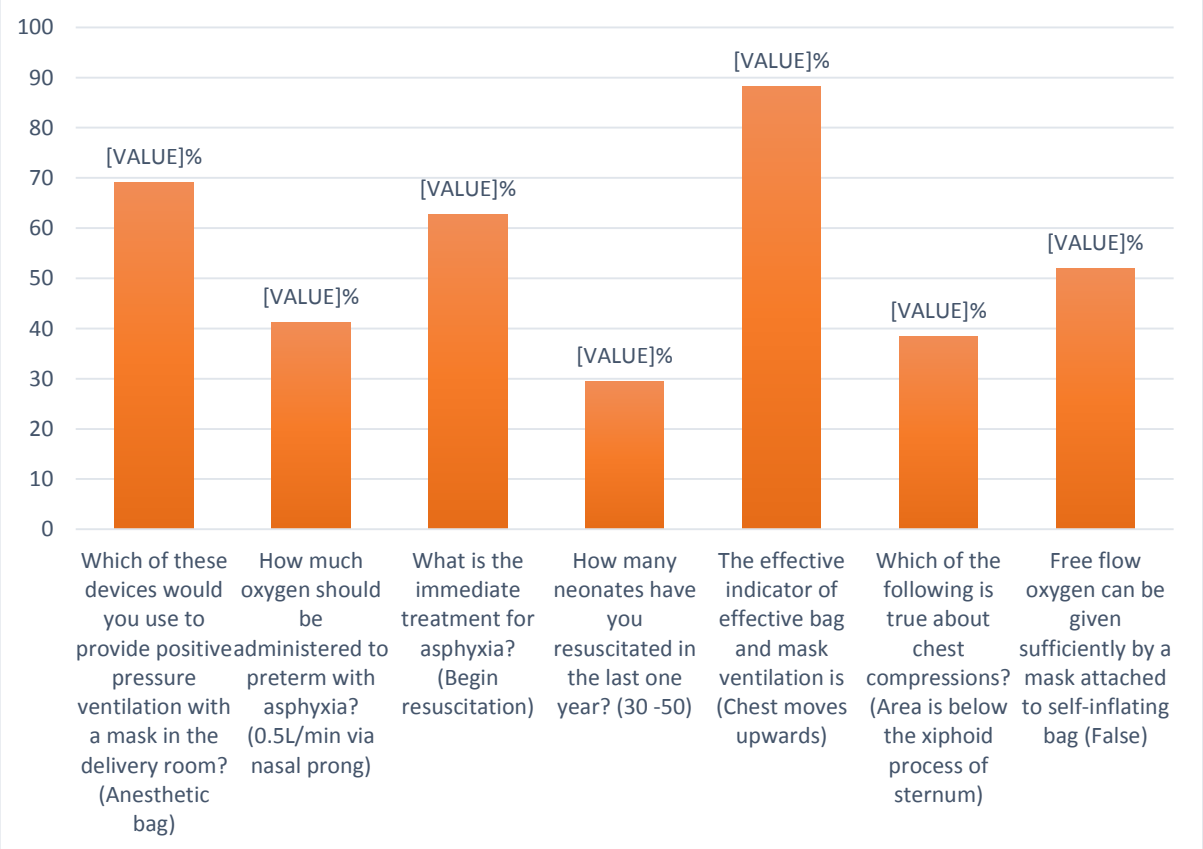

Figure 4.8.3: Practices of newborn unit nurses' practices on management of preterm asphyxia

The analysis also investigated the practices of nurses on management of preterm asphyxia. The nurses were asked to identify devices they would use to provide positive pressure ventilation with a mask in the delivery room, 32(69.2%) said they would use self-inflating resuscitation bag. Nurses were also asked to identify how much oxygen should be administered to preterm with asphyxia, 21(41.2%) identified 10L/min via re-breather mask as the appropriate oxygen levels. The analysis also showed that 32(62.7%) of the nurses had identified 'begin resuscitation' as the immediate treatment for asphyxia.

The nurses were asked to state the number of neonates they have resuscitated in the last one year, 29.4% of the nurse said they had resuscitated between 10 and 20 neonates, 23.5% had resuscitated between 30 and 50 neonates. The researcher asked how nurses would assess for effective bag and mask ventilation where 88.2% of the nurses asserted that chest moving upwards was the best indicator. Nurses were asked to identify true statements about proper landmark for chest compressions, 12(38.5%) identified 'area is below the xiphoid process of sternum', and 34.6% acknowledged 'using thumbs for compensation' as true statement. The analysis also showed that 27(51.9%) of the nurses considered the statement Free flow oxygen could be given sufficiently by a mask attached to self-inflating bag as being false while 25(48.1%) considered the statement as being true as presented in figure 4.8.3.

4.6.5 Newborn Nurses practice and neonatal outcome

A test for association was conducted to determine relationship between nursing practice and neonatal outcome. The findings showed that there was no statistically significant association between practice and neonatal outcome (P>0.05) as shown in Table 4.6.5.

Table 4.6.5: Cross-tabulation between practice and neonatal outcome

		Neonatal outcome			
		Recovered fully	*Continuing treatment*	*Died*	*p-value*
Immediate treatment of asphyxia	Begin resuscitation	10(52.6%)	7(36.8%)	2(10.5%)	0.512
	Shout for help	5(35.7%)	8(57.1%)	1 (7.1%)	

CHAPTER FIVE: DISCUSSION

5.0 Introduction

Discussion of results is presented in this chapter involving maternal, infant and health worker's characteristics in relation to outcome of preterm asphyxia. Neonatal comorbidity factor influence on asphyxia has also been discussed and conclusion made at the end of every narrative.

5.1 Maternal socio-demographic influence on neonatal outcome

The findings of this study showed that majority of preterm infants (73%) were born of mothers in their late twenties. An increase in maternal age by one-year was 3.38 times likely to increase the likelihood of a neonate dying than recovering from asphyxia. These findings was found to be consistent with a Kenyan study by (Nanychama, 2017) which showed maternal age of 26.7 to be the most prevalent among asphyxiated babies in KNH. The same statistics were comparable to two independent findings in Tanzania and Ethiopia which showed a mean age of 26 and 30 respectively a risk factor to birth asphyxia among pregnant women (Ibrahim, Muhye and Abdulie, 2018; Ibrahim, Muhye and Abdulle, 2017). In contrast, an Indian study by Amritanshu *et al.* (2014) found that maternal age was an isolated event in child birth and should therefore not be considered as a risk factor for birth asphyxia. From this study, a delay in fertility can be attributed to government rollout of free primary education to all children regardless of their socioeconomic background. Moreover, it could be presumed that with increased knowledge and awareness about sexual reproductive health, many young women are opting to concentrate on academic pursuit and shelving early marriages.

The results of this study also showed that an increase in monthly income was 23.6 times likely to cause neonatal recovery than death. This is consistent with finding from Nigeria, Pakistan and Ethiopia which demonstrated close association between low socioeconomic status and increased

incidence of asphyxia (Namusoke *et al.*, 2018; Wayessa, Belachew and Joseph, 2017; Berhe, Tinsae and Gebreegziabher, 2017). However, an Indian study by Amritanshu *et al.* (2014) found no association between maternal income level and outcome of asphyxia in babies. This could be explained by the fact that most women with poor financial ability have to look for an alternative source of income which could imply engaging in strenuous outdoor economic activities in order to fend for their family's material and financial needs. While working out in the field, these women are likely to suffer from occupational diseases such as pneumonia and Tuberculosis that is mostly associated with overcrowding and low-socioeconomic status. Inability to afford proper balanced diet can lead to maternal under-nutrition which causes intrauterine growth retardation thereby increasing neonatal morbidity and neonatal mortality in conjunction with birth asphyxia.

The study also showed that a neonate born via spontaneous vaginal delivery was 29.7 times more likely to recover fully than to expire. This finding contradicts an Ethiopian study by Tasew *et al.* (2018) that found out that spontaneous vaginal delivery in a preterm neonate was 2.2 times likely to predispose to birth asphyxia due to multiple morbidities from organ system failure and lung immaturity. Additionally, (Gebreheat *et al.*, 2018) found out that cephalo-pelvic-disproportion and peri-partum pyrexia mainly contributed to asphyxia during spontaneous vertex delivery. Spontaneous vertex delivery has been shown to decrease chances of developing asphyxia since the chest is squeezed so as to free any particulate matter (excess fluid) out of the lungs which could prevent pulmonary organ from functioning optimally. The vertical descent has also been shown to favor drainage of pulmonary fluid during childbirth which helps to prevent conditions such Transient Tachypnea of the Neonate (TTN) and birth asphyxia.

From this study it was also shown that an infant born of mother who had suffered anemia in pregnancy was 12.75 more likely to experience neonatal mortality than recovery. This concurs with Kenyan study by (Nanychama, 2017) who found out that maternal medical condition such

as anemia in pregnancy was a risk factor to birth asphyxia. Another study in Ethiopia by (Tasew *et al.*, 2018) found out that antepartum hemorrhage was highlighted as a major cause of birth asphyxia since it increases the risk of developing asphyxia by tenfold. Anemia which results from decreases in the number of red blood cell in the body can be caused by poor dietary intake of iron-rich food, parasitic infection, loss of blood through birth canal or gastrointestinal tract bleeding or from parasitic invasion by intestinal warms. If an expectant mother doesn't replenish her iron reserve adequately, then this may pose ventilation-perfusion mismatch on preterm neonate born with asphyxia thus hindering recovery.

Analysis of the study showed that neonates born to mothers residing closer to a healthcare facility were 32.1 times less likely to suffer neonatal death than recovery. This supports a Ugandan study by Namusoke *et al.* (2018) that found out that history of maternal referral and herbal use in antepartum period was significantly associated with complication of asphyxia namely hypoxic ischemic encephalopathy. This was similar to a Kenyan study by (Maalim, 2011) that showed considerable risk for asphyxia in infants that had been referred to Kenyatta National Hospital from peri urban medical facilities. This could be explained from the fact that during referral, poor planning and lack of efficient transport mechanism in most health clinics and medical facilities results in time wastage leading to late referral. The mothers that reside within KNH did not suffer the consequence of late referrals since it could have taken them less time to get to Kenyatta National Hospital and deliver their babies with good neonatal outcome.

5.2 Neonatal factor influence on preterm asphyxia

In this study male infants were shown to be 35.2 times likely to die than recover from preterm asphyxia. This findings are supported by Ugandan and Nigerian study that found asphyxia to be more prevalent in male than female infant (Ugwu, Abedi and Ugwu, 2012; Namusoke *et al.*,

2018). This can be attributed to the fact that females are more resistant to diseases because they possess double XX chromosomes. In most biological literature, X chromosome has been found to be the site for production of immunoglobulin which guarantees females gender double protection from diseases and squeale.

The finding in this study also showed that by the end of day seven of clinical assessment, three (9%) of the total infants had expired, nineteen (55.8%) had been discharged and twelve (35.2%) had developed adverse clinical condition such as hypoxic ischemic encephalopathy (HIE), aspiration pneumonia, seizure and were continuing treatment. This findings were in variance with Ugandan and Kenyan study by (Namusoke *et al.*, 2018) and (Maalim, 2011) both of which reported a neonatal mortality rate of 26 % and 31.1% on day seven of life in term-neonates. The difference in mortality rate could be attributed to a limited sample size, low gestational age of preterm neonates, study setting and maternal comorbidities.

Similarly, it was observed from the study that an increase in one unit of birth weight in kilogram, decreases the chances of death by 0.17 times compared to recovery from preterm asphyxia. This findings were supported by (Tasew *et al.*, 2018) from Ethiopia that found out low birth weight was significantly associated with birth asphyxia. In the same study, low birth weight was found to be 6.9 times likely to lead to asphyxia than in normal birth weight of 2,500 grams. Another study conducted in Nepal by Yadav *et al. (*2016) on risk factors for adverse outcome in asphyxiated newborn that showed prematurity to be the dominant cause of asphyxia which was attributed to decreased birth weight. Review of literature indicated that a unit increase in infant's weight in the first year of life from conception time relates to brain development and physical maturity (Mwendwa, 2006). Therefore, increased mortality rate associated with low birth weight in preterm neonates can be attributed to underdeveloped blood brain barrier that allows for

passage of stress mediators such as cytokines and chemokine which end up depressing respiratory center leading to asphyxia.

Reduction in APGAR score at 1 minute from this study was shown to be 91 times likely to result into mortality than recovery from asphyxia. This is in contradicts to a study in Pakistan by (Dalili *et al.*, 2015b) which found sound out that low APGAR score at 5^{th} minute by conventional APGAR method could not be used effectively to assess for asphyxia in preterm neonates. The disparity in findings may be attributed to the subjective nature of APGAR scoring criteria on assessment of physiologic responses to stimuli and the overall immature nature of preterm neonates may most certainly have resulted into contrasting findings.

5.3 Nurses knowledge and practice effect on outcome of preterm asphyxia

Research has shown that there exist gaps in nursing practice in relation to resuscitation practice of asphyxiated neonates. This is quite alarming given that nurses and midwives forms the first point of contact when patient arrives at the hospital. Therefore, by equipping nurses with basic lifesaving-skill in neonatal resuscitation can be of much significance in reducing the rate of neonatal morbidity and mortality in NBU.

In order to assess nurse's knowledge and practice effect on short-term outcome of asphyxia in preterm neonates, a set of question were designed to determine the knowledge and practice regarding neonatal resuscitation with much emphasis being placed on asphyxia. Scores were awarded based on individual responses and the outcome correlated with expected outcome for statistical association of significance. The questions that were considered to bear the greatest impact on neonatal outcome were therefore discussed. Furthermore, multinomial logistic regression of significant variables considered to affect asphyxia outcome were analyzed and test of association done to find out knowledge and practice effect on neonatal asphyxia outcome.

From the findings of the study majority of the nurses (96.2%) were able to define asphyxia as failure to initiate and sustain breathing at birth, most of them (55.8%) knew the duration that is supposed to be taken while resuscitating a neonate with asphyxia to be thirty minutes and a few (48.1%) got the normal respiratory rate of newborn to be between fifty and sixty breaths per minute. Most of the nurses (53.8%) in the unit were able to recognize HIE to be an example of short-term outcome of asphyxia. Majority of the nurses (93.3%) were able to identify drug used to treat apnea of preterm as caffeine citrate as well as naming correctly a drug that is used to promote lung maturity in utero as being dexamethasone. Most nurses (92.3%) cited birth weight as a parameter not used to diagnose asphyxia in neonates which was the odd one out from the rest of the choices that included umbilical blood PH les 7, failure to initiate breathing at birth and low APGAR score of less than 5 and 4 at first and fifth minute respectively.

On assessment of nurse's practices on management of asphyxia, a set of questions were asked for which majority scored above average. Most nurses (69.2%) could identify a device used to provide positive airway pressure which was self-inflating bag. Majority of nurses (62.7%) said they would commence resuscitation immediately if they encountered asphyxiated neonate and yet a few nurses (38.5%) were able to identify the correct landmark in chest compression during newborn resuscitation. Majority of nurses (88.2%) said chest expansion was a sign of effective ventilation and that free flow oxygen could not be administered sufficiently by mask attached to self-inflating bag.

The findings from this study is consistent with a Kenyan study by (Alwar, 2010) that found out that nurses performed well in bag-mask ventilation during resuscitation of a newborn. The same was consistent with findings by Opiyo *et al.* (2008) that showed one day resuscitation training lead to significant improvement in health worker's practices. However, this findings are opposed by those that were observed by (Kama, 2018) who concluded that nurses working in Uasin Gishu

county had deficient knowledge on newborn resuscitation as per set guidelines. The fact that nurses working in Kenyatta Newborn unit demonstrated fairly excellent knowledge on newborn resuscitation could be attributed to increased number of continuous medical education and on job training that is conducted on weekly basis. Kenyatta National Hospital being a teaching and referral hospital could imply that nurses working in this unit continuously get exposed to new ideas and current updates from lecturers and clinical instructors as they perform routine comprehensive ward rounds. Kenyatta National Hospital is also known to have an in-house training program for nurses that make them better skilled and informed at managing neonatal conditions.

The study fining also demonstrated that a reduction of vital sign monitoring in neonates at the time of admission was 1.17 times likely to result into death than recovery. This findings contradicts those by (Alwar, 2010) which showed that nurses working in KNH maternity theatre and labor ward were adequately prepared for emergency resuscitation and monitored vital signs closely. An Italian study by (Antonucci, Porcella and Pilloni, 2014) found out that temperature control, respiratory and cardiac monitoring, maintaining blood glucose control and monitoring of blood gases was essential in the management of asphyxiated newborns.

Furthermore, treatment option of cooling for hypoxic ischemic encephalopathy relies on periodic assessment of temperature level to ensure no supercoiling or warming occurs before the first 72 hours of therapy are over. Preterm neonates are a vulnerable hence requires close observation of vital signs especially blood pressure, temperature, respiratory rate, oxygen saturation rate and routine blood glucose monitoring. Immature body organ such as liver, kidney, hypothalamus make them susceptible to environmental changes without which can affect hemodynamic stability if observation is not taken. The reason for poor observation of vital signs among nurses working in new born unit could be attributed to lack of enabling resources to facilitate enhanced

monitoring of vital signs. Nurses appeared to be focusing on meeting the physiologic requirement of asphyxiated neonates such as feeding, drug administration, top tailing and among other things which would eventually result in them forgetting to monitor vital signs routines. Institutional challenge such as understaffing, sharing of observation measuring instrument such as blood pressure and pulse oximeter was also found to be a hindrance to successful monitoring of vital signs.

5.4 Infant comorbidity factors influencing outcome of asphyxia in preterm neonates

From this study, patients with hypoglycemia were more likely to recovery than die. This was consistent with Ugandan study by (Ondoa-Onama and Tumwine, 2003) which showed hypoglycemia to be a risk factor to poor outcome of asphyxia. In this study, an increase in hyperglycemia was found to be associated with poor outcome. This could have been attributed to presence of high serum glucose administered routinely in the first day of life when an infant is unable to tolerate oral feed (Kapadia *et al.*, 2013). Hypoglycemia may also affect the outcome of neonatal resuscitation especially if an infant is born of a diabetic mother (Mohamed, 2016). In such a situation, serial monitoring of random blood sugar at birth may have averted complications related to hypoglycemia such us diabetic coma.

The findings from this study showed that a neonate with sepsis as the underlying disease was 72.2 times more likely to die than recover from asphyxia. This concurs with a Kenyan study by (Gichogo, 2004) that found out that meconium staining and prolonged labor were main factors contributing to prevalence of asphyxia. Another Ethiopian study by Wayessa, Belachew and Joseph, (2017) found out that meconium and blood-stained amniotic fluid was significantly associated with birth asphyxia. Presence of meconium in amniotic fluid usually demonstrates

that a fetus is in distress and when aspirated into pulmonary cavity infections of the lower airway sets in which will necessitate administration of antibiotic treatment.

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.0 Introduction

In this chapter, a summary of the study findings is made plus general conclusion. Recommendations will also be stated from analysis of results together with a list of policy agenda.

6.1 Summary of findings

Maternal factors significantly associated with short-term outcome of asphyxia included; advanced maternal age, low income status, anemia in pregnancy and increased distance from the hospital.

Neonatal factors significantly associated with poor outcome of asphyxia in preterm neonate included; decreased birth weight, neonatal sepsis, low APGAR score and lack of vital sign monitoring. Preterm neonates had a mortality rate of 10% and morbidity rate of 35% on day seven of hospital admission.

There was no statistically significant association between knowledge and practice of nurses working in KNH NBU with short-term outcome of preterm asphyxia.

Neonatal comorbidity factors influencing outcome of asphyxia in preterm neonates included hyperglycemia, very low birth weight and meconium aspiration at birth.

6.2 Recommendations to the hospital

1. **Patient:** education on nutrition and identification of risk factors in pregnancy to facilitate seeking of early medical intervention.
2. **Nurses:** strictly practice observation of vital signs during resuscitation to establish baseline for assessment and intervention

3. **Hospital:** there is need to have more nurses trained on cooling therapy to treat short-term complication of asphyxia (Hypoxic Ischemic Encephalopathy)

6.3 Policy Agenda

1. There need for government to design a device that can predict and prognose birth asphyxia in preterm neonates.

6.4 Recommendation for further research

1. A follow up study needs to be undertaken to access long-term outcome of asphyxia in preterm infants and compare its finding with term babies.

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APPENDIX 1: BUDGET

Component	**Description**	**Item**	**Unit Measurement**	**Unit cost in Ksh.**	**TOTAL KSHS.**
Literature review	Personal literature search, transport and use of Wi-Fi.	Internet bundles Note books Pens	10 weeks 10 (2 quire) 10	@1000 150 25	16,000 1,500 250
Computing services	Stationary	A4 ream of paper	1	@750	750
		Proposal typing	3 drafts	@500	1,500
		Proposal printing	3 drafts	@500	1,500
		Photocopy charges	6 drafts	@300	1,800
Approval	KNH/UON Ethics Health Record Data		1 1	@2000 @500	2,000 500
Sub total					**25,800**
Research Phase	presenting	Printing and photocopy	10 Copies	@50	500
	Questionnaire and consent forms	Photocopy	220 copies	@30	6,600
	Data Collection	Research assistant	1x30 days	@1000	30,000
	Data entry clerk/ statistician		1x14 days	3,000	42,000
	Miscellaneous				7,500
TOTAL					**112,400**

APPENDIX 2: WORKPLAN

	Oct 2018	**Nov 2018**	**Dec 2018**	**Jan 2019**	**Feb 2019**	**Mar 2019**	**Apr 2019**	**May 2019**	**June 2019**	**July 2019**	**Aug 2019**	**Sep 2019**
Proposal development												
Ethical clearance												
Pretesting of the tool												
Data collection												
Data analysis												
Report writing and defense												

APPENDIX 3: BIODATA FORM FOR INFANT ADMITTED TO KNH NBU

Short-term outcomes of asphyxia in preterm neonates receiving care in Newborn Unit, Kenyatta National Hospital.

Instructions

- Do not write your name or any other identification anywhere on the questionnaire.
- Kindly complete all the sections.
- Respond by ticking the most appropriate response.☑

Neonatal demographics

1. Date (dd/mm/yy)

2. Time (Hr/min) of admission into NBU

Registration

3. Time of Birth

4. Birth weight in grams

5. Place of birth

6. Any underlying disease_____

7. Apgar score/score at:

A. 1 min [ ]

B. 5 min [ ]

NB: APGAR score as recorded on infant's medical record will be taken as the true and absolute value of initial assessment, since the researcher will not be deemed present at the time of delivery.

Neonatal factors

9. What was the color of liquor at birth?

Blood stained [ ] Meconium stained [ ] Clear liquor [ ]

10. Did the baby cry at birth?

Yes [ ] No [ ]

11. Was resuscitation done with Bag-Valve-Mask

Yes [ ] No [ ]

12. Was blood glucose test done?

Yes [ ] No [ ]

13. If yes, what was the value? [ ] mmol/L

14. Was oxygen saturation taken on admission at NBU?

Yes [ ] No [ ]

15. What was the degree of cyanosis?

Central [ ] Peripheral [ ] None [ ]

16. Any presence of yellow coloration (Jaundice)

Yes [ ] No [ ]

17. How frequent were vital signs monitored _____hourly?

18. Was there any sign of infection?

Yes [ ] No [ ]

19. If yes, please specify_____

20. Was the baby fed on anything in the first 24 hours after deliver?

Yes [ ] No [ ]

21. What type of feed was the neonate given?

EBM [ ] IVF [ ] Formula feed [ ]

22. Did the infant tolerate oral feeds?

Yes [ ] No [ ]

Neonatal outcome

To be completed on day seven of enrollment into study. (*tick appropriately*)

1. Recovered well and discharged [ ]
2. Still continuing with treatment [ ]
3. Died [ ]

APPENDIX 4: HEALTH WORKER'S QUESTIONNAIRE

Short-term outcomes of asphyxia in preterm neonates receiving care in Newborn Unit, Kenyatta National Hospital.

Date ----------

Unique Identification Number

Instructions

- ***Do not write your name or any other identification anywhere on the questionnaire.***
- ***Kindly complete all the sections.***
- ***Respond by ticking the most appropriate response.☑***

1. How old are you? [_____] (*Please indicate your completed birthday years*)
2. What is your gender?

   a) Male [ ] b) Female [ ]

3. What is your highest level of academic qualification?

   a) Certificate [ ]

   b) Diploma [ ]

   c) Higher Diploma, specify [_____]

   d) Bachelor's degree [ ]

   e) Master's degree [ ]

4. How long have you been practicing since qualification? _____years.
5. How long have you served in this unit?

   0-12 Months [ ] 1-9 Yrs [ ] More than 10yr [ ]

6. Have you ever attended any of the courses listed below? Yes [ ] No [ ]

1. Emonc [ ] 4. HBB [ ]

2. PALS [ ] 5. ALARM [ ]

3. ETAT+ [ ] 6. NRP [ ]

7. If yes, indicate which one (s).[_____

8. When was the last time you attended any pediatric-related course? _____

Knowledge of Health Care Providers on Immediate Care of Asphyxiated Neonate

9. What is asphyxia?

a) Failure of neonate to initiate and sustain breathing at time of birth? [ ]

b) Cardiopulmonary arrest before birth? [ ]

c) Failure of a neonate to cry when tapped on the back? [ ]

d) Failure of neonate to sneeze when sucked on the oropharynx? [ ]

e) None of the above [ ]

10. How long should resuscitation of preterm neonate last?

a) I hour [ ]

b) 30 mins [ ]

c) 12 mins [ ]

d) 10 mins [ ]

e) As long as there is sign of life. [ ]

11. What is the normal respiratory rate of a preterm neonate?

a) 40-50 bpm [ ]

b) 20-30bpm [ ]

c) 50-60bpm [ ]

d) 30-60bpm [ ]

e) 60-80bpm [ ]

12. Which of these is NOT a long-term complication of asphyxia?

a) Hypoxic Ischemic Encephalopathy [ ]

b) Mental retardation [ ]

c) Convulsive disorder [ ]

d) Cerebral palsy [ ]

e) Epilepsy [ ]

13. Which of the drugs below is given to promote lung maturity in a preterm neonate in utero?

a) Indomethacin [ ]

b) Dexamethasone [ ]

c) Caffeine [ ]

d) Vitamin K [ ]

e) None of the above [ ]

14. Which of the following drugs can be used to treat apnea of preterm neonate?

a) Indomethacin [ ]

b) Caffeine citrate [ ]

c) Sildenafil [ ]

d) Betamethasone [ ]

e) None of the above [ ]

15. Which of these parameters would not be appropriate in diagnosing asphyxia?

a) APGAR score of less than 5 at 1^{st} minute? [ ]

b) APGAR score of less than 4 at 5^{th} minute? [ ]

c) Umbilical blood PH of less than 7? [ ]

d) Birth weight of more than 2500 grams? [ ]

e) Failure to initiate breathing at time of birth? [ ]

Practices of health care providers on management of preterm asphyxia

16. Which of these devices would you use to provide positive pressure ventilation with a mask in the delivery room?

a) Self-inflating resuscitation bag [ ]

b) Anesthetic bag [ ]

c) Nasal pronged oxygen catheter [ ]

d) Neopuff T-Piece resuscitator [ ]

e) None of the above [ ]

17. How much oxygen should be administered to preterm with asphyxia?

a) 2L/min via nasal prong [ ]
b) 5l/min via non-rebreather mask [ ]
c) 10L/min via rebreather mask [ ]
d) 0.5L/min via nasal prong [ ]
e) As determined by physiologic demand [ ]

18. What is the immediate treatment of asphyxia?

a) Begin resuscitation with bag valve mask [ ]
b) Shout for help [ ]
c) Initiate antibiotic therapy [ ]
d) Give intravenous fluid [ ]
e) Give oxygen by nasal prong at 10L/min [ ]

19. How many neonates have resuscitated in the last one year?

a) Less than 10 [ ]
b) 10-20 [ ]
c) 30-50 [ ]
d) 50-100 [ ]
e) None [ ]

20. The best indicator of effective bag and mask ventilation is?

a) Rising of heart and audible breath sounds [ ]
b) Presence of central cyanosis [ ]
c) Rise in oxygen saturation [ ]
d) Chest moves upwards [ ]
e) None of the above [ ]

21. Which of the following is true about chest compressions?

a) Area is below the xiphoid process of sternum [ ]
b) Area is above the nipple line [ ]
c) Compression: ventilation rate is 1:2 [ ]
d) Using palm for compression [ ]

e) Using thumbs for compression [ ]

22. Free flow oxygen can be given sufficiently by a mask attached to self-inflating bag?

a) True [ ]

b) False [ ]

APPENDIX 5: QUESTIONNAIRE FOR INFANT'S MOTHERS

Short-term outcomes of asphyxia in preterm neonates receiving care in Newborn Unit, Kenyatta National Hospital.

Date ----------

Unique Participant ID:

Instructions

- ***Do not write your name or any other identification anywhere on the questionnaire.***
- ***Kindly complete all the sections.***
- ***Please tick the most appropriate response and answer all the questions***

1. How old are you? _____ (*Age in years*)

2. What is your marital status?

Married [ ] Single [ ] Divorced/Separated [ ] Widowed [ ]

3. What is your highest level of education?

Primary [ ] Secondary [ ] college [ ] University [ ]

4. Which religion are you?

Christian [ ] Muslim [ ] Atheist [ ]

5. What is your occupation?

Student [ ] Self-employed [ ] informal employment [ ] Housewife [ ]

6. Roughly, how much income does your family make in a month?

Kshs 1000-5,000 [ ] Ksh. 6,000-10,000 [ ]

Ksh. 11,000-24,000 [ ] Ksh. 25,000 and above [ ]

7. Where did you deliver?

Hospital [ ] Home [ ]

8. Did you attend Antenatal clinic?

Yes [ ] No [ ]

9. Which type of delivery did you have in your last pregnancy?

SVD [ ] C/S [ ] Breech [ ]

10. How many children do you have? _____(*Please indicate total number of children*)

11. Have you ever had a miscarriage(s)?

Yes [ ] No [ ]

12. Do you have any history of multiple pregnancies?

Yes [ ] No [ ]

13. Have you ever had history of premature delivery?

Yes [ ] No [ ]

14. Have you ever suffered from the following conditions while you were pregnant? (*Tick multiple*)

Anemia [ ] High blood pressure [ ] Bleeding while pregnant [ ]

Malpresentation [ ] Diabetes [ ] Malaria [ ]

15. How far do you stay from the nearest medical facility?

0.5-1km [ ] 5-10 Km 10Km and above [ ]

APPENDIX 6: NAKALA YA MASWALI KWA MAMA MTOTO

Ishara za mapema zinazojitokeza kwa mtoto mchanga aliyezaliwa kabla siku zake kutimia na akashindwa kupumua miongoni mwa waototo wanaopokea huduma katika wodi ya watoto wadogo hopsitali kuu ya Kenyatta.

Tarehe ----------

Nambari ya siri ya usajili:

Maelezo

- ***Usiandike jina lako wala nambari yako ya utambulisho popote kwenye Nakala hii.***
- ***Jaribu kukamilisha kila sehemu.***
- ***Tafadhali weka tiki kwenye jibu lililo sahihi na ujibu maswali zote.***

1. Una umri gani? _____ (*Miaka ngapi*)

2. Hali yako ya ndoa ni ipi?

Nimeolewa [ ] Sina mchumba [ ] Nimetalakiwa/ Tumeachana [ ] Mi mjane [ ]

3. Kiwango chako cha juu cha elimu ni ipi?

Shule ya msingi [ ] shule ya uipili [ ] Kolegi [ ] Chuo kikuu [ ]

4. Unashiriki dini gani?

Mkristo [ ] Muislamu [ ] Asiyekuwepo na dini [ ]

5. Wafanya kazi gani?

Mwanafunzi [ ] Nimeiajiri [ ] Nimeajiriwa Kwa mfumo rasmi [ ] Mke nyumbani [ ]

6. Unaweza kadiria mapato yako ya mwezi ni kama pesa ngapi hivi?

Shilingi 1000-5,000 [ ] Shilingi 6,000-10,000 [ ]

Shilingi 11,000-24,000 [ ] Shilingi 25,000 na zadi [ ]

7. Ulijifungulia wapi?

Kwenye kituo cha afya [ ] Nyumbani [ ]

8. Je ulikuwa watembelea cliniki ya ujauzito?

Ndio [ ] La [ ]

9. Ni njia ipi ujifungulia nayo Kwa ujauzito uliopita?

Kichwa kutanguliza [ ] Kupitia Kwa upasuaji [ ] Mtoto kuja na upande wa nyuma [ ]

10. Una watoto wangapi?_____ (*Tafadhali, andika nambari ya watoto wote kwa jumla*)

11. Je umewahi poteza mimba ikiwa bado changa?

Ndio [ ] La [ ]

12. Je unahistoria ya kushika mimba ya Zaidi ya mtoto mmoja?

Ndio [ ] La[ ]

13. Je umewahi fijungua mimba kabla siku za mtoto kutimia?

Ndio [ ] La [ ]

14. Umewahi patwa na matatizo yafwatayo ulipokuwa mjamzito? (*Weka tik kwingi*)

Upungufu wa damu mwilini [ ] Mpigo wa kasi wa moyo [ ] Kuvuja damu na ujauzito[ ]

Mtoto kuketi vibaya tumboni [ ] Kisukari [ ] Malaria [ ]

15. Unakaa umbali gani na kituo cha karibu cha afya?

Kilomita 0.5-1 [ ] Kilomita 5-10 [ ] Kilomita 10 na zaidi [ ]

APPENDIX 7: CONSENT FORM FOR HEALTH WORKERS

Title of the study: Short-term outcomes of asphyxia in preterm neonates receiving care in Newborn Unit, Kenyatta National Hospital.

Researcher: Madara Caleb William (Master of Science in Nursing student, Year II) University of Nairobi.

Introduction to the study: You are asked to participate in the study which is voluntary and will be conducted in the Newborn Unit of KNH. Please take time and decide whether you will participate in the study. Refusal to participate will not result in any penalty or loss of any benefits. There is neither cost nor compensation for participation.

Purpose of the study: This study aims at assessing short-term outcomes of asphyxia in preterm neonates with an aim of establishing its prevalence, equipping health care providers with knowledge on how best to prevent, treat and offer rehabilitative assistance in cases of established squeal and advancing the knowledge base on acute pediatric care.

Time: the questionnaire has fifteen simplified multiple-choice questions expected to guide the researcher on assessment of health care provider's knowledge on care of preterm neonate with asphyxia. Filling in of questions should take a minimum of ten minutes and research assistant may guide you were necessary.

Benefit of the study: This study will help identify the most important risk factors to target and implement during admission of pre-term neonates with birth asphyxia. It will also highlight frequency and sequence of birth asphyxia by creating awareness and capacity building among healthcare providers on postpartum care of asphyxia in pediatric patients. Knowledge generated from this study will also provide scholarly benefit to nursing researchers in the field of neonatal care.

Risks, stress and discomfort: There are no direct foreseen risks in you participating in this study. However, the study will require you to spare 10 minutes of your time and fill the questionnaire. If there are any questions you do not want to answer, you are obliged to skip. In addition, you have the right to decline giving information.

Cost and risk of loss of Confidentiality: There will be no direct cost incurred by you neither will you receive any money for participating in this study. Data including questionnaires and file

from the study will be kept locked in a cabinet during the study period. Your data will be labeled with your unique identity and your name concealed to maintain confidentiality when taking part in the study. Furthermore, your name will not appear in any report or publication of the research and all your personal information will be handled with a high level of confidentiality.

Voluntary Participation and withdrawal: Remember, your participation is entirely voluntarily. Should you consider changing your mind midway, you have the right to do so and you shall not suffer any consequence whatsoever.

Sharing of results: The results of this study may be presented during scientific and academic forums and may be published in scientific medical journals and academic papers.

In case of any questions, complaints or concerns kindly contact the primary investigator Caleb William Madara on 0722614092 or Email him at calebmadara35@gmail.com

Or

KNH/UON Ethics committee

P. O. Box 20723-00202

Telephone -020723-00202

CONSENT AGREEMENT

I participant confirm that I have read the consent explanation and have fully understood the purpose of the study and do hereby voluntarily agree to participate in the study.

Signature …… Date …….

Researcher's statement

Interviewer: I certify that the purpose, potential benefits and possible risks associated with participating in this research have been explained to the above participant and the individual has consented to participate.

Signature_____ Date_____

APPENDIX 8: CONSENT FORM FOR INFANT'S MOTHER

My name is Caleb William Madara, a nursing student from the University of Nairobi, School of Nursing science, undertaking Master of Science in nursing (Pediatrics). I am carrying out a study to assess the short-term outcomes of asphyxia in preterm neonates receiving care at Kenyatta National Hospital, Newborn Unit.

Research Procedure

I request you to support me by taking part in this research study. The purpose of this consent form is to provide you with the information you will need to help you decide whether to participate in the study. This process is called 'Informed Consent'. Please read this consent information carefully and ask any question or seek clarification on any matter concerning the study with which you are uncertain.

Participants

Health care providers, preterm infant's admitted in Newborn Unit with asphyxia together with you as the infant's mother are all invited to take part in this study.

Process

The researcher will be assessing and recording the outcomes of asphyxia in neonates admitted in Kenyatta National Hospital Newborn Unit for the first seven days of life. A questionnaire will be given to you to get more information about yourself in relation to infant's condition.

Confidentiality

Your name and title will not be used in any report of this work. Only a code number will be used to identify you as a participant. No other person will be allowed to access information contained in the file unless you grant permission.

Infant Medical record review

The researcher is requesting you to allow him together with his research assistant to review your child's medical record and child welfare booklets while completing Neonatal Characteristic Checklist. This is to assist him/her obtain necessary information about your child's health that will be useful in the study

Benefits

This study will help both health care providers and mothers of sick child identify the most important risk factors that will predispose an infant to developing asphyxia and address measure to prevent such occurrences. It will also provide you with knowledge on what to do when you have developed premature delivery unexpectedly and enumerate importance of seeking quick medical interventions. The finding from the study will enable stakeholder and policy maker to improve on the quality of service rendered through resource mobilization, increased staffing and hastening of referral mechanism for a better health care outcome. Finally, by allowing your child to take part in this study you will have helped the society and KNH on knowledge generation about prevalence and likely complications that may be seen in the first few days in the life of a preterm with birth asphyxia.

Risks There are no direct foreseen risks in you participating in this study. However, the study will require you to spare 10 minutes of your time and fill the questionnaire. If there are any questions you do not want to answer, you are obliged to skip. In addition, you have the right to decline giving information. Please note, there will be no disruption or interference in provision of care while you undertake this study.

Withdrawal from study

You are free to withdraw from the study anytime and your information will be confidentially destroyed.

Confidentiality

Your name and title will not be used in any report of this work. Only a unique number will be used to identify you as a participant. No other person will be allowed to access information contained in the file unless you grant permission. Furthermore, result of this study will be presented in aggregate manner, so no individual responses would be tracked back to you as an individual

Problems or Questions

Any queries about the study can be directed to the principal investigator;

Caleb William Madara

Mobile number 0722614092

OR

KNH/UON Ethics Committee,

P. O. Box -20723-00202

Telephone-020725272

CONSENT AGREEMENT FOR MOTHERS

I being a guardian of _____ (name of child) have received adequate explanation about the research to be conducted. I have understood all that has been read and had my questions answered satisfactorily. I understand that I can change my mind at any stage and it will not affect me/my child I any way.

I agree to allow my child to take part in this research and for the collection of clinical data.

Mother's/Guardian's signature_____ Date_____

I certify that I have followed all the study procedures required for obtaining informed consent.

Investigator Name: _____ Date_____

Investigator's signature: _____Time_____

Only necessary if the parent/guardian cannot read

I attest that the information concerning this research has been accurately explained to me and has been understood by the mother and that I freely give consent as a mother.

Witness Name_____

Witness Signature_____

APPENDIX 9: CHETI CHA KIBALI KUSHIRIKI UTAFITI

Jina langu ni Caleb William Madara muuguzi mkufunzi kutoka Chuo Kikuu cha Nairobi, Idara ya Uuguzi kwenye afya ya watoto. Ningependa kufanya utafiti kuhusu ishara za mapema zinazojitokeza kwa mtoto mchanga aliyezaliwa kabla siku zake kutimia na akashindwa kupumua miongoni mwa waototo wanaopokea huduma katika wodi ya watoto wadogo hopsitali kuu ya Kenyatta.

Mpangilio wa utafiti

Naomba usaidizi wako kwa wewe kama mama ya mtoto ama mlinzi kushirikiana nasi kwa hii utafiti. Kiini hasa cha cheti hiki ni kukuongezea ufahamu itakaokusaidia kufanya uamuzi kama utashiriki utafit hi.

Ningependa kujifahamisha ni kiwango kipi cha watoto hupata shida ya kushindwa kupumua punde wanapozaliwa ikiwa siku zao bado hazijawadia na baadhi ya yale mashida wanaokumbana nayo kwa muda mfupi wakiwa wanahudumiwa kwa ward ya watoto wchanga hapa hospitali kuu ya Kenyatta.

Washiriki wa utafiti

Kando na wewe kama mzazi ama mlinzi wa mtoto, wengine watakaoshirikishwa katika hii utafiti ni wahudumu wa afya pamoja na watotot walio na shida ya kupumua waliozaliwa kabla siku yao kutimia. Ndiposa ningependa kukuomba kuruhusu mtoto wako awe mmoja wa watakaongaliwa wakati wa kupeana huduma kwa muda wa siku saba na hata baadaye.

Uhifadhi wa siri

Hakuna habari yako ya kibinafsi au jina lako litakalo tumika wakati wa kutayarish ripoti ya utafiti huu. Utapewa numbari ya usajili ambayo itakuwa ni siri kati yako na msaidizi wa utafiti ama mtafiti mkuu.

Kutazamwa kwa Nakala ya Matibabu

Mtafiti mkuu atakusihi umruhusu yeye pamoja na mtafiti msaidizi kuangalia Nakala za matibabu za mwanao pamoja na kitabu chake cha kliniki ili aweze kukamilisha kujazwa wa Nakala inayohusu mambo ya mtoto. Hii itamwezesha yeye na mwenziwe kupata mambo muhimu kuhusu hasa kuhusu mwanao inayoambatana na utafiti huu.

Malipo

Hakuna pesa au zawadi zitakazotolewa kwa kushiriki lakini utafiti huu utatumika kuimarisha jinsi ya utenda kazi wa wafanyi kazi wa afya katika hospitali hii na kuongeza ujuzi kwa maswala ya afya kwa watoto wachanga wanaopokea huduma hapa hopitali kuu ya Kenyatta.

Manufaa

Matokeo ya utafiti huu itasaidia wewe pamoja na wahudumu wa afya kutambua kwa haraka yale mambo yanayo changia mtoto apate shida ya kushindwa kupumua wakati anapozaliwa na kueleza bayana jinzi ya kukabiliana na matatizo kama haya yanapo chipuka. Itakupea pia elimu na ujuzi ya kile unatakiwa kufanya ukipata kujifungua kabla tarehe hazijawadia na umuhimu wa kutufuta huduma ya afya kwa dharura. Wewe pamoja na washika dao mtanufaika katika uimarishaji wa huduma ya afya bayana ikiwemo usambazaji wa raslimali za afya, kuongezewa kwa kiwango cha madaktari, kurahisishwa katika usafirishaji kutoka hospitali moja hadi nyingine na matokeo mema ya matibabu. Mwishoe, kwa wewe mwenyewe kukubali mwanao ashiriki utafiti huu utakuwa umesaidia jamii kwa jumla pamoja na hopsitali kuu ya Kenyatta katika kubuni elimu msingi kuhusiana na kiwango kinachoshuhudiwa na mathara mabaya yanayoltwa na shida ya kutokupumua kwa mtoto machanga aliyezaliwa kabla siku zake kutimia siku chache baada ya kulazwa hospitalini.

Athari

Hakuna madhara yoyote kwa mtoto kushiriki kwa utafiti huu. Kutopeana ruhusa kwako hakutaadhiri wewe na mtotowako kwa njia yoyote. Utafiti huu ni wa kujitolea na unaweza kujiondoa kwa wakati wowote unapohisi kufanya hivyo.

Kujiondoa kwenye utafiti

Uko na uhuru wa kujiondoa wakati wowote kushiriki hii utafiti na baadhi ya maelezo uliopeana yatawekwa fiche ili yaharibiwe kisiri.

Shida au Maswali

Ukiwa na tashwishi yoyote unaweza kuyaelekeza kwa mtafiti mkuu-

Caleb William Madara

Sanduku la Posta 19676-00200

Nairobi.

Simu-0722614092

Ama Kwa,

KNH/UON Kamiti ya Maswala ya Jinsia,

S.L.P: 20723-00202

Nambari ya simu-020725272

CHETI CHA KIBALI CHA RUHUSA YA MZAZI KWA UTAFITI

Mimi nikiwa mzazi wa----------(jina la mtoto) nimeelezwe kwa kina juu ya utafiti huu. Nimepata ufahamu juu ya yale nimeelezewa na masesli yangu yakajibiwa kwa ukamilifu. Ninafahamu ua kwamba naweza kujitoa katika hatua yoyote pasipo na madhara yoyote kwangu na kwa motot wangu.

Nakubali kumruhusu mtoto wangu kuhusishwa katiak utafiti huu.

Sahihi ya mzazi----------Tarehe----------

Nadahibitishwa ya kuwa nimefuata kanuni zote zinazohitajika kwa minajili ya kupewa kibali

Jina la mtafiti----------Tarehe----------

Sahihi la Mtafiti----------Saa----------

Kama mzazi hawawezi kusoma

Nadhibitishwa ya kuwa maelezo kuhusiana na utafiti huu yametolewa kwa mzazi akaelewa na kuwa kibali cha utafiti kimetolewa bila ushawishi wowote.

Jina la shahidi_____Sahihi ya shahidi_____

APPENDIX 10: Daily Neonatal Neurologic Assessment Tool

(Tick where necessary in the column provided)

Status	**Grade 1**		**Grade 2**		**Grade 3**	
Conscious level	Irritable/Hyper alert		Lethargic		Comatose	
Suck Reflex	Abnormal/hyper		Poor		Absent	
Respiration	Tachypnea		Present within acceptable limit		Severe Apnea present	
Seizure	Absent		Present		Present/ Persistent	
Apex Beat	Above 100		Below 100		Absent	
Moro Reflex	Exaggerated		Depressed		Absent	
Tone	Increased		Mild		Flaccid	

Adopted from (Fenichel,1983) staging scale.

Remarks :……..

Checked by…….

Sign…….

.

APPENDIX 11: AUTHORIZATION LETTER TO ETHICS

Caleb William Madara,
H56/7430/2017,
University of Nairobi.
School of Nursing Sciences.
May 2019

The Chairman,
UoN/KNH Ethics and Research Committee,
P.O. Box 20723-00202,
Nairobi.
Dear Sir/Madam

RE: ETHICAL REVIEW AND APPROVAL

I am a second year post graduate nursing student, pursuing Master of Science in Nursing (Pediatrics). I am writing to request for permission to carry out research on "**Short-term outcome of asphyxia in pre-terms neonates receiving care at Kenyatta National Hospital, Newborn Unit**" The study will be carried out between the month of April and June 2019. Any assistance whatsoever rendered by your office towards achieving this task will be highly appreciated. The research findings will be significant in improving clinical outcome of newborn care and provide basis for timely intervention. I am looking forward to your comments and suggestions for improvement of the proposed study.

Yours faithfully

Caleb William Madara

APPENDIX 12: LETTER TO KNH CEO

Caleb William Madara,
University of Nairobi.
School of Nursing Sciences
May 2019

The Chief Executive Officer,
Kenyatta National Hospital, Nairobi.

Through

Assistant Chief Nurse,
Newborn Unit
Dear Sir/Madam

RE: PERMISSION TO UNDERTAKE STUDY

I am a second year post graduate nursing student, pursuing Master of Science in Nursing (Pediatrics). I am writing to request for permission to carry out research on "**Short-term outcome of asphyxia in pre-terms neonates receiving care at Kenyatta National Hospital, Newborn Unit**" The study will be carried out between the month of April and June 2019. Any assistance whatsoever rendered by your office towards achieving this task will be highly appreciated. The research findings will be significant in improving clinical outcome of newborn care and provide basis for policy formulation. Please find the attached approval letter form KNH/UON ERC.

Yours faithfully

Caleb William Madara

APPENDIX 13: APROVAL LETTER FROM ETHICS

APPENDIX 13: APROVAL LETTER FROM ETHICS

UNIVERSITY OF NAIROBI
COLLEGE OF HEALTH SCIENCES
P O BOX 19676 Code 00202
Telegrams: varsity
Tel:(254-020) 2726300 Ext 44355

KNH-UON ERC
Email: uonknh_erc@uonbi.ac.ke
Website: http://www.erc.uonbi.ac.ke
Facebook: https://www.facebook.com/uonknh.erc
Twitter: @UONKNH_ERC https://twitter.com/UONKNH_ERC

KENYATTA NATIONAL HOSPITAL
P O BOX 20723 Code 00202
Tel: 726300-9
Fax: 725272
Telegrams: MEDSUP, Nairobi

Ref: KNH-ERC/A/223

10th June, 2019

APPROVED
10 JUN 2019
KNH/UoN-ERC

Caleb William Madara
Reg. No.H56/7430/2017
School of Nursing Sciences
College of Health Sciences
University of Nairobi

Dear Caleb

RESEARCH PROPOSAL: SHORT-TERM OUTCOMES OF ASPHYXIA IN PRETERM NEONATES RECEIVING CARE IN NEWBORN UNIT, KENYATTA NATIONAL HOSPITAL (P165/03/2019)

This is to inform you that the KNH- UoN Ethics & Research Committee (KNH- UoN ERC) has reviewed and **approved** your above research proposal. The approval period is 10th June 2019 – 9th June 2020.

This approval is subject to compliance with the following requirements:

a. Only approved documents (informed consents, study instruments, advertising materials etc) will be used.
b. All changes (amendments, deviations, violations etc.) are submitted for review and approval by KNH-UoN ERC before implementation.
c. Death and life threatening problems and serious adverse events (SAEs) or unexpected adverse events whether related or unrelated to the study must be reported to the KNH-UoN ERC within 72 hours of notification.
d. Any changes, anticipated or otherwise that may increase the risks or affect safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH- UoN ERC within 72 hours.
e. Clearance for export of biological specimens must be obtained from KNH- UoN ERC for each batch of shipment.
f. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. (*Attach a comprehensive progress report to support the renewal*).
g. Submission of an *executive summary* report within 90 days upon completion of the study. This information will form part of the data base that will be consulted in future when processing related research studies so as to minimize chances of study duplication and/ or plagiarism.

Protect to discover

For more details consult the KNH- UoN ERC website **http://www.erc.uonbi.ac.ke**

Yours sincerely,

PROF. M. L. CHINDIA
SECRETARY, KNH-UoN ERC

c.c. The Principal, College of Health Sciences, UoN
The Director, CS, KNH
The Chairperson, KNH- UoN ERC
The Assistant Director, Health Information, KNH
The Director, School of Nursing Sciences, UON
Supervisors: Dr. Abednego Alibiri Ongeso, Prof. Grace Omoni

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APPENDIX 14: LETTER OF APPROVAL FROM KNH PEADIATRIC DEPARTMENT

APPENDIX 14: LETTER OF APPROVAL FROM KNH PEADIATRIC DEPARTMENT

KENYATTA NATIONAL HOSPITAL
P.O. BOX 20723, 00202 Nairobi

Tel.: 2726300/2726450/2726550
Fax: 2725272
Email: knhadmin@knh.or.ke

Ref: KNH/PAEDS-HOD/48 Vol.II

Date: 11th June 2019

Caleb William Madara
School of Nursing Sciences
College of Heath Sciences
University of Nairobi

Dear Caleb

RE: AUTHORITY TO COLLECT DATA IN PAEDIATRICS DEPARTMENT

Following approval by the KNH/UON-Ethics & Research Committee for your Research Proposal and subsequent filing of the Study Registration Certificate, this is to inform you that authority has been granted to collect data in ***Paediatrics Department***, on your study titled ***"Short-term outcomes of asphyxia in preterm neonates receiving care in New Born Unit at the Kenyatta National Hospital"***.

Kindly liaise with the Senior Assistant Chief Nurse Paediatrics for facilitation.

You will also be required to submit a report of your study findings to the Department of Paediatrics after completion of your study.

Dr. Douglas Makewa
Ag. HEAD OF DEPARTMENT, PAEDIATRICS

Cc. Senior Assistant Chief Nurse, Paediatrics