THE PREVALENCE OF BIRTH ASPHYXIA, ASSOCIATED FACTORS AND OUTCOMES AT A DISTRICT HOSPITAL IN KIGALI, RWANDA

Uwingabire Fauste

College of Medicine and Health Sciences

School of Nursing and Midwifery Sciences

Master of Science in Nursing (Neonatology)

2017

THE PREVALENCE OF BIRTH ASPHYXIA, ASSOCIATED FACTORS AND OUTCOMES AT A DISTRICT HOSPITAL IN KIGALI, RWANDA

Uwingabire Fauste

College of Medicine and Health Sciences

School of Nursing and Midwifery Sciences

Master of Science in Nursing (Neonatology)

Supervisor: Dr Marcella Gowan

Co-Supervisor: Tengera Olive, RM; MscN

July, 201

DECLARATION

Surname and first name of the student: Uwingabire Fauste

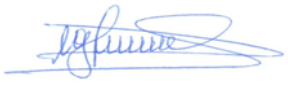
The title of the project: 'The Prevalence of Birth Asphyxia, Associated Factors and Outcomes at a District Hospital in Kigali, Rwanda.'

a. Decleration by the student

I do hereby declare that this dissertation '**The Prevalence of Birth Asphyxia, Associated Factors and Outcomes at a District Hospital in Kigali, Rwanda**'; submitted in partial fulfillment of the requirements for the degree of **Master of Science in Nursing (Neonatology)** at University of Rwanda/ College of Medicine and Health Sciences/ School of nursing and Midwifery sciences, is my original work and has not previously been submitted elsewhere. Also, I do declare that a complete list of references is provided indicating all the sources of information quoted or cited.

Uwingabire Fauste

UR reg. No: 216337852

Signed: 

Date: July 28th, 2017

b. *Authority to Submit the dissertation*

Surname and First Name of the Supervisor

Dr. Marcella Gowan

In my capacity as a Supervisor, I do hereby authorize the student to submit his/her dissertation.

Date and Signature of the Supervisor

June 12th,2017 

DEDICATION

This project is dedicated to all my family members especially my husband NDAYISENGA Jean Claude, my two daughters BYISHIMO ISIMBI Faustina and HIRWA ISHEJA Ella as well as my lovely parents MUKARUBUGA Faïna and TABARO Nicodem for their invaluable support during the Master's studies journey.

I also dedicated this project to all neonates who did not survive the insult caused by birth asphyxia in 2016. My your souls rest in peace.

ACKNOWLEDGEMENTS

First, I thank the Almight God for all I am and achieved during my Master's studies journey. I express my gratitude to the University of Rwanda/ College of Medicine and Health Sciences/ School of Nursing and Midwifery Sciences administration; academic faculties; and United States (US) faculties through Human Ressource for Health (HRH) program for this nursing specialization program in Rwanda. I also thank them for the program organization and quality education offered to us.

I value the work done by my supervisor Dr Marcella Gowan and Co-supervisor Mrs Tengera Olive, since the development of this research proposal up to the final project. This cost to them time, patience, collaboration, day and night guidance.

I am grateful to the Dean of SoNM/ CMCH/ UR; Dr MUKAMANA Donatilla for her advocacy in the Ministry of Health for financial support. My future goals are to improve neonatal outcomes through evidence based practice, research and advocacy for elimination of neonatal preventable deaths.

I would like to express my thanks to the study site administrators, Neonatal Intesive Care Unit (NICU) and archive staff for facilitation and help provided during data collection phase.

I am grateful to my classmates with whom I shared academic success, knowledges, skills and competences development. Also special thanks are addressed to my Co-workers who stayed at may work place and worked in my absence of 3 days/week to enable me to fulful both academinc and work responsabilities in this last two years period.

Finally, I am grateful to my dear friend Dr Geralyn Sue Prullage for the research tool face validation. I also remember her love to neonates especially the most vulnerable like premature babies "Inzovu" as she used to call them!

ABSTRACT

Neonatal mortality is the death of a newborn within the first 28 days of the life. Despite global efforts, neonatal mortality remains on the rise. It is estimated that 3 million neonates die within the first seven days of life and the highest number of those deaths (99%) occurs in LMICs (WHO, 2015:pp.1-6). The leading causes of neonatal mortality are prematurity, birth asphyxia (BA), and sepsis. Worldwide the neonatal mortality related to BA is 23% while it is at 41% in Rwanda (Liu et al., 2015:p.430 & MOH, 2014a:p:39). BA is an insult to the brain and other vital organs due to a decrease of oxygen before, during or immediately after birth (MOH, 2014b). **The purpose** of this study was to determine the prevalence, associated factors and outcomes of BA at adistrict hospital in Kigali, Rwanda. **Methodology**: A descriptive, retrospective, cross sectional study was done on 340 neonates admitted at the study site NICU in 2016. A valid and reliable data collection tool was used to collect data on researche variables. The analysis was done using SPSS version 20. The UR IRB ethical clearance was obtained prior to collect data. **Results:** BA was confirmed in 135 out of 340 (39.7%). Associated fetal factors were normal birth weight [OR: 12.982, *p*: 0.013*, CI: 1.7; 98.852]; term babies [OR: 2.279, *p*: 0.002*, CI: 1.081; 4.805]. Maternal factor was grand multigravida [OR: 5.266, *p*: 0.010*, CI: 1.500; 18.492]. Placental factors were normal duration of ROM [OR: 1.885, *p*: 0.049*, CI: 0.998; 3.560]; and meconium stained AF [OR: 3.562, *p*: 0.000*, CI: 1.881; 6.745]. Labor and birth factors identified were normal duration of labor [OR: 4.746, *p*: 0.042*, CI: 1.060; 21.257]; vaginal mode of delivery [OR: 2.762, *p*: 0.000*, CI: 1.675; 4.553]; Apgar score of ≤ 5 at 5 minutes [OR: 5.186, *p*: 0.001*, CI: 2.004; 13.417]; no cry history in the first 5 minutes of life [OR: 38.811, *p*: 0.000*, CI: 16.267; 92.599]; resuscitation up to cardiac massage [OR: 2.598, *p*: 0.003*, CI: 1.595; 4.248] and ventilated babied [OR: 2.030, *p*: 0.003*, CI: 1.487; 2.679]. BA outcomes were early seizures at 52.6%; a prolonged NICU stay with a mean days of 7.6 (SD 6.1) and a high specific mortality at 87%. **Conclusion**: BA prevalence was found to be 39.7%. Several modifiable and non modifiable risk factors were identified. BA outcomes were found to be high mortality, early seizures, and prolonged hospital stay. Further researches are needed to generate knowledge towards the global target of ending preventable neonatal deaths (SDG3:2).

Key words: Birth Asphyxia (BA), Prevalence, Risk factors, Outcomes, District hospital

TABLE OF CONTENTS

LIST OF SYMBOLS AND ABBREVIATIONS

AAP : American Academy of Pediatrics

AF : Amniotic Fluid

ANC : Antenatal Care

BA : Birth Asphyxia

BW : Birth Weight

C/B : Cesarean Birth

CMHS : College of Medicine and Health Sciences

FD : Fetal Distress

G : Gravidity

GA : Gestational Age

HBB : Helping Baby Breathe

IRB : Institutional Review Board

MDGs : Millennium Development Goals

Min : Minutes

N : Freguency

n : Sample Size

NICU : Neonatal Intensive Care Unit

NRFHR: Non reassuring Fetal Heart Rate

R-HMIS: Rwanda- Hospital Management Information System

PROM : Prolonged Rupture Of Membranes

PRN : Perinatal Rescuer Network

SD : Standard deviation

SDGs : Stustainable Development Goals

SVD : Spontaneous Vaginal Delivery

UNICEF: United Nations International Children's Emergency Fund

UN IGME: United Nations Inter-agency Group for Child Mortality Estimation

UR : University of Rwanda

V/B : Vaginal Birth

WHO : World Health Organization

LIST OF TABLES

LIST OF FIGURES

LIST OF ANNEXES

CHAPTER 1: INTRODUCTION

1.1. INTRODUCTION

Neonatal mortality is the death of a neonate within the first 28 days of the life (NISR et al., 2016:p.103). While there have been improvements in child morality the rates of neonatal mortality have been slower to decline, and form about one third of all child mortality. It is estimated that 1 million newborns die in the first 24 hours and 2 million more die within seven days of birth (WHO, 2015:p.7). The highest neonatal mortality (NMR) occurs in Sub-Sahara Africa, which has had the least progress in reducing neonatal deaths (WHO, 2016a). The leading causes of neonatal mortality are prematurity, asphyxia, and sepsis. According to the MOH (2013:.p.43) in Rwanda, birth asphyxia (BA) is the leading cause of neonatal mortality. According to the Ministry of Health annual reports BA related neonatal mortality had been increasing at 31.6% in 2012; 39% in 2013; and 41% in 2014 (MOH, 2012a:p.27; 2013:p.43 and 2014a:p.39). BA occurs when a baby's vital organs do not get enough oxygen during the birthing process. BA can be fatal or result in long termdebilitating conditions such as brain damage, cerebral palsy and epilepsy (Golubnitschaja et al., 2011:p.197).

1.2. BACKGROUND TO THE STUDY

In the year 2000, 189 countries committed to reduce child mortality through Millenium Development Goals (MDGs) specifically the goal number 4; where each country had to count down the child mortality by 2/3 within a period of 15 years (2000-2015). Significant progress has been made in the under-five mortality rate with 48 million lives of children being saved over the past 25 years (WHO, 2015:pp.1-7). However, this progress was not enough to meet the goal to reduce child mortality rate by two-thirds percent. In 2015, there were almost six million deaths of children under five. This means that every day 16,000 children are dying (WHO, 2015:p.3). Within this group is the newborn population that is the most vulnerable to death and make up 45% of the child mortality rate. The neonatal period is the first 28 days of life and is the time of the greatest risk of death in a newborn (WHO, 2016a).

Despite global efforts, neonatal mortality remains on the rise in some countries. It is estimated that 2 million newborns die on the day they are born and 3 million more die

within seven days of birth. It is important to note that an additional 3.3 million are stillborn (WHO, 2016a). As with many health issues the highest neonatal mortality (99%) occurs in low- and middle-income countries. Sub-Sahara Africa and South East Asia have had the least progress in reducing neonatal deaths (WHO, 2015:p 2-6). Neonates are susceptible to death not just because they are neonates but due to different maternal, neonatal and birth process factors (MOH, 2014b:p.59).

A global response adopted in 2015 by the United Nations was to set 17 new Sustainable Development Goals (SDGs). The SDGs were designed to maintain and improve upon what was achieved in the last fifteen years through the Millennium Development Goals (MDGs). According to Loewe & Rippin (2015:p.22); the third SDG target 3.2 is to'end preventable deaths of newborns and children under five by the year 2030'.

In Rwanda, NM is one of the leading causes of mortality in district hospitals and health centers, representing 33% (MOH, 2012a:p.26) and number one cause of under five mortality in 2014 (MOH, 2014a). Due to a national effort of achiving MDG4, the NMR decreased from 37 to 27 per 1,000 live births in 2010 and down to 20.1/1,000 live births in 2013 (MOH, 2013; UNICEF, 2014). This rate of 20 neonatal deaths /1,000 live births place Rwanda among 63 countries which need to accelerate progress to reach the Sustainable Development Goal (SDG) target of a neonatal mortality rate of 12 deaths per 1000 live births by 2030 (WHO, 2016a). According to MOH (2014a:p.38); most of neonatal deaths (72%) are due to avoidable causes. The three leading causes of neonatal mortality worldwide are birth asphyxia, prematurity, and neonatal sepsis. (WHO, 2016a, Winter et al., 2013:pp.28-41). Simular to Rwanda birth asphyxia is identified as the leading cause of neonatal mortality with a rate of 41% along with prematurity related complications at 32% and neonatal sepsis at 9% (MOH, 2014a:p.39). Factors associated with BA may be due to maternal, fetal or birth. Reported maternal factors are hemorrhage, hypertension, diabetes, infection, general anesthesia and drugs therapy. Fetal factors are pre or post-term, multiple births, abnormal presentation, intrauterine growth restriction (IUGR), meconium stained amniotic fluid, congenital abnormalities, and anemia. Other factors are related to the placenta, cord and membranes issues such as placenta previa, placental abruption, and cord prolapse and other conditions like, polyhydramnios, oligohydramnios, and chorioamnionitis. Those factors interfere with

normal blood flow to the fetus creating the hypoxia event even before birth (MOH, 2014b:p.59).

Neonates surviving BA are prone to early neurodevelopmental disorders due to the brain insult caused by low oxygen and blood flow to the cerebral tissues (Marshall and Raynor, 2014:pp.611-613). The early signs of brain injury range from mild to severe including hypertonic, hypotonic to floppy tone, aggressively or abolition of reflexes, jitteriness, seizures, severely abnormal to flat electo-encephalogram (EEG) (Marshall and Raynor, 2014:p.612). Quality interventions may help the newborn to survive. Longterm consequences like problems with sensation, , audition and language processing, cerebral palsy, autism and other cognitive impairments have been identified (Bobrow and Soothill, 2016 pp.248-249). Knowing this, BA is not only a cause of neonatal deaths but also has an impact on the quality of life with early and permanent neurological insults

Though BA is a global burden some simple and cost-effective interventions were identified to help babies to initiate and maintain breathing at birth. Essential care of the Newbon; is a package of interventions needed by all newborns; and consist of providing warmth and stimulation. Those simple interventions help 89% of all newborns at birth and help them to initiate and maintain regular breathing at birth (Marshall & Raynor, 2014:pp.611-612). Findings revealed that 10% of newborn need to be ventilated at birth while only one per cent of babies need advanced methods of resuscitation, such as chest compressions with or without medication. (AAP, 2008:p.3).

1.3. PROBLEM STATEMENT

The leading causes of neonatal mortality are prematurity, birth asphyxia, and sepsis. When a baby's vital organs do not get enough oxygen during the birthing process it is known as birth asphyxia and it can result in death or long term debilitating conditions such as brain damage, cerebral palsy, and epilepsy. **(**Bobrow and Soothill, 2016 pp.248-249; Golubnitschaja et al., 2011). Worldwide birth asphyxia (BA) related neonatal mortality is 23%. In 2014 MOH Rwanda annual health statistic report, BA was the leading cause of neonatal death with a rate of 41% (MOH, 2014:p.39). Liu et al., (2015) also highlighted birth asphyxia as the leading cause of neonatal mortality in 2015. Though BA mentioned in those reports and research findings; a critical literatures

search in online database using PubMed with Birth Asphyxia ; Prevalence; risk factors and Rwanda key words did not provide any study done in Rwanda on the prevalence and/ or associated factors and/ or outcomes of BA in any of the NICUs at any of the district hospitals. An understanding of the rate of BA, associated risk factors and outcomes in the NICU can help nurses and other health care providers to develop a more comprehensive plan of care for affected neonates as well as to address preventative measures.

1.4. OBJECTIVES

1.4.1. Main objective

To determine the prevalence, risk factors and outcomes of birth asphyxia at one of the NICU at a district hospital in Kigali, Rwanda

1.4.2. Specific Objectives

To determine the prevalence of birth asphyxia in a NICU at the district hospital in Kigali, Rwanda

To identify the risk factors associated with birth asphyxia in a NICU at the district hospital in Kigali, Rwanda

To determine the outcomes of birth asphyxia in a NICU at the district hospital in Kigali, Rwanda

1.5. RESEARCH QUESTIONS

What was the prevalence of birth asphyxia in a NICU at a districthospital in Kigali, Rwanda in 2016?

What risk factors were associated with birth asphyxia in a NICU at adistrict hospital in Kigali, Rwanda in 2016?

What were the outcomes of BA in a NICU at the district hospital in Kigali, Rwanda in 2016?

1.6. SIGNIFICANCE (RATIONALE) OF THE STUDY

To promote prevention and management of birth asphyxia, research findings are needed. A description of BA highlighting its' prevalence, associated factors and outcomes will contribute to the body of neonatal knowledge. It may serve as a foundation for health care providers in further researches. In addition, it is hoped that policy makers might use this information to see the need for the development of a more comprehensive national management plan for the prevention and treatment of BA. Rwanda is committed to achieve SDGs especially the SDG number three target 2; "ending preventable newborns deaths " by 2030; those early researches are needed and may serves as a baseline to identify changes and monitor improvement. To meet this

target; Rwanda nurses and midwives need evidence from research especially concerning those leading causes of neonatal mortality in order to inform their decisions regarding pregnancy, labor and/ or postnaltal management. Rwandan nurses and midwives are the only health care providers delivering ANC services in all health centers; managing pregnancies, labor and postnatal and referring high risk cases to the following level of care (district hospital) (MOH, 2011:pp.10-11). Findings of this study may also inform nurses and other health care providers and incite them to develop a more comprehensive local plan of care for sphyxiated neonates as well as to address preventative measures.

Also recommendation from this study will be addressed to the study site hospital administration and professional staff for a local improvement.

1.7. OPERATIONAL DEFINITIONS

Those are definitions of terms as used in this study. They are not necessary the standard definitions of those terms.

Birth Asphyxia: It is a condition resulting from inability to establish and maintain normal regular breathing at birth diagnosed based on: Apgar score <7 at 5min, respiratory depression at birth requiring respiratory support more than 5 minutes after birth and/ or clinical manifestations suggestives of a biological effect due to lack/lower oxygen delivery (hypoxemia, hypoxia, hypotonia, seizures, neurological weakness,etc.)

Case fatality: rate of deaths due to BA

Dystocia: Vaginal delivery of a baby presenting breech or shoulder.

Grand multigravida: is a woman who had been pregnant five times or more

Multigravida: awoman who had been pregnant more than once (2-4)

Nearly term baby: born between 35 and 36 weeks of gestation

Post term baby: born after 42 completed gestational weeks (Fraser, Cooper, and Nolte, 2010:p.552)

Prematurity: Born at greater than 22 weeks and less than 35 weeks of gestation.

Prevalence: Is a statistical concept stating a total number of people with a condition in particular population at a given time. (Moulton, 2011)

Primigravida: a woman having her first pregnancy

Prolonged labor: Latency and active phase equal or greater than 18 hours

Prolonged Premature rupture of membranes (PPROM): Membranes rupture lasting 18 hours and more before delivery

Risk factor: Avariable associated with an increased risk of an outcome

Term pregnancy: pregnancy lasting 38 to 42 weeks of gestation.

1.8. ORGANIZATION OF THE STUDY

This dissertation has two main parts. The first Part: Presentation of the Project" and the "Second Part: Structure of the project. The first part with small roman numerals contains: The title page, declaration, dedication, acknowledgements, abstract, table of contents, list of symbols and abbreviations/acronyms, list of tables, list of figures and list of annexes

The second part with arabic numerals contains 6 chapters: Introduction; Literature review; Methodology; Results; Discussion; conclusion and recommendations. It also includes references, work plan, Gantt chart and budget of the project.

CHAPTER 2: LITERATURE REVIEW

2.1. INTRODUCTION

Birth asphyxia, perinatal asphyxia, neonatal asphyxia, birth injury and/or intra-partum related complications are different terminologies used in different literatures to mirror a condition link with a decreased level of oxygen due to neonatal, maternal, labor and/ or birth factors. BA is not just a medical diagnosis but also a nursing concern. Since the time of Florence Nightingale; nursing theories have been developed and tested through research to constitute a body of nursing knowledge as a scientific profession and to guide nursing practice. Many nursing theorists in their paradigms had identified oxygen, respiration, fresh air and ventilation, as a vital and fundamental need to human being. For example, according to Florence Nightingale, clean air is among the five environmental factors essential to health (Parker and Smith, 2010:pp.32-44). Myra Levine focused on nursing care for clients with disturbance of homeostasis in terms of systemic oxygen needs as well as cellular oxygen needs (Parker and Smith 2010:pp111-113). Virginia Henderson in her fourteen fundamental needs model states the need for breathing normally as the first physiological and fundamental to life making it the priority component of basic nursing care (Henderson, 1964: p 62-68). A nursing theorist named Dorothy Johnson in her behavior system model has identified the role of internal and external environment on the wellbeing of the system or the person showing the person and environment interaction and impact of environmental factors to the person's health status (Parker and Smith, 2010:p.90). As nurses, we are concerned with all those patients with a disturbed physiological functions including those neonates who failed to initiate and/ or maintain regular breathing at and after birth.

2.2. THEORETICAL LITERATURE

Since many years back, researchers identified an imprecise and considerable confusion surrounging the term "birth asphyxia"(Gilstrap et al., 1989:pp.825-830 & Nelson and Leviton, 1991:pp.1325-1331; & BLAIR,1993:pp.449-452). Birth asphyxia had been defined based on neonatal neurological abnormalities, lower Apgar scores of 1 and 5 minute; arterial cord pH value; multi-organs involvement; inadequate intake of oxygen by the baby; inability to establish a normal regular breathing; etc. In recent studies,birth asphyxia, perinatal asphyxia, neonatal asphyxia, birth injury and/or intra-partum related

complications are different terminologies used in different literatures to mirror a condition link with a decreased level of oxygen at birth (Golubnitschaja et al., 2011:p.197; Morales et. al. 2011; Ilah et. al., 2014; Aslam et al., 2014; Marshall and Raynor, 2014; Zanell, 2015; & Bobrow and Soothill, 2016).

BA is clinically defined by WHO (2016) as a failure to initiate or maintain regular breathing at birth;. BA is mentioned in the Rwandan neonatology- clinical treatment guideline of 2012 in the third section us perinatal hypoxia/ Hypoxic Ischemic Encephalopathy (HIE) on the page 45, as a condition diagnosed not just basing on poor Apgar score alone but biological and clinical findings from a compromised gas exchangeBirth asphyxia is also mentioned in the Rwandan neonatal protocol as an inadequate prenatal, perinatal, intra- and/or post-natal oxygen delivery to meet metablic demands, leading to HIE (MOH, 2014b). Birth asphyxia is associated with a lower level of partial arterial pressure of oxygen (SPO_2) followed by a production of lactic acid from anaerobic metabolism and increase level of partial arterial pressure of carbon dioxide ($PaCO_2$) leading to lower PH. Diagnostic guidelines from the American Academy of Pediatrics (AAP) and the American College of Obstetrics and Gynecology (ACOG) require a pH < 7 in an umbilical artery blood sample, and lower level of bicarbonates (<12 Mmol/L). Clinical, BA results in HIE, a result of systemic hypoxemia and/or reduced blood flow to the vital organs especially the brain, the heart, the kidney, the lungs, the liver and the intestin. (MOH, 2012b; MOH, 2014b and Zanell, 2015). The persistence and magnitude of hypoxia explain the severity of potential complications as all body tissues need oxygen to survive and function.

BA has a negative impact on the developing brain, HIE is international staged using a staging system proposed by Sarnat in 1976 based on clinical features and an electro-encephalogram (EEG) findings. HIE is staged in three categories: mild (stage I), moderate (stage II), and severe (stage III).

Table 2.1. A modified Sarnat and Sarnat Stage

Staging	Grade I	Grade II	Grade III
Alertness	Hyperalert	Lethargy	Coma
Muscle tone	Normal or increased	Hypotonic	Flaccid
Seizures	None	Frequent	Uncommon
Pupils	Dilated, reactive	Small, reactive	Variable, fixed
Respiration	Regular	Periodic	Apnea
Duration	3-4 days of life	1-2 weeks	Weeks, months / death

(MOH, 2012b:p.46-47; 2014b:p.60)

In settings with limited ressorces to perform those laboratory tests, a persistence of a lower Apgar score for longer than 5 minutes, abnormal neurologic findings and multiple organ involvement such as brain, kidney, lungs, liver, heart, intestineshelp to make the diagnosis (MOH, 2012b; 2014b and Zanell, 2015). APGAR is an acronym (Appearance, Pulse, Griamce, Activity and Respiration) developed by Dr Virginia Apgar in 1952 and since the time it is used as an organized, meaningful way of assessing all newborns at birth and helps to identify those in needs of resuscitation. The 1 minute score determines how well the baby tolerated the birthing process while the 5-minute score tells how well the baby is adapting to extra-uterine life. An Apgar score <7 had been used in BA cases identification (Apgar, 1966; Chiabi et al., 2013; Hirsch, 2014; Ilah et al., 2015; Aslam et al., 2014).

Risk factors of birth asphyxia are variable, some directly linked to fetus's condition, fetus environment, mother condition of birth modalities (MOH, 2014b).

Volpe (2008) in Helmy (2014:p.4) highlighted features revealing intra-partum asphyxia such as meconium stained amniotic fluid, a sign of fetal distress; a depressed baby at birth; and signs of neonatal encephalopathy in the postpartum period. The management of BA starts with initial resuscitation and stabilization followed by a supportive treatment of an adequate ventilation, perfusion and blood pressure management. A mean blood pressure (BP) above 35-40 mm Hg is needed to avoid decreased cerebral

perfusion. Asphyxiated babies need vigilant fluid management, maintaining normal blood glucose level, management and control of seizures, and avoidance of hyperthermia. Hyperthermia is associated with negative outcomes in neonates with moderate to severe hypoxic-ischemic encephalopathy (Zanell, 2015:pp.3-4). In fact, in developed settings, therapeutic hypothermia (33-33.5C for 72h) followed by slow and meticulous rewarming for infants with moderate to severe HIE resulted in reduction of neonatal mortality as well as reduced rate of major neurodevelopmental disability (Jacobs, 2013). Therapeutic hypothermia would be dangerous to attempt in a resource limited country and is prohibited.

However, the Rwandan national neonatal care protocol require maintaining the newborn temperature at less than 37.5 and avoidance and control of heat sources such as bundling (excessive clothing), warmer or in incubator. Sarnat Stage 3. In this case, MOH requires to give an intravenous fluid of glucose 10% infusion at a rate of 60 ml/kg/day, to monitor and normalize the glucose and electrolytes levels, and to monitor and treat of seizures (MOH, 2014b:p61-62).

Studies revealed association of BA with later neuro-developmental disorders including cerebral palsy, autism, cognitive impairments, etc (Bobrow & Soothill, 2016 and Helmy 2014).

2.3. EMPIRICAL LITERATURE

Birth asphyxia is among the leading causes of newborns admission in neonatal intensive care unit and still causing neonatal deaths globally. BA is reported causing 23% of NICU admission in Zambia in 2008 (Halloran et al., 2008:pp.243). Though this study was limited in one hospital of Zambia, it made a prospective cross-sectional evaluation to determined the early neurodevelopmental effect of BA. The prevalence of BA was more than double higher in Nigeria in a civic hospital in 2014 where within 240 neonates admitted in NICU, 123 had BA as a diagnosis giving a higher rate of 51.25% (Aslam et al., 2014:pp.3), while it was the same year (2014) in another hospital of Nigeria (Ilah et al., 2015:p.1).

In Aslam et al.study, some risk factors were identified like primiparae, prolonged labor, maternal age, emergency cesarian birth, eclampsia, breech presentation, sex with a higher prevalence in female. Some factors where similar to those identified by Onyiriuka in 2009 in the same country of Nigeria, though the prevalence was low in Onyiriuka study at 8.4%, with prematurity, post-maturity, gravida one, grand multiparity, maternal age 19 years or 40 years and pregnancy-induced hypertension, breech deliveries as major factors. Even though Aslam et al. study found a higher rate of BA among female babies in Nigeria Onyiriuka (2009:p.84) found a higher mortality rate in male asphyxiated babies than in female.

Findings from other continents' studies are not different from those done in Africa. Tabassum, Rizv, Ariff, Soofi and Bhutta'scase control study done in 2014 in Pakistan revealed a higher birth asphyxia mortality rate being associated with a poor maternal obstetrical history, genital urinary infections, anemia, intra-partum maternal fever, prolonged or difficult labor, breech delivery, cord around child's neck, premature delivery and large baby size.

In the region of East Africa, where Rwanda is located, BA is also a neonatal problem causing more than half of early neonatal deaths. A one year prospective observational study done in Tanzania in 2012, by Ersda et al., identified BA as the major cause of early neonatal mortality at 61% in the first 24 hours. Another research done previously in the same country of Tanzania had also found the same; BA as number one cause of perinatal deaths (Mbaruku et al., 2009). The were attempt to deliver at home, geographical inaccessibility to health facility with transport problems and delayed to

initiate medical interventions where needed. In 2013, Tanzania was reported by AAP as LIC which successfully reduced the neonatal mortality through Helping Babies breathe program. In Uganda, a neighboring country of Rwanda; the neonatal mortality represents 34% of under-five mortality with main causes being prematurity 31% birth asphyxia 27% and neonatal infections 19% (WHO, 2013).

Though no study about BA had been identified in Rwanda, this birth condition is reported in the Rwandan Ministry of Health annual report 2013 and 2014 as the most prevalent causes of neonatal deaths (39% in 2013 and 41% in 2014) followed by prematurity related complications at 32% and neonatal sepsis at 9%. In the internal records of the study site in 2015, the NICU received 1150 neonates among them 376 admissions were due to BA giving aspecific morbidity rate of 33%.

NICU admission; motor, cognitive disabilities and early neonatal deaths (within the first 24 hours) were the outcomes of BA in various literatures(Halloran et al., 2008; Onyiriuka, 2009; Golubnitschaja et al., 2011; Ersdal, et al.,2012; Bobrow and Soothill, 2016; Helmy 2014).

2.4. RESEARCH GAP IDENTIFICATION

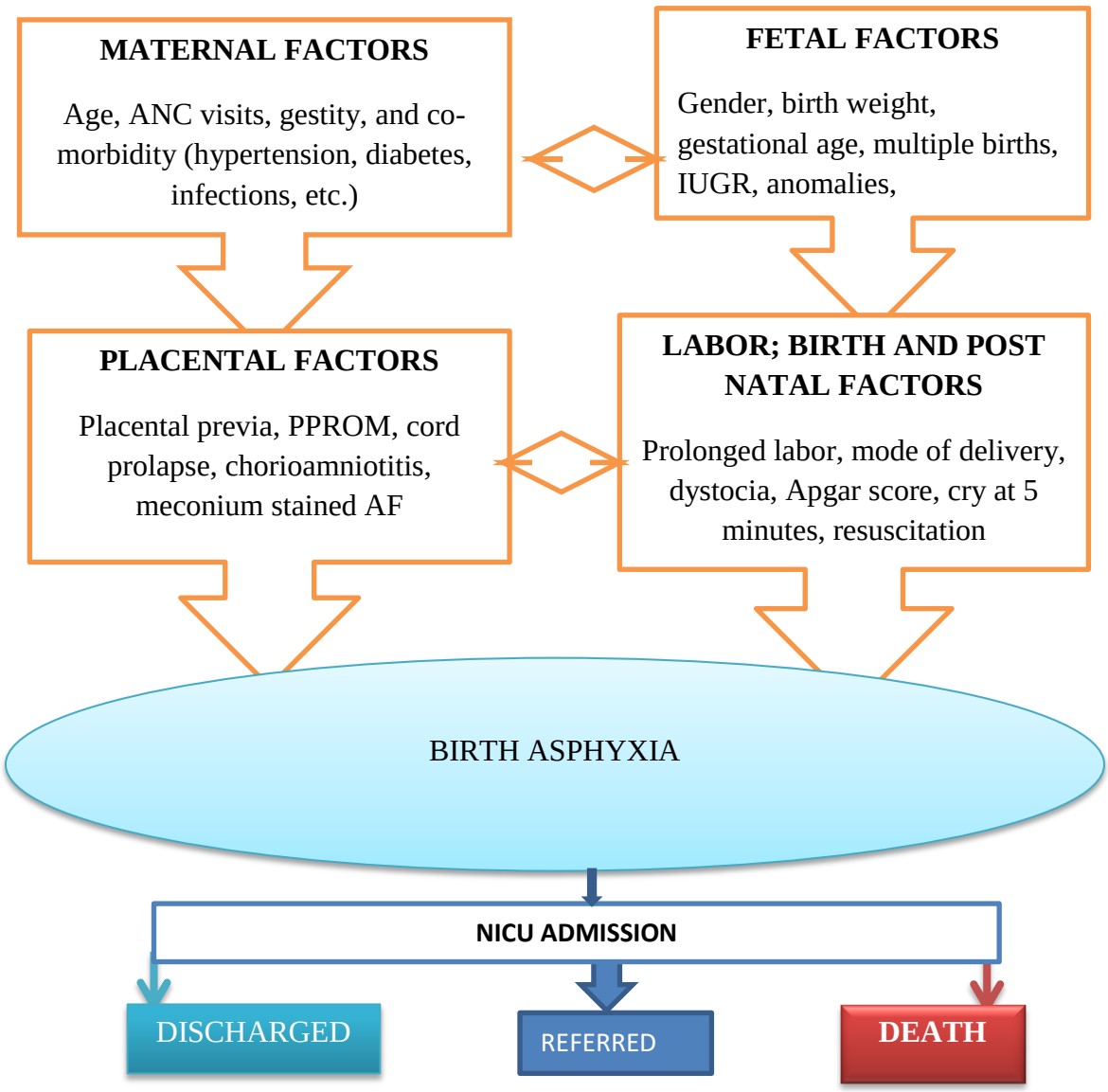
Neonatal mortality is reported in Rwandan literature especially in the MOH annual reports as the top cause of mortality in district hospitals and health centers. BA is reported by Rwanda MOH (2014:p.39) as number one cause of neonatal mortality with at a rate of 41%. From a critical literatures search in online database; PubMed with Birth Asphyxia ; Prevalence; risk factors and Rwanda key words, no study identified to be yet done in Rwanda on the prevalence and/ or associated factors and/ or outcomes of BA in any of the NICUs at any of the district hospitals. Also a review of unpublished literatures did not provide one. To the best of my knowledge; no retrievable study done in Rwanda to determine the prevalence, associated factors and outcomes of BA at any of the Rwandan district hospital NICU.

2.5. BIRTH ASPHYXIA CONCEPTUAL FRAMEWORK

BA is a result of any condition or factor which impair maternal, placental and fetal circulation during intra-uterine life where the baby does not get enough oxygen to meet her/his metabolism needs. Some factors originate from the mother like age, lifestyles, diseases or pregnancy induced complications. Other factors are linked with "fetal annexes", also called placenta factors such as placenta praevia, PROM, oligo/ polyhydramnios, cord prolapse etc. Factors attributed to the baby's condition are prematurity, those babies have immature lungs, immature neurological system and immature muscles to initiate or sustain respiration at birth. IUGR and anemic babies are likely to be weak, with less energy. BA can results from same birth modalities like prolonged labor, instrumental delivery where the baby get stuck and/or traumatized and blood exchanges are interrupted; emergency cesarean birth is associated with lungs full of fluids. Non assisted birth process had been associated with many maternal and fetal risks including asphyxia as both the mother and the baby lack timely and appropriate assistance. Asphyxiated babies are admitted for simple to high care. Some od those asphyxiated babies admitted for neonatal care respond well with a full recovery, others may servive with sequelaes or need advanced care but also a considerable number of those babies do not survive.

To guide this study aiming to determine the prevalence, associated factors and outcomes of BA, Magadi et al, (2004:p.159) conceptual framework was adapted. The Magadi et al.'s framework was developed for the analysis of the inter-relationships between potential risk factors and unfavorable birth outcomes; to adapt it to this study, known BA risks factors from the Rwanda neonatal protocol; and other previous researches findings (MOH, 2014:p59; Ilah et et al., 2014:pp.3-5; Aslam et al., 2014:pp.5-8) were included. Variables to be studied and relationship among them are shown below in the figure.

Figure 2. 1: Birth asphyxia conceptual framework



Adapted: Magadi et al., 2004:p.159

CHAPTER 3: METHODOLOGY

3. 1. INTRODUCTION

This chapter discusses the research methodology to be used. Descriptions of the study setting, design and study approach are discussed here. The study population, sample, sampling strategies, data collection methods, and procedures, data analysis, problems and limitations as well as ethical considerations information are provided.

3.2. STUDY DESIGN

The research design of a study spells out the basic strategies that researcher adopt to develop evidence that is accurate and interpretable (Polit and Beck, 2004). This sudy used previously recorded data making it a descriptive retrospective study to determine the prevalence, risks factors and outcomes of BA.

3.3. STUDY APPROACH

A quantitative descriptive cross sectional study was conducted to answer the research questions. According to Lakshman (2000) cross-sectional studies, are used to gather information on important health related issue and determine the prevalence. It is named cross-section because of the fact that data are collected once within a given period not repetitively. The main advantages of cross-sectional design in such situation is that it is practical, easy to do, it is relatively economical and quick, the representative sample results are generalizable to whole population. Though this study use a retrospective approach; the researcher did not benefit some of the above advantages due to problems and limitations explained below.

3.4. STUDY SETTING

This study will be conducted at one of Kigali city district hospitals. The one DH was selected based on the highest number of studied cases availability and to the feasibility of the study in terms of time and the researcher financial capacities. The chosen district hospital is located in Nyarugenge administrative district. It is an accessible hospital geographically as is located at 1.5 km from Nyabugogo main car park. It is also financially accessible as it is a public hospital receiving patients with public and private health insurance as well as private clients without health insurance.

The hospital has been operational since the lat 15 years ego. It serves a large population from Nyarugenge district and people coming from different areas of the country as visitors in Kigali or just coming to have deliveries there by choice. As a District Hospital, it oversees 10 health centers and one clinic at the central prison of Kigali. Eight of these health centers provide maternity services and conduct normal deliveries and refer the high risk labors; complicated post-partum and postnatal cases at this district hospital for further management. The hospital vision is to be an excellent referral center for maternal and child quality health care in Rwanda. The hospital is a maternal-child hospital with 160 beds and an average occupancy rate of 78% (study site, 2016).

As a maternal child hospital, it has only three in service departments (Gynecology-obstetric, Neonatology unit (NICU) and pediatric. An average of 25 deliveries occur every day meaning approximatevely 750 vaginal and cesarean deliveries every month (Study site, 2015).

In 2016 the hospital NICU reported to have 10 incubators, 6 radiant warmers, 10 beds for KMC and 10 cots. Tough called a NICU, all neonatal care ranging from intensive care, high dependent care, KMC, neonatal monitoring, and observation take place inside this unit until the baby meets discharge criteria or dies or is referred to the tertiary level. Those cares are continually(day and night) provided by one medical doctor, five midwives, and six nurses (Study site, 2016)

3.5. STUDY POPULATION

One thousand four hundred fourty one (1441) Neonates were admitted in the NICU in 2016. The neonatal registerof 2016 shows 1458 total cases admitted but real cases are 1441 as it has six duplicated order numbers for different cases which add 6 more cases but also in this register there were 23 missing order numbers, making the real number of 1441 NICU admitted neonates in 2016 (1458+6-23=1441). Those 1441 NICU neonates constituted the population of this study.

3.6. SAMPLING

Sampling is a process of selecting a portion or subset of the designated population to represent the entire population (Geri and Judith, 2006). Studying the whole population

may not be applicable in most of studies or may be too expensive in terms of resources (time, money) and workload. Sampling help to get a representative portion to be studied and find results with known accuracy that can be calculated mathematically and generalized. With academic schedule limiting data collection in two months and the researcher financial means, the whole population of 1441 NICU neonates couldn't be studied; a representative sample was needed.

3.6.1. Sampling strategy

A probability sampling type systematic random sampling was used. This sampling strategy require a sampling frame. The NICU register of 2016 served as a sampling frame of this study. It is a big registrer where all admitted neonates are registered since the 1st January up to 31st December, 2016. The nth systematic sampling was applied following the filling order. With a population of 1441 NICU neonates and a sample of 340; 1 out of 4 babies should have been selected ($\frac{1441}{340}$=4.2). But due to overall spreed of excluded cases this sampling did not help to get the required sample size and the researcher decided to select 1 case out of 3 (1st,..4th, ..7th, ..10th, ..13th, ..16th, ..etc) to select the study sample respecting the inclusion and exclusion criteria below. During sampling, the researcher collected the following information as they were documented in the register: Index number; names (due to documentation errors some cases index numbers and names were not matching; mentioned names helped to search for real files); birth weight; sex; Apgar Scores; HIV status of mothers; days spent in the NICU and reason of leaving the NICU. After sampling selected cases files were searched in the archive for more variables collection.

3.6.2. Inclusion criteria

Babies born at the study site (Inborn) and those born in other health settings or home (out born) babies admitted in NICU for any medical reason were randomly selected to make the study sample.

3.6.3. Exclusion criteria

The study excluded preterm babies less than 35 gestational weeks and preterm with unprecised gestational age, due to their neuromuscular immaturity and clinical criteria of diagnosing BA those babies may bias the diagnosis (MOH, 2014b). Babies with severe congenital defect (Down syndrome, congemital heart diseases, hydrocephalies)

were also excluded due to the uncertainty of diagnosing BA based on Apgar score and clinic. Other excluded cases were all babies admitted without any medical diagnosis (in this time "2016" at the study site NICU, all babies mixing those admitted due to medical reason and those admitted due to social issues like those left by their mothers, those broughy in by the police or those whom mothers died or were tranfered to higher settings after delivery without family member support etc.

3.6.4. Sample size

This study sample was obtained using statistical formula of Cochran (1963:75) developed equation 1 as specified in Israel (1992:p.3). A sample size is the quantity of units (i.e. individuals) for the study in order to present the study population. According to Miaoulis and Michener (1976) in Kish (1965:p.1) human sciences recommend a consideration of the purpose of the study and population size and other three criteria which are the level of precision, the level of confidence or risk, and the degree of variability in the attributes being measured (Israel, 1992:pp.1-4). Some studies do not study the entire population and need a certain number of units (i.e. individuals) in order to represent the study population. The following is the sample of this study using Cochran (1963:75) statistical formula of equation 1 for an effect size of 0.3 with a power of 80%, alpha at 5% considering 95% of confidence interval, 5% standard error and a prevalence 33%; (BA prevalence of 2015 at the study site as it is reported in the interal annual statistics).

$$n = \frac{Z^2pq}{e^2} = \frac{Z^2p(1-p)}{e^2}$$

n= Sample size

Z= The value for Z is found in statistical tables which contain the area under the normal curve. Confidence Interval 95% (z=1. 96)

p=power= is the estimated proportion of an attribute that is present in the population (33%)

q= 1-p= 1-0.33= 0.67

e= significance level= 5% of error (0.05)

Sample size determination:

$$n = \frac{(1.96)^2 \times 0.33 \times (1 - 0.33)}{(0.05)^2} = 339.75 \approx 340$$

In this study a sample of 340 was studied representing a population of 1441 neonates admitted at the study site NICU in 2016.

3.7. DATA COLLECTION METHODS AND PROCEDURES

A modified data collection tool from a Nigerian researcher, Dr Ilah was used with permission (ANNEXE A) to collect variables needed to answer the research questions. Similar questionnaire had been tested and used in Nigeria in 2014 to study the prevalence and risk factors for perinatal asphyxia as seen at a pecialist hospital in Gusau, Nigeria (Ilah et et al., 2014). The tool was modified and adapted to the Rwandan context and to the conceptual framework of this study. The modifications done consist of: Removing the participant name; remplacing one intem which was looking for booking and non booking status by number of antenatal care visits done by studied newborns's mothers during pregnancy. The booking status had no meaning in Rwandan context because all pregnant women who attend a public institution for antenatal care visit (ANC) receives a follow up card. The tool also has some variables added by the researcher like the one looking for aspect of amniotic fluid; maternal age and initial help provided to newborns after birth in terms of neonatal resuscitation. Also More possibilities on place of delivery were added as the tool received from Dr Ilah was only looking for hospital and home as place of delivery.

The data collection instrument had a total of 25 items: 1 item to identify the participants with NICU index number; 1 to determine the age of NICU neonates on admission; 1 to determine the prevalence of BA; 2 to record the one and ten minute APGAR scores of BA cases; 18 items to assess BA risk factors (4 to assess the fetal factors; 4 to assess maternal factors; 2 to assess placental factors; 5 to assess labor and birth factors and 3 items to assess post natal factors) and finaly 3 items to assess BA outcomes.

The entire proposal and the tool were submitted to an expert nurse with Doctorate in Nursing Practitioner (DNP) in neonatology science for a face validation to confirm if the tool will be measuring what is supposed to measure (the prevalence, risk factors and outcomes of BA). The tool was piloted on 34 cases admitted in NICU in 2017 and a reliability of the tool was tested using this pilot study. For this study, a reliability coefficient (Cronbach's Alpha) of 0.810 was obtained. The original documented reliability coefficient for the tool was not provided but Dr Ilah in his permission letter to use his research instrument mentioned that it was also pre-tested in Nigeria. The obtained reliability test result confirmed that the tool is reliable.

3.8. DATA ANALYSIS

The first analysis was done by the researcher to confirmed BA diagnosis (BA: Yes). A retrospective clinical diagnosis of BA was done based on an attentive analysis of the following criteria: Babies Apgar scores$<$ 7 at 5 min; crying/ no crying in the first 5 min of life and the first 24 hours clinical manifestations confirming compromised gas exchange, cardio-respiratory depression and/ or multiorgans insults. BA was also retained as a diagnosis for babies whom files were not retrievable in the archive but had been documented in the NICU register with a persistent lower apgar 0-5 longer than 5 minutes and/ or certified dead from BA.

Data were entered and analyzed using SPSS software version 20. Data presentation was done using tables. Descriptive statistics such as frequencies, percentages, means, standard deviations (SD) were used to interpret and summarize quantitative variables. Categorical variables were summarized using frequency and percentages. Chi-square test and Fisher's exact test (for sample size <5 in a cell) were used to test association between variables and BA. A p value < 0.05 was considered statistically significant . Variables with p value $<$ 0.05 were analyzed using logistic regression model to identify independent risk factors of BA.

For continuous categorized variables; the following statistics formula was used to abtain the mean and standard deviation (Crawshaw and Chambers, 2001:p.103)

Mean: $\overline{x} = \frac{\sum f x_m}{n}$

Standard deviation: $\delta = \sqrt{\delta^2} = \sqrt{\frac{\sum f(x_m)^2}{n} - (\overline{x})^2}$

3.9. PROBLEMS AND LIMITATIONS OF THE STUDY

3.9.1. Problems

The researcher experienced incomplete, missing and inaccurate documentation in the NICU registers and files. This impacted on time to try validating documented data through maternity records verification. This impacted also on the sample size which was changing from one variable to another (a changing sample size was recorded as n* in this study). The poor record keeping led to none retrieved files. The APGAR scoring was inconsistent, inaccurate and not recorded systematically in same cases.

The diagnosis of BA has many and different names; in mixed languages (French and English). It is either recorded as Souffrance Fetal Aigue (SFA), or asphyxia neonatale or Fetal Distress (FD), or birth asphyxia, or Hypoxic Ischemic Encephalopath (HIE). Though there is no standard names comfirmed to solve those inconsistency, the term Birth Asphyxia is the one reported by WHO and MOH documents. The diagnosing criteria are also changing from one health care provider to another. At the study site cases presenting a low Apgar score, post neonatal rescussitation cases, and those with a history of fetal distress are documented as asphyxiated while it was not the case for this study and it not the case for MOH (2012:pp.44-48) diagnosing criterias where a clinical evidence of compromised gases exchange should be identified; this study also confirmed the diagnosis of BA only in cases with a specific clinical manifestation with the first 24 hours of life.

3.9.2. Limitations

This retrospective study concerned only cases admitted in NICU in 2016. This may not represent the true figure of BA as some cases might have died before being admitted in NICU. The detailed management of BA and the long-term complications; family experience; quality of life of BA survivors are beyond the scope of this study. The n* on risk factors variable might had an impact on findings. This study was in purpose of academic activities with a limited time schedule; a broad study looking at BA cases management would be more informative about factors influencing deaths, discharge and/ or BA cases reference to high settings. Looking at the longterm BA compilcations

and quality of life of babies surviving this insult, could also inform more about the burden of BA on babies and their family. In Rwandan culture when a woman women has a delivery; this means she has to be and rest with the baby; closer to her, in the same bed (Ikiriri as called in the culture). BA happens at birth; in the first minutes of life and was identified to cause early NICU admission, separing the baby from his/ her mother/ family to receive health care. Studying family's experience of having an asphyxiated babies could help to identify a more comphrensive way of working with them and involve them to reduce/ deal with their emotions.

3.10. ETHICAL CONSIDERATIONS

Before starting the data collection process the University of Rwanda/ College of Medicine and Health Sciences/ Institutional Review Board (IRB) ethical clearance was obtained (ANNEXE). The Dean of the school also provided a recommendation letter for data collection (ANNEXE). The study site ethical clearance was also requested and obtained prior to data collection (ANNEXES). Records from registers and client files were collected only for the purpose of the study. Anonimity was maintained. Although selection from the register was done according to babies' mothers' names to retriew files as there was an inconstistancy of identification numbers in the register and files, the rest of the process was anonymous. After obtaining the files, only unique identification numbers were used on the research tools as well as for entering data into SPSS. A personal computer locked with secret password was used for data entry to keep all information confidential. All tools used are being kept confidentially in a locked cardboard at the researcher's home for at least 5 years.

CHAPTER 4: RESULTS

This chapter presents the findings of the data collected. The neonates are described by their demographic information. This section also contains all results needed to answer the three research questions; the prevalence of BA for 2016, associated factors (maternal; placenta; fetal; labor, birth and postnatal) and outcomes of those babies with BA.

The research sample size (n) was 340 participants but there is a variations (n*) on different variables mainly due to missing variables from poor documentation or poor records keeping at the situdy site.

4.1. GENERAL DESCRIPTION OF THE STUDY PARTICIPANTS

4.1.1: Demographic characteristics of NICU neonates

According to table 4.1 there were 192 (56.5%) male babies and 148 (43.5%) female. Regarding the age of the infants on admission in NICU; 283 (83.2%) were less than12 hours of age; 291(85.6%) of the babies had body weight between 2500-3999 gr, with mean birth weight of 3.227 (SD: 0.55). Looking at gestation age; 284 (85.6%) were term babies and 332 (97.6%) of the NICU babies were born single (singleton).

Table 4. 1: Demographic characteristics of admitted cases

		N	Percentages	(Mean, SD)
1. **Gender**				
	Male	192	56.5	
	Female	148	43.5	
	Total	340	100	
2. **Age categories**	< 12 hours	283	83.2	
	12-24 hours	16	4.7	
	> 24 hours	41	12.1	
	Total	340	100	
3. **Birth weight**	1500-2499 gr	31	9.1	3.227 (0.55)
	2500-3999 gr	291	85.6	
	4000-5450 gr	18	5.3	
	Total	340	100	
4. **Gestational age**	Nearly term	43	12.7	
	Term	284	83.5	
	post-term	13	3.8	
	Total	340	100	
5. **Number of babies**	Singleton	332	97.6	
	Twins	7	2.1	
	Triplets	1	0.3	
	Total	340	100	

Note: To get the mean and standard devision of quantitative; categorized variables, the following were statistical formula used:

Mean: $\overline{x} = \frac{\sum f\, x_m}{n}$

Standard deviation: $\delta = \sqrt{\delta^2} = \sqrt{\frac{\sum f(x_m)^2}{n} - (\overline{x})^2}$

4.1.2: Description of NICU neonates in the immediate postnatal period

The initial assessment findings of NICU neonates and the initial assistance provided (after birth in terms of neonatal resuscitation) are presented in the table below (table 4.2). It was demonstrated that babies' five minute Apgar score was as follow: 79* (23.7%) had an Apgar score of 5 or less; 87* (26%) babies had a score of 6 while 168* (50.3%) had a score of 7 or more. Regarding the cry assessment 122*(65.9%) of the babies cried in the first 5 minutes of life while 65* (34.1%) did not cry. Assistance in terms of neonatalresuscitation provided; 165*(58.1%) were just dried, stimulated and suctioned, 100* (35.2) were ventilataed and 19* (6.7%) received cardiac massage. No baby was reported to have an advanced resuscitation with adrenaline.

Table 4.2: Findings of neonates' assessment and assistance received

1. Five minute APGAR score		N	Percentages
	≤5	79	23.7
	6	87	26
	≥7	168	50.3
	Total	334*	100
2. Cry at five minute			
	Cried	122	65.9
	Not cried	65	34.1
	Total	187*	100
3. The initial help provided			
	Dry, stimulation, suctioning	165	58.1
	Ventilated	100	35.2
	Cardiac massage	19	6.7
	Adrenaline	0	0.0
	Total	284*	100

4.1. 3. Maternal demographics and obstetrical characteristics

The table below (4.3) demonstrates that admitted babies (participants) were born from mothers aged from 15 to 43 years old. The range of 18-34 maternal age range had

88.3% of the sample. The mean maternal age was 27.2 years old (SD: 3.7). 163 (50.6%) babies were born from primigravidamothers ; 137 (42.6%) from multigravida mothers and 22 (6.8%) from grand multigravida (5+) mothers. Antenal care attendance showed that 33 (22%) of the mothers attended 4 or more antenatal care visits during pregnancy; 114 (78%) of the mothers attended 3 or less vists with a mean antenatal visit of 2.68 (SD: 1.113).

Table 4. 3: Maternal demographics and obstetrical characteristics

1. **Maternal age categories** (Mean, SD)		**N**	**Percentages**	27.2 (3.7)
	15-17	4	1.3	
	18-34	270	88.3	
	35-43	30	9.9	
	Total	304*	100	
2. **Gravida of mothers**				
	1	163	50.6	
	2-4	137	42.6	
	≥ 5	22	6.8	
	Total	322*	100	
3. **ANC visits (mean, SD)**				2.68 (1.113)
	Zero	3	2.0	
	1	26	17.3	
	2	24	16	
	3	64	42.7	
	4	29	19.3	
	5	4	2.7	
	Total	150*	100	

4.1.4. Maternal co-morbidity during pregnancy and/ or labor

Table 4.4 shows that 83.9% (260) babies' mothers were reported healthy, while 25 were HIV positive on ARVs (24 mothers were reported HIV positive only and one case reported HIV positive with a positive syphilis test "RPR" 0.3%). Malaria with a positive

blood smear was reported in 13(4.2%) mothers and 3 (1%) had a reported maternal fever during labor.

Table 4. 4: Maternal co-morbidity

		N	Percentages
1.	Healthy mothers	260	83.9
2.	HIV positive	24	7.7
3.	Pre-eclampsia	1	0.3
4.	Diabetes Mellitus	3	1.0
5.	Malaria	13	4.2
6.	STIs: TrichomonasVaginalis	1	0.3
7.	HIV and syphilis	1	0.3
8.	Maternal fever during labor	3	1.0
9.	TB	1	0.3
10.	Cough	1	0.3
11.	Traditional medicine	2	0.6
	Total	310*	100

4.1. 5. Placental and labor characteristics of NICU neonates

The table 4.5 shows that 306 (90%) babies admitted to the NICU were inborn, while 27 (7.9%) babies were born in catchment area health centers. Looking at the duration of labor; 188 (85.1%) of babies were born from a normal duration of labor, 15 (6.8%) were born after a prolonged labor. There were prolonged ROM in 65 (25.6%) and 129 (57.3 %) meconium stained amniotic fluid (MSAF)

Table 4. 5: Placental and labor characteristics of NICU neonates

1. Place of birth		N	**Percentages**
	In born	306	90.0
	In another DH	2	0.6
	Health Center	27	7.9
	Private clinic	3	0.9
	At home	1	0.3
	On the road	1	0.3
	Total	340	100
2. Duration of labor	No labor	18	8.1
	Normal	188	85.1
	Prolonged	15	6.8
	Total	221*	100
3. ROM	Not prolonged	189	74.4
	Prolonged	65	25.6
	Total	254*	100
4. Aspect of AF	Clair	78	34.7
	Meconium stained	129	57.3
	Bloody stained	2	0.9
	Malodorous	1	0.4
	Meconium stained and malodorous	14	6.2
	Purulent	1	0.4
	Total	225*	100

4.1.6. Birth characteristics of NICU neonates

The table 4.6 below shows that 226 (66.5%) of babies were born vaginal and 114 (33.5%) by cesaren. Cesarean birth with prior labor was reported in 96 (84.2 %) while there were 18 (15.8%) cesarean births without prior labor. Spontaneous vaginal delivery (SVD) was the mode of birth for 207 (91.6%) babies; vacuum for 15 (6.6%). Among babies born by caesarean birth (C/B); fetal distress (FD)/ non reassuring fetal heart rate (NRFHR) was reported as the indication at 41 (67.2%).

Table 4.6: Birth modalities of NICU neonates

		N	Percentages
1.Mode of birth			
	Vaginal	226	66.5
	Cesarean	114	33.5
	Total	340	100
2. Caesarian with UC			
	No	18	15.8
	Yes	96	84.2
	Total	114	100
3. Mode of vaginal birth (V/B)			
	SVB	207	91.6
	Vacuum	15	6.6
	Non-assisted vaginal birth	2	0.9
	Dystocia (breech, shoulder dystocia)	2	0.9
	Total	226	100
4. C/B with FD/ NRFHR			
	FD NO	20	32.8
	FD Yes	41	67.2
	Total	61*	100

4.1.7. The main clinical features presented by NICU neonates

Table 4.7 demonstrates the variations of clinical signs observed among NICU neonates. The most noted clinical finding wasseizures at 93(27.9%), fever at 30 (9.0%); limp/ floppy status at 18 (5.4); hypoxia (SPO2 < 88%) on admission were reported at20 (6%).

Table 4. 7: The main clinical features of NICU neonates

Clinicla features	N	Percentages
Normal clinical	64	19.2
Hyperactivity	11	3.3
Seizures/ convulsions	93	27.9
Weak reflexes (sucking, Grasping, Moro and Steping)	4	1.2
Hypotonia	12	3.6
Limp/ Floppy	18	5.4
Hypoxia (SPO2 < 88%)	20	6
Tachypnea	4	1.2
Excessive crying	1	0.3
Weak suck reflex	16	4.8
No suck reflex	15	4.5
weak cry at five minutes	3	0.9
No cry at five minutes	13	3.9
Fever	30	9.0
Jaundice	6	1.8
Macrosomia	1	0.3
Dyspnea	14	4.2
Vomiting	3	0.9
Pain	1	0.3
Hypoglycemia	1	0.3
Hypothermia	3	0.9
Total	333*	100

4.1.8: Outcomes of NICU neonates/ Infants

Babies were hospitalized in the NICU between 0-38 days. The mean hospital stay days was 6.2 (SD: 0.925). Authorized discharged was granted to 315 (92.6%); 23 (6.7%) neonates died; 10 (2.9%) during the first 24 hours and 13 (3.8%) after 24 hours and 2(0.6%) were referred to high settings; tertiary level of care.

Table 4.8: Outcomes of NICU neonates/ Infants

1. Days spent in NICU(Mean, SD)		**N**	**Percentages**	6.2 (4.9)
	0-3	99	29.1	
	4-7	162	47.6	
	8-14	61	17.9	
	15-21	12	3.5	
	22-28	2	0.6	
	29- 38	4	1.2	
	Total	340	100	
2. Reason of leaving NICU				
	Authorized discharge	315	92.6	
	Referred	2	0.6	
	Death <24hours	10	2.9	
	Death ≥ 24hours	13	3.8	
	Total	340	100	

Mean: $\overline{x} = \frac{\sum f\, x_m}{n}$

Standard deviation: $\delta = \sqrt{\delta^2} = \sqrt{\frac{\sum f(x_m)^2}{n} - (\overline{x})^2}$

4.2: THE PREVALENCE OF BIRTH ASPHYXIA IN 2016

This section 4.2 provides results to answer the first research question; the prevalence of BA. In the selected study sample of 340 babies, a clinical retrospective diagnosis of BA was confirmed in 135 babies based on; analysis of their Apgar scores at five minute, cry or no cry in the first five minute, and the clinical features in the first 24 hours . This give a prevalence of 39.7% as demonstrated in the table 4.9 below.

Table 4.9: The prevalence of BA

Birth asphyxia		**N**	**Percentages**
	BA Yes	135	39.7
	BA No	205	60.3
	Total	340	100.0

The table 4.10 below demonstrates Apgar scores of 1; 5 and 10 minutes of asphyxiated babies. 112 (93.3%) scored ≤ 5 at one minute with improved score to 31.3% at 10 minutes.

Table 4.10. Apgar scores at 1, 5 and 10 minutes of BA cases

Timing /Apgar	**≤ 5**	**6**	**>7**	**Total**
1 minute	112 (93.3)	6 (5)	2 (1.7)	120* (100)
5 minutes	73 (54.5)	61 (45.5)	0 (0.0)	134* (100)
10 minutes	30 (31.25)	35 (36.45)	31 (32.3)	96* (100)

4.3: BIVARIATE ANALYSIS ON FACTORS ASSOCIATED WITH BA

This section 4.3 provides results to identify factors associated with BA and provides the answer to the second research question. Fetal/ neonatal; maternal; placental; labor, birth and postnatal factors were analyzed in this section.

4.3.1: Fetal and neonatal factors associated with BA

The table 4.11 below demonstrates gender variation among asphyxiated babies. For male babies 77 (40.1%) were asphyxiated while 58 (39.2%) of females were diagnoses with BA. However the difference was not statistically significant ($p>$ 0.05). Concerning birth weight; asphyxia was diagnosed in 8 (25.8%) babies born with 1500 to 2449grs., 126 (43.3%) weighed between 2500 and 3999 grs. and 1 (5.6%) of those born with 4000 grs and more. Birth weight in BA group was statistically significant (Fisher exact test, 13.998^{F} *p*, 0.001) with a mean difference in asphyxiated babies and non asphyxiated babies of 3.2 (SD: 0.2); 3.3 (SD: 0.33) respectively.

The analysis of GA shows that BA was as follow: 10/43 (23.3%) in early term babies, 116 /284 (40.8%) of term babies and 9/13 (69.2%) in post term babies. In this study the variable GA was statistically significant in BA (Chi-Square, 9.748^{a}, *p* 0.008). With regard to babies number, asphyxia was diagnosed in 134/332 (40.4%) singletons babies and in 1/8 (12.5%) twin/ triplet. The number of babies was statistically insignificant in BA with a $p>$ 0.05.

Table 4.11: Bivariate analysis on fetal and neonatal factors associated with BA

		Birth asphyxia			
		Yes (%)	NO (%)	Chi-square/ Fisher exact test	*p*-value
1. **Gender**				0.029[a]	0.864
	Male	77 (40.1)	115 (59.9)		
	Female	58 (39.2)	90 (60.8)		
	Total	135 (39.7)	205 (60.3)		
2. BW				13.998[F]	**0.001***
	1500- 2499	8 (25.8)	23 (74.2)		
	2500-3999	126 (43.3)	165 (56.7)		
	4000- 5450	1 (5.6)	17 (94.4)		
	Total	135 (39.7)	205 (60.3)		
3. GA				9.748[a]	**0.008***
	Nearly term	10 (23.3)	33 (76.7)		
	Term	116 (40.8)	168 (59.2)		
	post-term	9 (69.2)	4 (30.8)		
	Total	135 (39.7)	205 (60.3)		
4. Number of babies				2.341[F]	0.153
	Singleton	134 (40.4)	198 (59.6)		
	Twins and triplets	1 (12.5)	7 (87.5)		
	Total	135 (39.7)	205 (60.3)		

* Significant *p* value (<0.05) Mean BW BA yes = 3.2 (SD: 0.2); BA No= 3.3 (SD: 0.33)

All variables above had n:340

4.3.2: Maternal factors associated with BA

The table 4.12 presents results of association of maternal factors and BA. The statistical ananlysis of maternal age factors and BA demonstrated that babies born from under 18 years mothers were equally distributed in BA and non BA groups (50%). Babies born to mothers aged 35 years of age or more were 10/30 (33.3%) asphyxiated compared to20/30 (66.7) who were not asphyxiated. Maternal age in birth asphyxia had no statistical significance ($p > 0.05$) in this study.

Regarding maternal gravidity the findings were as follow: the group of babies from gravida 1 had 74 /163 (45.4%) of asphyxiated babies, the group of multigravida (gravida 2 to 4) had 46/137 (33.6%) while the group of grandmultigravida (gravida 5 or more) had 3/19 (13.6%) of asphyxiated babies. The gravididity of mothers in BA was statistically significant (Chi-Square, 10.442a, *p* 0.005*).

The analysis of the association between numbers of antenatal care (ANC) visits done by the babies' mothers during pregnancy showed that 15/33 (45.5%) of the group of mothers with 4 or more ANC visits were asphyxiated, while 42/114 (36.8%) mothers who attended ≤3 ANC visits were asphyxiated. The number of ANC attended during pregnancy had no statistical significancy for BA in this study ($p > 0.05$). The analysis of maternal health during pregnancy/ labor (co-morbid factor) demonstrated BA in 103/260 (39.6%) reported healthy mothers while BA was diagnosed at 28% (14/50) in mothers with a co-morbid condition during pregnancy and/or labor. Maternal co-morbidity in BA was statistically insignificant ($p > 0.05$).

Table 4.12: Bivariate analysis on maternal factors associated with BA

		Birth asphyxia			
		Yes (%)	NO (%)	Chi-Square/ Fisher exact test (F)	*p*-value
1. Maternal age				1.971^{F}	0.616
	15-17	2 (50)	2 (50)		
	18-34	104 (38.5)	166 (61.5)		
	35-46	10 (33.3)	20 (66.7)		
	Total	116 (38.2)	188 (61.8)		

2. Gravida				10.442[a]	**0.005***
	G1	74 (45.4)	89 (54.6)		
	G2-4	46 (33.6)	91 (66.4)		
	≥G5	3 (13.6)	19 (86.4)		
	Total	123 (38.2)	199 (61.8)		
3. ANC visits				0.800[a]	0.371
	< 4	42 (36.8)	72 (63.2)		
	≥ 4	15 (45.5)	18 (54.5)		
	Total	57 (38.8)	90 (61.2)		
4. Maternal health				2.408[a]	0.121
	Healthy	103 (39.6)	157 (60.4)		
	Unhealthy	14 (28)	36 (72)		
	Total	117 (38)	193 (62)		

* Significant *p* value (<0.05) n: maternal age: 304; gravidity:322; ANC: 147; maternal health 310,

4.3.3. Placental factors associated with BA

The table 4.13 analysed the association between placental factors and BA. The duration of membrane rupture in terms of prolonged rupture of membranes (ROM) or not; reveals that 24.6% (16/45) of PROM group were asphyxiated while 38.1 % (72/189) asphyxiated babies came from a normal duration of ROM. The duration of membranes rupture in BA was statistically significant with a borderline p value (Chi-Square, 3.881[a], *p* 0.049*). As regards to the amniotic fluid (AF) status in BA, babies from stained and malodorous AF were asphyxiated at 48.3% (71/147) while they were 20.8% (16/77) in the clear AF group. The association of the aspect of AF and BA is statistically significant (Chi-square, 16.111[a], *p* 0.000*).

Table 4.13: Bivariate analysis on placental factors associated with BA

	Birth asphyxia			
	Yes (%)	NO (%)	Chi-Square	*p*-value (Fisher)
1. Rupture of Membranes (ROM)			3.881[a]	**0.049***
Normal duration	72 (38.1)	117 (61.9)		
Prolonged	16 (24.6)	49 (75.4)		
Total	88 (34.6)	166 (65.4)		
2. Aspect of Amniotic Fluid (AF)			16.111[a]	**0.000***
Stained and malodorous	71 (48.3)	76 (51.7)		
Clear	16 (20.8)	61 (79.2)		
Total	87 (38.8)	137 (61.2)		

* Significant *p* value (<0.05); Stained and malodorous groups all meconium, bloody, pus stained, malodorous AF. n: ROM 254; Aspect of AF 224

4.3.4: Labor and birth factors associated with BA

Table 4.14 below presents the analysis of labor and birth factors in BA. Babies with BA were born from a normal duration of labor at 70/188 (37.2%) while 3/15 (20%) were born from a prolonged labor. There was a statistical significance of the duration of labor in BA (Fisher exact test 6.377[a], *p* 0.039*). Analysis of the place of birth revealed that 38.6% (118/306) asphyxiated babies were inborn; while BA was diagnosed at 50% among outborn babies. However the place of birth had no statistical significance in BA ($p > 0.05$). For mode of delivery there was 107/226 (47.3%) of BA in vaginal born babies while BA was at 28% of babies delivered by cesarean birth. The mode of delivery in BA had a statistical significance (Chi-Square, 16.431[a], *p* 0.000*). The analysis showed that C/B with a history of labor; prior uterine contractions (UC) had 27/96 (28.1%) of babies with BA while 1/18 (5.6%) asphyxiated baby were born from a C/B without a prior labor. C/B with or without a prior labor was not statistically significant in BA ($p>0.05$). The analysis of different modes of vaginal birth revealed birth asphyxia at 47.4 % among babies born through SVD and at 47.1% among those born by vacuum and dystocia. Types of V/B was statistically insignificant in BA ($p>0.05$).

Table 4.14: Bivariate analysis on Labor and birth factors associated with BA

		BAYes (%)	BA NO (%)	Chi-square/ Fisher exact test	*p*-value
1. Duration of labor				6.377[F]	**0.039***
	No labor	2 (11.1)	16 (88.9)		
	Normal	70 (37.2)	118 (62.8)		
	Prolonged	3 (20)	12 (80)		
	Total	75 (33.9)	146 (66.1)		

2. Place of birth				1.672[a]	0.196
	In born	118(38.6)	188 (61.4)		
	Outborn	17 (50)	17 (50)		
	Total	135(39.7)	205 (60.3)		
3. Mode of delivery				16.431[a]	**0.000***
	Vaginal	107(47.3)	119 (52.7)		
	C-Birth	28 (24.6)	86 (75.4)		
	Total	135(39.7)	205 (60.3)		
4. Cesarean with prior UC				Fisher	0.069
	Yes	27 (28.1)	69 (71.9)		
	No	1 (5.6)	17 (94.4)		
	Total	28 (24.6)	86 (75.4)		
5. Type of VD				0.001[a]	0.980
	SVD	99 (47.4)	110 (52.6)		
	Dystocia + vacuum	8 (47.1)	9 (52.9)		
	Total	107(47.3)	119(52.7)		

4.3.5: Post natal factors associated with BA

Table 4.15 demonstrates the analysis of the three postnatal factors; cry or no cry; Apgar score and extended of help in terms of neonatal resuscitation provided to NICU babies and their association to BA. BA was diagnosed at 92.4% (73/79) babies of Apgar score $<$ 5 at 5 min group, and at 70.1 % (61/87) of babies with an Apgar score of 6 at five minute. BA was also diagnosed at 79.4% (50/63) babies who did not cry in the first 5 minutes of life and at 9% (11/122)) babies who were reported having had a cry within the fifth minutes of live. As regards to newborn resuscitation, BA was at 78.9% (15/19) among babies who were resuscitated up to cardiac massage; at 68% (68/100) of ventilated babies and at 21.8% (36/165) of those who got help at the first step of newborn resuscitation (dry $\pm$ stimulation $\pm$ suctioning). All three factors 5 minutes Apgar score, Cry and resuscitation were statistically significant in BA with $p < 0.05$. Five mimute apgar score Chi-Square 13.22[a], p 0.000*; cry Chi-square 93.032[a] , p 0.000*; resuscitation Chi-square 66.028[a], p 0.000*

Table 4.15: Bivariate analysis on post natal factors associated with BA

Factor		Birth asphyxia			
		Yes (%)	NO (%)	Chi-Square	*p*-value
1. **APGAR- Score at 5 minute**				13.220[a]	**0.000***
	≤ 5	73 (92.4)	6 (7.6)		
	6	61 (70.1)	26 (29.9)		
	Total	134(80.7)	32 (19.3)		
2. Cry at 5 minute				93.032[a]	**0.000***
	Not cried	50 (79.4)	13 (20.6)		
	Cried	11 (9)	111 (91)		
	Total	61 (33)	124 (67)		
3. **Resuscitation**				66.028[a]	**0.000***
	Routine care and step 1	36 (21.8)	129 (78.2)		
	Ventilated	68 (68)	32 (32)		
	Cardiac massage	15 (78.9)	4 (21.1)		
	Total	119 (42)	165(58)		

4.4. LOGISTIC REGRESSION MODEL FOR BA ASSOCIATED FACTORS.

To identify factors independently associated with BA unvariate, bivariate, ordinal or multiple logistic regression model were used. The logistic analysis results are summarized in table below (table 4.16). According to the table, babies with Birth weight ranging fro 2500 to 399 grs.were more likely to be asphyxiated compared to those with 4000-5450 grs. Of birth weight [OR: 12.982, *p* 0.013* CI: 1.705; 98.852]. With regard to GA, term babies were more likely to be asphyxiated [OR: 2.279, *p* 0.002*, CI: 1.081; 4.805] compared to nearly term babies. The analysis of maternal gravidity factors demonstated an association between grandmultigravida and BA [OR: 5.266, *p* 0.010*, CI: 1.500; 18.492] compared to grandmultigravida mothers. BA was also identified higher among babies born from mothers with normal duration ofROM with a borderline *p* value of 0.049* [OR: 1.885, *p* 0.049, CI: 0.998; 3.560] compared to those born from a PROM. Analysis of the duration of labor demonstared BA being associated with a normal duration of labor compared to those without labor history[OR: 4.746, *p* 0.042, CI: 1.060;21.257].The analysis of labor and birth factors revealed BA to be higher in vaginal delivery mode compared to Cesarian delivery [OR: 2.762, *p* 0.000*, CI: 1.675; 4.553].

The analysis of BA and Apgar score of 5 minutes revealed a higher rate of BA among those who scored ≤ 5at 5 minute compared to those who scored 6 at 5 minute of life [OR: 5.186, *p* 0.001*, CI: 2.004; 13.417], those reported having not cried in the first five minutes of life were also more asphyxiated compared o those who had had a cry [OR: 38.811, *p* 0.000*, CI: 16.267; 92.599]. The analysis of BA and neonatal resuscitation revealed that the more the baby was helped with advanced levels of neonatal resuscitation, the more was asphyxiated. BA was higher among babies who were resuscitated up to cardiac massage [OR: 2.598, *p* 0.003*, CI: 1.595; 4.248] and also higher in those babies who were ventilated [OR: 2.030, *p* 0.003*, CI: 1.487; 2.679] compared to those with no resuscitation or just helped with the first step of neonatal resuscitation (dry, stimulation, suction).

Table 4. 16: Logistic regression model for factors associated to BA

			95% CI	
Variables	**OR**	***p*-value**	**Lower**	**Upper**
1. Birth weight				
1500-2499 gr	5.913	0.109	0.674	51.857
2500-3999 gr	12.982	**0.013***	1.705	98.852
4000-5450 gr	1			
2. GA				
Nearly term	1			
Term	2.279	**0.002***	1.081	4.805
Post-term	0.307	0.054	0.092	1.020
3. Gravidity				
G1	1			
G2-4	3.201	0.072	0.901	11.380
G ≥ 5	5.266	**0.010***	1.500	18.492
4. ROM				
Normal	1.885	**0.049***	0.998	3.560
Prolonged	1			
5. Status of AF				
Clear	1			
Stained and malodorous	3.562	**0.000***	1.881	6.745

6. Duration of labor				
No labor	1			
Normal labor	4.746	**0.042***	1.060	21.257
Prolonged	2	0.484	0.288	13.910
7. Mode of delivery				
C/B	1			
Vaginal	2.762	**0.000***	1.675	4.553
8. Apgar at 5 min				
≤ 5	5.186	**0.001***	2.004	13.417
6	1			
9. cry at 5 min				
No cry	38.811	**0.000***	16.267	92.599
Cry yes	1			
5. Resuscitation				
Routine care	1			
Ve tilated	2.030	**0.003***	1.487	2.679
Cardiac massage	2.598	**0.003***	1.595	4.248

* significant *p* value

4.5: OUTCOMES OF BA CASES

This section 4.5 displays results to answer the third research question related to BA outcomes in terms of NICU admissions, clinical presentations of asphyxiated babies, duration of NICU stay as well as reasons of leaving NICU.

4.5.1: BA and NICU admission

The table below 4.17 revealed that the early NICU admission in the first twelve hours of life was made of 130 (45.9%) cases of BA compared to 153 (54.1%) in the control group. Later admission was made by 41 cases among the 3 BA (7.3%)

The table 4.17: NICU admission age				**Chi-Square**	***p*-value**
				27.501[a]	**0.000***
	< 12 hrs	12-24 hrs	> 24 hrs		
BA Yes	130 (45.9)	2 (12.5)	3 (7.3)		
BA No	153 (54.1)	14 (87.5)	38 (92.7)		

n: 340

4.5.2. The first 24 hours clinical signs of asphyxiated babies

BA cases presented various clinical signs. The main signs were seizures; limp/ floppy, hypotonic status and hyperactivity. Seizures were presented in 76.3% babies with BA while they were 23.7% in non BA cases. Limp/floppy/hypotonic status was present in 66.7% of BA cases while hyperactivity was presented in 45.5%.

Table 4.18: Bivariate analysis of the first 24 hours clinical signs

	Hyperactivity	Seizures	Limp/ Floppy and hypotonic
BA yes	5 (45.5)	71 (76.3)	20 (66.7)
BA No	6 (54.5)	22 (23.7)	10 (33.3)

n: 38; Chi-Square, 103.121[a], *p* 0.000*

4.5.3. Effects of BA on the duration of NICU stays

The table below 4.19 demonstartes that BA cases stays in NICU beyond the neonatal period at 75% compared to non asphyxiated babies (25%). The Mean Days of NICU stay was 7.6 (SD:6.1) for BA while it was 5.3 (SD: 4.16) for non asphyxiated babies.

Table 4.19: Bivariate analysis of association on BA and NICU stay

BA/ Days	**0- 3**	**4-7**	**8-14**	**15-21**	**22-28**	**29-38**
BA Yes	28 (28.3)	62 (38.3)	33 (54.1)	7 (58.3)	2 (100)	3 (75)
BA No	71 (71.7)	100 (61.7)	28 (45.9)	5 (41.)	0 (0.0)	1 (25)
Total	99 (100)	162 (100)	61 (100)	12 (100)	2 (100)	4 (100)

Fisher exact test, 17.122, *p* 0.002*; Mean Days spent in NICU in BA group= 7.6 SD (6.1); BA no group 5.3 (SD: 4.16)

4.5.4. Effect of BA on reasons of NICU discharge

The table 4.20 shows that all 135 asphyxiated babies left the NICU for different reasons:Comparing to the control group BA cases leaved the NICU with an authorized discharge at 35.9%, two referred cases were asphyxiated (100%)of referred, death within the first 24 hours occurred in 9/10 (90%) and death after 24 hours in 11/ 13 (84.6%).

Table 4.20: Bivariate analysis on BA and reasons of discharge

					Fisher exact test	*p*-value
	Discharged	Referred	Death $< 24hrs$	Death $\geq$24 hrs**	29.490	0.000*
BA Yes	113 (35.9)	2 (100)	9 (90)	11 (84.6)		
BA No	202 (64.1)	0 (0.0)	1 (10)	2 (15.4)		
Total	315 (100)	2(100)	10 (100)	13 (100)		

N= 340; ** all other deaths occurred between 1 and 21 days

4.5.5. BA case fatality with gender and Apgar score

The table 4.21 shows that male babies were more likely to die in the NICU population 14/ 23 (60.9%) compared to female at 9/23 (39.1%) and similar finding was applied to BA case fatality rate with 12/20 (57.1%) male and 8/20 (42.9%) female.

Table 4. 21: BA case fatality and gender

	BA Yes	BA No	Total
Male	12 (60)	2 (66.7)	14 (61)
Female	8 (40)	1 (33.3)	9 (39)
Total	20 (87)	3(13)	23 (100)

In parenthesis are the percentages. Fisher exact test ,*p* 0.502

The table 4.22 below shows that the mortality was at 89% among babies who scored 6 at with minutes and at 87.5 % among those with an Apgar score of 5 or less than five at five minutes of life.

Table 4. 22: BA case fatality and 5 minutes Apgar Scores

	BA Yes	BA No	Total
≤ 5	14 (87.5)	2 (12.5)	14 (100)
6	8 (89)	1 (11)	9 (100)
Total	20 (87)	3(13)	23 (100)

In parenthesis are the percentages. Fisher exact test , *p* 1

CHAPTER 5: DISCUSSION OF FINDINGS

5.1: DESCRIPTIVE FINDINGS OF THE STUDY SAMPLE

From the general description of this study sample there were more male babies than female (56.5% vs. 43.5% respectively). Early NICU admission in the first 12 hrs of life was at 83.2% with a mean birth weight of 3.227 (SD: 0.55). There was 85.6 % term babiesand 97.6 babies were born single. A $<$ 7 Apgar score of 5 minute was presented by 49.7% babies, 34.1% did not cry in the first five minutes and 58.1% babies were just helped up to the first step of neonatal resuscitation. Maternal age ranged from 15 to 43 years with a mean of 27.2 years old (SD: 3.7). The sample was made of 42.6% babies born from gravida 1, while they wer 6.8% from grand multiparous mothers. 83.9% babies mothers were reported healthy during pregnancy and labor; HIV on ARVs was reported at 8% and Malaria with a positive blood smear at 4.2%. ANC visits mean was 2.68 (SD: 1.113) in this sample.

Ninety percent of the babies were born at the selected DH and (66.5%) were born vaginaly from a normal duration of labor at 85.1% . Prolonged ROM was reported at 25.6% and 63.5% from a MSF. For babies born by cesarean birth 84.2 % were born with prior labor while 15.8%.reported having no prior labor, of the C/B babies and 67.2%. had FD/NRFHR as an indication of C/B. For those born by vaginal birth 91.6% were by spontaneous vaginal delivery (SVD); 6.6 % of were by vacuum; 0.9% for dystocia (breech and shoulder dystocia) and 0.9% birth occurred outside of health facilities (at home and on the road). The most presented clinical signs was seizures 27.9%; fever at 9.0%; limp/ floppy status and hypoxia at 5.4% .

Babies were hospitalized in the NICU with a mean hospital stay of 6.2 days (SD: 4.9) and NICU leave were due to authorized discharge at 92.6%, death at 6.7% (2.9% during the first 24 hours and 3.8% after 24 hours) and 0.6% referrals to high settings.

5.2. KEYS MAIN FINDINGS TWO ANSWER RESEARCH QUESTIONS

The analysis of this study sample described above came up with keys mains findings to answer research questions. BA was confirmed in 135 out of 340 babies giving a prevalence of 39.7%. This prevalence is in accordance with previous researches findings identifying BA among leading causes of NICU admission. The identified prevelance of 39.7% was noteably higher than what was found by Ilah et al.,(2014) in

Nigeria at 30.1% but lower than the one of Aslam et et.(2014) who reported 51.25% also in Nigerian but in another setting.This study was retrospectively done on records of 340 babies randomly selected from a general NICU population of 1441 babies admitted in 2016. The two study above were also retrospective over one year period with a sample of 47 cases in Ilah et al.(2014) over two years (2011-12) in Aslam et al, (2014) the sample size was 240.

The analysis of BA cases demonstates that all BA cases scored less than 7 at 5 minutes of life with a variation of 1, 5 and 10 minutes (table4.10).

Risk factors associated with BA were analysed. Fetal factors analyzed were gender (male/female) without a statistical significance of gender in BA ($p > 0.05$) but the male group was more affected (40.1%) compared to the female group (39.2%).

BA was significantly associated with birth weight (*p* 0.001*) with a higher incidence in Normal birth weight babies being near 13 times more at risk compared to LBW babies [OR: 12.982, *p* 0.013*, CI: 1.705;98.952]. The gestational age was also statistically significant in BA (p 0.008) with a higher risk in term babies being 2 times more asphyxiated compared to nearly term babies [OR: 2.279, *p* 0.002*, CI:1.081; 4.805].

The number of babies do not have a statistical significance in BA (p> 0.05) but singletons babies group had a higher prevalence 40.4% of asphyxia compared to twins and triplets group, in this BA was at 14.3%. The factor maternal age was not significant in BA but the group of teenegers (15-17) had a high prevalence of BA at 50 % compared to other groups aged 18 and more. BA was also diagnosed at 45.5% in the group with 4 antenatal visistsvesus 36.8% of those with less than 4 visits. The analysis of reported mothers'health conditions demonstrate no influence to BA.Grandmultigravida exposed babies to BA 5 times more compared to gravida one mothers [OR: 5.266; *p* 0.010***,** CI:1.500; 18.492].

The group of babies with a normal duration of rupture of membranes (ROM) had a borderline *p* value of 0.049* making them more prone to BA compared to prolonged ROM cases [OR: 1.885, *p* 0.049*, CI: 0.998;3.560].

As regards to the aspect of AF, BA was 4 times more in babies born from meconium stained amniotic fluid compared to those born from a clear AF [3.562, *p* 0.000*, CI: 1.881;6.745]. BA was also 5 times higher in the group of normal duration of labor compared to those from a prolonged labor [OR: 4.746, *p* 0.042*, CI: 1.060;21.257]); V/B was also a foctor to BA with 3 times more exposition to BA compared to those born by C/B [OR: 2.762, *p* 0.000*, CI 1.675; 4.553]. The C/B as a mode of delivery had no statistical significancy but the C/B with a prior labor had 28.1% of BA while it was at 5.6% among those with no prior UC; The study could not find the indications of those C/B. The analysis of different modes of vaginal delivery had no statistical significamce in BA but a high rate of BA was in vacuum group (53.3%) and non assisted delivery (50%) compared to SVD (47.3%). Though the place of delivery was not statistically significant in BA ($p > 0.05$),babies born at home were 100% asphyxiated and 51.9% of those born at HC were also asphyxiated.BA and lower five minutes Apgar score (< 7) were associated ($p < 0.05$). The score of ≤ 5 at 5 min was more associated with BA [OR: 5.186, *p* 0.001*, ci: 2.004; 13.417] The analysis of recorded data on cry or not in the first five minutes revealed a 39 higher association of BA and babies reported without a cried [OR: 38.811, *p* 0.000*, CI: 16.267; 92.599]. BA was also more observed in the group of babies who were helped with advanced steps of neonatal resuscitation around 3 times in those with cardiac massage [OR: 2.598, *p* 0.003*, CI: 1.595;4.248] and 2 times among those who had been ventilated [OR: 2.030, *p* 0.003* CI: 1.487; 2.679] compared to the group of babies who were just helped with routine care and/or the first step of neonatal resuscitation ($\text{dry} \pm \text{stumulation} \pm$ suctioning).

A comparaison of key indentified risk factors with previously research findings demonstates similarities and differences. Fetal and neonatal factors identified to be associated with BA were normal birth weight and term babies. Completely similar to Ilah et al., (2014:p.65) findings; He also found a higher proportion of BA in term babies and normal birth weight was the risk factor. Male babies were slightly more

asphyxiated than female (40.1% vs. 39.2%) in this study as well as in an India study (Saranappa et al., 2015:p.10) with a male BA proportion of 70%. However, Ilah et al., (2014:p.64) found BA to be higher in female babies (59.6%) but gender factor in this study was not significant in BA.

Maternal factors associated with BA was grandmultigravida; grand multiparous mothers. Gravidity ≥ 5 is considered as a high risk pregnancy. In Rwanada, grandmultiparity has been associated with obstetrical complication(MOH, 2015). Maternal age was not statistically significant but teenage mothers were more likely (50%) to have asphyxiated babies, also considered criteria for a high risk pregnancies (CLADHO, 2016; NISR, MOH AND ICF International, 2016). Though poor antenatal visit attendance has been associated with poor pregnancy outcomes (Tabassum et al., 2014). But in this study, they was no protective effect of ANC visists because those with ≥ 4 visists had a higher proporation of asphyxia (45.5%) compared to those with < 4 (36.8%) (see table 4.12).

Among placental factors normal duration of ROM and stained AF were identified as a significant risk factors of BA in this study. As regards to labor and birth factors; normal duration of labor, C/B, Apgar score of ≤5 at 5 minutes, absence of cry in the first five minutes and resuscitation with cardiac massage/ ventilatationwere factors associated with BA in this study. Lower 5 minute Apgar, C/B, absence of cry within the first minutes of life, andneed for neonatal resuscitation had been identified in various literatures as a predictive risk factors of BA (Aslam et al., 2014; MOH, 2012; MOH, 2014; Saranappa et al., 2015; WHO, 2016). The more depressed was the baby at five minute of life without cry, lower apgar, need for ventilation the more were likely to develop clinical signs of asphyxia; this is completely similar to already known literatures (MOH, 2014: p59).

Looking at previous research findings, this study had identified some different findings in terms of BA risk factors which werenormal duration of labor and normal duration of ROM;usualy considered normal labor factors; but were more associated with BA in this study findings compared to prolonged labor and PROM which are known to be

associated with poor or negative labor outcomes.This finding highlights the need for close labor monitoring, skilled birth attendants at all pregnancies as BA is not limited to previously known risk factors.

Another finding which could incite reasearchers was that eventhough babies without a cry in the first five minutes of life were around 39 times more likely to be asphyxiated, 11/122 (9%) cases with a history of cry were also asphyxiated. As preterm and severly malformed babies were excluded in this study; further researches could help to identify other factors exposing newborns with initial breathing to asphyxia. This may also inform that having initiated breathing at birth is not enough but newborns need to be monitored and helped to stustain/ maintain regular breathing after birth and/ or think about a new and more accurate way of appreciating babies'cry.

Finally this study analyzed retrospective information about neonatal resuscitation and found a higher rate in those with advanced levels of resuscitation such as cardiac massage and ventilation being more exposed to BA. But reported information also revealed cases with a lower Apgar score; respiratory depression at birth but who were not resuscitated (table 4.15). With a retrospective study, the researcher could not have enough to comment on this findings because there was no information to explain why those babies did not receive further resuscitation help with ventilation, cardiac massage, etc. But looking at the Apgar score, crying findings, it is likely that some babies did not receive an appropriate level of neonatal resuscitation while they needed them may be due to over Apgar scoring or other factors that this study could not identify.

In terms of outcomes, BA cases presented various clinical signs . The main signs were seizures; limp/ floppy, hypotonic status and hyperactivity. Though the staging system of Sarnat and Sarnat could not apply, seizures are reported to be more common in HIE grade II (moderate stage). The first 24 hours seizures were reported in 76.3% of BA cases. Seizures also predict possible permanent neurological sequelaes among BA NICU graduates though this study was limited to those babies life during NICU stay. Seizures were reported in the control group at 23.7% and not necessarly within the first 24 hrs. Limp/floppy/hypotonic status was present at 66.7% of BA cases while

hyperactivity was presented by 45.5%. Hyperactivity is mostly the dominant clinic in HIE grade I while limpy/ floppy/ hypotonic status are associated with a severe form of HIE (grade III) (MOH, 2012: pp.46-47).

BA cases experienced prolonged NICU stays beyond the neonatal period at 75% compared to non asphyxiated babies (25%). The mean number of days NICU stay was 7.6 (SD:6.1) in BA while it was 5.3 (SD: 4.16) in no BA babies. Though they was not staging system in this retrospective study, prolonged hospital stays ranging from weeks to months are known to be associated with sarnat stages II and III MOH, 2014b: p.60)

Reasons for NICU leave were authorized discharge for 113 ;2 references to higher settings and 20 deaths (for a total of 135 BA cases). The two referred cases were hypotonic/ floppy in the first 24 hours with an equal male female ration 1:1. But male asphyxiated babies were more likely to die (57.1%) than female. In the NICU population all deaths occurred in the first 21 days of life with a neonatal mortality rate of 23/340 (6.8%); BA specific mortality was 87% (20/23) with a case fatality rate of 17.04% (20/150). As regard to timing of death in BA cases, it occurred within the first 24 hours in 9 cases (45%) and after 24 hrs in 11 cases (55%). Comparing those findings to the MOH reports about causes of neonatal deaths, BAstills the leading cause. It is number one cause of neonatal deaths but this time more than 2 times higher than it is in 2014 (87% vs. 41%) in MOH reports of 2014a. Some elements to explain this huge difference are that MOH reports are done at a national scale and include all causes of neonatal deaths while his study was limited on a sample of 340 neonates; at one Distict hospital NICU with exclusion criteria of all preterms babies less than 35 GA and those with severe congenital anomalies.Looking at BA specific mortality association with Apgar score demonstrated being slitly higher among those with Apgar of 6 at 89% while the proporition was at 87.5% among babies with $\leq$ 5 at 5 minute of life. This challenges the process of Apgar scoring but also the management of BA cases. It may probably request an observational study about apgar scoring as regards to the timing and accuracy assessment of each of the five Apgar elements and qualitative studies about NICU staff caring BA cases.

5.3: STUDY FINDINGS AND USED CONCEPTUAL FRAMEWORK

The study findings fit with the used conceptual framework of BA. Some maternal, placental, labor, fetal, birth process and neonatal factors were identified to contribute to BA. Asphyxiated babies were admitted in NICU where some babies passed different days ending in early deaths; later deaths; reference to higher levels of care or discharge.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1. CONCLUSION

Birth asphyxia is reported among leading causes of neonatal morbidity and mortality at global, regional and local levels. This study findings demonstate a higher prevalence of BA at 39.7% at the study setting NICU in 2016. BA was found to be associated with mostly non modifiable risk factors like normal birth weight; term pregnancy, normal duration of ROM, labor; and other factors which could be managed or modified like grandmultiparous; stained AF; lower Apgar score; no cry; need for advanced steps of neonatal resuscitation.Vaginal mode of delivery need to be mastered by birth attendants to reduce the proportion of asphyxiated babies after vaginal birth. In this study the neonatal mortality was at 6.8 % (all deaths had occurred in the first 21 days of life) with BA specific mortality 13 times more higher (87%). BA specific mortality was also 3 times more higher than what was known in Rwanda national records, where BA is recorded causing 41% of neonatal mortality (MOH, 2014b: P39). In this study, survivors of BA had experienced diverses biological insults including neurological with early (within the first 24 hours) seizures observed in 71 out of 135 (52.6%) BA cases. Prolonged NICU stays was also observed in BA group compared to non asphyxiated babies with a mean of 7.6 SD (6.1) versus 5.3 (SD: 4.16) days in NICU. The quality of life of those babies out of NICU is beyond the scope of this study.

This conclude that BA prevalence is high; BA can be an outcome of any pregnancy including those without any previously known risk factor and it is increasing early and later neonatal mortality. Pregnancy and labor monitoring; skilled birth attendance could help in monitoring and decrease the rate of BA through early identification and management of already known risk factors but also adequate and timely skills to improve all pregnancies outcomes.

To the best of my knowledge, this is the first study done at a Rwandan District Hospital looking at BA prevalence, risk factors and outcomes. Though findings could have been influenced by problems related to documentations and records keeping, they provide information about BA in the local context of Rwanda. Further reseach, including prospective research could overcome challenges encountered in this study and come up

with relevant information about BA. Also studies looking at the quality of life of BA cases after NICU discharge could inform more about later and/or permenant sequelaes associated with this condition.

6.2. RECOMMENDATIONS

Towards SDG3: 2 targeting to end preventable neonatal deaths by 2030; measures should be taken to reduce the prevalence of BA and associated mortality. Great emphasis should be made on labor monitoring; skilled birth attendance, accurate initial assessment of all neonates, accuracy in Apgar scoring, quality neonatal resuscitation, and appropriate care of asphyxiated babies.

Further researches, including prospective research could overcome challenges encountered in this study and come up with relevant information about BA.

6.2.1: To the Ministry Of Health

Establish a clear clinical criteria for diagnosing birth asphyxia throughout birthing facilities in Rwanda because from this study, BA is over and unclearly diagnosed.

6.2.2:To other researchers

Quantitative studies on intrapartum management of deliveries by providers to determine intrapartumBA risk factors prevention and management.

Research on APGAR scoring in selected research sites because from this study findings there is an assumptions of overscroring.

Qualitative studies on NICU staff caring for birth asphyxiated neonates. This study revealed a high BA specific mortality but did not provide details of some deaths which could have been prevented by a proper BA management. In the ligne of SDG 3 target 2; qwesting to end all preventable newborns deaths this study would be significant.

Follow up studies on BA discharged babies from the NICU to identify the quality of life of BA NICU graduates.

Elaborate a standardized way of appreciating the quality of the baby cry at birth because actualy only asking if the baby cried or did not cry does not inform much about breathing initiation and maintainance at birth. The should be a standardized tool of qualifying the cry of babies after birth.

6.2.3: To the study site professional staff and administration

Elaborate and implement a documentation policyto provide health care providers accountability for documentation in patient files and register.

Elaborate and implement arecords keeping policy for safe and accourate storing of all medical records

There need for improvement in labor monitoring, Apgar scoring and neonatal resuscitation

There is an immediate need to develop strategies for early identification and management of factors associated with birth asphyxia

The referral notes (internal and external) need to be systematic and kept in the case file

There need for a common and standardized language around birth asphyxia

6.2.4: To the UR

There is an urgent need of higher academic training for skilled health care providers in neonatal sciences.

REFERENCES

AAP (2015) 5-year analysis: Helping Babies Breathe saves lives. Retrieved from http://www.aappublications.org/content/36/8/32.2 [Accessed 09 August 2016].

AAP (2011) Helping Babies Breathe, The golden minute, History of courses conducted Retrieved from http://www.helpingbabiesbreathe.org/historyCoursesResults.cfm?cID=a9dc6514-b06c-6da8-d79d-fe4f3a5c391f [Accesse 11 August 2016].

AAP (2006) Neonatal Resuscitation.Text book 5th edition. Canadian Paediatric Society 2305 St. Laurent Blvd Ottawa, Ontario K1G 4J8

Aslam, H. M., Saleem, S., Afzal, R., Iqbal, U., Saleem, S. M., Waqas, M., Shaikh, A. and Shahid, N. (2014) 'OF PEDIATRICS " Risk factors of birth asphyxia "', pp. 1–9. doi: 10.1186/s13052-014-0094-2.

BLAIR, E., (1993) A Research Definition for 'Birth Asphyxia'?.Developmental Medicine & Child Neurology, 35(5), pp.449-452.
Bobrow, C. S. and Soothill, P. W. (1999) 'Causes and consequences of fetal acidosis', pp. 246–250.

Carolina, S. (2008) 'Birth asphyxia survivors in a developing country', (December). doi: 10.1038/jp.2008.192.

Chiabi A, Nguefack S, Mah E, Nodem S, Mbuagbaw L, Mbonda E, Tchokoteu PF, Doh A. (2013) Risk Factors for Birth Asphyxia in an Urban Health Facility in Cameroon. Iran J Child Neurol. 2013 Summer; 7(3):46-54.

CLAHDO (2016) 'Report on Early / Unwanted Pregnancy For Under 18 Years In 10 Districts Of Rwanda. Retrieved from http://www.cladho.org.rw/fileadmin/templates/document/REPORT_OF_THE_RAPID_ASSESSMENT_ON_TEENAGE_PREGNANCY.PDF [Accessed 02 june 2017].

Crawshaw and Chambers, 2001
A_Concise_Course_in_Advanced_Level_Statistics__With_Worked_Examples__Fourth_Edition-JUGG3RNAUT.pdf', Stanley thornes p.103

Ersdal. L. H, Mduma. E, Svensen. E and Perlman, J. (2012) Birth Asphyxia: A Major Cause of Early Neonatal Mortality in a Tanzanian Rural Hospital. Available at www.pediatrics.org/cgi/doi/10.1542/peds.2011-3134 doi:10.1542/peds.2011-3134 [Accessed 06 November 2016].

Fraser, M. D; Cooper, A. M and Nolte, G, W. A. (2010) Myles Text book for Midwives African Edition second edition Elsevier ltd 2010 British Library of Congress

Geri L.W. and Judith H. (2006) Nursing Research: methods and critical appraisal for Evidence-Based practice.6th edition. Philadelphia. Mosby.
Golubnitschaja, O., Yeghiazaryan, K., Cebioglu, M., Morelli, M. and Herrera-

Gilstrap, L.C., Leveno, K.J., Burris, J., Williams, M.L. and Little, B.B. (1989) Diagnosis of birth asphyxia on the basis of fetal pH, Apgar score, and newborn cerebral dysfunction. American journal of obstetrics and gynecology, 161(3), pp.825-830.

Halloran, D.R., McClure, E., Chakraborty, H., Chomba, E., Wright, L.L. and Carlo, W.A. (2008) Birth Asphyxia Survivors in a Developing Country. Journal of Perinatology, 29, 243-249. https://doi.org/10.1038/jp.2008.192

Heerden, BCur, and MCur (2012) An introduction to Helping Babies Breathe: the "Golden Minute" is here for South African newborn babies. Retrieved from http://www.helpingbabiesbreathe.org/docs/An%20intro%20to%20HBB.pdf [10 May 2016]

Helmy. M (2014) Mechanisms of Birth Asphyxia and a Novel Resuscitation Strategy https://helda.helsinki.fi/bitstream/handle/10138/43159/Helmy_dissertation.pdf?sequence=1

Henderson,V.A.(1964).The nature of nursing.The American Journal of Nursing Vol. 64, No. 8 (Aug., 1964), pp. 62-68

Ilah, B. G., Aminu, M. S., Musa, A. and Adelakun, M. B. (2015) 'Prevalence and Risk Factors for Perinatal Asphyxia as Seen at a Specialist Hospital in Gusau , Nigeria', 2(2), pp. 1–6. doi: 10.4103/2384-5147.157421.

Israel, D. G (1992) Determining Sample Size Fact Sheet PEOD-6 University of FLORIDA. URL Available at http://sociology.soc.uoc.gr/socmedia/papageo/metaptyxiakoi/sample_size/samplesize1.pdf [10 October 2016]

Jacobs E S, Berg M, Hunt R, Tarnow-Mordi o W, Inde E T and Davis G P (2013) Cooling for newborns with hypoxic ischaemic encephalopathy. Cochrane Database of Systematic Reviews DOI: 10.1002/14651858.CD003311.pub3

Kaneshiro. K.N, 2014 Apgar score U.S. National Library of Medicine. Retrived from https://www.nlm.nih.gov/medlineplus/ency/article/003402.htm [03 September 2016]

Kish, L.(1965) Survey Sampling. New York, NY: John Wiley and Sons, Inc

Lakshman, M. (2000)Indian journal of pediatrics, clinical epidemiology and research.Laval, Bruxelles/Québec.

Liu, L., Oza, S., Hogan, D., Perin, J., Rudan, I., Lawn, J.E., Cousens, S., Mathers, C. and Black, R.E.(2015) Global, regional, and national causes of child mortality in 2000–13, with projections, to inform post-2015 priorities: an updated systematic analysis. The Lancet, 385(9966), pp.430-440.

Loewe. M and Rippin. N. (2015) The Sustainable Development Goals of the Post-2015 Agenda: Comments on the OWG and SDSN Proposals German Development Institute / DeutschesInstitutfürEntwicklungspolitik (DIE) pp. 21-25 Available at www.die-gdi.de

Magadi, M., Diamond, I., Madise, N. & Smith, P. (2004)Pathways of the determinants of unfavorable birth outcomes in Kenya. Journal of Biosocial Science, 36(2), 153– 76

Marshall and Raynor (2014) Myles' Textbook for Midwives 16th edition

Marschitz, M. (2011) Birth asphyxia as the major complication in newborns: moving towards improved individual outcomes by prediction, targeted prevention, and tailored medical care. EPMA Journal, 2(2), p.197.

Mbaruku. G, Roosmalen. V. G, Kimondo. I, Bilango. F and Bergström, S. (2009)Perinatal audit using the 3-delays model in western Tanzania - International Journal of Gynecology and Obstetrics DOI: http://dx.doi.org/10.1016/j.ijgo.2009.04.008 available at http://www.ijgo.org/article/S0020-7292(09)00237-9/pdf [28 July 2016].

MOH (2015) Key Indicators/ Rwanda Demographic and Health Survey 2014-2015 Retrieved from http://www.moh.gov.rw/index.php?id=3 [08 August 2016].

MOH (2014a) Rwanda Annual Health Statistics Booklet. Kigali-Rwanda. Available at http://moh.gov.rw/fileadmin/templates/HMIS_Docs/MOH_Statistical_Booklet_2014.pdf [05 June 2016]

MOH (2014b) National Neonatal Care Protocol 2nd edition, Kigali-Rwanda

MOH (2013) Rwanda Annual Health Statistics Booklet. Available at http://www.moh.gov.rw/fileadmin/templates/policies/Rwanda_Annual_Health_Statistics_Booklet_2013_signed.pdf [Accessed 04 May 2016]

MOH (2012a) Rwanda Annual Health Statistics Booklet. Retrieved from http://www.moh.gov.rw/fileadmin/templates/HMIS_Docs/MOH_Booklet_2012.pdf [Aceessed 01 June 2016].

MOH (2012b) Neonatology Clinical treatment guideline.Kigali-Rwanda.Retrivable at http://www.moh.gov.rw/fileadmin/templates/Norms/Neonatology-Clinical-Treatment-Guidelines-OTHER-VERSION.pdf [03 April 2016]

MOH, 2011 Sercices pachages for health facilities at different levels of sercive delivery:pp.10-11. Available from http://www.moh.gov.rw/fileadmin/templates/Clinical/SERVICE-PACKAGES-FOR-HEALTH-FACILITIES-AT-DIFFERENT-LEVELS-OF-SERVICE-DELIVERY-last-version.pdf [30 October 2016].

Morales, P., Bustamante, D., Espina-Marchant, P., Neira-Peña, T., Gutiérrez-Hernández, M. A., Allende-Castro, C., & Rojas-Mancilla, E. (2011) Pathophysiology of perinatal asphyxia: can we predict and improve individual outcomes? The EPMA

Journal, 2(2), 211–230. http://doi.org/10.1007/s13167-011-0100-3 retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3405380/ [22 September 2016].

Moulton, G. (2011) Basic Statistics for Epidemiology: Prevalence vs Incidence. Available at http://health.knowledgeblog.org/2011/07/22/basic-statistics-for-epidemiology/ [Accessed 19 May 2016]

Msemo G, Massawe A, Mmbando D, Rusibamayila N, Manji K, et. al. (2013) Newborn mortality and fresh stillbirth rates in Tanzania after Helping Babies Breathe training. Pediatrics February 2013, volume 131 /issue 2.doi: 10.1542/peds.2012-1795 Available at http://pediatrics.aappublications.org/content/131/2/e353 [10 August 2016].

Musafiili,A;Essén, B; Baribwira, C, and Perrson, A L (2014) Evaluating Helping Babies Breathe: training for healthcare workers at hospitals in Rwanda.Actapediatrica doi:10.1111/apa.12034. Available at https://www.researchgate.net/publication/232744840_Evaluating_Helping_Babies_Breathe_training_for_healthcare_workers_at_hospitals_in_Rwanda [accessed 10 August 2016].

Nelson, K.B. and Leviton, A. (1991) How much of neonatal encephalopathy is due to birth asphyxia?.American journal of diseases of children, 145(11), pp.1325-1331.

NISR, MINECOFIN, MOH, and ICF International (2016) Rwanda Demographic and Health Survey 2014-2015 pp 53-150 Rockville, Maryland, USA: NISR, MOH, and ICF international. Available at http://www.statistics.gov.rw/publication/demographic-and-health-survey-20142015-final-report

Onyiriuka, A.N., 2009. Birth Asphyxia in a Nigerian Mission Hospital in Benin City. Tropical Journal of Obstetrics and Gynaecology, 26(1), pp.80-88.

Parker E M and Smith C M (2010) Nursing theories & nursing practice. Third edition Davis Company 1915 Arch Street Philadelphia, PA 19103

Polit, D. F and Beck, C. T. (2004) Nursing research: principles and methods.7th edition. Philadelphia. Lippincott Williams and Wilkins.

Rajaratnam, et. al. (2010) Neonatal, postneonatal, childhood, and under-5 mortality for 187 countries, 1970–2010: a systematic analysis of progress towards MDG 4

Rwanda MDGR (2015) Millennium Development Goals Rwanda Final Progress Report: 2013 Kigali, Rwanda.

Saranappa, S. S., Nair, C. C., Madhu, G. N., Srinivasa, S. and Mn, M. (2015) 'Clinical profile and outcome of perinatal asphyxia in a tertiary care centre', 19, pp. 9–12.

Study site (2016) Administrative policies and procedures manual, Kigali-Rwanda

Study site (2016) internal report (unpulished)

Tabassum. F,Rizvi. AAriff. S, Soofi. S and Bhutta. A. Z, (2014) Risk Factors Associated with Birth Asphyxia in Rural District Matiari, Pakistan: A Case Control StudyInternational Journal of Clinical Medicine, 2014, 5, 1430-1441 Published Online December 2014 in SciRes. Available at http://www.scirp.org/journal/ijcm http://dx.doi.org/10.4236/ijcm.2014.521181 [Accessed 18 june 2016].

UNICEF (2016) Basic indicators Retrieved from http://www.unicef.org/infobycountry/stats_popup1.html [accessed 08 August 2016].

UNICEFRwanda (2014), African Region, Neonatal and Child Health Profile Retrieved at http://www.who.int/maternal_child_adolescent/epidemiology/profiles/neonatal_child/rwa.pdf [05 August 2018].

UN IGME (2015) Levels & Trends in Child Mortality Report 2015 available at http://www.childmortality.org/files_v20/download/igme%20report%202015%20child%20mortality%20final.pdf [Accessed on 11 June 2016].

WHO (2016a) Children reducing mortality. Fact sheet URL. Available from http://www.who.int/mediacentre/factsheets/fs178/en/ [05 May 2016].

WHO (2015) Levels and Trends in Child Mortality: Report 2015: Estimates Developed by the UN Inter-Agency Group for Child Mortality Estimation (IGME).

WHO (2013) Uganda African region Neonatal and Child Health Profile available at http://www.who.int/maternal_child_adolescent/epidemiology/profiles/neonatal_child/uga.pdf [2 December 2016].

WHO (2011) Neonatal deaths and illness Available at http://www.who.int/pmnch/media/press_materials/fs/fs_newborndealth_illness/en/ [05 September 2016].

WHO (2006) Neonatal and perinatal mortality: country, regional and global estimates. WHO Press,World Health Organization, 20 Avenue Appia, 1211 Geneva 27, Switzerland +41 22 791

Winter, R; Pullum, T; Langston, A; Mivumbi, V,N;Rutayisire, P, C; Muhoza, N,D and Hakiba, S. (2013) Trends in Neonatal Mortality in Rwanda, 2000-2010 ICF International Calverton, Maryland, USA. Retrieved from http://www.dhsprogram.com/pubs/pdf/FA88/FA88.pdf [09 August 2016].

Zenell,A. S. (2015) Hypoxic-Ischemic. Retrieved from Encephalopathyhttp://emedicine.medscape.com/article/973501-overview#showall [22 September 2016].

WORK PLAN FOR THE DISERTATION

TASKS TO BE PERFORMED	**DATES TO BE COMPLETED**	**PERSONNEL ASSIGNED TO TASK**	**PERSON DAYS REQUIRED.**
1. Research Proposal preparation and submission	Week 1-20 May 16th, 2016 to October 02nd 2016	UWINGABIRE F	40 days
2. Proposal presentation	Week 21 -22 October 03rd to October 16th, 2016	UWINGABIRE Fauste	1 day
3. Correction of the feedback from the panel and turnitun	Week 23-31 October 17th to December 18th, 2016		
4. IRB submission for ethical clearance and permission to do the work	Week 32 December 19th to December 25th, 2016	UWINGABIRE Fauste	4 days
5. Waiting for feedback from IRB	Week 33-36 December 26th, 2016 to January 22nd, 2017		
6. MH/NICU contact to brief staff about the project	Week 37 January 23rd to January 29th, 2017	UWINGABIRE Fauste	1 day
7. Pre-testing and finalizing research instruments	Week 38 January 30th to February 05th 2017	UWINGABIRE Fauste	3 days
8. Data Collection (Fieldwork)	Week 39-47 February 06th to April 02nd 2017	UWINGABIRE Fauste	18 days

9. Data coding, and entry into computer	Week 48-49 April 03rd to April 16th,2017	UWINGABIRE Fauste and statistics expert	6 days
10. Data analysis	Week 50 to 52 April 17th to May 07th 2017	UWINGABIRE Fauste	9 days
11. Report Writing (First Draft)	Week 53-54 May 08th to may 21st2017	UWINGABIRE Fauste	6 days
12. Report Submission (To supervisors)	Week 55 May 22nd to May 28th,2017	UWINGABIRE Fauste	1 day
13. Report Writing (Final draft)	Week 55-57 May 22nd to June11th, 2017	UWINGABIRE Fauste	2 days
14. Submission of Final Project	Week 58 June 12th, 2017	UWINGABIRE Fauste	1 day
15. Oral presentation of the project	Week 59 June 19th ,2017	UWINGABIRE Fauste	1 day
16. Feedback to the study site	July 2017	UWINGABIRE Fauste	1 day

The researcher will offer 2 to 3 days a week for this project due to the overlapping off academic and job responsibilities. This plan will be adjusted according to the academic calendar.

GANTT CHART

TASKS TO BE PERFORMED	Year 2016- 2017													
	May	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
1. Research Proposal preparation and submission	xx	Xxx xx	xx xx	xxx xx	xxxx									
2. Proposal presentation						xx								
3. Correction of the feedback from the panel and turnitun						xx	xxx xx	xx						
4. IRB submission for ethical clearance and permission to do the work								x						
5. Waiting for feedback from IRB								x	Xxx x					

6. MH/NICU contact to brief staff about the project									X					
7. Pre-testing and finalizing research tool										x				
8. Data Collection (Field work)										xx x	Xxx xx			
9. Data coding, and entry into computer												xx		
10. Data analysis												xx	x	
11. Report Writing (First Draft)													xx	
12. Report Submissiont o the supervisor													x	
13. Report Writing (Final draft)													x	x
14.														x

Submission of Final Project														
15. Oral presentation of the project														x
16. Feedback to the study site														*

x: a week (2 to 3 days/week dedicated to the research project

***Feedback to the study site:** A seminar will be given to the study site professional staff and administartion to disseminate the results obtained from the study highlighting relevant specific recommendations for consideration.

BUDGET

PREPARATION FOR THE STUDY

N°	Activity	N° of persons	N° of days	Cost / Unit (RWF)	Total RWF
1	Research proposal preparation and submission	1	40	3000	120,000
2	Ethical clearance and authorization, for research	1	4	5,000	20,000
3	MH/NICU contact	1	1	5,000	5,000
4	Pre-test and finalization questionnaire	1	6	5,000	30,000
Sub-total 1					**175,000**

THE STUDY ON THE GROUND

N°	**Tasks to be performed**	**N° of persons**	**N° of days**	**Unit cost RWF**	**Total RWF**
1	Data collection	1	18	10,000	180,000
2	Transport	1	18	5,000	90,000
3	Restaurant	1	18	5,000	90,000
Sub-total 2					**360,000**

STUDY SUPPLIES

N°	Items	Quantity	Unit price	Total RWF
1	Computer	1	500,000	500,000
2	External disk	1	300,000	300,000
3	Papers reams	2	4,000	8,000
4	Pens	10	100	1,000
5	Pencil	4	50	200
6	Modem	1	10,000	10,000
7	Internet subscription	12 months	10,000	120,000
8	Calculator	1	1500	1500
9	Rulers	1	200	200
10	Perforator	1	1,200	1,200
11	Staple	1	1,000	1,000
12	Stapler	1	1,500	1,500
13	Paper holder	2	2,000	4,000
14	Photocopies	300	20	6,000
15	Printing	500	20	10,000
Sub-Total 3				**964,600**

4. PRODUCTION OF THE REPORT

N°	Item	Quantity	N° of days	Pers.-days	Unit Price RWF	TotalRWF
1	Crosscheck & Verification of data	1	2	2	3,000	6,000
2	Entering Data	2	4	8	5,000	40,000
3	Analysis of Data	1	2	2	3,000	6,000
4	Report (Draft 1)	1	2	2	3,000	6,000
Sub – total 4						**58,000**

5. FINAL ACTIVITIES

Nº	Item	Quantity	N°/Days	No.pers-days	Unit Price RWF	Total RWF
1	Reduction of Report (final copy)	1	2	2	5,000	10,000
2	Submission of final report	1	1	2	10,000	10,000
3	Oral presentation	1	1	1	20,000	20,000
4	Feedback to the study site	1	1	20	5,000	100,000
Sub-total 5						**140,000**

BUDGET SUMMARY

Nº	**DESCRIPTION**	**TOTAL / COST RWF**
1	Preparation for the Study	175,000
2.	The study on the ground	360,000
3	Study supplies	964,600
4.	Production of the Report	58,000
5	Final activities	140,000
TOTAL BUDGET		**1,697,600**

ANNEXES

BIRTH ASPHYXIA DATA COLLECTION TOOL

Introduction:

This is a 25 items data collection tool used to determine the prevalence, risk factors and outcomes of BA. Some items have a filling in space and others have precised information to collect and require a circuling of a case's corresponding variable category. The item number 25 looking for BA was filled after analyzing the intem 19 (Apgar score at 5 minute); 21 (baby cry) and 23 (main clinical features in the first 24 hours).

1. Hospital No: Month:

2. Sex: Male Female

3. Age on admission: <12hours 12-24hours 24hours

4. Birth Weight(gr): 1500-2499 2500-999 000-5450

5. Gravidity of mother: primigravida multigravida (2-4) grand-multigravida (≥5)

6. Gestational age: nearly term term post term

7. Maternal age: 15-17 18-20 21-34 35-43

8. Number of ANC: 1 2 3 4 5

9. Labor: No labor normal labor prolonged (>18 hours)

10. Membrane rupture: prolonged (> 18hours) not prolonged

11. Status of the amniotic fluid: Clear meconium stained malodorous other: specify……

12. Maternal co-morbid conditions: None hypertension pregnancy induced hypertension diabetes mellitus renal diseases others: ……

13. Place of delivery: hospital Health center Private clinic home

14. Mode of delivery: caesarean birth vaginal birth

15. Caesarean birth with fetal distress : Yes No

16. If vaginal birth: normal non-assisted

17. Number of baby: singleton twins triplets

18. The one minute APGAR score: ≤5 6 ≥ 7

19. The fsAPGAR score: ≤5 6 ≥ 7

20. The 10sAPGAR score: ≤5 6 ≥ 7

21. Cry of baby in the first 5 minutes: cried not cried

22. Initial help received: Dried ± stimulated± suctioned Ventilated

Cardiac massage Adrenaline

23. Main clinical signs in the / admission:……

24. Duration of hospital stay umber of days:…….

24. Outcomes: discharged referred death

25. Birth asphyxia case: Yes NO

Adapted from Dr Bilkisu Garba Ilah

Department of Paediatrics,
Ahmad SaniYarimanBakura Specialist Hospital,
P.M.B 1010,
Gusau,
Zamfara State,
Nigeria.

03/09/2016

To whom it may concern,

PERMISSION TO USE RESEARCH TOOL

I permit MsFausteUwingabire to use my research tool which I forwarded on request to enable her carry out a research.

The research tool was pre tested but not validated before being used for my research titled ‘Prevalence and risk factors for perinatal asphyxia as seen at a Specialist Hospital in Gusau, Nigeria.

You may wish to contact me in case you need further clarification.

Kind regards,

DrBilkisuGarbaIlah,
bgilah @yahoo.com
+2348036782582

UNIVERSITY OF RWANDA

COLLEGE OF MEDICINE AND HEALTH SCIENCES

CMHS INSTITUTIONAL REVIEW BOARD (IRB)

Kigali, 16/01/2017
Ref: CMHS/IRB/060/2017

Fauste Uwingabire
School of Nursing and Midwifery, CMHS, UR

Dear Fauste Uwingabire

RE: ETHICAL CLEARANCE

Reference is made to your application for ethical clearance for the study entitled ***"Prevalence and Risk Factors of Birth Asphyxia in the Neonatal Intensive Care Unit at a District Hospital in Kigali, Rwanda".***

Having reviewed your protocol and found it satisfying the ethical requirements, your study is hereby granted ethical clearance. The ethical clearance is valid for one year starting from the date it is issued and shall be renewed on request. You will be required to submit the progress report and any major changes made in the proposal during the implementation stage. In addition, at the end, the IRB shall need to be given the final report of your study.

We wish you success in this important study.

Professor Kato J. NJUNWA
Chairperson Institutional Review Board,
College of Medicine and Health Sciences, UR

Prof. JB Gahutu
IRB Vice-Chair

Cc:
- Principal College of Medicine and Health Sciences, UR
- University Director of Research and Postgraduate studies, UR

UNIVERSITY OF RWANDA

COLLEGE OF MEDICINE AND HEALTH SCIENCES

SCHOOL OF NURSING AND MIDWIFERY

Kigali, on 06 / 02/2017

Ref. No: 125/ UR-CMHS/SoNM/17

TO WHOM IT MAY CONCERN

Dear Sir/Madam,

Re: Request to collect data

Referring to the above subject, I am requesting for permission for **UWINGABIRE Fauste**, a final year student in the Masters of Science in Nursing at the University of Rwanda/College of Medicine and Health Science to collect data for his/her research dissertation entitled: "**Prevalence and Risk Factors of Birth Asphyxia in the Neonatal Intensive Care Unit at a District Hospital in Kigali, Rwanda.**"

This exercise that is going to take a period of 2 months starting from 13th February 2017 to 12th April 2017 will be done at Muhima District Hospital

We are looking forward for your usual cooperation.

Sincerely,

for Dr. Donatilla MUKAMANA, RN, PhD

Dean, School of Nursing and Midwifery

College of Medicine and Health Sciences

Email: schoolofnursingandmidwifery@ur.ac.rw, P.O.Box: 3286 Kigali-Rwanda, Website: www.ur.ac.rw

UWINGABIRE Fauste

Muhanga- Nyamabuye

UR/ CMHS Student

E –mail: uwingafausta@yahoo.fr

Contact: 0788535243

Tuesday January 24, 2017

Pour Préposé(e)

Date: 30/01/2017

Signature

To: Muhima Hospital Director

Re: Request for permission to conduct a research at Muhima Hospital

Dear Sir,

I am UWINGABIRE Fauste a student at University of Rwanda College of Medicine and Health Sciences (CMHS) at Master's level. I am specializing in Neonatal and conducting a research to fulfill the academic requirements of this program. I am interested doing my study on the leading cause of neonatal death in Rwanda which is birth asphyxia with a research title of "Prevalence and Risk factors of Birth asphyxia in the Intensive Care Unit at a District Hospital in Kigali, Rwanda".

I have planned to conduct this research as a retrospective study at Muhima Hospital, using neonatal records in registers and case files for those admitted in neonatal unit in 2016. The study protocol was submitted to the CMHS Institutional Review Board (IRB) to request for ethical clearance and the summary of the proposal and this was provided.

Attached are copies of the IRB ethical clearance and the summary of research proposal

Looking forward to hearing from you soon

Respectfully yours,

UWINGABIRE Fauste

REPUBLIQUE DU RWANDA

VILLE DE KIGALI
DISTRICT DE NYARUGENGE
HOPITAL DE MUHIMA
B.P : 2456 KIGALI
Tél. /Fax : +252 50 37 7
E-mail : muhimahospital1@gmail.com

ETHICS COMMITTEE/ COMMITTEE D'ETHIQUE

06 January, 2017

Review Approval Notice

Dear Fauste UWINGABIRE,

Re: Your request to conduct a research at Muhima hospital.

During the meeting of ethic committee of Muhima District Hospital that was held on 03 February 2017 to evaluate your demand we are pleased to inform you that the Muhima Hospital Ethic Committee has approved your request.

You are required to submit progress report(s) regularly as dictated by your proposal. Furthermore, you must notify the committee of any proposal change(s) or amendment(s), serious or unexpected outcomes related to the conduct of the research, or research termination for any reason. The committee expects to receive a final report at the end of the research.

Yours sincerely,

Dr MANIRAGUHA YEZE Aimée Victoire

Chair Person, Ethics Committee

MUHIMA HOSPITAL
- ETHIC COMMITTEE -