MATERNAL RISK FACTORS FOR PERINATAL ASPHYXIA AT THE KIAMBU LEVELFIVE HOSPITAL. (A Case Control Study)

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DECLARATION

I do declare that this research is to be undertaken in part fulfilment of the masters of medicine in Obstetrics and Gynaecology from the University of Nairobi and is be my original work and has not been undertaken and presented for a degree in any other institution.

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LIST OF ABBREVIATIONS

ACOG	American College of Obstetricians and Gynecologists
APGAR	Appearance, Pulse, Grimace, Activity, Respiration
AKI	Acute Kidney Injury
BP	Blood Pressure
ERC	Ethics Review Committee
GCS	Glasgow Coma Scale
HDP	Hypertensive Disorders in Pregnancy
HIE	Hypoxic Ischemic Encephalopathy
ICD	International Classification of Disease
JOGECA	Journal of Obstetrics and Gynecology, East and Central Africa
WHO	World Health Organization
KL5H	Kiambu level five Hospital
MSAF	Meconium-stained Amniotic Fluid
SVD.	Spontaneous Vaginal Delivery
NICU	Newborn Intensive care Unit
SDG	Sustainable Development Goals
NBU	Newborn Unit
CS	Cesarean Section

OPERATIONAL DEFINATION

Apgar score-An object objective method of scoring the condition of a baby after birth.It determines heart rate , respiratory rate , respiratory effort , muscle tone , skin color, and response to stimulation.

Anemia-In pregnant women defined when the hemoglobin level is <10g/dl

Antepartum Hemorrhage-Bleeding from or into the genital tract occurring from 24+ weeks of pregnancy and prior to the birth of the baby.

Acidemia -Increased acidity of blood

Birth asphyxia -A newborn was considered to have birth asphyxia when its fifth minute APGAR score was < 7

Mal-presentation -was defined as any fetal presentation other than vertex.

Neonate-A newborn less than 28 days

Neonatal mortality-Death within first 28 days of life expressed per 1000 live births.

Preterm-when the newborn was born <37 weeks gestational age

Primigravida-A woman who is pregnant for the first time

Prolonged Labor-When labor after the latent phase of the first stage exceeds 12 hours in primigravida or 8 hours in multipara mothers.

Premature rupture of Membranes-This is defined as a condition in which rupture of the membranes of the amniotic sac and chorion occurs 1 hour before the onset of labor.

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ABSTRACT

Introduction: The prevalence rate of birth asphyxia in resource poor countries in Africa is high with Kenya reporting a prevalence rate of 5.1 % in one local hospital. However, this prevalence is an under estimation of the actual prevalence of birth asphyxia in the community given the exclusion of many occurrence outside health facility settings. Due to the significantly high contribution of perinatal asphyxia to neonatal mortality in the underdeveloped countries, the study aimed at conducting an in-depth assessment of the factors associated with development of perinatal asphyxia in a busy level 5 hospital in Kenya.

Objectives of the Study: To determine the maternal risk factors associated with the development of perinatal asphyxia among newborns at the Kiambu Level Five Hospital between year 2017-2020.

Methods and materials: This was a case control study in which 636 neonates with an Apgar score less than 7 at 5 minutes (cases) and 1272 neonates with an Apgar score more than 7 at 5 minutes (controls) were recruited from a cohort of mothers who delivered at a gestational age of 38wks-42 weeks at the Kiambu Level five hospital between year 2017-2020. Data was collected from the patients 'files selected from maternity registry in the records department. Analysis of the data was done using SPSS version 23 software; bivariate statistics was used to determine the association of selected maternal risk factors with perinatal asphyxia. A multivariate logistic model was used to determine the independent variables associ- ated with asphyxia. The statistically significant value of p was taken to be <0.05.

Results: Primiparity(,AOR, 1.3,CI 95% 1.1-1.5 ,p 0.002), pre-eclampsia (AOR, 2.0,CI 95% 1.1-3.2, p 0.009),cesarean delivery (AOR 1.6 ,CI 95% 0.4-0.6,P<0.001)Breech presentation(AOR ,2.7,CI 95% 1.3-**5.6** P 0.006) and meconium-stained amniotic fluid (,AOR 1.9,CI 95% 1.4-2.5, p<0.001) were signifi- cantly associated with development of birth asphyxia in the newborn. Partogram use was not associated with the development of birth asphyxia.

Conclusion: Primiparity, preeclampsia, cesarean delivery, breech presentation and meconium-stained amniotic fluid were identified as significant maternal risk factors for perinatal asphyxia.

Recommendations: Measures should be put in place to reduce the maternal risk factors of birth asphyxia. This would include screening for and timely management of pre-eclampsia, meconium-stained liquor; breech presentation; and removing barriers to timely caesarean delivery

CHAPTER 1: INTRODUCTION

The World Health Organization (WHO) defines birth asphyxia as the failure in initiating and sustaining breathing at birth, while the American College of Obstetricians and Gynecologists (ACOG) defines it as the marked impairment in the exchange of the respiratory gases, mainly carbon dioxide and oxygen, which leads to hypoxemia, hypercapnia, and other metabolic acidosis (2, 3). Birth asphyxia may also be defined as a failure in initiating, establishing, and sustaining breathing at birth or the impairment of the placental or pulmonary gas exchange that eventually leads to hypoxemia and hypercapnia (4, 5). Due to lack of a general consensus as what constitutes birth asphyxia,. the APGAR score is ordinarily used as the indicator for the fetal condition at birth (6, 7).

Worldwide, around 4 million babies are born with asphyxia, making birth asphyxia to be considered as a serious clinical problem. Almost 1million deaths occur from asphyxia and an equal number experience serious neurological sequel, including epilepsy, mental retardation, and cerebral palsy, each year (8). Events due to perinatal asphyxia are estimated to occur in approximately 2 to 4 per 1000 newborns worldwide who are alive at term. The leading cause of neonatal mortality is perinatal asphyxia after prematurity (9.10). Over one million newborns who end up surviving asphyxia at birth, develop disabilities such as epilepsy, development problems, and cerebral palsy associated with long-term sequel (9, 10). According to the WHO, about 23% of theneonatal deaths globally is caused by birth asphyxia and is the fifth largest cause of under-five mortality among children (8%). Birth asphyxia is associated with 1.1 million intrapartum stillbirths and it accounts for 920,000 neonatal deaths every year (12, 13).

The prevalence of birth asphyxia in resource poor countries in Africa is high with Kenya reporting a prevalence rate of 5.1 % (43) in one local hospital. . However, this prevalence is sometimes an under estimation of the actual prevalence of birth asphyxia in the community given the exclusion of many occurrences outside health facility settings. Neonatal mortality in Kenya is stillhigh at 21 per 1000 live births (54) with Kenya aiming to achieve the global SDG target of neonatal mortality to at least as low as 12 per 1000 live births by 2030 (55). Birth asphyxia is the leading cause of neonatal mortality contributing to 29% of the deaths in the country (56). A significant number of neonatal admissions (10. 8%) at Newborn Unit (NBU) of Kiambu level five Hospital(KL5H) are attributable to birth asphyxia. Most of these neonates are referred from the maternityward in the hospital. However there has been no recent scientific evidence about theexact bur- den of birth asphyxia and its specific determinants among live births at maternity wardof KL5H. The number of reported birth asphyxia cases at the KL5H in 2017-2020 was 946 (DHIS, 2021). When viewed in the context of total deliveries in the hospital, the prevalence was 27/1,000 live births (DHIS, 2021).

CHAPTER 2: LITERATURE

2.1 Introduction

High risk pregnancies account for about 10-20% of the population and include those who are experiencing diabetes mellitus, cardiac, pulmonary, and circulatory problems. The high-risk preg- nancies, when associated with prolonged hypo-perfusion of the placenta may lead to multi organ injury during labor and delivery when the demand for oxygen exponentially rises. Perinatal
asphyxia may therefore occur in utero, during labor and delivery, or in the neonatal period second- ary to cardiovascular or pulmonary disease (19).

Many reasons may lead to a fetus being deprived of oxygen before, during, or just after birth; these range from the mother having pre-existing conditions that contribute to diminished levelsof oxygen, to the development of a placenta problem that deprives the fetus oxygen or the fetus experiences difficulties and being unable to breathe properly during delivery. Aslam H.M et al in 2014, in a study done in Karachi Pakistan, found out that birth asphyxia was caused by events during the antepartum, intrapartum or postpartum periods (20).

2.2 Antepartum Maternal Risk Factors Associated with Perinatal Asphyxia

2.2.1 Level of Education

A study in Ethiopia conducted by Hagos Tasew et al 2018 indicated that illiterate mothers were 6 times likely to birth neonates suffering from asphyxia when compared to the mothers educated above diploma level (1). These results are consistent with a similar study conducted in Indonesia (21, 22) that indicated there was an association with birth asphyxia and the levels of illiteracy of the mothers. This can be attributed to the fact that illiteracy is considered as an indicator of poor

socio-economic conditions that the mothers are subjected to leading to malnutrition and poor health during the antepartum period (1).

2.2.2 Antenatal Clinic Attendance and Access to skilled Delivery services

In a study conducted by shaheen F .et al, the perinatal mortality rate that was attributable to birth asphyxia was 111/1000 live births in cases who didn't have antenatal visits as compared to 17/1000 in cases who had regular antenatal visits (23) Onyearugha and Ugboma (2012)in their study on fetal outcomes of antepartum and intrapartum eclampsia in Aba, southeastern Nigeria, reported that perinatal asphyxia incidence is significantly influenced by antenatal attendance in primary healthcare facilities.The authors also indicated that lack of qualified staff in the health centers result in poor follow up of the pregnant women seeking antenatal care and only complicated cases were reffered (56) Chiabi et al (2013) following a study in Cameroonian urban health facility on birth asphyxia risk factors,concluded that what matters is the quality of the care accorded as opposed to the number of consultations. Prenatal visits in primary health facilities compared to the tertiary facility significantly increased the occurrence of asphyxia (OR=3.81, CI 95%=1.8-7.7)

Chandra et al, in their multivariate analysis of risk factors of asphyxia found less number of antenatal visits (Mean = 1) in the asphyxia group while control group had a mean of 2 antenatal visits (59) Aslam et al 2014, in their study on risk factors of birth asphyxia found 74.7% cases to be un-booked (20). Booked cases receive better antenatal care along with early detection and management of maternal health conditions and so there are fewer cases of poorer fetal outcome and birth asphyxia.

Data from a study conducted by Ejaz I, et al in 2001 at the Mayo Hospital, Lahore, Pakistan emphasized the importance of skilled delivery services on the reduction of perinatal asphyxia and Mortality. In this study, the mortality was found was found to be 27% for skilled Deliveries compared to 45% among babies who were delivered at home by unskilled personnel. The previous data that was published from the children Hospital also in Lahore indicated that about 38% of the new borns were delivered at home and all of them showed HIE with a mortality rate of 40% (24,25)

2.2.4 Parity

Parity has a huge association with birth asphyxia. Women who were primiparous have been shown to be 3 times at a higher risk of perinatal asphyxia compared to those who were multiparous (1) In a study conducted in Ethiopia by Woday A et al (2019) primipara mothers were found to have four times greater risk of birth asphyxia compared to multiparous women.

(36) Onyiriuka AN, 2009 in a study conducted at a Nigerian mission Hospital, revealed that primiparity is one ofthe predictors of birth asphyxia (61). This could be partly due to the fact that the primiparous women are likely ignorant to the demands that come with pregnancy andtherefore end up neglecting antenatal care attendance regularly. This ignorance leads to pregnancy complications resulting in perinatal asphyxia. However, socioeconomic and cultural factors such as lower level of education and financial instability may also contribute towards the same.

2.2.5 Ante Partum Hemorrhage

Antepartum hemorrhage has significant association with birth asphyxia. In a study conducted by Tasew H et al 2018 at a public hospital in central zone Ethiopia on the risk factors associated with perinatal asphyxia, neonates of mothers who experienced antepartum hemorrhage were 12 times more likely than those without antepartum hemorrhage to develop asphyxia (1). This could

be due to the fact that in antepartum hemorrhage, there is a decreased flow of the blood from the mother to the fetus resulting in hypoxemia.

In previous studies, prenatal asphyxia and neonatal mortality has been associated with abruption of the placenta. Martinez et al., 2012 conducted a retrospective cohort study that examined the perinatal morbidity and the rate of infants ’asphyxia who were exposed to intrapartum sentinel events. It was found out that in about 11% of the births, there was an occurrence of placental abruption leading to the development of Hypoxic Ischemic Encephalopathy. Also, the levels of separation of the placenta was associated with the risk of stillbirth (27).

2.3 Intrapartum Maternal Factors Associated with Perinatal Asphyxia

2.3.1 Sepsis/Pyrexia during Labor

Neonatal encephalopathy is associated with a longer interval between delivery and the rapture of the membrane, and pyrexia during labor. The prolongation of labor and the deterioration of the acid-base of the fetus has been associated with the fetal sepsis at term. (22), Nelson KB and Ellenberg JH showed that chorioamnionitis and ruptures of membranes for a prolonged time were predictors of cerebral palsy (7).

2.3.2 Oxytocin Use during Labor

Although augmentation of labor may be effective to shorten the first and second stages of labour(62) several studies have given conflicting results on its association with birth Asphyxia. During uterine contractions, the maternal spiral arteries are compressed, and placental perfusion is strangulated. As oxytocin increases the intensity of uterine contractions and decreases the resting time between contractions, (63) it has been suggested that augmentation of labor with oxyto-

cin increases the risk of fetal asphyxia.(64)Although previous studies have reported increased risk of uterine hyper stimulation (65) and fetal heart rate anomalies8, (66) during augmentation of labor with oxytocin, several large randomized controlled trials in high-resource contexts have failed to establish an association between augmentation of labor with oxytocin and adverse perinatal outcomes.(63,64,65,66).study conducted by Litorp H, et al 2020 , A large-scale cohort study in 12 public hospitals in Nepal .Women with augmentation of labour had increased risk of bag-and-mask ventilation (aRR 2.1, 95% CI 1.8-2.5), Apgar score <7 at 5 minutes (aRR 1.65, 95% CI 1.49-1.86), and neonatal death (aRR 1.93, 95% CI 1.46-2.56). (67).

2.3.3 Meconium Staining of the Amniotic Fluid

Dabalo ML, et al 2021 in a study conducted in Ethiopia concluded that Neonates born from mothers with meconium-stained amniotic fluid were 4.6 times more likely to suffer from perinatal asphyxia(68) .The study finding was congruent with other studies done in different parts of Ethiopia (69,70)and also with a study done locally by Gichogo DM, et al (43) The explanation might be due to the fact that meconium-stained amniotic fluid may cause mechanical obstruction to airways after being inhaled during intrapartum period. Dysfunction of surfactant caused by meconium, as well as its direct toxicity, also causes tissue inflammation, necrosis, and hypoxia, which in turn stimulates colonic activity by increasing intestinal peristalsis and loosening of the anal sphincter resulting in passage of meconium, which increases the risk of developing birth asphyxia (71, 72).

2.3.4 Mode of Delivery

Data obtained from several studies shows that there is a correlation between caesarean section and birth asphyxia In a study conducted by Wosenu L, et al 2014 in Ethiopia, Newborns delivered by cesarean section had 3.6times more risk of birth asphyxia. (73) Other studies conducted in

Gusau, Nigeria (74), Combined Military Hospital Multan, Pakistan (75) concluded that the odds of birth asphyxia among newborns delivered by CS were about 2 to 19 times higher compared to newborns who were born through spontaneous vaginal delivery. The high rate of asphyxia among newborns delivered by CS might be due to the fact that either most of the mothers go to the hospital with complications or the decision for CS might be made late after they develop complications or due to factors associated with indications of caesarean section and an added stress of anesthesia (76). The fetus chest might be squeezed when the newborn passes through thebirth canal in vaginal delivery which might evacuate secretion. This in turn reduces the chance ofdeveloping birth asphyxia, but this physiological advantage is not seen in CS delivery.

2.3.5 Partogram use during labour

A retrospective study done at St Anthonny's Hospital in Ghana by Reindolf Anokye et al,2019 revealed that use and completion of partograms was found to be associated with less Asphyxiated birth outcomes .Labours which were monitored with partograms were 4.3 times less likely to result in birth asphyxia and those that were monitored with a completed partogram were 5.3 times less likely to result in birth Asphyxia (50).In a study done by Paschal Francis Mdoe et al 2018 at Muhimbili National hospital in Tanzania it was concluded that substandard paragraph recordings of the fetal heart rate and uterine contractions were significantly associated with perinatal asphyxia.(51)

2.4 Problem Statement

Worldwide, around 4 million babies are born with asphyxia, making birth asphyxia to be considered as a serious clinical problem. Almost 1 million deaths occur from asphyxia and an equal number experience serious neurological sequel, including epilepsy, mental retardation, and cerebral palsy, each year (8). Events due to perinatal asphyxia are estimated to occur in approximately 2 to 4 per 1000 newborns worldwide who are alive at term. The leading cause of neonatal mortality is perinatal asphyxia after prematurity (9.10). Over one million newborns who end up surviving asphyxia at birth, develop disabilities such as epilepsy, development problems, and cerebral palsy associated with long-term sequel (9, 10). According to the WHO, about 23% of the neonatal deaths globally is caused by birth asphyxia and is the fifth largest cause of under- five mortality among children (8%). Birth asphyxia is associated with 1.1 million intrapartum stillbirths, and it accounts for 920,000 neonatal deaths every year (12, 13).

The prevalence of birth asphyxia in resource poor countries in Africa is high with Kenya re- porting a prevalence rate of 5.1 % in one local hospital (43). However this prevalence is some- times an under estimation of the actual prevalence of birth asphyxia in the community given the exclusion of many occurrence outside health facility settings. Neonatal mortality in Kenya is stillhigh at 21 per 1000 live births (54) with Kenya aiming to achieve the global SDG target of neo- natal mortality to at least as low as 12 per 1000 live births by 2030 (55). Birth asphyxia is the leading cause of neonatal mortality contributing to 29% of the deaths in the country (56). A significant number of admissions (10.8 %) at Newborn Unit (NBU) of Kiambu level fiveHospital (KL5H) are attributable to birth asphyxia. Most of these neonates are referred from the maternityward in the hospital. However there has been no recent scientific evidence about the exact bur- den of birth asphyxia and its specific determinants among live births at the maternity ward of

KL5H. The number of reported birth asphyxia cases at the KL5H in 2017-2020 was 946 (DHIS, 2021). When viewed in the context of total deliveries in the hospital, the prevalence was 27/1,000 live births (DHIS, 2021).

2.5 Conceptual Framework

2.5.1 Narrative

Perinatal asphyxia is considered as a global problem causing significant morbidity and mortality. Perinatal asphyxia is a multi-systemic disorder emanating from either acute or chronic exposure of the fetus to sub optimal oxygenation with subsequent brain damage. Several factors, both maternal and fetal/neonatal have been studied and been linked with the perinatal asphyxia development. The interplay of these factors, coupled with the health system factors to a great extent influence the severity of the asphyxia and the neonatal outcomes.

Maternal factors associated with asphyxia include lower age, parity, medical conditions such as anemia, hypertension, diabetes and chronic airway diseases such as asthma. Fetal and neonatal factors associated with the development of perinatal asphyxia include congenital anomalies such as myopathy and hydrocephalus, age at delivery and neonatal birth weight. Health systems factors that may influence the development of birth asphyxia include provision of antenatal services, labor monitoring and the availability of emergency response services during pregnancy and in labor.

2.5.2 Schematic conceptual framework

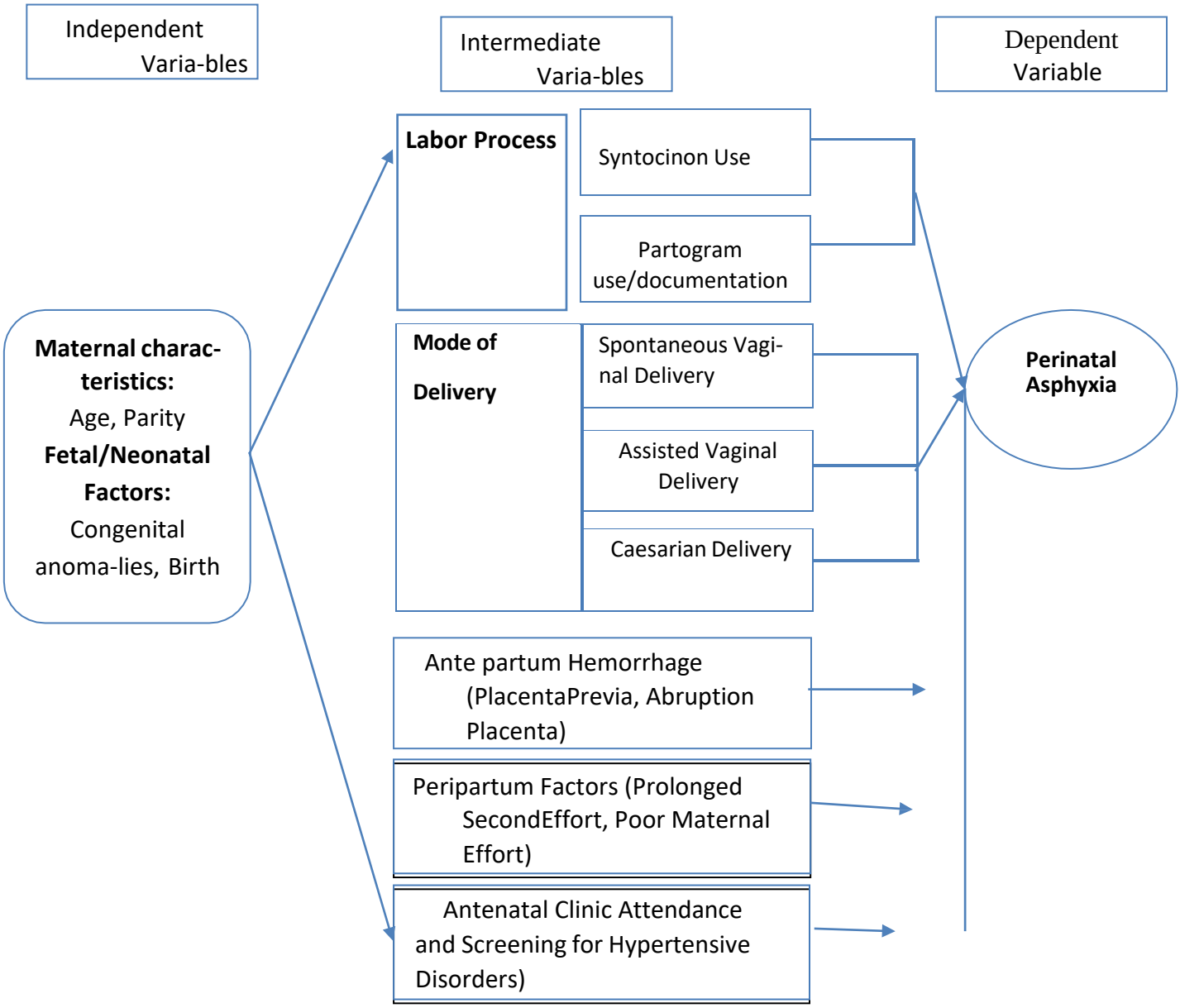

*Figure 1**: schematic** conceptual framework*

2.6 Study Justification

Efforts have been put in place to reduce maternal mortality ratio and neonatal mortality rate; however, the neonatal mortality rate in Kenya remains high at 21 per 1000 live births with birth asphyxia causing 29 % of the deaths. Understanding of the maternal risk factors of birth asphyxia will therefore inform the maternal continuum of care from antenatal, and intrapartum period. The findings of this study will therefore help in identifying the preventable risk linked to perinatal asphyxia and help in the formulation of prevention strategies for better patient care.

2.7 Research Questions

1. What were the maternal risk factors associated with perinatal asphyxia development at the Kiambu Level Five Hospital between year 2017- 2020?

2.8 Null Hypothesis

There was no association between partogram use and perinatal asphyxia development among newborns at the Kiambu Level Five Hospital between year 2017– 2020.

2.9 Study Objectives

2.9.1: Broad Objective

To determine maternal risk factors associated with perinatal asphyxia development among new-borns at the Kiambu Level Five Hospital between year 2017-2020.

2.9.2 : Specific Objectives

Among newborns Born at the Kiambu Level Five Hospital between year 2017 and 2020:

1. Determine the association of selected maternal risk factors and perinatal asphyxia development
2. Determine the association between partogram use and perinatal asphyxia development

CHAPTER 3.0 METHODOLOGY

3.1 : Study Design

This was a retrospective case control study. The primary cohort consisted of mothers (and their neonates) who delivered at the Kiambu Level 5 Hospital between January 2017 and December 2020 at a gestational age of 38wks - 42 weeks. The case control study design enabled us to interrogate various maternal risk factors in detail. The retrospective nature enabled us to attain the desired sample size since birth asphyxia is a relatively rare outcome with a prevalence of 5.1% as indicated in a similar study that was conducted at the Naivasha District Hospital by Gichogi DM et al 2018. (43) .

3.2 : Study Site and Setting

Kiambu Level 5 Hospital (KL5H) is situated in Kiambu County, with a bed capacity of 74 in the maternity department. The catchment area for the hospital is about 2.4 million people with an area coverage of 2543.5 square kilometers. It is one of the largest referral hospitals in the County with a heavy workload hence increasing cases of perinatal asphyxia. KL5H conducts on average 1000 deliveries per month, conducts ANC clinics five times a week with the obstetrics and gynecology unit managed by a team off three obstetricians. In addition, the facility has a newborn unit with a bed capacity of 50 that is managed by two pediatricians and medical officer interns.

3.3 : Study Population

The study population was generated from a cohort of women who delivered at the KL5H between year 2017 to 2020, at a gestation age of 38 to 42 weeks.

3.3.1 1nclusion Criteria

Cases: Records for patients whose newborns had an APGAR score of less than 7 at 5 minutes at birth.

Controls: Records for patients whose newborns had an APGAR score of more than 7 at 5 minutes at birth.

3.3.2 Exclusion Criteria:

1. Records with incomplete data to allow for any meaningful analysis
2. Newborns who suffer from congenital malformations that mainly involves the central nervous or cardiovascular system, dysmorphism (obvious chromosomal abnormalities), severe hyperbilirubinemia bordering on kernicterus, evidence of meningitis or bleeding disorders.
3. Birth before arrivals, multiple fetuses.

3.4 Sample Size Determination and Formula

The study's sample size was calculated by the difference in proportions - Fleiss JL formula with CC (Statcalc epi-info^{TM}) as outlined below. The following assumptions, from a similar study in Ghana (50), where those monitored with a complete partogram were 5.3 times less likely to result in birth asphyxia was considered during the calculation:

$$n = \left(\frac{r+1}{r}\right)\frac{(\bar{p})(1-\bar{p})(Z_{\beta} + Z_{\alpha/2})^2}{(p_1 - p_2)^2}$$

n = sample size per arm

r = ratio of unexposed to exposed, 2:1

P_1= proportion of mothers in the cases group who had complete partogram done = 22%

P_2= proportion of mothers in the control group who had complete partogram done = 97.7%

Ṕ =measure of variability, taken as 20+97.7/2=58.85

Z_β=Value corresponding to the power of the study, in this case 80% = 0.84

$Z\alpha$ = Value corresponding to the normal standard deviate at 95% C.I in this case = 1.96, with 0.05 level of significance

P_1- P_2 = effect size (difference in proportions: 97.7 – 20=77.7%)

Odds Ratio = 5.3

Sample size for cases = 627; and for controls = 1,254: Total sample size = **1,881**

3.5 Sampling Procedures

Following approval to collect data by the Kenyatta National Hospital – University of Nairobi Ethical Review Committee, data was extracted from the register in the maternity Unit where all mothers with cases of perinatal asphyxia were identified and based on each record, maternal files accessed backwards from year 2020 - 2017 at the maternity unit. All the files of mothers whose newborns had an APGAR score of less than 7 at 5 minutes from December 31st, 2020, backwards to January 2017 were retrieved as cases.

Maternal files with neonates who had an Apgar score of <7 at 5 minutes and met the inclusion criteria 636, were selected. For the controls, 1,272 files for records with an APGAR score of >7at 5 minutes on the same day, month, year a birth asphyxia occurred were randomly selected us- ing proportionate sampling.Ten data clerks who were records department officers at the KL5H retrieved files per year, per month and if possible per week. For each week if not month, cases that met the inclusion criteria were identified and within the same week if not month, two controls that met the inclusion criteria were randomly selected and matched to the cases in the ratio of 1;2.

3.6: Recruitment of Study Participants

A cohort of all the records for the women who delivered at the KL5H between January 2017 to December 2020 (this was done in one-year batches) at 38 to 42 weeks gestation (based on the documented last normal menstrual period or an ultrasound study conducted in the 1st trimester) were identified and separated. From these, 636 records for mothers with neonates who had birth asphyxia (cases) and met the inclusion criteria were identified and separated.

Matching of the identified cases (based on the week, month when the identified case occurred) Was done to identify the files in the control group; for each case, two controls were identified using multi stage sampling technique (proportionate sampling for the year and month and random sampling to identify the controls).The identified files were safely kept in a lockable cabinet and clearly labelled for review during the two weeks period over which data was collected. Any file that did not have relevant data as per the data extraction tool were replaced by the next randomly selected file from the same month. A total of 10 data clerks from the records department were engaged to conduct data extraction on to the specially designed data abstraction tools.

3.7 Data Variables

The following data variables were assessed during the study

Objective	Variables	Definition	Source of Data
Determine the maternal risk factors for development of perinatal asphyxia	Age, marital status, level of education, Parity, Pre-Eclampsia/Eclampsia, Diabetes, Gestation Age, induction of labor, Delayed Second Stage, HIV Status, Prolonged second stage of labor, use of oxytocin in labor, Antenatal clinic attendance, partogram documentation	Independent variables Intermediate variable	Patient Files
Determine association between partogram use and perinatal asphyxia development	Cervical dilatation documentation, Descent documentation,FHR documentation, Amniotic fluid documentation, Fetal Head moulding documentation, Uterine contraction documentation, crossing of action line documentation, oxytocin use documentation.	Intermediate variables	Patients files

3.8 Study Materials

Materials used for this study included stationery, data retrieval forms, storage files, flash drives, hard drives and password protected computers.

3.9 Training Procedures

The ten data clerks, all registered clinical officers with experience in data collection received a two-day training and piloting of the data collection tool before the actual data collection.

3.10 : Quality Assurance Procedures

The following measures were taken for quality assurance through all the stages of the study.

- Data obtained from the maternity registers and patient files were counterchecked by the principal investigator to ensure it is correctly filled. This was done on a daily basis
- Data was stored in password protected computers, hard drives and flash drives that were accessible only to the principal investigator, supervisors and statistician to ensure confidentiality is maintained.
- Double entry of data was done before analysis by ten trained data clerks who were KL5H records officers

3.11 Ethical Considerations

The study proposal was submitted to the KNH/UON ERC for approval before the commence- ment of the study. In addition, administrative approval was sought from the KL5H management to carry out the study. Since the study was retrospective the patients ʼconsent was not required but a request for a waiver for consent of the study from the ethics committee was obtained. Pa- tients ʼdata was also de-identified to maintain confidentiality and only `used to answer the objec- tives of this study.

3.12 : Data Collection Management and Analysis

Data was collected using a specially designed data abstraction tool, entered into excel sheet and analyzed using SPSS version 23 software for cleaning and coding. Multivariate statistics for the

maternal socio demographic and maternal clinical characteristics was conducted to establish association between the maternal risk factors and the development of perinatal asphyxia. This has been presented as odds ratios. Multivariate logistic model was used to determine the independent variables associated with birth asphyxia. This was presented as adjusted odds ratios. The out- come of the analysis has been presented as shown in the results section, taking a p value of 0.05 to be statistically significant.

CHAPTER 4.0 RESULTS

Out of the 34928 records of live births at the KL5H, 946 were reported to have had a diagnosis of birth asphyxia for the period 2017 to 2020. As shown in figure 2, all the cases of birth asphyxia were identified from the original cohort of all the records for patients with live births at the KL5H for the period 2017 to 2020, out of which 636 were selected for inclusion in to the study. A total of 1272 records for the control group were randomly selected from the same week, month as the identified cases and included in the study.

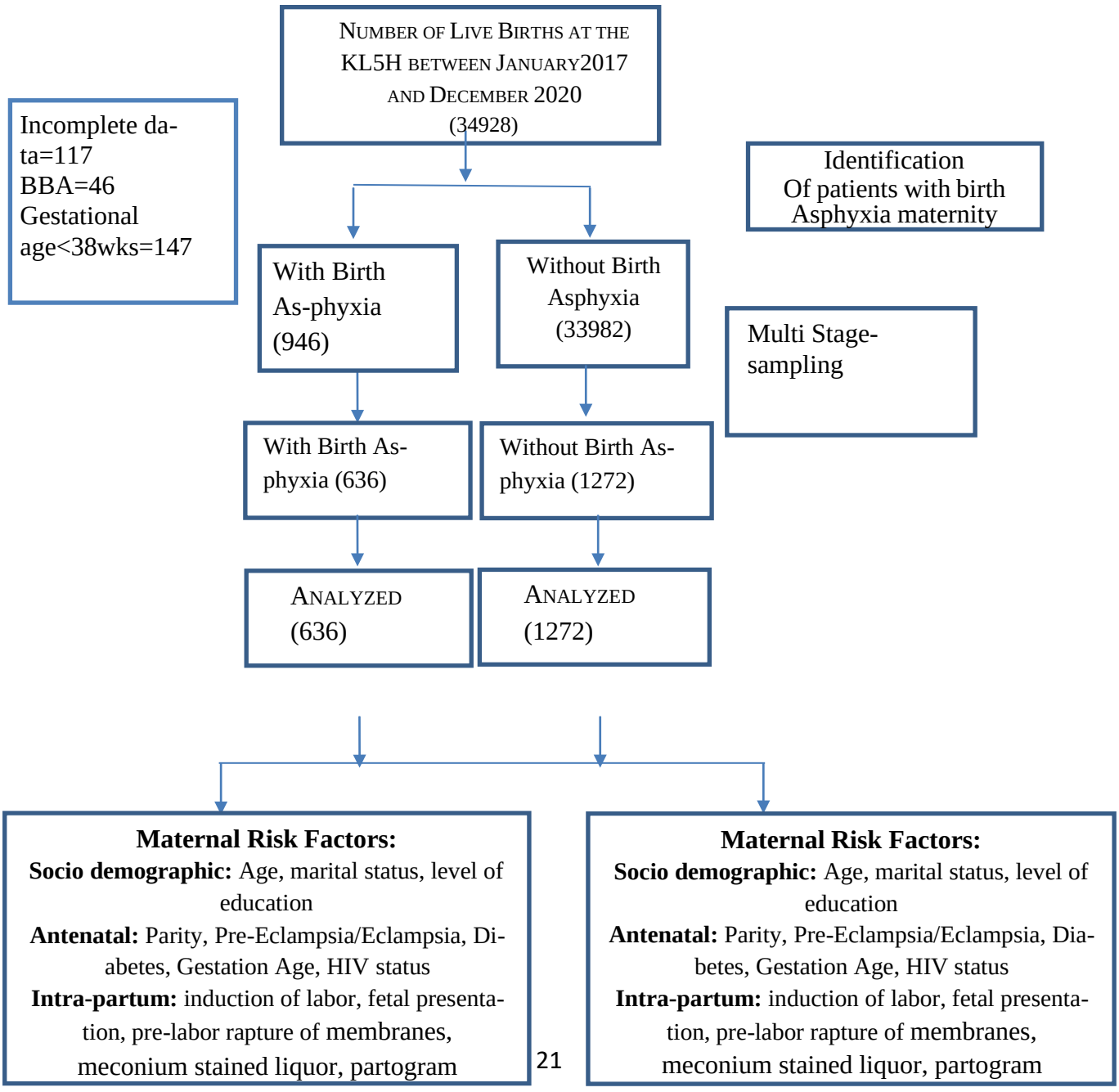

Table 1 Maternal socio-demographic factors in a sample of women who delivered at the KL5H be-tween years 2017 to 2020

Maternal demographic characteristics	Cases n =636(%)	Controls n=1272 (%)	Total n=1908 (%)
Age			
Mean SD	(6)25	(6)26	
Median IQR	(8)24	(8)25	
Range	15-45	15-46	
• < 20	83 (12.9)	113 (8.8)	196(10.3%)
• 20 – 29	418 (65.2)	840 (65.5)	1258(66.1%)
• 30 – 39	127 (19.8)	295 (23.0)	422(22.2%)
40+	8 (1.2)	18 (1.4)	26(1.4%)
Age			
< 35	594 (92.7)	1,184 (92.4)	1778(93.5%)
≥ 35	42 (6.6)	82 (6.4)	124(6.5%)
Education Level			
Primary	148 (23.1)	295 (23.0)	443(26.0%)
Secondary	323 (50.4)	619 (48.3)	942(55.2%)
Tertiary	107 (16.7)	215 (16.8	322(18.9%)
Marital Status			
Married	530 (82.7)	1,098 (85.6)	1628(85.2%)
Single	110 (17.2)	172 (13.4)	282(14.8%)
Religion			
Christian	640 (99.8)	1,272 (99.2)	1912(100%)
Muslim	1 (0.2)	1 (0.1)	2

As shown in table 1 above the mean age of the mothers with cases and controls were 25(SD±6) and 26(SD±6) years respectively. A majority of the mothers were aged between 20-29 years (66%) with cases compared to controls likely to be younger than 20years (12.9% vs 8.8%) likely to be single (17.2% vs 13.4%).The two groups were similar regarding Educational level and religion

Table 2 Maternal socio-demographic factors associated with perinatal asphyxia in a sample ofwomen who delivered at the KL5H between years 2017 to 2020

Characteristics	Cases, n (%) n=636	Controls, n (%) n=1272	OR (95% CI)	P-value
Age				
Mean SD	(6)25	(6)26	-	0.075
Median IQR	(8)24	(8)25	-	0.045
Range	15-45	15-46	-	-
• < 20	83 (12.9)	113 (8.8)	1.7 (1.1-2.4)	0.003
• 20 – 29	418 (65.2)	840 (65.5)	1.2 (0.7-3.9)	0.259
• 30 – 39	127 (19.8)	295 (23.0)	1	
• 40+	8 (1.2)	18 (1.4)		
Age				
• **< 35**	594 (92.7)	1,184 (92.4)	1.1(0.7-1.4)	0.916
• **≥ 35**	42 (6.6)	82 (6.4)	1	
Education Level				
• Primary	148 (23.1)	295 (23.0)	1.0 (0.2-1.1)	0.061
• Secondary	323 (50.4)	619 (48.3)	1.0 (0.2-1.1)	0.091
• Tertiary	107 (16.7)	215 (16.8	1	
Marital Status				
• Married	530 (82.7)	1,098 (85.6)	1	
• Single	110 (17.2)	172 (13.4)	1.3 (1.0-1.7)	0.034
Religion				
• Christian	640 (99.8)	1,272 (99.2)	1	
• Muslim	1 (0.2)	1 (0.1)	2.0 (0.0-8.1)	0.621

As shown in table 2, .Mothers aged less than 20 years had higher odds of birthing asphyxiated neonates compared to the higher age groups (OR 1.7 95%CI 1.1-2.4,p value 0.003).Singlemothers had a slightly more association with birth asphyxia, Single (OR 1.3 95% CI 1.0-1.7, p, 0.034).

The maternal age was further dichotomized into age less than 35 years and more than 35 years . The risk of delivering a child with birth asphyxia was similar between the two groups(OR 1.1,95%CI 0.7-1.4 ; p value 0.916). The two groups were similar with regards to level of education and religion.

Table 3 Maternal Ante-natal factors associated with perinatal asphyxia in a sample of women whodelivered at the KL5H between 2017 to 2020

Characteristics	Cases, n (%) n=636	Controls, n (%) n=1272	OR (95% CI)	P-value
HIV Status				
• HIV+	17 (2.7)	40 (3.1)	0.8 (0.5-1.5)	0.562
• HIV –	598 (93.3)	1,187 (92.6)	1	
• Unknown	26 (4.1)	55 (4.3)		
Parity				
• Zero	359 (56.0)	535 (41.7)	1.8 (1.5-2.2)	-<0.001
• 1 – 4	265 (41.3)	702 (54.8)	1	
• ≥ 4	13 (2.0)	37 (2.9)		
Parity if > 0 Interval between Birth				
• < 2 years	20 (7.4)	83 (11.6)	0.6 (0.4-1.0)	0.051
• ≥ 2 Years	252 (92.6)	632 (88.4)	1	
Gestation Period (weeks)				
• 38 – 41	597 (95.7)	1,203 (96.8)	1	
• > 41	27 (4.3)	40 (3.2)	1.4 (0.4-1.2)	0.224
Preeclampsia	58 (9.0)	48 (3.7)	2.6 (1.7-3.8)	<0.001

Diabetes	2 (0.3)	1 (0.1)	-	-
APH	5 (0.8)	3 (0.2)	-	-
HB • < 10 • ≥ 10	 61 (9.5) 527 (82.2)	 132 (10.3) 1,041 (81.2)	 0.9 (0.7-1.3) 1	 0.578
Pre-labour premature rupture of membranes	16 (2.5)	26 (2.0)	1.2 (0.7-2.2)	0.508

Table 3 shows the maternal ante-natal risk factors associated with perinatal asphyxia. From our findings, the only statistically significant maternal antenatal risk factors associated with perina- tal asphyxia were primiparity and preeclampsia. First time mothers were 2 times more likely to deliver a child with birth asphyxia compared to multiparous women (95%CI 1.5-2.2, p, <0.001)

Women with pre-eclampsia were 2.6 times more likely to deliver a child with perinatal Asphyx- ia (95%CI 1.7-3.8, P <0.001), Other maternal antenatal risk factors were non significantly asso- ciated with birth asphyxia. Mothers who were HIV positive (OR 0.8, 95%CI 0.5-1.5, p, 0.562).

Women with birth interval less than two years (OR 0.6 95%CI 0.4-1.0) p, 0.051). women with haemoglobin level less than 10g/dl (OR 0.9 95%CI 0.7-1.3 p, 0.578). Women with pre-labour premature rupture of membranes (OR 1.2 (95%CI 0.7-2.2, P 0.508).

Table 4 Maternal intrapartum risk factors associated with perinatal asphyxia in a sample of womenwho delivered at the KL5H between 2017 and 2020

Characteristics	Cases, n (%) n=636	Controls, n (%) n=1272	OR (95% CI)	P-value
Mode of Delivery • SVD • CS • Un Documented	427 (66.6) 214 (33.4) -	1,077 (84.0) 203 (15.8) 2 (0.2)	1 2.7(2.12-3.3)	**<0.001**
Time of Delivery • Day time • Nighttime	358 (55.9) 278 (43.4)	678 (52.9) 594 (46.3)	1 1.1 (0.9-1.4)	0.216
Presentation • Breech • Cephalic • Other	45 (7.0) 572 (89.2) 3 (0.5)	26 (2.0) 1199 (9.5) -	3.6 (2.2-5.9) 1	<0.001
Induction of Labor • Yes • No • Not Indicated	59 (9.2) 579 (90.3) 3 (0.5)	67 (5.2) 1,195 (93.2) 20 (1.6)	1.8 (1.3-2.6) 1	0.001
Staining of Liquor • Yes • Clear	242 (37.9) 644 (50.3)	265 (20.7) 896 (46.7)	1.3(1.0-1.6) 1	**0.019**
Cord Prolapse	6 (0.9)	3 (0.2)	4.0 (1.0-16.1)	0.034
Birth Weight • < 2,500 • ≥ 2,500	50 (7.8) 577 (90.0)	61 (4.8) 1,212 (94.5)	1.7 (1.2-2.5) 1	0.005
Sex • Male • Female • Not Indicated	377 (58.8) 254 (96.6) 10 (1.6)	628 (49.0) 642 (50.1) 12 (0.9)	1.5 (1.3-1.8) 1	<0.001

Table 4 shows the maternal intrapartum risk factors associated with perinatal asphyxia. There was a statistically significant association for most intrapartum factors and birth asphyxia: womenwho underwent induction of labour were 1.8 times more likely to deliver neonates with birth as- phyxia (95%CI 1.3-2.6, p 0.001) Caesarean delivery was associated with 2.7 times more risk of birth asphyxia (95%CI 2.12-3.3, p< 0.001); liquor staining (meconium staining vs. clear liquor, OR, 1.3, 95%CI 1.0-1.6,p 0.019); cord prolapse (present vs. absent prolapse, OR 4.0, 95%CI 1.0-16.1 p, 0.034) and fetal presentation (breech vs. cephalic), OR 3.6, 95%CI 2.2-5.9 p, <0.001). Neonates with birth weight of less than 2500g were 1.7 more likely to develop birth asphyxia compared to those with birth weight more than 2500g.There was no association between time of delivery and birth asphyxia, Daytime vs. Nighttime (OR 1.1,95%CI 0.9-1.4, P 0.216).

Table 5 Partogram documentation and association of perinatal asphyxia in a sample of women whodelivered at KL5H between year 2017-2020

Characteristics	**Cases, n (%) n=636**	**Controls, n (%) n=1272**	**OR (95% CI)**	**P-value**
Partogram used				
• *No*	146 (22.8)	338(26.4)	0.8(0.7-1.0)	0.087
• *Yes*	495 (77.2)	944(73.6)	1	
Cervical Dilation documen-tation				
• *No*	0	11(1.2)	-	
• *Yes*	495(100.0)	933(98.8)		**0.059**
Descent documentation				
• *No*				
• *Yes*	20(4.0)	39(4.1)	0.9(0.6-1.7)	0.934
	475(96.0)	905(95.9)	1	

FHR documentation • *No* • *Yes*	 18(3.6) 477(96.4)	 17(1.8) 927(98.2)	 2.1(1.1-4.0) 1	 **0.032**
Amniotic Fluid documentation • *No* • *Yes*	 81(16.4) 414(83.6)	 135 (14.3) 809 (85.7)	 1.2(0.9-1.6) 1	 0.298
Fetal Head Moulding documentation • *No* • *Yes*	 115(23.2) 380(76.8)	 223 (23.6) 721 (76.4)	 0.9(0.8-1.3) 1	 0.298
Uterine Contraction documentation • *No* • *Yes*	 17(3.4) 478(96.6)	 16 (1.7) 928 (98.2)	 2.1(1.0-4.1) 1	 **0.036**
Crossing of Action Line documentation • *No* • *Yes*	 401(81.0) 94(19.0)	 827 (87.6) 117 (12.4)	 0.6(0.4-0.8) 1	 **<0.001**
Oxytocin use documentation • *No* • *Yes*	 471(95.2) 24(4.8)	 889 (94.2) 55 (5.8)	 1.2(0.7-1.9) 1	 0.439
Partogram filled appropriately • *No* • *Yes*	 116(23.4) 379(76.6)	 211 (22.4) 733 (77.6)	 1.1(0.8-1.4) 1	 0.642

As shown in table 5 above, mothers who had no fetal heart rate documentation on their partogram were 2 times more likely to birth asphyxiated neonates. (No or yes OR 2.1,95% CI 1.1-4.0, P 0.032) Luck of uterine contraction documentation on the partograms was associated

with 2 times more risk of birth asphyxia. (No or yes OR 2.1,95% CI 1.0-4.1,P 0.036) .Mothers with partograms that had no documentation on crossing of action line were associated with 40%

less risk of birth asphyxia.(OR 0.6,95%CI 0.4-0.8,P <0.001) Partogram use was not associated with birth asphyxia (No or Yes OR O.8,95%CI 0.7-1.0,P 0.087) Among the mothers who used partogram ,substandard Partogram documentation was not associated with perinatal asphyxia (partogram filled appropriately No or Yes OR 1.1 CI 0.8-1.4 P 0.642) Other partogram components were non significantly associated with birth asphyxia (Descent documentation (No or Yes OR 0.9,95% CI 0.6-1.7 P 0.934)Amniotic fluid documentation (No or Yes 0R 1.2,95% CI 0.9-1.6 P, 0.298) Fetal head moulding documentation (No or Yes OR 0.9 95% CI 0.8-1.3 P 0.298)Oxytocin use documentation (No or Yes OR 1.2,95%CI 0.7-1.9 p 0.439)

Multivariate Logistic Regression

Logistical regression for the statistically significant variables (Marital status, primiparity, pre-eclampsia, gestational age, induction of labour, cord prolapse, documentation of uterine contractions, documentation of FHR, crossing of action line, mode of delivery, meconium-stained liquor and fetal presentation (breech) was done as shown in table 6.

Table 6 Logistic regression for maternal factors associated with perinatal asphyxia at the Kiambulevel 5 Hospital between year 2017and 2020

Maternal risk factors	**AOR (95% CI)**	**SE (±)**	**p-value**
Marital Status (single)	1.1 (0.8-1.5)	0.18	0.709
Primiparity	1.3 (1.1-1.5)	0.11	**0.002**
Pre-eclampsia (Yes)	2.0 (1.1-3.2	0.53	**0.009**
Gestational Age	0.95 (0.9-1.1)	0.04	0.369
Induction of Labor (yes)	1.5 (0.9-2.3)	0.34	0.095

Cord Prolapse (Yes)	2.6 (0.4-16.4)	2.4	0.321
Documentation of FHR(NO)	1.4(0.7-2.8)	0.5	0.384
Documentation of uterine contractions (NO)	0.9 (0.5-1.8)	0.31	0.800
Crossing of Action Line (NO)	1.1 (0.8-1.6)	0.2	0.578
Mode of Delivery (SVD)	0.4 (0.4-0.6)	0.1	**<0.001**
Presentation (Breech)	2.7 (1.3-5.6)	0.9	**0.006**
Meconium-stained liquor (yes)	1.9 (1.4-2.5)	0.2	**<0.001**

N/B: *p = <0.05

After controlling for the potential confounders as age, birth weight in the relationship, primiparity (AOR 1.3, 95%CI 1.1-1.5, p 0.002); pre-eclampsia (AOR 2.0,95%CI 1.1-3.2, p 0.009); mode of delivery (SVD) (AOR 0.4, 95%CI 0.4-0.6, p<0.001) Breech presentation (AOR 2.7, 95%CI 1.3-5.6, p 0.006) and meconium stained liquor (AOR 1.9 ,95%CI 1.4-2.5 , P <0.001) were significantly associated with development of birth asphyxia in the newborn.

CHAPTER 5.0 DISCUSSION

This study aimed to evaluate the antepartum and labor risk factors for low APGAR (<7) score as an indicator of birth asphyxia among term neonates at the Kiambu Level Five Hospital. Adverse factors in the antepartum and intrapartum periods have been associated with poor fetal growth and strain on the fetal physiological function with resultant asphyxia. The main statistically significant maternal risk factors associated with birth asphyxia at the hospital were, Primiparity, Preeclampsia, caesarian delivery, breech presentation and meconium stained liquor. Partogram use was not a predictor of birth asphyxia.

5.1 Maternal Socio Demographic Factors

The age of the mothers reflected the general distribution within our population, with the two groups for mothers being comparable (<35 years or >35 years). Our findings showed no statisti- cally significant relationship between level of education, marital status and development of birth asphyxia. Our findings about the marital status are not similar with the findings of Chiabi A, et al 2013, in a study done in Cameroon who found that there is a statistically significant association between being single and development of birth asphyxia; possibly because mothers living with their partners would better meet all their needs, including seeking of early interventions in case of emergencies during pregnancy compared to single mothers (30). According to the study by Raatikainen K et al, 2003 in India, single status constitutes a risk factor for asphyxia and low birth weight during pregnancy (31).

Kinoti SN et al 1993, in a study done in the East African countries, found that age less than 20 years, unemployment, and low level of education are other risk factors in addition to the marital status (32) On the other hand, Rehana M et al. in India noted that the risk of asphyxia increased

with the mother's age above 35 years, unemployment of the mother, or performing an intense physical activity, (33) while Diallo S, et al. in Guinea observed that a large proportion of asphyxiated neonates were born from uneducated mothers. (34). The difference in research findings between the current study and above studies could be due to difference in studymethodology and sample size.

5.2 Antepartum Risk Factors

The antepartum risk factors assessed in our study included HIV status, parity, pre-eclampsia, and haemoglobin level. The only statistically significant antepartum maternal risk factors asso- ciated with birth asphyxia were primiparity and preeclampsia. Our findings showed primiparous women had increased risk of delivering asphyxiated neonates. Our findings are similar with other authors who noted primiparity in their respective studies (14,20,21,36,37) to be associated with birth asphyxia. The study finding was not similar to a study conducted by Andrew H Mgayaet al at Muhimbilli National hospital Tanzania where grand multi-parity was associated with birth asphyxia.The different findings could be due to different study methodology and sample size (52).Primipara mothers tend to be found in the younger age bracket and they are more prone for mal-presentations and prolonged obstructed labor. Thus, it is believed that peri- natal asphyxia is expected to be high among these women compared to the multipara women.

Preeclampsia was significantly associated with birth asphyxia, this was a similar finding to other authors who noted preeclampsia as a significant risk factor for birth asphyxia (20, 26, 30) Muhammad A, 2004 reported bleeding in pregnancy, hypertension in pregnancy, eclampsia, and diabetes in the mother as major antepartum risk factors for asphyxia as they are associated with compromised maternal fetal blood flow with resultant hypo perfusion. (38)

5.3 Intrapartum risk factors

Patients who delivered via cesarean section were significantly likely to have neonates with birth asphyxia. Studies have shown a strong relationship between emergency caesarian section and neonatal asphyxia. This could be explained by the fact that most of the indications for the emergency cesarean sections were due to conditions which compromise adequate oxygen delivery to the foetus as prolonged labor, arrest of labor, hypertensive disorders in pregnancy, and cephalopelvic disproportions. Muhammad A in 2004 in Pakistan had similar findings (38). Chandra S et al 1997, in India found elective cesarean to be a risk factor for neonatal asphyxia and postulated that this might be due to some risk factors, which are not identified early in pregnancy, and which might cause acute foetal distress and consequently lead to asphyxia. (42). The current study had similar findings by a study conducted at the Kenyatta National Hospital by Were NN, 2017. C e s a r e a n delivery was associated with greater odds of admission to NICU, resuscitation, and perinatal deaths as compared to vaginal deliveries (77).

Meconium-staining of the amniotic fluid is present in 9-14 per cent of all deliveries at the time of delivery (39). The quoted rate of meconium aspiration syndrome, however, is lower, being 2 per cent (40). For the fetus, meconium in conjunction with other signs of fetal distress precedes probable morbidity and mortality with resultant Cesarean delivery, which is likely to compound the birth asphyxia (41).

For the neonate, meconium alone, when aspirated causes significant mortality. In the current study meconium staining was significantly associated with development of birth asphyxia. Simi- lar findings by Tolu et al,2020 in Ethiopia meconium-stained deliveries were associated with increased frequency of operative delivery, birth asphyxia, neonatal sepsis and neonatal intensive

care unit admissions(78) .Contrast findings by Michoma MP , 2009 at Kenyatta National Hospital labour ward .Newborn acidosis was slightly high among meconium stained fluid (MSAF)as compared with those with clear liquor (38% vs. 20 %)(OR 2.5,95%CI ,1.0-6.0,P=0.05.There was no statistical difference of acidosis between the two groups .Meconium stained amniotic fluid was associated with increased cesarean section rates (79).Odongo BE et al, 2007 , study at the Agha Khan University Hospital ,Nairobi .The risk of having a poor 1 minute Apgar score in the meconium stained amniotic fluid group compared to the clear group was not significant (RR 0.39,95%CI ,0.131-1.160)The relative risk of having an Apgar score of <7 was more likely if the initial base line rate of the CTG was abnormal (RR 1.357,95%CI ,1.39-1.009)irrespective of the state of liquor (80).

Our study showed breech delivery as a significant maternal risk factor associated with birth asphyxia .It may be due to the fact that breech presentation had high risk of umbilical cord prolapse ,head entrapment ,birth trauma and perinatal mortality (81).Similar findings were reported by P. Foumane et al 2013 in a study done in Cameroon at a tertiary hospital in Yaoundé where vaginal breech deliveries were more likely to have prolonged labor and their newborns we're more likely to suffer from birth asphyxia (53).

In the current study induction of labour was not associated significantly with birth asphyxia ,similar finding by Gulmezoglu AM, et al ,Cochrane review 2012.There was no significant difference between the rates of Apgar scores less than seven at five minutes between the induction group and the expectant management groups(RR 0.72,95%CI 0.44 to 1.18)(82). Consistent findings by Esiromo MA, 2008, study at Kenyatta National Hospital. M a j o r i t y of the newborns (94%) had an Apgar score of 7 and above, while 12 (4.6%) had a score of 4-6(83). Kipchumba

BC, 2015.Study at Moi Teaching and Referral Hospital, Eldoret. Mean Apgar score of 9 at 5minutes following term labour induction (84).

5.4 Partogram documentation during labour

In the present study there was no association between partogram use and completion and development of birth asphyxia .Similar findings by Bor RK, 2010, .Study at Kajiado District Hospital .Apgar score at 5 minutes as well as rate of infant resuscitation and admission to new born unit were comparable between those who were exposed to partogram use and those who had no exposure (85).This findings are different to a study done by Reindolf Anokye et al 2019 at St Anthony's Hospital in Ghana where it was revealed that use and completion of partogram was associated with less asphyxiated birth outcomes .Labours monitored with partogram were 5.3 times less likely to result in birth Asphyxia(50) .Mdoe ,paschal F et al 2018 at Muhimbili Na- tional hospital, Tanzania concluded that substandard partogram recordings of the fetal heart rate and uterine contractions were significantly associated with perinatal asphyxia. The difference in research findings could be due to different study methodology and sample size (51).

5.5 Study Strength and Limitations

The strength of the study lies in its case control study design. Previous studies in Kenya have targeted few and selected maternal risk factors but we discuss nearly each and every risk factors of birth asphyxia. All attempts were made to ensure that the data collected was reliable and the methods were reproducible .0ur large sample size also reduced selection bias. However, our study was not free from limitations.

The diagnosis of perinatal asphyxia has been based on APGAR scoring and not fetal academia. This is likely to introduce selection bias as the assessment using APGAR scoring may be subjective with subsequent missing out of potentially asphyxiated neonates. Secondly, the evidence of maternal risk factors was based on maternal history without consideration of when the events

occurred, their duration and how they were managed. There was limited data to access certain important maternal risk factors like duration of second stage of labour and antenatal visits.

The study assessed the completion of the parameters of partograph during labour .As completion may not necessarily mean use ,the findings of the present study may not show the extent of use of the partograph for monitoring labour progress .The partographs might have been used only to record events in labour rather than to guide management of labour

CHAPTER 6.0 CONCLUSION

The main statistically significant risk factors associated with birth asphyxia were primiparity, preeclampsia, meconium-stained liquor, caesarian delivery and breech presentation

6.1 Recommendation

Early screening of high risk pregnancies complicating with preeclampsia, fetal surveillance, proper management and timely delivery at the facility.. Refresher courses for the management of breech delivery should be organized at the facility for health personnel in order to minimize risk of perinatal asphyxia**.** Judicious use of partogram, timely decision making and adequate antici- pation of neonatal resuscitation in breech presentation, preeclamptic mothers and meconium stained amniotic fluid deliveries should be emphasized at the facility in order to reduce birth as- phyxia .The results of the study will help policy -makers ,program designers and Non - governmental organization to support the study area.

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ANNEXES

Annex 1: Data Abstraction Tool

Referral status

Referred
Not referred

Socio Demographic data

Age in years……
Education level

Primary

Secondary

Tertiary

Clinical Characteristics

Maternal

Diagnosis at admission…….

Serostatus

Positive

Negative

Don't know

Parity…….P……..+…….. .

If parity > 0 interval between birth

Less than 2 years

More than 2 years

Gestation Age at Delivery (Complete weeks)……

Pregnancy type

Singleton

Multiple

History of:

a. Preeclampsia/Eclampsia

Yes

No

b. Diabetes

Yes

No

c. Ante partum Hemorrhage

Yes

No

d. Hemoglobin level in pregnancy……..

e. Ante partum hemorrhage

Yes

No

f. Pre-labor premature rapture of membranes

Yes

No

LABOR AND DELIVERY

Place of Delivery

Home

Health Facility

PARTOGRAPH USE

Partograph used

Yes

No

Documentation of cervical dilation

Yes

No

Documentation of descent

Yes

No

Documentation of FHR

Yes

No

Documentation of Amniotic Fluid

Yes

No

Documentation fetal head moulding

Yes

No

Documentation of Uterine Contraction

Yes

No

Crossing of the action line

Yes

No

Documentation of oxytocin use

Yes

No

Mode of delivery

SVD

CS

Was the partograph filled appropriately

Yes

No

TIME OF DELIVERY

Night …….

Daytime…..

Induction of labor

Yes

No

Duration of labor in hours……

Duration of second stage in minutes……..

Mode of Delivery

Vaginal

Caesarian Section

Caesarian Section

Elective

Emergency

Fetal/Neonatal Factors

Presentation

Cephalic....

Breech.....

Transverse….

Others…

Liquor staining at birth

Clear Liquor

MSL 1

MSL 2

MSL3

Birth Weight (in g)…….

Sex

Male

Female

APGAR score at 5 minutes……..

Grade of birth Asphyxia……..

Annex 2: Study Timeframe

Activity	**Dec 2019 – August 2020**	August 2020– **November 2020**	Novemeber **2020-February 2021**	**February 2021-May 2021**	May 2021-December 2021
Proposal Development					
Ethical Approval					
Data Collection					
Data Analysis					
Dissertation Writing and Presentation					

Annex 3: Study Budget

Item	Unit Cost (Ksh)	Units	Total Cost (Ksh)
Research Assistant Per Diem	21, 000	2	42000
Printing	10,000	1	10,000
Photocopy and Binding	10000	3	10000
Flash Drives and Stationery	5000	2	5000
Communication/ Airtime	1000	2	2000
Statistician/ Data Analysis	40000	1	40000
Miscellaneous	5000	1	5000
Total Cost			**112, 000**

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27th November 2020

Dr. Nahashon Kagwe Mukiri
Reg. No.H58/7499/2017
Dept. of Obstetrics and Gynaecology
School of Medicine
College of Health Sciences
University of Nairobi

Dear Dr. Kagwe

RESEARCH PROPOSAL – INCIDENCE AND MATERNAL RISK FACTORS FOR PERINATAL ASPHYXIA AT KIAMBU LEVEL FIVE HOSPITAL (A retrospective Cohort with a Nested Care Control Study Design) (P430/08/2020)

This is to inform you that the KNH- UoN Ethics & Research Committee (KNH- UoN ERC) has reviewed and **approved** your above research proposal. The approval period is 27th November 2020 –26th November 2021.

This approval is subject to compliance with the following requirements:

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

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

Yours sincerely,

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

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The Chairperson, KNH- UoN ERC
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