FETOMATERNAL OUTCOMES OF MOTHERS IN LABOUR REFERRED TO MOI TEACHING AND REFERRAL HOSPITAL: A DESCRIPTIVE PROSPECTIVE STUDY.

BY

DENNIS OERI ONG'ERA

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DECLARATION

Declaration by candidate:

I declare that this thesis is my original work and has not been presented in any other institution or University for the award of degree or any academic credit. No part of this proposal may be reproduced without prior written permission of the author, supervisors and or Moi University.

Dennis Oeri Ong' era
Registrar, Department of Reproductive Health
Moi University School of Medicine
SM/PGRH/04/2016

Signature……... Date: …….

Declaration by the supervisors:

This thesis has been submitted for consideration with our approval as university supervisors.

Dr. David Kaihura, MBChB, MMED (OBS/Gyn)
Lecturer, Department of Reproductive Health,
Moi University, School of Medicine, Eldoret.

Signature……... Date: …….

Dr. Kipchumba Bett, MBChB, MMED (Reproductive Health), MFM fellow- Moi University.
Consultant Obstetrician and Gynecologist,
Department of Reproductive Health,
Moi Teaching and Referral Hospital, Eldoret.

Signature……... Date: …….

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DEDICATION

This thesis is dedicated to my lovely wife, Triza, for being the support system in the family while I was away. To my children Kimberly, Gian and Liam whose innocent smiles give me the motivation to work hard. To my late father who gave me the wings to fly. To my mother, my pillar of strength. To my siblings whose tremendous encouragement has motivated me to keep going.

ACRONYMS AND ABBREVIATIONS

ANC	Antenatal Clinic
APGAR	Appearance, Pulse, Grimace, Activity, Respiration
BP	Blood pressure
CHW	Community Health Workers
EBL	Estimated blood loss
FSB	Fresh still birth
Hb	Hemoglobin level
HIV	Human immunodeficiency virus
IUFD	Intrauterine Fetal Demise
LBW	Low Birth Weight
LMP	Last menstrual period
MBChB	Bachelor of Medicine and Bachelor of Surgery
MO	Medical Officer
MSB	Macerated still birth
MTRH	Moi Teaching and Referral Hospital
NBU	Newborn Unit
NICU	Neonatal Intensive Care Unit
PPH	Post-Partum Hemorrhage
RCO	Registered Clinical Officer
RIMS	Regional Institute of Medical Sciences
RMBH	Riley mother and Baby Hospital

SVD	Spontaneous vaginal delivery
TBA	Traditional Birth Attendant
VDRL	Venereal Disease Research Laboratory
W. H. O	World Health Organization

DEFINITION OF TERMS

Term pregnancy:

Descending phase: From full dilatation to strong and irresistible urge to push.

Early stillbirth: fetal death occurring between 20 and 27 completed weeks of pregnancy.

Early term: thirty-seven weeks, zero days through thirty-eight weeks, six days

Expulsive phase: Strong and irresistible pushing during the major part of the contraction.

First stage: From onset of regular contractions leading to cervical dilatation to full dilatation. **Latent phase**: Cervix <4 cm dilatation. **Active phase**: Cervix ≥4cm dilatation.

Full term: thirty-nine weeks, zero days through to forty-weeks, six days

High risk pregnancy: pregnancy in which the mother and/or the baby has an increased chance of developing a serious health issue.

Late stillbirth: occurs between 28 and 36 completed pregnancy weeks.

Late term: forty-one weeks, zero days through to forty-one weeks, six days

Post-partum hemorrhage: Blood loss in excess of 500ml or 1000mls following vaginal delivery or cesarean section delivery respectively.

Primigravidae: a woman who is pregnant for the first time

Second stage:

Stages of labour:

Stillbirth: is the death or loss of a baby before or during delivery.

Term stillbirth: occurs between 37 or more completed pregnancy weeks.

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ABSTRACT

Background: Majority of obstetric patients are usually healthy and free from co-morbidities. Most of them can be managed at the primary health care center. However, pregnancy and child birth are not free from complications, some of which may prove to be life threatening. Timely identification of high risk cases prone to end up in such complications and their prompt referral to a center well equipped to handle such cases may improve the feto-maternal outcome. According to WHO reports in 2005, 529 000 women die annually due to pregnancy and childbirth. With this background in mind, this study was conducted to review the primary reasons and pattern of mothers referred in labour and their feto-maternal outcomes.

Objective: To determine feto-maternal outcomes of mothers referred in labour.

Methods: After obtaining approval from institutional ethical committee a descriptive prospective study of mothers who were referred from periphery to our tertiary institution for a one-year duration was conducted. Inclusion criteria was referred intrapartum mothers to our institution > 34 weeks' gestation. Participants were sampled using consecutive sampling technique, to achieve a sample size of 254. A semi-structured questionnaire was used for data collection. Categorical variables were summarized as frequencies and percentages while continuous variables as mean and their respective standard deviations. Bivariate analysis was done using Chi square and Fishers'exact tests. Variables that exhibited an association with the outcome at the bi-variate level were considered in a multivariate regression model for each of the outcomes. P-value <0.05 was considered to be significant.

Results: Majority (68.1%) of the study participants were admitted in active phase of labour, 38.2% (97) were nulliparous and 61.8% (157) were multiparous. Prolonged labour (20.1%), preeclampsia (19%) and fetal distress were the main reasons for referral. Regarding admission to delivery interval 146 (57.4%) mothers delivered within 4 hours of admission. Out of the 254 mothers who delivered, 111 (43.7%) underwent emergency cesarean section. Nine (3.5%) mothers developed postpartum hemorrhage, 60 (23.6%) sustained perineal lacerations. There was a total of 243 (95.7%) live births and 11 (4.3%) still births. Forty (15.7%) neonates had low birth weight. Forty-two (16.5%) neonates had an APGAR score of less than 7 in 5 minutes and 43 (17.7%) neonates required admission to NBU.

Admission to delivery time interval of >4hrs was significantly associated with admission in latent labour (AOR=11.2,95% CI:5.52,24.1, p<0.001) and vaginal delivery (AOR=3.67, 95% CI:0.91,7.34, p<0.001). Sustaining a perineal laceration was significantly associated with age ≥35yrs (AOR=0.11,95% CI:0.01,0.56, p=0.034), urban residence (AOR=2.04,95% CI:1.05,3.95, p=0.034) and using other means of transport other than ambulance (AOR=2.20,95% CI:1.05,4.56, p=0.034). Babies weighing ≥2500g had higher odds of having APGAR score≥7 at 5minutes (AOR=6.61,95% CI:2.90,15.3, p<0.001). Birth weight ≥2500g and vaginal delivery were protective of admission to new born unit (AOR=0.09,95% CI:0.03,0.21, p<0.001) and (AOR=0.29,95% CI:0.12,0.65, p=0.004) respectively.

Conclusion: Most common diagnosis at the time of referral was prolonged labour. Majority of the referred women delivered within 4 hours of admission, there was a high cesarean section rate. Approximately a quarter of the referred women sustained perineal laceration and very few had postpartum hemorrhage. Weight of <2500grams was significantly associated with Apgar score <7. Weight <2500 grams and delivery through cesarean section were significantly associated with neonates' admission to NBU.

Recommendation: Mothers who have been referred in labour should be categorized as high-risk births and therefore monitored closely in order to detect any adverse outcome early.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Pregnancy and child birth are physiological processes. However, these are not free of risks. A woman can come across a number of health-related problems during pregnancy as well as also becoming a victim of death during this process. About 295,000 women die worldwide annually due to pregnancy and child (*Trends in maternal mortality 2000 to 2017*). Maternal mortality ratio (MMR) reflects the overall health care system of the society and their attitudes towards the women.

Nearly all of these deaths occur in developing countries where integrated health care system is not well defined. MMR is almost negligible in developed countries with ranges from 6-30/100000 live births (W.H.O 2015). Developing countries of Asia and Africa still have the highest maternal mortality rates, that is, almost 99% of total maternal mortality. In Tanzania MMR is 398/100,000, India's MMR is 174/100,000 while Nigeria has one of the highest maternal mortality rates 814/100,000 live births among the developing countries (W.H.O 2015). MMR for Kenya is 362/100,000(KDHS, 2014).

Lack of trained birth attendants, lack of education, low social economic status of women, poor family, financial dependency of women and delay in seeking medical treatment in cases of obstetric emergencies are the key factors contributing towards the adverse maternal and perinatal outcomes (Khatoon et al, 2011).

Majority of obstetric patients are healthy and free from co-morbidities. Most of them can be managed at the primary health care center. However, pregnancy and child birth are not free from complications, some of which may prove to be life threatening

(Poornima et al, 2018). Timely identification of high risk cases prone to land up in such complications and their prompt referral to a center well equipped to handle such cases may improve the fetomaternal outcome. The fact that many of the complications responsible for fetal and maternal mortality can't be predicted needs to be emphasized. Various factors responsible for maternal morbidity and mortality such as PPH, septicemia, disseminated intravascular coagulopathy, obstructed labour and eclampsia can develop suddenly and may surprise even the most experienced obstetricians (Danilack et al,2015). It is for this reason that every pregnancy needs to be managed very vigilantly and there must be a system in place for identification and management of any complication associated with pregnancy and child birth.

Referral institutions should provide a reasonable level of quality care. Well-established operational referral system is an essential component of health care system (Shenoy et al, 2018). Obstetric emergencies are most of the times life threatening both for the patient and her unborn. Prompt and appropriate care reflects the actual status of maternal health services in the region. Unmet obstetric needs can be better monitored if primary, secondary and tertiary levels of health care are linked through an established communication system.

With this background in mind, this study is to review the primary reasons and pattern of mothers referred to MTRH and to study the feto-maternal outcomes in such referred cases.

1.2 Statement of the research problem

Majority of the population in Kenya lives in rural areas. Disproportionate concentration of health services in urban areas and ineffective access of rural population to these services results in huge proportion of obstetric emergencies being referred to referral hospitals and institutions. Lack of specialist services and transport facilities at the periphery further results in delayed referral to tertiary centers, thus increasing the fetal and maternal morbidity and mortality (Badal et al, 2017).

Despite the fact that mothers referred in labour are handled in tertiary institutions in Kenya, little is known on their maternal and fetal outcomes because there is little publication on it.

Most studies done have been in other countries and have yielded mixed and contradictory results making it impossible to draw conclusions on the association between mothers referred in labour and pregnancy outcomes. Generalization of findings from studies conducted in other countries, with unique health parameters, indicators and population dynamics, to our population needs to be done with caution.

This study will therefore address the existing gaps and form a basis to propose guidelines to standardize and improve management of mothers referred in labour.

1.3 Justification

This study is being done as there is minimum or no data available concerning the varieties of referred obstetric cases managed in MTRH and their feto-maternal outcomes. Being referred to MTRH is one of the significant factors associated with maternal mortality (Yego et al, 2014), this study will try to address this finding by looking into the primary reasons and pattern of mothers referred in labour. Time is often of crucial importance in obstetric emergencies (Strand et al, 2009), this study

will provide baseline information on how timely mothers referred in labour are attended to and its correlation to feto-maternal outcomes.

1.4 Study significance

This study will provide insights into the management of mothers referred in labour in MTRH. Knowledge of the burden and a variety of obstetric cases referred to MTRH would provide necessary data that could inform decision makers formulate a local protocol, standard of care and organize staff trainings regarding handling of such cases, not only in MTRH but also in other national hospitals and county hospitals.

1.5 Research questions

i. What are the indications for referral of mothers in labour to MTRH?
ii. What is the time interval between admission and delivery of mothers in labour referred to MTRH?
iii. What are the feto-maternal outcomes of mothers in labour referred to MTRH?

1.6 Objectives

1.6.1 Broad objective

To determine feto-maternal outcomes of mothers in labour referred to MTRH.

1.6.2 Specific objectives

1. To identify the indications for referral of mothers in labour to MTRH.
2. To establish the time interval between admission and delivery of mothers in labour referred to MTRH.
3. To assess maternal outcomes (mode of delivery, PPH, perineal lacerations, uterine rupture, cervical tears and vulval hematoma) and factors associated with the outcomes.
4. To assess fetal outcomes (5-minute APGAR score, NBU admission and fetal death) and factors associated with the outcomes.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

Labour is a physiologic process during which the fetus, membranes, umbilical cord and placenta are expelled from uterus. Labour is attained through biochemical changes in the connective tissue and progressive effacement and dilatation of the uterine cervix due to rhythmic uterine contractions of sufficient frequency, intensity and duration (ACOG, 2003). Labour is a clinical diagnosis. The onset of labour is defined as regular, painful uterine contractions resulting in progressive cervical effacement and dilatation. Cervical dilatation in the absence of uterine contraction suggests cervical insufficiency, whereas uterine contraction without cervical change does not meet the definition of labour. Labour is divided into three stages.

The first stage of labour starts with regular uterine contractions and ends with complete cervical dilatation at 10cm. In Friedman's landmark studies of 500 nulliparous, he subdivided the first stage into an early latent phase and a later active phase (Friedman, 1955). The latent phase begins with mild, irregular uterine contractions that soften and shorten the cervix. The contractions become progressively more rhythmic and stronger. This is followed by the active phase of labour, which usually begins at about 4 cm of cervical dilation and is characterized by rapid cervical dilation and descent of the presenting fetal. The first stage of labour ends with complete cervical dilation at 10 cm.

The second stage begins with complete cervical dilatation and ends with the delivery of the fetus. The American College of Obstetricians and Gynecologists (ACOG) has suggested that a prolonged second stage of labor should be considered when the second stage of labor exceeds 3 hours if regional anesthesia is administered or 2 hours

in the absence of regional anesthesia for nulliparous. In multiparous women, such a diagnosis can be made if the second stage of labor exceeds 2 hours with regional anesthesia or 1 hour without it (ACOG, 2003).

The third stage of labor is defined by the time period between the delivery of the fetus and the delivery of the placenta and fetal membranes. During this period, uterine contraction decreases basal blood flow, which results in thickening and reduction in the surface area of the myometrium underlying the placenta with subsequent detachment of the placenta (Herman et al.,2002). Although delivery of the placenta often requires less than 10 minutes, the duration of the third stage of labor may last as long as 30 minutes.

Expectant management of the third stage of labor involves spontaneous delivery of the placenta. Active management often involves prophylactic administration of oxytocin or other uterotonics (prostaglandins or ergot alkaloids), cord clamping/cutting, and controlled cord traction of the umbilical cord. Andersson et al found that delayed cord clamping (≥180 seconds after delivery) improved iron status and reduced prevalence of iron deficiency at age 4 months and also reduced prevalence of neonatal anemia, without apparent adverse effects (Andersson et al.,2011)

Gestation in singleton pregnancies lasts an average of forty weeks (280 days) from the first day of the last menstrual period to the estimated date of delivery. In the past, the estimated date of delivery was considered ‘term’ (WHO, 2004), with the expectation that neonatal outcomes from deliveries in this interval were uniform and good. However, research has found out that neonatal outcomes, especially respiratory morbidity, vary depending on the timing of delivery even within this 5-week gestational age range. To address this lack of uniformity, a work group was convened

in late 2012, which recommended that the label ‘term’ be replaced with the designations early term (37 weeks 0 days and 38 weeks 6 days), full term (39 weeks 0 days through 40 weeks 6 days) and late term (41 weeks 0 days through 41 weeks 6 days), to more accurately describe deliveries occurring at or beyond 37 weeks 0 days of gestation (Spong, 2013).

A high-risk pregnancy is one that threatens the health or life of the mother or her fetus. It often requires specialized care from specially trained providers (Hamilton et al.,2015). Some pregnancies become high risk as they progress, while some women are at increased risk for complications even before they get pregnant for a variety of reasons. Early and regular prenatal care helps many women have healthy pregnancies and deliveries without complications.

Risk factors for a high-risk pregnancy can include:

- **Existing health conditions**, such as high blood pressure, diabetes, or being HIV-positive
- **Overweight and obesity.** Obesity increases the risk for high blood pressure, preeclampsia, gestational diabetes, stillbirth, neural tube defects, and cesarean delivery.
- **Multiple births.** The risk of complications is higher in women carrying more than one fetus (twins and higher-order multiples). Common complications include preeclampsia, premature labor, and preterm birth. More than one-half of all twins and as many as 93% of triplets are born at less than 37 weeks' gestation.
- **Young or old maternal age.** Pregnancy in teens and women age 35 or older increases the risk for preeclampsia and gestational high blood pressure.

Women with high-risk pregnancies should receive care from a special team of health care providers to ensure the best possible outcomes.

The new WHO guidance increases the number of contacts a pregnant woman has with health providers throughout her pregnancy from four to eight. Recent evidence indicates that a higher frequency of antenatal contacts by women and adolescent girls with a health provider is associated with a reduced likelihood of stillbirths. This is because of the increased opportunities to detect and manage potential complications. Eight or more contacts for antenatal care can reduce perinatal deaths by up to 8 per 1000 births when compared to 4 visits (WHO, 2016).

A woman's 'contact' with her antenatal care provider should be more than a simple 'visit' but rather the provision of care and support throughout pregnancy. The guideline uses the term 'contact' as it implies an active connection between a pregnant woman and a health care provider that is not implicit with the word 'visit'. The new model increases maternal and fetal assessments to detect complications, improves communication between health providers and pregnant women, and increases the likelihood of positive pregnancy outcomes. It recommends pregnant women to have their first contact in the first 12 weeks' gestation, with subsequent contacts taking place at 20, 26, 30, 34, 36, 38 and 40 weeks' gestation.

2.2 Prevalence of mothers referred in labour.

In a prospective study that examined the nature of emergency obstetric admissions in a Nigerian University Hospital in association with such factors as late referrals and misdiagnosis and their contribution to maternal and perinatal morbidity/mortality, an incidence of 13.6% emergency admissions was recorded (Onwudiegwu et al,2001).

The study comprised of 144 consecutive emergency obstetric admissions to the hospital over a 6.5-month period. Despite the proximity of the hospital to the parturient, most of them labored in substandard facilities within the community. Referrals to the university hospital were made only after prolonged delay and onset of complications. Obstetric haemorrhage (24.6%) was the most common cause for referral followed by labour disorders (19%) and hypertensive disorders (8.4%). Thirteen maternal deaths occurred, giving a maternal mortality ratio of 6.2%, while perinatal mortality rate was 461 per 1000 births. There was a cesarean section rate of 50.9%, a 4.8% incidence of diagnostic laparotomy, a 9% incidence of emergency hysterectomy and 44% of emergency blood transfusions.

Misdiagnoses of clinical conditions were made by the referring centers in 68% of cases, which contributed to the high maternal morbidity and mortality. Patient attitude was the main cause of non-use of teaching hospital facilities (fear of operation in 32% of cases, dissuasive advice friends in 27.4% and negative staff attitude in 7%). There is need for a programme that will promote increased utilization of modern maternal health services in the community (Onwodiegwu et al, 2001).

Goswami et al (2017) conducted a prospective study at a tertiary center in central India. The intention of their study was to review the pattern of obstetric cases referred to a tertiary center, to identify their clinical course, mode of delivery and maternal outcomes. The study population was all obstetric patients referred to the hospital from January 2015 to July 2016. The total number of referred cases was 4085. The proportion of referred cases in the hospital was 20.86%. Mode of transport used by the referred patients was hospital ambulances (38%) and private vehicles (62%). Most common diagnosis at the time of referral was anaemia (27.8%). Out of the total

referred cases, 48% had vaginal delivery (either spontaneous or induced), 28% had CS and 24% were managed conservatively. Hypertensive disorders (25.4%) constitute the leading cause of maternal deaths amongst the referred cases. They concluded that peripheral health care system needs to be strengthened and practice of early referral needs to be implemented for better maternal outcome (Goswami et al, 2017).

In southern Tanzania Jahn et al (1998) did study whose aim was to assess whether antenatal care achieves identification and timely referral of high risk pregnancies. Of the 415 admissions observed, 15.9% were antenatal, 82.9% were referrals for delivery and 1.2% were obstetric emergency referrals. In relation to the expected deliveries in the districts, the referral rates were 3.4% for antenatal, 17.5% for delivery and 0.3% for emergencies. Most (57.7%) obstetric care users originated from within a 10-kilometer radius around the hospital (Jahn et al, 1998).

2.3 Indications for referral

In Angola, Strand et al (2009) conducted a study titled 'Audit of referral of Obstetric emergencies in Angola: A tool for assessing quality of care'. By auditing various aspects of referrals of obstetric emergencies, they wanted to study the effectiveness over time of a recently established network of peripheral birth units and two central hospitals in Luanda. The first part of the study took place in the year 1996 and included 157 women referred for obstetric emergencies. The second part of the study comprised of 92 referrals from the same three health facilities, in 1999. The total number of births and referrals admitted during the two study periods were; 2443 births, 398 referrals in 1996, 1752 births and 429 referrals in 1999. The proportion of referrals differed widely among the 3 health facilities, from 1.7% to 28.7%. Maternal mortality decreased from 17.8% to nil in the second. Total mean waiting time was

reduced from 13.7 hours to 1.2 hours. Partogram quality was significantly improved. Cesarean rate increased from 13 to 30%. Prolonged labour was the most common diagnosis. Their study demonstrated the importance of clinic-based audit to enhance quality of care regarding referrals of patients with obstetric emergencies (Strand et al, 2009).

Maskey (2015) carried out a study in a tertiary hospital in Nepal. The study was done to review the primary reasons and pattern of obstetric cases referred to a University Teaching Hospital and to identify the clinical course, mode of management, maternal and perinatal outcomes. This was a prospective observational study reviewed 112 obstetric cases referred from various centers. Data was collected from October 2011 to September 2012. Most common diagnosis at referral was medical disorders complicating pregnancy (38%) among which cardiac disease accounted for 20%, followed by hypertensive disorder (17%). Unavailability of perinatal facility was the most frequent reason (24%) for referral. 27% of the patients were in serious or critical condition on arrival, 52% patients required surgical intervention, 19% received intensive care management and there were mortalities of 2 women (1.8%). Total number of live births were 70 (62.5%) among which 28 (42%) required neonatal admission and 3 (4% of live birth) had early neonatal death (Maskey, 2015).

An audit of obstetrics referrals to Abbasi Shaheed Hospital in Karachi, India, was done by Khatoon et al. it was a prospective observational study in which 234 patients were included. A detailed proforma, including history and examination, investigations, source and reasons for referral, mode of delivery, maternal outcome, perinatal outcome, maternal complications and their management was done. Most

common reasons for referral were prolonged labour, fetal distress, repeat cesarean section and meconium stained liquor, respectively (Khatoon et al.,2011).

In a study done in North India by Kant et al, the referral rate was found to be 31.7%. preterm labour (30.6%), pregnancy-induced hypertension (17%) and fetal distress (10.6%) were the main reasons for referral (Kant et al., 2018).

2.4 Admission to delivery time interval

In agreement with studies by Rohit et al (2016) and Goswami et al (2017), Sabale et al (2015) found out in their study the proportion of referral cases was 17.83%. This was a prospective observational study whose aim was to review obstetric cases for reason of referral and to study the maternal and perinatal outcome. They looked at all referred ANC cases to a tertiary care institute >20weeks gestation. The total number of deliveries during the study period were 11106, the total number of referred was 1980. Out of these 1520 met the inclusion criteria and according to the sample size calculated 380 cases were selected for the study. Selection of cases was done by systemic sampling technique. Majority (43.37%) of referred cases were from the district level hospitals. There was unavailability of ambulance in 65.26% of cases for transport. Most (92.89%) were not accompanied by any medical assistance during transport. Major complication during immediate postpartum period was PPH (Sabale et al, 2015).

In their study, 31.84% of the patients required blood/blood products transfusion. There were 3 (0.79%) maternal mortalities in present study and behind these there were a total 70 (18.42%) near miss cases which provide valuable information on the quality of antenatal care at the periphery. 54.87% of all neonates had LBW. 45.90% were preterm. Total NICU admission rate was 14.36%, neonatal mortality was 5.38%.

These showed that improper antenatal and intrapartum care at the periphery level is responsible for poor maternal and perinatal outcome. Rural women have very poor access to MCH services. There is lack of transportation facilities for referral patients and they have to travel a longer distance to seek emergency obstetric care. Obstetric hemorrhage is the leading cause of maternal mortality (Sabale et al, 2015).

2.5 Mode of delivery

Poornima et al (2018) did a prospective study of 332 obstetric cases that were from other government, private or peripheral hospitals to a tertiary hospital. The objective of their study was to study the pattern of obstetric cases referred to tertiary care center and to study the maternal and fetal outcome in those cases. A detailed clinical history, place from which patients were referred, type of transport used, causes of referral were studied. Physical and obstetric examination was done and relevant investigations were done. Management of the patients, course in the ward, mode of delivery, maternal and neonatal outcome was documented. Out of 265 patients who were delivered, 149 (56%) underwent normal vaginal delivery while cesarean was done in 116 (44%) patients (Poornima et al, 2018). The common indications for cesarean included previous CS (32%), fetal distress (16%) and pregnancy induced hypertension and its complications (18%). 98 (27%) patients were at risk of maternal mortality. Blood transfusions and CCU admissions were required in 20% and 10% patients respectively.

Maternal mortality was seen in 26 (7%) patients. The common cause of maternal mortality included medical disorders complicating pregnancy (31%) followed by pregnancy induced hypertension (19%) and PPH (16%). There were 27 (9.7%) stillbirths while NICU admissions and neonatal deaths in NICU admitted neonates

were seen in 68 and 22 patients respectively. Out of the cases 265 (80%) patients were delivered in the institution and out of remaining 67 patients 38 (11%) were discharged before delivery and 29 (9%) patients either aborted or were having ectopic pregnancy (Poornima et al, 2018).

Shenoy et al conducted a study titled, pattern of obstetric referrals in a tertiary hospital in south Kerala. This was a retrospective study whose aim was to review the primary reasons for obstetric referral and place of referral and also to evaluate the maternal morbidity, neonatal course and care during NICU stay and perinatal outcomes. A total of 124 obstetrical referrals from nearby private and public health care settings over a period of three years were examined. Out of these, 73.4% were in the age group 20-30 years with a mean age of 26 years. 82.3% were in the rural set up. 48.3% were nullipara and 50% were multipara. Materno-fetal issues were the main reasons for obstetric referral (58.1%). 103 referrals (83.1%) were from private sector. 64 were in labour referrals. 48 hours of delay was noted for emergency decision in 64.5% cases. 47.6% referrals were noted in the 33-36.6 weeks' gestation. Previous cesarean in labour comprised 29 cases. Cesarean section was the mode of delivery in 83% (Shenoy et al, 2018).

Anaemia was the most common medical disorder (34%) followed by hypertensive disorders of pregnancy (30.5%). Gestational diabetes mellitus was noted in 14.2% and hypothyroidism in 17.7%. There was one maternal death and 4 near miss mortality. 104 of 135 neonates were singletons and 31 (23%) were multiples. 96 neonates needed NICU admissions. 72% were preterm babies and 84% neonates survived. They concluded that materno-fetal causes were the main reason for obstetric referrals. Maternal co-morbidities like anaemia, hypertensive disorders, preterm labour,

infections and fetal risk factors have to be diagnosed and referral at the earliest to a tertiary hospital to avert maternal and perinatal morbidities. This could ascertain better maternal and fetal health in a country like India (Shenoy et al, 2018).

In Tanzania, a study was done to compare cesarean section rates among women formally referred to a tertiary care centre versus self-referred women, and to assess the effect of referral status on adverse outcomes after cesarean section. Referral status contributed substantially to the cesarean section rate, which was 55.0% in formally referred and 26.9% in self-referred women (Sorbye et al.,2011).

2.6 Postpartum hemorrhage

The definition of PPH is somewhat arbitrary and problematic. PPH is defined as blood loss of more than 500 mL following vaginal delivery or more than 1000 mL following cesarean delivery (Sentilhes et al.,2016). A loss of these amounts within 24 hours of delivery is termed early or primary PPH, whereas such losses are termed late or secondary PPH if they occur 24 hours after delivery. Another consideration is the differing capacities of individual patients to cope with blood loss. A healthy woman has a 30-50% increase in blood volume in a normal singleton pregnancy and is much more tolerant of blood loss than a woman who has preexisting anemia, an underlying cardiac condition, or a volume-contracted condition secondary to dehydration or preeclampsia. For these reasons, various authors have suggested that PPH should be diagnosed with any amount of blood loss that threatens the hemodynamic stability of the woman.

PPH is the leading cause of maternal mortality in low-income countries, and the primary cause of nearly one quarter of all maternal deaths globally (WHO, 2012). Most deaths resulting from PPH occur during the first 24 hours after birth; the

majority of these could be avoided through the use of prophylactic uterotonics during the third stage of labour and by timely and appropriate management.

Kaye et al (2011) did a prospective study, maternal morbidity and near miss mortality among women referred for emergency obstetric care in rural Uganda. Their study assessed the causes of near miss mortality in women referred for emergency obstetric care to Kabale regional hospital, southwestern Uganda. The study was done among 140 women undergoing prenatal, labour or postpartum emergency referral. Participants were monitored either until discharge from hospital or until death. Of the total women 64.3% reported complications in prior pregnancies, including cesarean delivery (24.4%), antepartum hemorrhage (30%), stillbirth (24.4%) and neonatal death (30%). Overall 90.7% women had attended prenatal care at least 4 times during the current pregnancy and 27.1% had experienced complications including hemorrhage, premature rupture of membranes and preeclampsia, during prenatal care. The reasons for referral included obstructed labour (45%), fetal distress (10.7%) and ruptured uterus (5%). Forty-seven (33.6%) women developed obstructed labour during delivery. The most common causes of the 45 near miss mortality and morbidity cases were obstructed labour (28.9%) and PPH (24.4%). The finding that many of the women were in a critical condition at admission indicates possible delays by health workers in making referral decisions (possibly owing to difficulties in making diagnosis), delays in reaching referral hospital, or poor quality of care at the referral facility (Kaye et al, 2011).

Sabale et al in their study of maternal and perinatal outcome in referred obstetric cases in India, found out that the major complication during immediate postpartum period

was PPH (19.99%) (Sabale et al.,2015). This further points out the fact that PPH is a leading cause of maternal morbidity and mortality in low-income countries.

Perineal lacerations

The female perineum is the diamond-shaped inferior outlet of the pelvis, bordered by the pubic symphysis anteriorly and the coccyx posteriorly. Perineal trauma involves any type of damage to the female genitalia during labour, which can occur spontaneously or iatrogenically (via episiotomy or instrumental delivery). Anterior perineal trauma can affect the anterior vaginal wall, urethra, clitoris and labia. Posterior perineal trauma can affect the posterior vaginal wall, perineal muscle, perineal body, external and internal anal sphincters, and anal canal. During labour, the majority of perineal tears occur along the posterior vaginal wall, extending towards the anus (Goh et al.,2018).

2.7 Classification of perineal tears

Degree	Classification
1	Laceration of the vaginal mucosa or perineal skin only
2	Laceration involving the perineal muscles
3	Laceration involving the anal sphincter muscles, further subdivided into:
3A	Where <50% 0f the external anal sphincter is torn
3B	Where >50% of the external anal sphincter is torn
3C	Where the external and internal anal sphincters are torn
4	Laceration extending through the anal epithelium (resulting with a communication of vaginal epithelium and anal epithelium)

More than 85% of females who undergo a vaginal birth will suffer from some degree of perineal tear, with 0.6–11% of all vaginal deliveries resulting in a third-degree or fourth-degree tear (Frohlich et al.,2015). Fortunately, the incidence of perineal tears decreases with subsequent births, from 90.4% in women who are nulliparous to 68.8% in women who are multiparous undergoing vaginal deliveries.

Risk factors for sustaining a perineal laceration include:

Maternal: nulliparity, Asian ethnicity, vaginal birth after C/S, ≤20 years of age, shortened perineal length (<25mm).

Fetal: large fetal weigt (>4000g), shoulder dystocia, occipito-posterior position.

Intrapartum factors: instrumental delivery (eg vacuum, forceps), prolonged second stage of labour (>60 minutes), epidural use, oxytocin use, midline episiotomy, delivery in lithotomy or deep squatting position.

2.8 Apgar score

The Apgar score describes the condition of the newborn infant immediately after birth and, when properly applied, is a tool for standardized assessment. It also provides a mechanism to record fetal to neonatal transition. Apgar scores do not predict individual mortality or adverse neurologic outcome. However, based on population studies, Apgar scores of less than 5 at 5 and 10 minutes clearly confer increased risk of cerebral palsy and the degree of abnormality correlates with the risk of cerebral palsy. Most infants with low Apgar scores, however, will not develop cerebral palsy. The Apgar score is affected by many factors, including gestational age, maternal medications, resuscitation and cardiorespiratory and neurologic conditions. If the

Apgar score at 5 minutes is 7 or greater, it is unlikely that peripartum hypoxia-ischaemia caused neonatal encephalopathy (AAP, 2015)

A prospective observational study was done by Rohit et al (2016). The objective was to study the referred obstetric cases for appropriateness and timeliness of referral and to study the maternal and perinatal outcome. The study population was all referred cases >28weeks of gestation from periphery to tertiary care institute in one-year duration. The total number of referred cases was 1468. Selection of cases was done by systemic sampling technique. The proportion of referral cases was 15.37%. There was unavailability of ambulance in69.34% of cases for transport. Major cause of maternal death was eclampsia. There were 40 (2.68%) maternal mortalities. 17.57% of all neonates had LBW. 10.01% babies were still births and 14.9% were preterm. Neonatal mortality was 4.08% (Rohit et al, 2016).

The study showed that inadequate antenatal and intrapartum care at the periphery level is responsible for increased maternal and perinatal morbidity and mortality. Even today, hypertensive disorder is the leading cause of maternal mortality, health education to the community, better antenatal care up to grass root level, emergency intrapartum care, availability of services of skilled birth attendants at the time of child birth, well organized first referral center with better transportation facility, availability of blood, anaesthetic facilities and availability of specialist in the field of obstetrics at the referral unit will definitely reduce maternal and perinatal morbidity and mortality (Rohit et al,2016).

In contrast to other studies, Badal et al (2017) studied 153 cases of obstetric emergency referred to RIMS, giving a proportion of referral cases as 0.90%. The objective of the study was to identify the pattern of obstetric emergency cases referred

from health centers to RIMS hospital and to evaluate the outcome in these cases. 101 cases were referred from rural health centers. Most of the patients utilized local transport the hospital 76.47%. Total number of births was 150, of which 92% were live births, still births were 1.33%, IUFD were 7.33%, and neonatal deaths were 8.66%, giving a total perinatal mortality of 17.33%. NICU admission was done in 46 babies. No maternal mortality was recorded. In conclusion there is need to strengthen the peripheral health centers with specialists, improve transport facilities for better access to tertiary centers, to create awareness among rural population to avail them and develop attitude and will of the patients to go to the tertiary center (Badal et al,2017).

A prospective study was done by Htwe et al (2011) in Australia to assess the strengths and weaknesses of inter-hospital transfer process. There were 92 obstetric patients who were transferred from other hospitals to Raja IsteriPengiranAnakSaleha (RIPAS) hospital, over a period of six months. The prevalence of emergency transfers was 3.65% of total obstetric admissions. The most common reason for transfer was gestational hypertension followed by labour pain. Multiple reasons led to 25% of referrals. Sixteen patients (17%) arrived without any accompanying medical personnel and 10 patients (11%) used their own transport. Duration from referral to arrival ranged from 25minutes to 72 hours. Twenty-one (23%) and 18 (19%) arrived without any investigation or medications and without referral letters respectively. The mean hospital stay was 3.4 days. There were no neonatal deaths. The study revealed deficiencies in the transfer procedures that can be improved (Htwe et al, 2011).

Another prospective observational study was done to review the referred obstetric cases; for reasons of referral and to study the maternal and perinatal outcome. The

first 100 referred obstetric cases were examined. 67% of the referrals were from urban areas and 33% from rural areas. Educational status of the urban patients was markedly better than the rural patients. Majority of referrals were for hypertensive disorders (26%) and preterm labour (26%). 60% of the rural population was anaemic. 62% of the total live born required nursery care. The study showed that delay in referral and referrals to intermediary centers are the main causes for adverse maternal/perinatal outcome. Peripheral healthcare system needs to be strengthened and practice of early referral needs to be implemented for better maternal and perinatal outcome (Charu et al, 2010).

In Ghana, a 6-week prospective study of women referred to Korlu Bu Teaching hospital during labour and delivery was conducted to determine the sources of and indications for referral, and to assess the adequacy of various aspects of the referral mechanisms. Of 396 women referred, 86% were referred from polyclinics (which are state-owned) and private midwives. The commonest indications were failure to progress (21.5%) and hypertensive disease (15.7%). A total of 35 (8.8%) women were referred with 3rd stage or immediate postpartum complications. Referrals constituted 17.6% of hospital deliveries. Significant deficiencies were identified in the referral mechanisms. 72.7% of the patients travelled by public or private means and 54.2% were not accompanied by any staff during transfer. Only 16.7% of those expected to have partographs came with one and 55.6% of women with complications of vaginal bleeding did not have intravenous infusions sited. However, in almost 90% of patients, the general condition on arrival in the hospital was good, and some referrals could probably have been avoided. Efforts must be made to improve patient transport and to evaluate labour management practices in the referring centers (Nkyerkyer, 2000).

In a retrospective study carried out in Enugu, southeast Nigeria, childbirth emergency referrals from the trained birth attendants (TBAs) accounted for 58.1% of the deliveries (Okafor et al, 2015). The aim of the study was to audit childbirth emergency referrals by trained TBAs to a specialist hospital in Enugu. 205 childbirth emergencies referred to Semino Hospital and Maternity by trained TBAs were examined. Most of the patients (90.2%) were married and 48.8% had earlier booked for antenatal care in formal health facilities. There were obstetric danger signs in 53.7% women on admission. 56.1% women walked into the hospital by themselves while 24.4% could not walk. The fetal heart sounds were normal in 45.6%, abnormal in 31.8% and absent in 20.4% of the women on admission. Five healthy babies were delivered by TBAs before referring their mothers. Delays of more than 12 hours had occurred in 76.6% of the women before referral. Prolonged labour (48.8%), obstructed labour (19.5%), attempted vaginal birth after previous cesarean delivery (19.5%) and malpresentation (14.6%) were the common indications for referrals. The maternal mortality and perinatal mortality ratios were 610/100,000 live births and 228/1000 total births respectively. They concluded that delays at TBA centers are common before referral and most patients are referred in poor clinical state. More training and retraining of TBAs is recommended (Okafor et al, 2015).

Echoka et al carried out a facility based qualitative study titled ‘Barriers to emergency obstetric care services: accounts of survivors of life threatening obstetric complications in Malindi District, Kenya. In-depth interviews were conducted with 30 women who experienced obstetric “near miss” at the only public hospital with capacity to provide comprehensive emergency obstetric care (EmOC) services in the district. Findings indicate that pregnant women experienced delays in making decision to seek care and in reaching an appropriate care facility. The first delay was

due to lack of birth preparedness, including failure to identify a health facility for delivery services regardless of antenatal care and to seek care promptly despite recognition of danger signs. The second delay was influenced by long distance and inconvenient transport to hospital. These delays resulted in some women arriving at the hospital too late to save the life of the unborn baby (Echoka et al, 2014).

Yego and friends conducted a study in Moi Teaching and Referral Hospital (MTRH) in Kenya. The aim of their study was to identify risk factors associated with maternal mortality in a tertiary hospital in Kenya. A manual review of records of 150 maternal deaths (cases) and 300 (controls) was undertaken using a standard audit form. The sample included pregnant women aged 15-49 years admitted to the obstetric and gynaecological wards at MTRH in Kenya from January 2004 to March 2011. Factors significantly associated with maternal mortality included: having no education relative to secondary education, history of underlying medical conditions, doctor attendance at birth, having no antenatal visits, being admitted with eclampsia, being admitted with co-morbidities, having elevated pulse on admission and being referred to MTRH (Yego et al, 2014).

2.9 Conceptual Framework

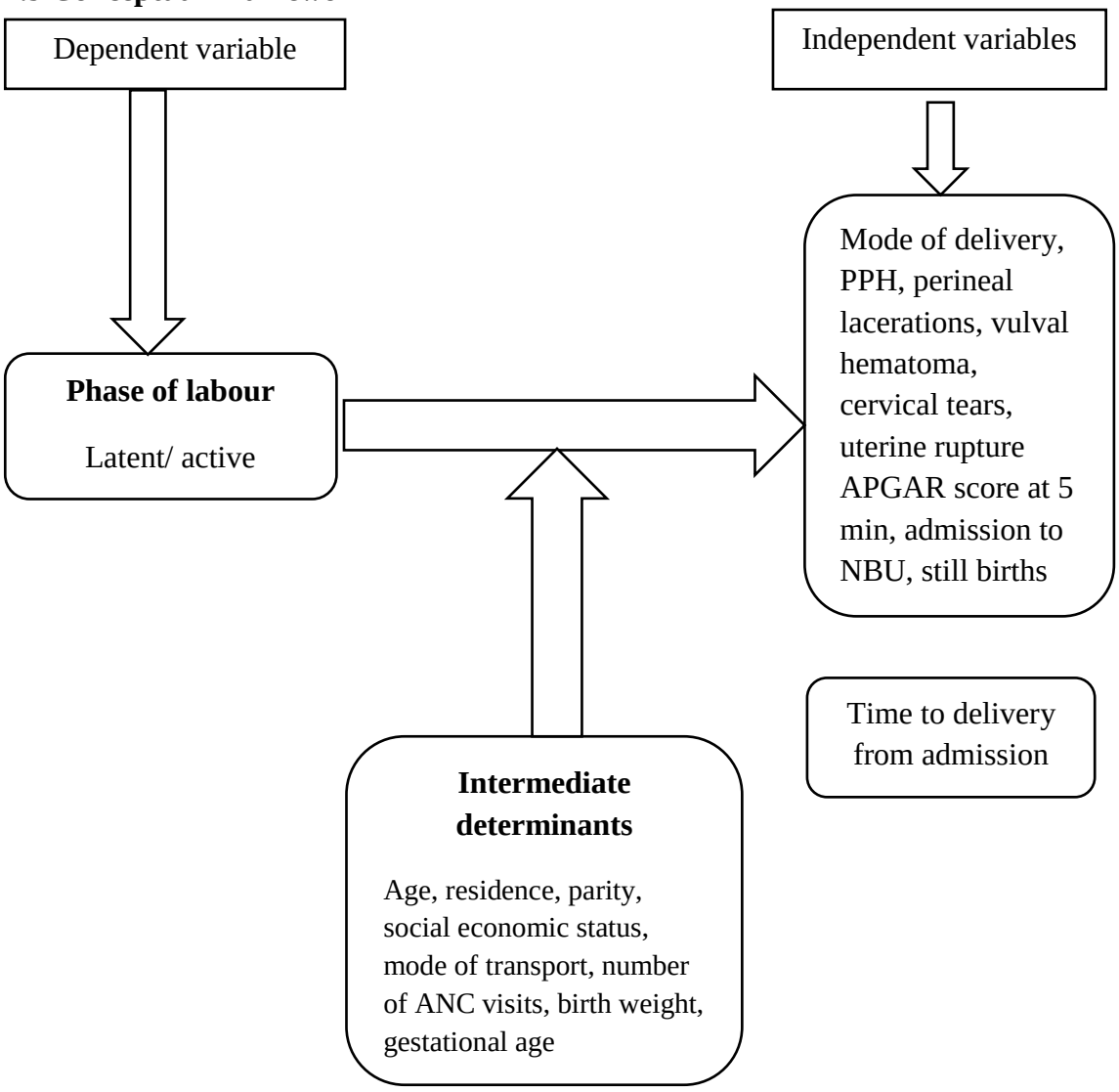

Figure 1: Conceptual Framework

The conceptual framework is drawn from the Donabedian model (Donabedian, 2005). It provides a framework for examining health services and evaluating quality of health care. According to the model, information about quality of care can be drawn from 3 categories: structure, process and outcomes. Structure describes the context in which care is delivered, including hospital buildings, staff, financing and equipment. Process denotes the transactions between patients and providers throughout the delivery of healthcare. Outcomes refer to the effects of healthcare on the health status of patients and population.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Study design

A descriptive prospective study was conducted in MTRH, in Eldoret, Kenya.

3.2 Study setting

This study was conducted at the Riley Mother and Baby Hospital (RMBH) unit at Moi Teaching and Referral Hospital, Eldoret, Kenya. The hospital is the second largest referral facility in Kenya, located in Eldoret town in Uasin Gishu County. The hospital doubles as the teaching hospital for Moi University School of medicine. Its catchment area includes populations from Rift valley, Western and Nyanza regions. On average, 1000-1200 deliveries are conducted per month at the facility (MTRH statistics, 2018).

RMBH has three wards namely; antenatal ward (ANW), postnatal ward (PNW) and labour ward (L/W) where women in active phase of labour are admitted for monitoring and delivery. The RMBH unit is staffed by about 16 consultant obstetrician/gynecologists from Moi University and MTRH, 46 residents/registrars and 88 nurses/midwives (RMBH records, 2018).

3.3 Target population

Mothers admitted for delivery at RMBH, having been referred from other health facilities for management while in labour.

3.4 Study population

Mothers delivering at age 18 years or more at MTRH who met the defined criteria.

3.5 Eligibility

3.5.1 Inclusion criteria

- Mothers in labour referred from peripheral facilities
- Women aged ≥18 years at the time of delivery
- Gestational age ≥34 weeks
- Both latent and active phases of labour

3.5.2 Exclusion criteria

- Mothers who are in labour but not willing to participate in the study
- Sonographically confirmed anomalous fetus

3.6 Sample size determination

The Cochran sample size formula was used in the estimation of the sample size that was used in this study (Singh et al.,2014). The Cochran formula is expressed as shown in equation 1.1 below.

1.1 $n_{opt}=\frac{z^2\times pq}{e^2}$

Where:

e is the desired level of precision (i.e. the margin of error)

p is the (estimated) proportion of the population which has the attribute in question

q 1-p

Z denotes the 95th quartile of the Standard Normal Distribution

In this study the estimated value of p (proportion of referrals) was obtained from literature through averaging the proportions reported in the following three studies.

Emergency obstetric admissions: late referrals, misdiagnoses and consequences (Onwudiegwu et al, 2015) p=13.6%

To study pattern of obstetric cases referred at tertiary center central India (Goswani et al, 2017) p=20.86%

Obstetric care in southern Tanzania: does it reach those in need? (Jahn et al, 1998) p=17.5%

The three estimates of proportion averaged 17.32% with a standard deviation of 2.96. The extreme values of p therefore were 14.36% and 20.28% for the maximum and minimum proportions respectively. Applying the extreme values of p to the Cochran Sample Size formula in equation 1.1 yields the maximum and minimum sample size of 248 and 189 as shown in equation 1.2 and 1.3 respectively. The maximum sample size of 248 will therefore be adopted for this study.

1.2 $n_{opt}=\frac{z1.96^2\times0.2028\ (1-0.2028\ )}{0.05^2}$=248

1.3 $n_{opt}=\frac{z1.96^2\times0.1436\ (1-0.1436\ )}{0.05^2}$=189

3.7 Sampling procedure

According to MTRH 2018 records, 675 obstetric patients were referred from other health facilities to MTRH between January and December. This translated to an average of approximately 57 referrals per month. Consecutive sampling was therefore used to recruit eligible participants over a period of one year (July 2019 to June 2020) from the time of attainment of ethics approval.

3.8 Source and methods of recruitment

After confirmation of labour (uterine contractions accompanied by progressive cervical dilatation) by trained research assistants or the principal investigator mothers who had been referred to MTRH from other health facilities, were approached for participation by the study team. The expectant mothers were provided with all the relevant information regarding the study in a language that they best understood;

English or Kiswahili. In situations where the potential participant neither understood English nor Kiswahili, a translator was provided after which they were given a chance to make comments or ask questions. Further, those who were willing to participate in the study were assessed for eligibility, and only those who met the inclusion criteria were enrolled. Signatures and/ or prints of the left thumb were the only acceptable form of consent to participation in the study. Therefore, participants signed or placed the left thumb print on the consent form. The principle investigator/research assistant then signed and dated the consent form and made a copy which was left in the participants file. Enrollment of study participants started and continued in this manner until the desired sample size was met.

3.9 Data collection procedure

A standard semi-structured questionnaire that incorporates both open and closed-ended questions were used to collect data for this study. Confirmation of labour was done using clinical assessment after which the survey questions were administered to those who have fully consented to participation in the study.

Data collection process was done through an electronic questionnaire that was administered by trained research assistants under supervision of principal investigator. Information on the outcomes was updated from time to time, during the study in relation to the progress of the patient.

3.10 Data quality assurance

EpiData software was used during designing of the questionnaire, data collection and entry so as to get rid of inconsistencies and to ease data cleaning. The actual data collection process was done by trained research assistants to ensure questionnaires' completeness and that relevant information is collected. This was done under close

guidance and supervision of the principal investigator. Study validity was ascertained through ensuring that data collection instruments reflect the objectives of the study.

The research assistants were trained by the principal investigator on data collection and entry. Data cleaning was done by the statistician before analysis commenced. Moreover, checks and balances were put in place to ensure the electronic questionnaire only accepts relevant entries through creation of pop-up alerts. The process of data collection and entry was done through close supervision of the principal investigator.

3.11 Data management

Data captured using the data collection forms was entered into an electronic database created using Microsoft Access. The data entered was de-identified to ensure that the confidentiality of the participants was maintained. After entry is complete, data verification and cleaning was done. The databases were encrypted with password to cushion against unauthorized access, and the data collection forms was kept in a safe cabinet under a lock and the key retained by the lead investigator. The electronic databases were backed up and kept in separate safe locations to cushion against data loss.

3.12 Data variables

The independent variable included the stage of labour in which the expectant mother was referred. This was dichotomized into latent and active phases. Other independent variables were socio-demographic characteristics of the patient (age, education and socioeconomic status), number of ANC visits, number of ultrasounds done within the pregnancy period and fetal birth weight. The last one served as a neonatal determinant while the rest were considered as maternal determinants.

Mode of delivery, PPH, perineal lacerations, vulval hematomas, cervical tears and uterine rupture were considered as maternal outcomes. Mode of delivery was categorized as spontaneous vaginal delivery or cesarean section. PPH, vulval hematoma, cervical tears and uterine rupture were considered as having existed or not while perineal lacerations were grouped into first, second, third and fourth degree tears.

APGAR score at first and fifth minute of life, as neonatal outcomes, was categorized into two namely those who scored 7 and above and those who scored below 7 in aggregate. Admission to NBU and neonatal death were both considered Boolean variables denoting whether the event happened or not.

3.13 Data analysis

The outcomes of interest in this study were grouped into two. Maternal outcomes of interest included the mode of delivery, perineal laceration, postpartum hemorrhage, uterine rupture, cervical tears and vulval hematomas. Neonatal outcomes included APGAR scores taken at the first and fifth minute, admission of newborn to the newborn unit and neonatal death.

Descriptive analysis- means and their respective standard deviations were calculated as a measure of central tendency and dispersion respectively. This was done for variables measured in continuous scale. Median was used in cases where data was skewed while proportions and percentages were used for categorical data such as level of education and socioeconomic status.

Objective 1 and 2: The indications for referral and admission to delivery time interval were presented using frequency tables

Objective 3 and 4: The maternal and fetal outcomes were presented using a frequency table.

To assess factors associated with mode of delivery, perineal lacerations, APGAR score at 5 minutes and admission to NBU at bivariate analysis the Chi square test was used, in cases where the cell count were small the Fishers' exact test were used. Variables that were significant at 0.20 were considered in the multivariate logistic regression

In all analysis a p-value less than 0.05 was considered to be significant.

3.14 Ethics consideration

Ethical approval to conduct the study was sought from the Institutional Research Ethics Committee (IREC) at the Moi Teaching and Referral Hospital and Moi University School of Medicine. Verbal and written informed consent was obtained from all the study participants. The participants were not coerced and they had a right to withdraw at any point from participation in the study. The identity and replies of participants were kept confidential.

3.16 Dissemination plan/ study utility

The study results will be presented to the department of reproductive health after which the work will also be published in a manuscript of journals both locally and internationally. The findings will also be written up as dissertation and will be made available online.

CHAPTER FOUR

4.0 RESULTS

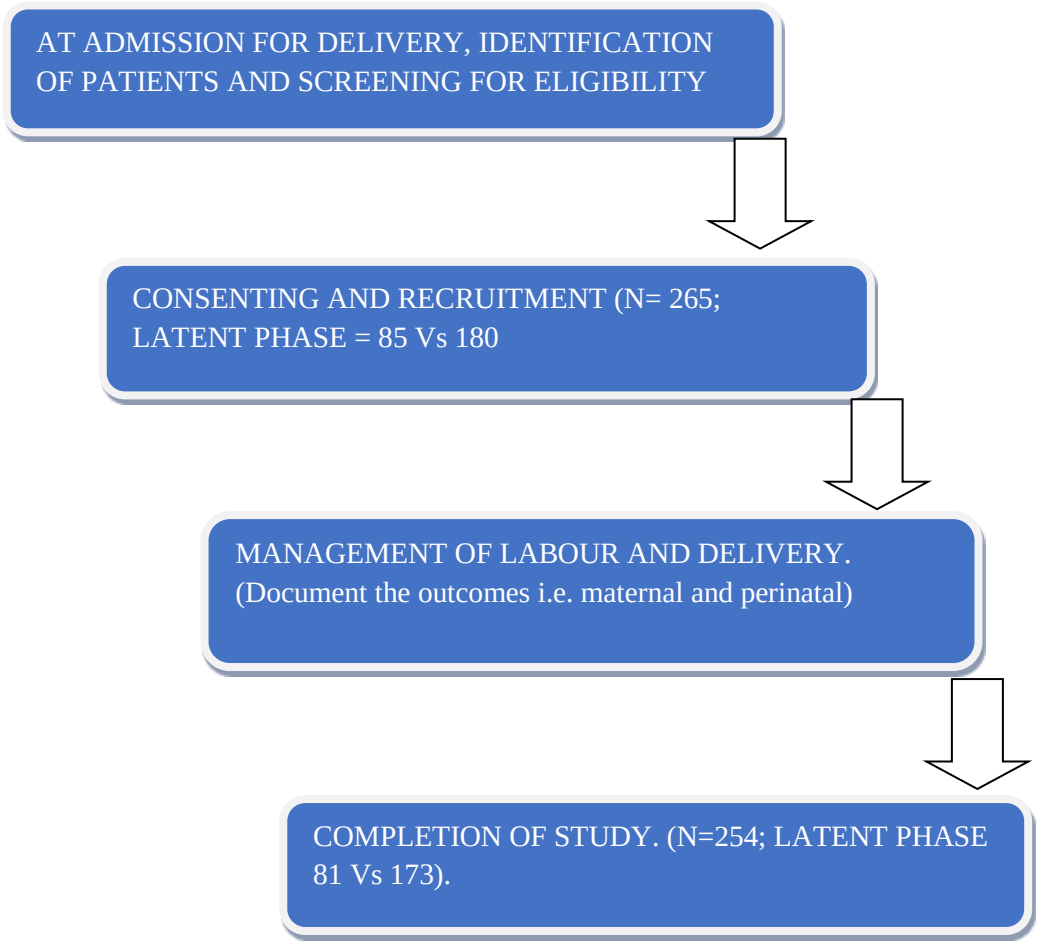

Figure 2: Study Flow Chart

Participants recruited were 265, this was to cushion for any loss or withdrawal of participants during the study. There was incomplete documentation among 11 participants, we therefore ended up remaining with 254.

4.1 Socio-demographic characteristics of the study participants

A total of 265 participants were recruited of which 254 participants completed the study.

Two hundred and twenty-six (89%) participants were aged below 35 years while 28 (11%) were 35 years and above. One hundred and eighty-eight (74%) were unemployed whereas 66 (26%) were employed. Majority (66.7%) of the study participants had attained secondary school education, 18.3% primary level and 15.5% tertiary level. A bigger percentage (78%) of the mothers had a medical insurance, NHIF, 22% lacked the cover. One hundred and eighty-eight (74%) of the mothers lived in the rural areas and 26% lived in urban areas. (Table 1).

Table 1: Socio-demographic characteristics

Variable		n (%)
Age	<35 years	226 (89%)
	≥35 years	28 (11%)
Marital status	Single	50 (19.7%)
	Married	204 (80.3%)
Education Primary	Primary	46 (18.3%)
	Secondary	168 (66.7%)
	Tertiary	39 (15.5%)
Occupation	Unemployed	188 (74%)
	Employed	66 (26%)
Monthly income	< Ksh 10,000	227 (89.4%)
	10,000-30,000	18 (7.1%)
	>Ksh 30,000	9 (3.5%)
Insurance (NHIF)	Yes	198 (78%)
	No	56 (22%)
Residence	Rural	188 (74%)
	Urban	66 (26%)

4.2 Maternal clinical characteristics

Two hundred and twenty-six (89%) mothers were aged below 35 years and 28 (11%) were above 35 years old. Ninety-seven (38.2%) participants were nulliparous while 157 (61.8%) were multiparous. Majority (81.1%) of the mothers attended ANC visits more than 4 times, 18.9% attended less than 4 times. Gestational age at delivery for 70 (27.6%) mothers was less than 37 weeks, 184 (72.4%) delivered at 37 weeks and above. (Table 3).

Table 2: Maternal clinical characteristics

		n (%)
Stage of labour	Latent	81(31.9%)
	Active	173 (68.1%)
Parity	Nulliparous	97 (38.2%)
	Multiparous	157 (61.8%)
ANC visits	< 4	48 (18.9%)
	≥4	206 (81.1%)
Gestational age	<37	70 (27.6%)
	≥37	184 (72.4%)

4.3 Referral pattern

Nurses referred 158 (62.2%) of the mothers. Clinical officers referred 75 (29.5%) and medical officers 21 (8.3%). A phone call was made from the referring facility in 216 (85%) of the mothers, there was no phone call made in 38 (15%) of them. The mode of transport used by the referred mothers were hospital ambulances 204 (80.3%) and other means 50 (19.7%). Two hundred and twelve (83.5%) mothers referred were accompanied by a health care worker while 42 (16.5%) were not accompanied by a health care worker. Two hundred and twenty-four (88.2%) of the mothers were referred from public health facilities, 20 (7.9%) from private facilities and 10 (3.9%) from faith based facilities. (Table 2).

Table 3: Referral pattern

Referring personnel	Nurse	158 (62.2%)
	Clinical officer	75 (29.5%)
	Medical officer	21 (8.3%)
Phone call	Yes	216 (85%)
	No	38 (15%)
Type of transport	Ambulance	204 (80.3%)
	Others	50 (19.7%)
Accompanied by Health worker	Yes	212 (83.5%)
	No	42 (16.5%)
Referring facility	Public	224(88.2%)
	Private	20 (7.9%)
	Faith based	10 (3.9%)

4.4 Indications for referral of mothers in labour

The most common indication for referral was prolonged labour, which accounted for 51 (20.1%) of all referrals. It was followed by pregnancy induced hypertension, which contributed to 48(19%) of the referrals. Fetal distress 34 (13.4), mal-presentation 23 (9.1%), obstructed labour 20 (7.9%) and previous cesarean section 14 (5.5%) were the other causes for referrals. Besides these, other conditions such as antepartum hemorrhage 11 (4.3%), severe anemia 9 (3.5%), post term pregnancy 8 (3.1%), prolonged rupture of membranes 7 (2.8%), cord prolapse were the cause of referral among other mothers (Table 4).

Table 4: Indications for referrals of mothers in labour

Indication	n (%)
Prolonged labour	51 (20.1%)
Preeclampsia	48 (19%)
Fetal distress	34(13.4%)
Malpresentations	23 (9.1%)
Obstructed labour	20 (7.9%)
Previous uterine scar	14 (5.5%
Antepartum hemorrhage	11 (4.3%)
Severe anaemia	9 (3.5%)
Post term pregnancy	8 (3.1%)
Prolonged rupture of membranes	7 (2.8%)
Cord prolapse	6 (2.4%)
Intrauterine fetal demise	3 (1.2%)
Reduced fetal movement	3 (1.2%)
Retained second twin	2 (0.8%)
Oligohydramnios	2 (0.8%)
Facility not operating at night	2 (0.8%)
Polyhydramnios	1 (0.4%)
Chorioamnionitis	1 (0.4%)
Preterm labour	1 (0.4%)
Intrauterine growth restriction	1 (0.4%)
Cardiac disease	1 (0.4%)
Thrombocytopenia	1 (0.4%)
For Mc Donald stitch removal	1 (0.4%)
Asthma	1 (0.4%)
Macrosomia	1 (0.4%)
Cephalopelvic disproportion	1 (0.4%)
Myometrial mass	1 (0.4%)

4.5 Admission to delivery interval

Seventy-three (28.7%) mothers delivered within one hour of admission, an equal number delivered between two and four hours of admission. Sixty-two (24.4%) delivered after five to eight hours of admission, whereas 46 (18.1%) delivered after more than eight hours. (Table 5)

Table 5: Admission to delivery interval

Time (hours)	n (%)
< 1	73(28.7%)
2 to 4	73 (28.7%)
5 to 8	62 (24.4%)
> 8	46 (18.1%)

4.5.1 Factors associated with admission to delivery time interval

Bivariate analysis

We observed that age, birth weight, mode of transport, phone call made, phase of labour and mode of delivery were statistically significantly associated with admission to delivery time interval. Specifically, a higher proportion of mothers aged less than 35 years delivered within 4 hours of admission compared to those aged ≥35 years 58.4% vs 39.3%). Mothers who were brought in by an ambulance had a higher proportion deliver within 4 hours of admission compared to those who utilized other means of transport 62.7% vs 30.0%). The mothers in which a phone call was made from the referring facility had a higher proportion deliver within 4 hours of admission compared to those in which a phone call was not made (62.5% vs 21.1%). A higher proportion of mothers admitted in active phase of labour delivered within 4 hours of admission compared to those admitted in latent phase of labour (73.4% vs 19.8%). Those mothers who delivered through C/S had a higher proportion deliver within 4 hours compared to those who delivered through SVD (71.2% vs 44.8%). Women who delivered babies weighing ≥2500g had a higher proportion deliver within 4 hours of

admission compared to those who delivered babies weighing <2500g (59.3% vs 40.0%). (Table 6)

Table 6: Bivariate analysis of factors associated with admission to delivery time interval

	Time to delivery		
Variable	**≤4 hours (n=143)**	**>4 hours (n=111)**	**p value**
Age (yrs)			0.054[1]
<35	132 (58.4%)	94 (41.6%)	
≥35	11 (39.3%)	17 (60.7%)	
Parity			0.253[1]
Multiparous	84 (53.5%)	73 (46.5%)	
Nulliparous	59 (60.8%)	38 (39.2%)	
Marital status			0.962[1]
Married	115 (56.4%)	89 (43.6%)	
Single	28 (56.0%)	22 (44.0%)	
Education level			0.921[1]
Primary	27 (58.7%)	19 (41.3%)	
Secondary	93 (55.4%)	75 (44.6%)	
Tertiary	22 (56.4%)	17 (43.6%)	
Residence			0.076[1]
Rural	112 (59.6%)	76 (40.4%)	
Urban	31 (47.0%)	35 (53.0%)	
Birth weight			0.024[1]
<2500	16 (40.0%)	24 (60.0%)	
≥2500	127 (59.3%)	87 (40.7%)	
Mode of transport			<0.001[1]
Ambulance	128 (62.7%)	76 (37.3%)	
Other	15 (30.0%)	35 (70.0%)	
Phone			<0.001[1]
No	8 (21.1%)	30 (78.9%)	
Yes	135 (62.5%)	81 (37.5%)	
Personnel referring			0.850[1]
CHW/Nurse	88 (55.7%)	70 (44.3%)	
CO	44 (58.7%)	31 (41.3%)	
MO/Obstetrician	11 (52.4%)	10 (47.6%)	
Stage of labour			<0.001[1]
Active	127 (73.4%)	46 (26.6%)	
Latent	16 (19.8%)	65 (80.2%)	
Gestation age			0.070[1]
<37	33 (47.1%)	37 (52.9%)	
≥37	110 (59.8%)	74 40.2%)	
Mode of delivery			
C/S	79 (71.2%)	32 (28.8%)	<0.001[1]
SVD	64 (44.8%)	79 (55.2%)	

1. Pearson's Chi-squared test

4.6 Multivariate analysis

On multivariate analysis, we observed that phase of labour and mode of delivery were significantly associated with admission to delivery time interval. Controlling for other variables, women who were admitted in latent phase of labour had higher odds of delivering >4 hours of admission compared to those admitted in active phase of labour (AOR=11.2, 95% CI:5.52,24.1). In terms of mode of delivery, those who delivered through SVD had higher odds of delivering >4 hours of admission compared to those who delivered through C/S (AOR=3.67, 95% CI:0.91,7.34) (Table 7).

Table 7: Multivariate analysis of factors associated with time to delivery

Characteristic	OR	95% CI	p-value
Age in categories			
<35	1		
≥35	2.42	0.88,6.78	0.087
Residence			
Rural	1		
Urban	1.16	0.56,2.38	0.700
Birth weight			
<2500	1		
≥2500	0.43	0.18,1.01	0.055
Mode of transport			
Ambulance	1		
Other	0.69	0.16,2.62	0.600
Phone call			
No	1		
Yes	0.24	0.05,1.14	0.078
Stage of labor			
Active	1		
Latent	11.2	5.52,24.1	<0.001
Gestation age			
<37	1		
≥37	0.95	0.47,1.97	0.900
Gestation age			
C/S	1		
SVD	3.67	.91, 7.34	<0.001

4.7 Maternal Outcomes of mothers referred in labour

Out of 254 mothers who were delivered 143 (56.3%) underwent normal vaginal delivery while cesarean section was done in 111 (43.7%) mothers. Nine (3.5%) mothers developed PPH.

Sixty (23.6%) participants sustained perineal lacerations and 194 (76.4%) did not sustain a laceration. Of those who sustained perineal laceration, most (55.7%) had first degree. Only one (0.04%) mother had a uterine rupture, no one sustained a vulval hematoma or a cervical tear. (Table 8).

Table 8: Maternal outcome

Outcome	Overall (N=254)
Mode of delivery	
Cesarean section	111 (43.7%)
SVD	143 (56.3%)
Post-partum hemorrhage	
No	245 (96.5%)
Yes	9 (3.5%)
Perineal lacerations	
No	194 (76.4%)
Yes	60 (23.6%)
Degree of laceration	
1st	34 (55.7%)
2nd	23 (37.7%)
3rd	3 (4.9%)
4th	1 (1.6%)
Vulval hematoma	
No	254 (100.0%)
Cervical tear	
No	254 (100.0%)
Uterine rupture	
No	253 (99.6%)
Yes	1 (0.4%)

4.7.1 Factors associated with maternal outcome

a. Mode of delivery

Bivariate Analysis

On bivariate analysis, we observed that the only variables that were statistically significantly associated with mode of delivery were mode of transport and whether a phone call was made. We observed that a higher proportion of those who were brought by an Ambulance underwent a Cesarean section (49%) compared to those who used a different mode of transport (22%). Referred mothers who had a phone call made from the referring facility had a higher proportion undergoing Cesarean section (47.2%) compared to those where there was no phone call prior to referral (23.7%) (Table 9).

Table 9: Bivariate analysis of factors associated with Mode of delivery

	Mode of delivery		
	Cesarean section (n=111)	SVD(n=143)	
Variable	**Freq (Row %)**	**Freq (Row %)**	**p value**
Age (yrs)			0.758[1]
<35	98 (43.4%)	128 (56.6%)	
≥35	13 (46.4%)	15 (53.6%)	
Parity			0.497[1]
Multiparous	66 (42.0%)	91 (58.0%)	
Nulliparous	45 (46.4%)	52 (53.6%)	
Marital status			0.715[1]
Married	88 (43.1%)	116 (56.9%)	
Single	23 (46.0%)	27 (54.0%)	
Education level			0.760[1]
Primary	18 (39.1%)	28 (60.9%)	
Secondary	76 (45.2%)	92 (54.8%)	
Tertiary	17 (43.6%)	22 (56.4%)	
Residence			0.092[1]
Rural	88 (46.8%)	100 (53.2%)	
Urban	23 (34.8%)	43 (65.2%)	
Birth weight (grams)			0.607[1]
<2500	16 (40.0%)	24 (60.0%)	
≥2500	95 (44.4%)	119 (55.6%)	
Mode of transport			<0.001[1]
Ambulance	100 (49.0%)	104 (51.0%)	
Other	11 (22.0%)	39 (78.0%)	
Phone			0.007[1]
No	9 (23.7%)	29 (76.3%)	
Yes	102 (47.2%)	114 (52.8%)	
Personnel referring			0.852[1]
CHW/Nurse	67 (42.4%)	91 (57.6%)	
CO	34 (45.3%)	41 (54.7%)	
MO/Obstetrician	10 (47.6%)	11 (52.4%)	
Stage of labour			0.356[1]
Active	79 (45.7%)	94 (54.3%)	
Latent	32 (39.5%)	49 (60.5%)	
Gestation age (wks)			0.309[1]
<37	27 (38.6%)	43 (61.4%)	
≥37	84 (45.7%)	100 (54.3%)	

1. Pearson's Chi-squared test

Multivariate analysis

Factors that were significant at bivariate at 0.20 level of significance were considered in the multivariate analysis. In the multivariate analysis we observed none of the factors was statistically significantly associated with mode of delivery (P-value> 0.05) (Table 8).

Table 10: Multivariate analysis of factors associated with mode of delivery

Characteristic	Adjusted OR	95% CI	p-value
Residence			
Rural	1		
Urban	0.71	0.39, 1.30	0.300
Phone			
No	1		
Yes	0.67	0.09, 3.19	0.600
Mode of transport			
Ambulance	1		
Other	0.23	0.03, 0.90	0.061

a. Perineal Lacerations

Bivariate analysis

We observed that age, parity, residence, birth weight and mode of transport were statistically significantly associated with perineal lacerations. Specifically, a higher proportion of women aged less than 35 years had perineal tears compared to those aged 35 and older (26.1% vs 3.6%). Women who were nulliparous had a higher proportion with tears compared to the multiparous women (30.9% vs 19.1%). In terms of residence those living in urban had a higher proportion with tears compared to those in the rural areas (36.4% vs 19.1%). Women who delivered babies weighing above 2500grams had a higher proportion with tears (26.2%) compared to those who had baby weighing less than 2500 grams (10%). For the referral characteristics women who were brought in by an ambulance a lower proportion had tears compared to women who used other means of transport (36% vs 20.6%) (Table 11).

Table 11: Factors associated with Perineal lacerations

	Perineal laceration		
	No (n=194)	Yes (n=60)	Pvalue
Variable	**Freq(Row%)**	**Freq (Row %)**	
Age (yrs)			0.008[1]
<35	167 (73.9%)	59 (26.1%)	
≥35	27 (96.4%)	1 (3.6%)	
Parity			0.031[1]
Multiparous	127 (80.9%)	30 (19.1%)	
Nulliparous	67 (69.1%)	30 (30.9%)	
Marital status			0.659[1]
Married	157 (77.0%)	47 (23.0%)	
Single	37 (74.0%)	13 (26.0%)	
Education level			0.654[1]
Primary	34 (73.9%)	12 (26.1%)	
Secondary	128 (76.2%)	40 (23.8%)	
Tertiary	32 (82.1%)	7 (17.9%)	
Residence			0.005[1]
Rural	152 (80.9%)	36 (19.1%)	
Urban	42 (63.6%)	24 (36.4%)	
Birth weight (grams)			0.026[2]
<2500	36 (90.0%)	4 (10.0%)	
≥2500	158 (73.8%)	56 (26.2%)	
Phone			0.402[1]
No	27 (71.1%)	11 (28.9%)	
Yes	167 (77.3%)	49 (22.7%)	
Mode of transport			0.021[1]
Ambulance	162 (79.4%)	42 (20.6%)	
Other	32 (64.0%)	18 (36.0%)	
Personnel referring			0.973[2]
CHW/Nurse	120 (75.9%)	38 (24.1%)	
CO	58 (77.3%)	17 (22.7%)	
MO/Obstetrician	16 (76.2%)	5 (23.8%)	
Stage of labour			0.966[1]
Active	132 (76.3%)	41 (23.7%)	
Latent	62 (76.5%)	19 (23.5%)	
Gestation age (wks)			0.242[1]
<37	57 (81.4%)	13 (18.6%)	
≥37	137 (74.5%)	47 25.5%)	

1.Pearson's Chi-squared test

2. Fisher's Exact Test for Count Data

Multivariate Analysis

On multivariate analysis, we observed that age, residence, and mode of transport were significantly associated with perineal lacerations. Controlling for other variables women aged 35 and above had statistically significantly lower odds for lacerations compared to those aged below 35 years (AOR=0.11, 95%CI:0.01,0.56) while women residing in urban areas had significantly higher odds for perineal lacerations compared to those residing in rural areas (AOR=2.04, 95%CI:1.05, 3.95). In terms of mode of transport adjusting for age, parity and residence women who were brought in by other means other than ambulance had a higher odds of lacerations compared to those who used an ambulance (AOR=2.20,95%CI:1.05,4.56). (Table 12).

Table 12: Multivariate analysis of factors associated with Perineal lacerations

Characteristic	Adjusted OR	95%CI	p-value
Age in years			
<35	1		
≥35	0.11	0.01,0.56	0.034
Parity			
Multiparous	1		
Nulliparous	1.70	0.92, 3.18	0.092
Residence			
Rural	1		
Urban	2.04	1.05,3.95	0.034
Birth weight (grams)			
<2500	1		
≥2500	2.95	1.08,10.4	0.055
Mode of transport			
Ambulance	1		
Other	2.20	1.05,4.56	0.034

4.8 Fetal Outcomes in Mothers Referred in labour

Two hundred and twelve (83.5%) fetuses had an APGAR score of more than 7 at 5 minutes while 42 (16.5%) had a score of less than seven at 5 minutes. The total number of live births were 243 (95.7%) among which 43 (17.7%) required admission to NBU. There were 11 (4.3%) still births. Fresh still births were 8 (72.7%) and macerated still births were 3 (27.3%). Two hundred and fourteen (84.3%) babies delivered weighed above 2500g, 40 (15.7%) babies weighed below 2500g (Table 13).

Table 13: Fetal Outcome

Outcome	Overall (N=254)
Pregnancy outcome	
Live Birth	243 (95.7%)
Still birth	11 (4.3%)
Still birth	
FSB	8 (72.7%)
MSB	3 (27.3%)
Birth weight (grams)	
<2500	40 (15.7%)
≥2500	214 (84.3%)
Apgar 1min	
<7	101 (39.8%)
≥7	153 (60.2%)
Apgar 5min	
<7	42 (16.5%)
≥7	212 (83.5%)
Admitted NBU	
No	200 (78.7%)
Yes	43 (16.9%)

4.8.1 Factors associated with Fetal outcomes

a. Apgar at 5 minutes

Bivariate Analysis

On bivariate analysis, birthweight greater than 2500 grams, active stage of labour, time to delivery less than 4 hours and gestation age more than 37 weeks were statistically significantly associated with an APGAR score of between 7 and 10 (Table 14)

Table 14: Bivariate analysis of factors associated with Apgar5

	Apgar		
	<7 (n=42)	**≥7 (n=212)**	
Variable	**Freq(Row%)**	**Freq (Row %)**	**p value**
Age (yrs)			1.000[1]
<35	38 (16.8%)	188 (83.2%)	
≥35	4 (14.3%)	24 (85.7%)	
Parity			0.080[2]
Multiparous	31 (19.7%)	126 (80.3%)	
Nulliparous	11 (11.3%)	86 (88.7%)	
Marital status			0.676[1]
Married	35 (17.2%)	169 (82.8%)	
Single	7 (14.0%)	43 (86.0%)	
Education level			0.487[1]
Primary	9 (19.6%)	37 (80.4%)	
Secondary	29 (17.3%)	139 (82.7%)	
Tertiary	4 (10.3%)	35 (89.7%)	
Residence			0.177[1]
Rural	35 (18.6%)	153 (81.4%)	
Urban	7 (10.6%)	59 (89.4%)	
Birth weight (grams)			< 0.001[2]
<2500	19 (47.5%)	21 (52.5%)	
≥2500	23 (10.7%)	191 (89.3%)	
Phone			0.813[1]
No	7 (18.4%)	31 (81.6%)	
Yes	35 (16.2%)	181 (83.8%)	
Mode of transport			0.462[2]
Ambulance	32 (15.7%)	172 (84.3%)	
Other	10 (20.0%)	40 (80.0%)	
Personnel referring			0.154[1]
CHW/Nurse	21 (13.3%)	137 (86.7%)	
CO	16 (21.3%)	59 (78.7%)	
MO/Obstetrician	5 (23.8%)	16 (76.2%)	
Stage of labour			0.006[2]
Active	21 (12.1%)	152 (87.9%)	
Latent	21 (25.9%)	60 (74.1%)	
Time to delivery			0.003[2]
≤4 hours	15 (10.5%)	128 (89.5%)	
>4 hours	27 (24.3%)	84 (75.7%)	
Mode of delivery			0.575[2]
Cesarean section	20 (18.0%)	91 (82.0%)	
SVD	22 (15.4%)	121 (84.6%)	
Gestation Age (wks)			0.015[2]
<37	18 (25.7%)	52 (74.3%)	
≥37	24 (13.0%)	160 7.0%)	

1.Fisher's Exact Test for Count Data

2.Pearson's Chi-squared test

Multivariate Analysis

On multivariate analysis the factors that were statistically significantly associated with APGAR was birth weight. Adjusting for parity, stage of labour, time to delivery and gestation age babies weighing 2500 grams and above had a 6.61 odds of having an APGAR of 7 and above at 5 minutes compared to babies who were born weighing less than 2500 grams (AOR=6.61, 95%CI:2.90,15.3) (Table 15).

Table 15: Multivariate analysis of factors associated with Apgar5

Characteristic	OR	95%CI	p-value
Parity			
Multiparous	1		
Nulliparous	1.81	0.83,4.19	0.150
Birth weight(grams)			
<2500	1		
≥2500	6.61	2.90,15.3	<0.001
Stage of labor			
Active	1		
Latent	0.58	0.24,1.40	0.200
Time to delivery			
≤4 hours	1		
>4 hours	0.62	0.26,1.49	0.300
Gestation Age (wks)			
<37	1		
≥37	1.28	0.56,2.81	0.600

b. Admission to NBU

Bivariate Analysis

Bivariate analysis showed a significant association between admission to NBU with birth weight <2500g, admission in latent phase of labour and gestational age <37 weeks. Age of the mother, parity, marital status, level of education, residence, phone call made, mode of transport, referring personnel and admission to delivery interval all showed non-significant association with admission to NBU of neonates (Table 16).

Table 16: Bivariate analysis of factors associated with Admission to NBU

	Admission to NBU		
	No (n=200)	**Yes (n=43)**	
Variable	**Freq(Row%)**	**Freq (Row %)**	**p value**
Age (yrs)			0.600[1]
<35	178(82.8%)	37 (17.2%)	
≥35	22 (78.6%)	6 (21.4%)	
Parity			0.457[2]
Multiparous	118(80.8%)	28 (19.2%)	
Nulliparous	82 (84.5%)	15 (15.5%)	
Marital status			0.204[1]
Married	157(80.5%)	38 (19.5%)	
Single	43 (89.6%)	5 (10.4%)	
Education level			0.795[1]
Primary	35 (85.4%)	6 (14.6%)	
Secondary	133(82.1%)	29 (17.9%)	
Tertiary	31 (79.5%)	8 (20.5%)	
Residence			0.450[1]
Rural	146(81.1%)	34 (18.9%)	
Urban	54 (85.7%)	9 (14.3%)	
Birth weight (grams)			< 0.001[2]
<2500	15 (41.7%)	21 (58.3%)	
≥2500	185(89.4%)	22 (10.6%)	
Phone			0.488[1]

No	29 (78.4%)	8 (21.6%)	
Yes	171(83.0%)	35 (17.0%)	
Mode of transport			0.525[2]
Ambulance	162(83.1%)	33 (16.9%)	
Other	38 (79.2%)	10 (20.8%)	
Personnel referring			0.111[1]
CHW/Nurse	126(82.4%)	27 (17.6%)	
CO	60 (87.0%)	9 (13.0%)	
MO/Obstetrician	14 (66.7%)	7 (33.3%)	
Stage of labour			0.031[2]
Active	145(85.8%)	24 (14.2%)	
Latent	55 (74.3%)	19 (25.7%)	
Time to delivery			0.050[2]
≤4 hours	121(86.4%)	19 (13.6%)	
>4 hours	79 (76.7%)	24 (23.3%)	
Mode of delivery			0.020[2]
Cesarean section	82 (75.9%)	26 (24.1%)	
SVD	118(87.4%)	17 (12.6%)	
Gestation Age (wks)			0.014[2]
<37	47 (72.3%)	18 (27.7%)	
≥37	153(86.0%)	25 14.0%)	

1.Fisher's Exact Test for Count Data
2.Pearson's Chi-squared test

Multivariate Analysis

Results obtained through fitting a multivariate logistic regression model showed that birth weight more than 2500 grams and SVD were statistically significantly protective of admission to NBU. Adjusting for other referring personnel, stage of labor, time to delivery, mode of delivery and gestation age babies born weighing 2500grams and above had a lower odds of admission to NBU compared to those born weighing less than 2500 grams (AOR=0.09,95%CI: 0.03, 0.21). While controlling for birth weight, referring personnel, stage of labor, time to delivery and gestation age babies born via SVD had a lower odds of admission to NBU compared to those born via CS (AOR=0.29: 95%CI:0.12,0.65) (Table 17).

Table 17: Multivariate analysis of factors associated with admission to NBU

Characteristic	OR	95% CI	p-value
Birth weight (grams)			
<2500	1		
≥2500	0.09	0.03,0.21	<0.001
Personnel referring			
CHW/Nurse	1		
CO	0.66	0.24,1.64	0.400
MO/Obstetrician	1.31	0.36,4.32	0.700
Stage of labor			
Active	1		
Latent	1.69	0.66,4.34	0.300
Time to delivery			
≤4 hours	1		
>4 hours	1.67	0.65,4.24	0.300
Mode of delivery			
Cesarean section			
SVD	0.29	0.12,0.65	0.004
Gestation age (wks)			
<37	1		
≥37	0.63	0.27,1.53	0.300

CHAPTER FIVE

5.0 DISCUSSION

The study was undertaken in the department of reproductive health, MTRH, to determine feto-maternal outcomes of mothers in labour referred to our institution. The study includes 254 cases of obstetric emergency referrals to MTRH from nearby rural and urban areas during the study period, July 2019 to June 2020.

5.1 Socio-demographics

A total of 254 participants were recruited in this study. A study in Kerala state in India by Shenoy et al on assessing the overall age distribution found that majority (73.4%) of the respondents were between 20-30 years. In central India, Goswami et al had their maximum number of participants (78%) in the 20-30 years' age group. In our study majority (89%) of the participants were aged below 35 years.

Onwudiegwu et al conducted a study in Nigeria and found that 92.4% of participants were married, in our study 80.3% were married while 19.7% were single. The level of education of 66.7% was secondary, 18.3% primary and 15.5% tertiary education. Majority (74%) of the participants were unemployed while 26% were employed.

The income status showed that 227 (89.7%) earned a monthly income that was less than KSh. 10,000, 7.1% earned a monthly income between KSh. 10,000-30,000, while 3.5% had a monthly income more than KSh. 30,000.

In Manipur state in India, Badal et al found that 66.01% of the participants were from rural area while Shenoy et al found 82.3%. In our study 188(74%) resided in the rural areas and 66 (26%) resided in the urban areas. This high proportion of rural population may be attributed to delay in access to health care and lack of awareness and poor transport facilities.

One hundred and ninety-eight (78%) had a medical insurance cover (NHIF) whereas 56 (22%) did not have NHIF cover. The high rate of insurance cover may be due to the provision of free maternity services by the government of Kenya, through the Linda Mama NHIF programme.

Over half of the study participants (62.2%) were referred by nursing officers from peripheral facilities, 75 (29.5%) were referred by clinical officers while 21 (8.3%) were referred by medical officers. A phone call was made from the referring facility in 85% of the participants, 15% mothers were referred without a phone call being made to MTRH.

In a study conducted by Nkyekyer in a teaching hospital in Ghana only 27.3% of the patients travelled by ambulance, this is similar to a study by Rohit et al in a tertiary care center India where 30.7% travelled by ambulance. In contrast, in our study 80.3% of the referred mothers used ambulance, 19.7% travelled by other means of transport. The high proportion of mothers using ambulance may be due to devolution of health by the government of Kenya, whereby each sub-county has a stand by ambulance for use.

Nkyekyer noted that 45.8% of the referred patients were accompanied by a health care staff. In a study conducted in Nagpur India, Sabale et al found that only 7.11% patients were accompanied by a health care staff. In contrast, in our study 83.5% mothers were accompanied by a health care staff. This could be attributed to the fact that most (80.3%) mothers utilized ambulance for transport to MTRH. It is a norm that a health care staff has to be in an ambulance whenever a patient is referred.

In our study 88.2% mothers were referred from public facilities, 7.9% from private facilities and 3.9% from faith based facilities. In contrast, Nkyekyer found that 36.4% were from public, 35.6% from private and 28% from faith based facilities.

5.2 Maternal characteristics

One hundred and seventy-three (68.1%) mothers were admitted in active phase of labour while 81 (31.9%) came in latent phase of labour.

Badal et al noted 50.32% nulliparous, 45.75% multiparous and 3.92% grand multiparous. Shenoy et al had 48.4% nulliparous, 50% multiparous and 1.6% grand multiparous. Onwudigwe et al had 25.7% nulliparous, 47.2% multiparous and 27.2% grand multiparous. In contrast in our study, we had 38.2% nulliparous and 61.8% were multiparous.

Majority (72.4%) of the mothers' gestational age at the time of admission was ≥37 weeks, whereas 27.6% were below 37 weeks. In a study by Onwudiegwu et al, they classified gestational ages into 26-36, 37-42 and ≥42 the proportions were 34.9%, 62.2% and 2.8% respectively.

5.3 Indications for referral

The most common reasons for referral were prolonged labour (20.1%), preeclampsia (19%), fetal distress (13.4%) and malpresentation (9.1%). This is comparable to a study done in North India by Kant et al (2018) in which they found reasons for obstetric referrals to be preeclampsia (17.0%), fetal distress (10.6%) and malpresentation (8.5%). Other studies have also reported that the patients were referred to tertiary care hospitals for conditions such as preeclampsia, hemorrhage, fetal distress and prolonged labour (Khatoon et al (2011), Strand et al (2009), Maskey (2015), Nkyekyer (2000)). The findings of previous studies were similar to our

findings, may be due to almost similar health system characteristics in developing countries.

5.4 Admission to delivery interval

More than half (57.4%) of the mothers delivered within four hours of admission. This may be due to the fact that majority (68.1%) of the mothers were admitted in the active phase of labour. Sabale et al (2015) noted that admission to delivery interval in majority (46.97%) of the patients was 6 hours or less. Being referred in active phase of labour and delivery through cesarean section were significantly associated with delivering within four hours of admission.

5.5 Maternal outcomes

Out of the total referred cases, 56.3% had vaginal delivery and 43.7% had cesarean section. This is comparable to a study by Poornima et al (2018) in Mumbai India, in which 56% underwent normal vaginal delivery while 44% underwent cesarean section. Sabale et al (2015) found cesarean section rate of 42.11%. Sorbye et al noted a cesarean section rate of 55% and Shenoy et al (2018) found a cesarean section rate of 83% in their studies. Our results are comparable with most of the studies and we can conclude that the rate of cesarean section is substantially high in referral cases. The higher cesarean section rate suggest that the referral system successfully identifies high-risk birth.

Nine (3.5%) mothers developed PPH in our study. This finding was similar to the one by Sorbye et al (2011) which the PPH rate was 3.5%, they did a cohort study in a tertiary hospital in northeastern Tanzania. In the contrary, Sabale et al (2015) noted a PPH rate of 19.99% while Kaye et al (2011) in Uganda found a rate of 24.4% among

referred mothers. The lower PPH rate in our study could be attributed to routine active management of third stage of labour in our institution.

Perineal laceration was sustained by 23.6% of the mothers, previous studies did not look into perineal laceration as a maternal outcome. Mothers aged ≥35 years had lower odds for sustaining lacerations compared to those aged < 35 years. Women residing in urban areas had significantly higher odds for perineal lacerations compared to those residing in rural areas. Mothers brought in by other means other than ambulance had a higher odds of lacerations compared to those who used an ambulance.

5.3 Fetal outcomes

In our study 16.5% of the neonates had an APGAR score of less than 7 in 5 minutes. In the contrary, in a study by Sorbye et al (2011) 5.3% of the neonates had an APGAR score of less than 7 at 5 minutes. Babies weighing ≥2500grams had a 6.61 odds of having an APGAR of ≥7 at 5 minutes compared to babies born weighing <2500grams. This could be attributed to the fact that with higher weight the babies have good lung maturity and therefore better APGAR score.

The total number of live births were 243 (95.7%) among which 43 (17.7%) required admission to NBU. This was comparable to studies by Rohit et al (2016) and Sabale et al (2015) in which NBU admission rates were 16.55% and 14.36% respectively. Badal et al (2017) found NBU admission rate of 30.7%. Babies born weighing ≥2500grams had a lower odds of admission to NBU compared to those born weighing <2500grams. This could be attributed to the fact that at ≥ 2500grams lung maturity of the neonates is better. Babies delivered via SVD had a lower odds of admission to NBU compared to those delivered through cesarean section.

Out of 254 deliveries there were 11 (4.3%) still births. Badal et al (2017) noted a still birth of 1.33% while Rohit et al (2016) had a rate of 10.01%.

In their study, Rohit et al (2016) found that 17.57% of all neonates had low birth weight (<2500g), this is comparable to the present study in which 15.7% neonates had low birth weight. However, Sabale et al (2015) in their study found that 54.87% of all neonates had low birth weight.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATION

6.1 Conclusion

We found out that most mothers were referred due to prolonged labour, pregnancy induced hypertension, fetal distress and mal-presentation. We established that more than half of the mothers referred in labour delivered within four hours of admission. We assessed the maternal outcomes of mothers referred in labour. Our conclusions are as follows:

i. Cesarean section rate was high (43.7%)
ii. Post-partum hemorrhage occurred in few mothers (3.5%).
iii. Approximately a quarter of the mothers had perineal lacerations. Age below 35 years, urban residence and mode of transport other than ambulance significantly contributed to sustaining perineal laceration.

We assessed the fetal outcomes of mothers referred in labour, we concluded as follows;

i. The neonates who had APGAR <7 at 5 minutes (16.5%) were mostly the ones who had low birth weight.
ii. The still birth rate was low (4.3%)
iii. The NBU admission rate was 17.7%. Birth weight <2500 grams and delivery through cesarean section contributed significantly to neonates' NBU admission.

6.2 Study limitation

In the present study we were not able to compare feto-maternal outcomes of mothers who were referred in labour with those who were not referred.

6.3 Recommendation

1. Mothers who have been referred in labour should be categorized as high-risk births and therefore monitored closely in order to detect any adverse outcome early.
2. We recommend for a study to compare feto-maternal outcomes of mothers referred in labour and those who were not referred.

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APPENDICES

APPENDIX I: PATIENT INFORMATION AND INFORMED CONSENT FORM

Dear participant,

My name is Dr. Dennis Oeri. I am a qualified medical doctor, registered by the Kenya Medical Practitioners and Dentist Council. I am currently pursuing a Master's Degree in Reproductive Health at Moi University. I am conducting a study on feto-maternal outcomes of mothers in labour referred to MTRH. I wish to invite you to participate in this study. Participation is entirely voluntary. However, your participation is important as it will provide valuable information regarding the feto-maternal outcomes of mothers in labour referred to MTRH.

The information gathered from this research shall be confidential and your identity will be protected (your name will not be used and you will be identified with a study number). The findings from our study shall be used to improve services in MTRH, inform protocols and may be published in medical journals and or presented in scientific conferences (local or international). Your management will not be affected in any way by your participation in this study. You will be free to withdraw from the study at any point in time without any repercussions.

The Moi University/MTRH Ethics and Research Committee has approved the study.

For any question or clarification, please do not hesitate to contact me on 0721 140 430, my research assistants or:

The chairperson,

IREC, MOI TEACHING AND REFERRAL HOSPITAL

P.O BOX 3-30100

ELDORET.

Tel: +254 787 723 677.

Your participation is highly appreciated. Thank you.

Consent

I have read the information herein (or it has been read to me) concerning this study and I understand what is required of me to participate in the study. My questions and concerns have been addressed to my satisfaction. I also understand that all the information provided is only for the purpose of research. I voluntarily agree to take part in the study.

Respondent's signature (or thumb print) ……Date……...

Witness' signature (PI or research assistant) ……..Date……...

APPENDIX II: CHETI CHA KUKUBALI KUSHIRIKI KATIKA UTAFITI

Jina langu ni daktari Dennis Oeri. Nimehitimu kama daktari nakusajiliwa na tume ya kusajili madaktari Kenya. Kwa sasa mimi ni mwanafunzi wa shahada ya uzamili (MMed) katika afya ya uzazi, chuo kikuu cha Moi. Ninafanya utafiti kuhusu matokeo ya uzazi ya kina mama wajawazito walioko kwa leba na vile vile wametumua kutoka hospitali nyingine kuja MTRH. Naomba kukualika ushiriki kwa huu utafiti. Kushiriki ni kwa hiari. Kushiriki kwako kwenye utafiti ni muhimu kwani itatuwezesha kupata habari ambazo zitachangia katika kuboresha huduma za afya ya kina mama wajawazito.

Habari zitakazo kusanywa ikiwemo utambulisho wako utalindwa kwa mujibu wa sheria (jina lako halitatumika na utatambuliwa kwa nambari itakayojulikana na mimi au wasaidizi wangu). Matokeo ya utafiti huu yanaweza kutumiwa kuunda itifaki au kuchapishwa katika majarida ya matibabu na kuwasilishwa kwa mikutano yakisayansi humu nchini na hata kimataifa. Matibabu yako hayataadhirika kwa vyovyote vile nakujiunga kwako kwa huu utafiti. Una huru wakujiondoa kutoka utafiti huu wakati wowote bila majuto yoyote.

Kamati ya utafiti na maadili (IREC) ya chuo kikuu cha Moi na Hospitali ya Rufaa ya Moi imeidhinisha utafiti huu. Kwa swali lolote au ufafanuzi zaidi, tafadhali usisite kuwasiliana na wasaidizi wangu au mimi kwa nambari ya simu 0721 140 430. Pia unaweza kuwasiliana na kamati ya maadili na utafiti kwa anwani zifuatazo:

Mwenyekiti wa IREC,

Hospitali ya Rufaa ya Moi (MTRH),

Sanduku la posta 3-30100,

ELDORET.

Nambari ya simu +254 787 723 677.

Asante sana.

Ridhaa ya kushiriki kwenye utafiti

Nimejuzua au kusoma habari iliyopo katika cheti hiki na nimeelewa kile kinachohitajika kwangu kushiriki katika utafiti huu. Maswali yote na wasiwasi wowote niliokuwa nayo yameshughulikiwa kikamilifu. Pia nimeelewa ya kwamba habari nitakazo toa ni za matumizi ya utafiti pekee.

Kwa hiari yangu nimekubali kushiriki katika utafiti huu.

Sahihi ya mshiriki/ kidole gumba……. Tarehe……

Sahihi ya shahidi (Mtafiti mkuu/wasaidizi) …… Tarehe……

APPENDIX III: QUESTIONNAIRE

PART A: BIO DATA

This section presents the socio demographics of the respondents (Tick where applicable)

1. Name
   (Abbreviations)_____
2. IP NO.…… Date (dd/mm/yy) ……
3. Age (years)

18 – 34 [ ] ≥35 [ ]

4. Parity……Gravida…….
5. Marital status:

Single [ ] Married [ ] Separated [ ] Divorced [ ] Engaged [ ] Widowed [ ]

6. Level of education

Primary [ ] Secondary [ ] Tertiary College [ ] University [ ]

7. Occupation

Not employed [ ] Self Employed [ ] Employed [ ]

8. Estimated income per month

<ksh.10, 000 [ ] 10,000-30,000 [ ] 30,000-50,000 [ ] >50,000 [ ]

9. Health insurance cover (NHIF)
   Yes [ ] No [ ]

10. Residence
    Rural [ ] Urban [ ]

Part B: Referral data

11. Referring facility name…….
12. Referring facility Public [ ] Private [ ] Faith based [ ]
13. Reason for referral……...

    ……

    Referring personnel

    CHW [ ] Nurse [ ] CO [ ] MO [ ] Obstetrician [ ]
14. Was a phone call made from the referring facility?

    Yes [ ] No [ ]
15. Type of transport

    Ambulance [ ] Private means [ ]
16. Was the patient accompanied by a health care provider?

    Yes [ ] No [ ]

Part C: Obstetrical and maternal outcome data

17. Gestational age at delivery (weeks) ……..
18. Cervical dilatation on admission

    <4cm [ ] ≥4cm [ ]
19. Number of ante natal visits attended

    None [ ] 1-2 [ ] 3-4 [ ] >4 [ ]
20. Is the ANC profile complete (blood group, Hb, VDRL, HIV, Bp, urinalysis)?

    Yes [ ] No [ ]

21. Mode of delivery

    Vaginal delivery [ ] Caesarean section [ ]

22. Admission to delivery interval

    <1hour [ ] 2-4hours [ ] 5-8hours [ ] >8hours [ ]

23. Post-partum hemorrhage

Yes [ ] No[ ]

24. Perineal lacerations Yes [ ] No [ ]

If yes, what degree of laceration/tear?

1st [ ] 2nd [ ] 3rd [ ] 4th [ ]

25. Vulval hematoma: Yes [ ] No [ ]

26. Cervical tear: Yes [ ] No [ ]

27. Uterine rupture: Yes [ ] No [ ]

Part D: Fetal outcome (s)

30. Pregnancy outcome: Live birth [ ] Stillbirths [ ]

If still birth,

FSB [ ] MSB [ ]

31. Birth weight (grams)

<2500 [ ] ≥2500 [ ]

32. Apgar score at 1 minute

<7 [ ] ≥7 [ ]

33. Apgar score at 5 minutes

<7 [ ] ≥7 [ ]

34. Was the baby admitted to NBU?

Yes [ ] No [ ]

Thank you for your cooperation and please check if there is any quiz that you forgot to answer.

…….. END ……

APPENDIX IV: STUDY SCHEDULE

TIME	ACTIVITY
April 2019	Submission of proposal to IREC
April-May 2019	IREC review and approval
June 2019	Pilot data collection Design of data base
July 2019-July 2020	Data collection
August 2020	Data entry and analysis
September 2020	Report writing
November 2020	Mock defense
January 2021	Thesis submission

APPENDIX V: BUDGET

Items	**Quantity**	**Unit price**	**Total (Kshs)**
STATIONERY / EQUIPMENT			
Printing papers	5 reams	500.00	2500.00
Black cartridges	2	2000.00	4000.00
Writing pens	1 packet	600.00	600.00
Flash Disc	1	2000.00	2000.00
Box files	2	250.00	250.00
Document wallets	4	100.00	400.00
Sub total			**10,000.00**
PROPOSAL DEVELOPMENT			
Printing drafts & final proposal	10 copies	700.00	7,000.00
Photocopies of final proposal	6copies	150.00	900.00
Binding of copies of proposal	6copies	100.00	600.00
Sub total			**8,500.00**
PERSONNEL			
Biostatistician	1	40,000.00	40,000.00
Research assistants	3	15,000.00	45,000.00
Sub total			**85,000.00**
THESIS DEVELOPMENT			
Printing of drafts and final thesis	10copies	1,000.00	10,000.00
Photocopy of final thesis	6copies	2,000.00	12,000.00
Binding of thesis	6copies	300.00	1,800.00
Sub total			**23,800.00**
TOTAL			**127,300.00**
Miscellaneous expenditure (10% of total)			**12,730.00**
GRAND TOTAL			**140,030.00**

APPENDIX VI: IREC AND MTRH APPROVALS

INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE (IREC)

MOI TEACHING AND REFERRAL HOSPITAL
P.O. BOX 3
ELDORET
Tel: 33471/2/3

MOI UNIVERSITY
COLLEGE OF HEALTH SCIENCES
P.O. BOX 4606
ELDORET
Tel: 33471/2/3

Reference: IREC/2019/88
Approval Number: 0003365

27th June, 2019

Dr. Dennis Oeri Ong'era,
Moi University,
School of Medicine,
P.O. Box 4606-30100,
ELDORET-KENYA.

Dear Dr. Ong'era,

FETOMATERNAL OUTCOMES OF MOTHERS IN LABOUR REFERRED TO MOI TEACHING AND REFERRAL HOSPITAL: A PROSPECTIVE COHORT STUDY

This is to inform you that ***MU/MTRH-IREC*** has reviewed and approved your above research proposal. Your application approval number is ***FAN:0003365.*** The approval period is ***27th June, 2019 – 26th June, 2020.***

This approval is subject to compliance with the following requirements;

i. Only approved documents including (informed consents, study instruments, MTA) will be used.
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by ***MU/MTRH-IREC***.
iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to ***MU/MTRH-IREC*** within 72 hours of notification.
iv. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to ***MU/MTRH-IREC*** within 72 hours.
v. Clearance for export of biological specimens must be obtained from relevant institutions.
vi. 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.
vii. Submission of an executive summary report within 90 days upon completion of the study to ***MU/MTRH-IREC.***

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) https://oris.nacosti.go.ke and also obtain other clearances needed.

Sincerely,

PROF. E. WERE
CHAIRMAN
INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE

cc CEO - MTRH Dean - SOP Dean - SOM
Principal - CHS Dean - SON Dean - SOD

An ISO 9001:2015 Certified Hospital

MOI TEACHING AND REFERRAL HOSPITAL

Telephone :(+254)053-2033471/2/3/4
Mobile: 722-201277/0722-209795/0734-600461/0734-683361
Fax: 053-2061749
Email: ceo@mtrh.go.ke/directorsofficemtrh@gmail.com

Nandi Road
P.O. Box 3 – 30100
ELDORET, KENYA

Ref: ELD/MTRH/R&P/10/2/V.2/2010

3rd July, 2019

Dr. Dennis Oeri Ong'era,
Moi University,
School of Medicine,
P.O. Box 4606-30100,
ELDORET-KENYA.

APPROVAL TO CONDUCT RESEARCH AT MTRH

Upon obtaining approval from the Institutional Research and Ethics Committee (IREC) to conduct your research proposal titled:-

"Fetomaternal Outcomes of Mothers in Labour Referred to Moi Teaching and Referral Hospital: A Prospective Cohort Study".

You are hereby permitted to commence your investigation at Moi Teaching and Referral Hospital.

03/07/2019

DR. WILSON K. ARUASA, *MBS*
CHIEF EXECUTIVE OFFICER
MOI TEACHING AND REFERRAL HOSPITAL

MOI TEACHING AND REFERRAL HOSPITAL
CEO
APPROVED
03 JUL 2019
SIGN.....
P.O. Box 3 - 30100, ELDORET

cc - Senior Director, (CS)
- Director of Nursing Services (DNS)
- HOD, HRISM

APPENDIX VII: Apgar score chart

Apgar Score

Gestational age_____weeks

Sign	0	1	2	1 minute	5 minute	10 minute	15 minute	20 minute
Color	Blue or Pale	Acrocyanotic	Completely Pink					
Heart rate	Absent	<100 minute	>100 minute					
Reflex irritability	No Response	Grimace	Cry or Active Withdrawal					
Muscle tone	Limp	Some Flexion	Active Motion					
Respiration	Absent	Weak Cry; Hypoventilation	Good, Crying					
			Total					

Comments:

Resuscitation

Minutes	1	5	10	15	20
Oxygen					
PPV/NCPAP					
ETT					
Chest Compressions					
Epinephrine					

APPENDIX VIII: Referring Facilities

	Name of Referring Facility	No. of patients
1.	Uasin Gishu County Hospital	23
2.	Kesses Subcounty Hospital	18
3.	Chepkigen Health Centre	18
4.	Huruma Health Centre	17
5.	Ziwa Subcounty Hospital	16
6.	Moi's Bridge sub county Hospital	14
7.	Matunda Sub County Hospital	13
8.	Likuyani Sub County Hospital	12
9.	Langas Racecourse Health Centre	11
10.	Burnt Forest Sub County Hospital	10
11.	West Maternity Health Centre	9
12.	Turbo Sub County Hospital	8
13.	Kapteldon Health Centre	8
14.	Moiben Sub County Hospital	8
15.	Lumakanda Sub County Hospital	7
16.	Plateau Mission Hospital	4
17.	Pioneer Health Centre	4
18.	Soy Health Centre	3
19.	Kabiyet Health Centre	3
20.	Chepterwai Health Centre	3
21.	Baringo County Hospital	3
22.	Kitale County Hospital	3
23.	Worldwide Clinic	2
24.	Chesongoch Mission Hospital	2
25.	Kamwosor Health Centre	2
26.	Bungoma County Hospital	2
27.	Kapsoya Health Centre	2
28.	Mwangaza Clinic	2
29.	Chepkenye Health Centre	2
30.	Trinity Mission Centre	2

31.	Kapyemoi Health Centre	2
32.	Kapenguria County Hospital	1
33.	Palm Care Hospital	1
34.	Rural Health Centre	1
35.	Kaptarakwa Health Centre	1
36.	Umoja Health Centre	1
37.	Mti moja Clinic	1
38.	Cheborорwa Health Centre	1
39.	Kisor Dispensary	1
40.	Kaiboi Health Centre	1
41.	Webuye County Hosital	1
42.	Chepkanga Health Centre	1
43.	Kisii County Hospital	1
44.	Kongoni Health Centre	1
45.	Starlight Medical Clinic	1
46.	Alexandria Hospital	1
47.	St. Lukes Hospital	1
48.	Chepleskei Dispensary	1
49.	Merewet Dispensary	1
50.	Kapkemoi Dispensary	1
51.	Muyenwet Dispensary	1
52.	Yamunini Mission Hospital	1
53.	SOS Health Centre	1
	Total	254