

**FETAL OUTCOME IN CESAREAN DELIVERIES FOR NON-REASSURING FETAL  
STATUS AT JARAMOGI OGINGA ODINGA TEACHING AND REFERRAL  
HOSPITAL**

**BY**

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**A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS  
FOR THE DEGREE OF MASTER OF MEDICINE  
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**SCHOOL OF MEDICINE**

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**DECLARATION**

I Grievance Calvin Otieno Oyolo, declare that this research thesis is my own work and that it has never been presented to any other institute/university for a similar or any other award.

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## **DEDICATION**

I am dedicating this thesis to my beloved parents who have meant and continue to mean so much to me. Although they are no longer of this world, their memories continue to regulate my life. My father Mr. Calleb Oyolo whose love for me knew no bounds and my mother Anna Odindo who taught me the value of hard work. Thank you so much I will never forget you.

## ABSTRACT

Non-reassuring fetal status (NRFS) encompasses a spectrum of fetomaternal conditions that causes hypoxia in utero and commonly presents as abnormal fetal heart rate and meconium-stained liquor, these abnormal changes are leading indicators for emergency cesarean sections (EMCS). In 2021 NRFS accounted for 36.03% of cesarean sections (CS) done at Jaramogi Oginga Odinga Teaching and Referral Hospital (JOOTRH). Research is recommended to provide better knowledge base to guide decision regarding CS and to encourage policy changes. The broad objective was to determine the fetal outcome in cesarean deliveries for NRFS at JOOTRH. The specific objectives were to assess the immediate consequence of non-reassuring fetal heart rate on fetal outcome among mothers in labor at JOOTRH. To evaluate the decision to delivery interval (DDI) on fetal outcome among mothers with Non-Reassuring Fetal Heart rate who underwent emergency CS at JOOTRH. To determine the significance of meconium stain liquor (MSL) on fetal outcome among mothers who underwent emergency CS at JOOTRH. This was an institutional-based retrospective cross-sectional study, simple random selection was used to select files from January, 2020 to December, 2022. Fisher's formulae was used to calculate the desired sample size of 191 patient files. Statistical Package for Social Sciences (SPSS) version 25, Chicago IL was used to analyze quantitative data. Both descriptive and inferential statistics was used to analyze the three specific objectives. Chi-square test was used to determine the association between the following dependent variables; APGAR score at 1 and 5 minutes, new born unit admission, resuscitation and fetal demise by the following independent variables; bradycardia, tachycardia and meconium stain liquor. It was also used to evaluate the mediator variable decision to delivery interval on fetal outcome among mothers with NRFHR who underwent emergency CS at JOOTRH. The study found that NRFHR had significant association with the APGAR score at 1 minute with a P value of  $<0.0001$ , APGAR score at 5 minutes with a P value of 0.002 and Neonatal demise with a P value of 0.001. DDI had a significant association with APGAR score at 5 minutes with a P value of 0.005 and Neonatal demise with a P value of  $<0.0001$ , There was no statistically significant difference in the other fetal outcomes. Only 1 (0.5%) emergency cesarean section was done under 30 minutes. MSL was found to have no significant association with the fetal outcomes. In conclusion, bradycardia was associated with poor neonatal outcomes, the average DDI is longer than the recommended target and MSL was not associated with poor fetal outcomes. We therefore recommend expediated interventions in all cases with fetal bradycardia and a review of the factors contributing to DDI with a view of reducing the waiting time.

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## ABBREVIATIONS

<b>ACOG</b>	American Collage of Obstetric and Gynecologist
<b>CS</b>	Cesarean Section
<b>CTG</b>	Cardiotocograph
<b>DDI</b>	Decision to Delivery Interval
<b>EMCS</b>	Emergency Caesarean section
<b>FHR</b>	Fetal Heart Rate
<b>FIGO</b>	International Federation of Obstetric and Gynecologist
<b>GBD</b>	Gestation by date
<b>GB-US</b>	Gestation by Ultrasound
<b>HR</b>	Heart rate
<b>IA</b>	Intermittent Auscultation
<b>IREC</b>	Institutional Research and Ethical Committee
<b>JOOTRH</b>	Jaramogi Oginga Odinga Teaching and Referral Hospital.
<b>MSAF</b>	Meconium-stained amniotic fluid
<b>MSL</b>	Meconium-stained liquor
<b>MUERC</b>	Maseno University Ethical Review Committee
<b>NBU</b>	New Born Unit
<b>NICE</b>	National Institutes of Clinical Excellence
<b>NRFHRS</b>	Non-reassuring fetal heart rate status
<b>NRFS</b>	Non-Reassuring Fetal Status
<b>SPSS</b>	Statistical Package for Social Sciences
<b>W.H.O</b>	World Health Organization

## OPERATIONAL DEFINATION OF TERMS

**Bradycardia** - Fetal heart rate of less than 110 bpm lasting more than 10 minutes.

**Cesarean Section** - Delivery of the fetus by incision through the abdominal wall and into the uterus.

**Decision to Delivery Interval** - The interval between the time at which the senior seniormost doctor on duty makes the decision that a caesarean section is required and the time at which the fetus (or first fetus in the case of multiples) is delivered.

**Emergency Cesarean Section** – Cesarean Section performed when there is an immediate threat to the life of a fetus and/or the mother

**Intermittent Auscultation** - The technique of listening to and counting the fetal heartbeats for short periods of time during active labor using a pinard fetoscope or hand held Doppler

**Labor** - The process that begins with the onset of repetitive and forceful uterine contractions sufficient to cause dilation of the cervix and ends with delivery of the fetus and placenta.

**Non-Reassuring Fetal Status** – An interim diagnosis used to describe acute suspected fetal compromise.

**Resuscitation** – A spectrum of tailored of interventions at the time of birth to support the establishment of breathing and circulation.

**Tachycardia** – Fetal heart rate of above 160 bpm lasting more than 10 minutes.

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# CHAPTER ONE

## INTRODUCTION

### 1.1 Background of the study

Non-reassuring fetal status (NRFS) is a terminology used to describe progressive fetal hypoxia and commonly presents as abnormal fetal heart rate or meconium-stained amniotic fluid (MSAF), other presentations include decreased fetal movement, and fetal growth restriction, (Gravett *et al.*, 2016). Fetal heart rate monitoring can be indirectly used to diagnose non reassuring fetal status” (MacKenzie *et al.*, 2001).

The normal fetal heart rate ranges between 110 and 160 beats per minute. A fetal heart rate is considered abnormal if the heart rate is beyond the normal ranges or the rhythm is irregular. The rate, duration, and origin of the rhythm and degree of irregularity usually determine the potential for hemodynamic consequences.

Heart rate is the major determinant of resuscitation of infant and also widely used to determine response to resuscitation, the most common cardiac response to hypoxia is an increase in inhibitory cholinergic nervous response to the hearts pace maker leading to reflex bradycardia, fetuses with asystole or bradycardia have worse clinical outcome.

The use of electronic fetal monitoring to make a diagnosis of non-reassuring fetal status on the basis of fetal heart rate abnormalities has led to a high rate of caesarean deliveries without the fetuses being adversely affected. ACOG Practice Bulletin No. 106: Intrapartum Fetal Heart Rate Monitoring: Nomenclature, Interpretation, and General Management Principles.

JOOTRH performs over 350 CS quarterly. In 2021, NRFS was found to be one of the leading indicators for emergency cesarean sections. Non-reassuring fetal heart rate accounted for 36.03%

of CS done at JOOTRH (JOOTRH theater register). JOOTRH commonly uses tachycardia or bradycardia lasting more than 10 minutes to make the diagnosis of NRFHR.

Clear amniotic fluid is commonly considered a reassuring sign during labor but its presence is an undependable sign of fetal wellbeing yet minimal evidence linking meconium-stained amniotic fluid to poor perinatal outcome (Odongo *et al.*, 2010).

## **1.2 Statement of the problem**

Previously, the abnormal fetal heart rate (FHR) was considered the single most reliable measurement to detect fetal distress; however, this led to frequent improper management and inaccuracies since fetal distress by itself is not well defined, and that is why the concept of the non-reassuring fetal heart rate pattern (NRFHRP) was introduced.

Intrapartum FHR monitoring is a basic component to assess fetal wellbeing during labor. Even though its false positive rate is approximately 99%, failure to recognize or address a concerning FHR can lead to numerous health risks and devastating injuries such as hypoxia/anoxia, either partial or complete brain damage, cerebral palsy, paralysis, nerve damage, and stillbirth (Fuller *et al.*, 2017)

Decision-to-delivery interval within the recommended time is not achieved in many institutions. The following contributors have been identified; “a referral, timing of EMCS, type of anesthesia, client preparation and transfer to the operation theater, and the surgeon’s competency are associated factors of DDI. Hence, institutional delays can be addressed by preparation by the facility and health care” (Kitaw *et al.*, 2021).

There is minimal evidence linking meconium-stained amniotic fluid to poor perinatal outcome and clear amniotic fluid is commonly considered a reassuring sign during labor but its presence is an

undependable sign of fetal wellbeing. In the absence of a CTG, health care providers will rely on the color of meconium and intrapartum fetal auscultation to identify non-reassuring fetal status” (Odongo *et al.*, 2010).

African Population and Health Research Center noted that paucity of accurate, reliable and timely data has been a recurring issue and continues to be a major limitation to the effective monitoring and evaluation of interventions and development programs across African countries. (APHRC, 2016).

The findings from this study will provide crucial data on NRFS newborn outcome and inform decision on optimal indications of emergency CS and proper observation of the required DDI if found to be above the normal.

### **1.3 Objectives of the study**

#### **1.3.1 Broad objective**

To determine fetal outcome in cesarean deliveries for non-reassuring fetal status at Jaramogi Oginga Odinga Teaching and Referral Hospital.

#### **1.3.2 Specific Objectives**

- i. To assess the immediate consequence of non-reassuring fetal heart rate at JOOTRH.
- ii. To evaluate the decision to delivery interval on fetal outcome at JOOTRH.
- iii. To determine the significance of meconium stain liquor on fetal outcome at JOOTRH.

#### **1.4 Research question**

1. What is the immediate consequence of non-reassuring fetal heart rate among delivering women at JOOTRH?
2. How does decision to delivery interval affect fetal outcome among mothers with non-reassuring fetal status at JOOTRH?
3. What is the significance of meconium stain liquor on fetal outcome among mothers undergoing emergency CS at JOOTRH?

#### **1.5 Justification of the study**

Non-reassuring fetal heart rate is one of the four major indications of emergency CS encountered in different studies on CSs (Najmi *at al.*, 1997). In the US, it is the second major indication of primary CS after failure to progress in labor, (Spong *et al.*, 2012).

Once the diagnosis of NRFS is made, an emergency delivery plan is undertaken. 30 minutes is considered the standard decision to delivery interval for better neonatal outcome. The American College of Obstetricians and Gynecologists (ACOG) in 2010 also recommended that this time interval should be  $\leq 30$  minutes for favorable neonatal outcomes. (ACOG, 2010)

To safely lower the rate of primary cesarean delivery, American College of Obstetrics and Gynecologist recommends that individuals, organizations, and governing bodies work to ensure that research is conducted to provide better knowledge base to guide decision regarding cesarean deliveries and to encourage policy changes. (ACOG 2010)

latest available data (2010–2018) covering 154 countries of the world live births shows that 21.1% of women gave birth by CS worldwide, 5% were in sub-Saharan Africa and 42.8% in Latin America and the Caribbean”. They further explain that, “the number of CSs has risen in all regions since 1990. That means, regions with the greatest increases were Eastern Asia, Western Asia and



Northern Africa (44.9, 34.7 and 31.5 percentage point increase, respectively) sub-Saharan Africa and Northern America (3.6 and 9.5 percentage point increase, respectively)". Projections showed "28.5% of women worldwide will give birth through CS by the year 2030 (38 million caesareans of which 33.5 million in LMIC annually) ranging from 7.1% in sub-Saharan Africa to 63.4% in Eastern Asia" (Betran *et al.*, 2021).

Non-reassuring fetal heart rate is one of the four major indications of emergency CS encountered in different studies on CSs (Najmi, 1997). In the US, it is the second major indication of primary CS after failure to progress in labor, (Spong *et al.*, 2012).

Transferring the patient to the operation theatre and establishing an effective anesthesia is a major delay in handling of obstetric emergencies and common in developing countries. In Rwanda a retrospective study in a district hospital showed that only 14.8% of CS meet the standard 30 min from decision to delivery time. However, it has been found longer time interval from a decision to perform cesarean section to the surgical incision was associated with fewer risk of poor neonatal outcome possibly due to thorough preoperative interventions including intrauterine resuscitation and triage" (Byiringiro *et al.*, 2018)

There is minimal evidence linking meconium-stained amniotic fluid to poor perinatal outcome and clear amniotic fluid is commonly considered a reassuring sign during labor but its presence is an undependable sign of fetal wellbeing (Odongo *et al.*, 2010).

## **1.6 Significance of the study**

Over 300 CS are performed quarterly at JOOTRH and NRFS is one of the leading indicators for emergency cesarean sections, in 2021 NRFS accounted for 36.03% of CS done at JOOTRH, hence need to establish fetal outcome of NRFS at JOOTRH.

This study was helpful in investigating the extent to which both national and international reproductive good practices regarding emergency caesarean section have been achieved at JOOTRH.

Data collected will be used to establish the current DDI for JOOTRH, which is an important index to measure the quality-of-service delivery at the maternity unit.

Data collected will also be used to influence policy formulation on management of bradycardia, tachycardia and meconium-stained liquor at the hospital level, county and national level.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 General history of auscultation.**

Hippocrates is said to be the first person to describe “the practice of listening to the internal sounds of the body by placing the ear on the skin near the organ of interest. However, the perception of fetal heart sounds using this method was not reported until the 1600s” (Hajar *et al.*, 2012). Interest accelerated and as a result, “Kennedy published a book on the subject of obstetric auscultation in 1833, in 1816 Laennec “first recorded the use of an amplification device for examination of an adult heart rate, he overcame the embarrassment of placing the ear on a young woman's chest to hear her heart beat by rolling sheets of paper into a tube and listening through this device later the tool was soon made of wood, and gained widespread usage for fetal heart auscultation. Pinard stethoscope is the most common instrument in use for fetal heart rate monitoring, but in some countries, DeLee stethoscope is used as an alternative in some countries. (Kamala *et al.*, 2018)

#### **2.2 Intermittent auscultation Technique**

The client needs a clear explanation and its purpose before intermittent auscultation is initiated and consent to be obtained. This is followed by an assessment of the fetal position via abdominal exam, and placement of the stethoscope or handheld doppler over the fetal back where the heart rate will be clearly heard. Simultaneous palpation of the maternal pulse provides reassurance that the FHR is being monitored. Just before and during intermittent auscultation. The timing of uterine contractions is done by placing a hand on the uterine fundus to determine and detect fetal movements.

Paucity of studies comparing the benefit of different auscultation intervals. In a randomized trial comparing CTG with intermittent auscultation, CTG was usually performed every 15 minutes in the first stage and every five minutes or after every other contraction in the second stage. Recommendations for the scheduling of intermittent auscultation are based only on expert opinion, therefore standardization of procedures is important for planning of health care and for medical – legal purposes. (Lewis *et al.*, 2015)

Practice recommendations for intermittent auscultation during labor according to NICE, listening for a duration of at least 60 seconds, normal range is considered to be between 110 to 160 beats per minute, the interval to be every 15 minutes in the active phase and every 5 minutes in second stage, fetal movement should be assessed when assessing uterine contraction and maternal pulse rate to be assessed at the time of FHR auscultation. (NICE, 2022)

### **2.3 Non-reassuring fetal status**

Studies done across the world revealed that prevalence of NRFHRP ranges between 9.9 and 30.7% (Kassahun *et al.*, 2020). A cross sectional study conducted in Kenyatta national hospital found that 51% of cesarean sections had a sub optimal diagnosis. 72% were due to previous CS and presumed fetal compromise, hence “Strategies should be devised to improve optimality of diagnosis by paying attention to the six commonest indications” (Gwer *et al.*, 2009). JOOTRH performs over 350 CS quarterly, in 2021, NRFS was found to be one of the leading indicators for emergency cesarean sections. Non-reassuring fetal heart rate accounted for 36.03% of CS done at JOOTRH.

Non-reassuring fetal status is a pointer to “an underlying disorder resulting in momentary or permanent oxygen scarcity to the fetus which may lead to fetal hypoxia and metabolic acidosis. Fetal oxygenation depends on maternal oxygenation and placental perfusion, disturbance of

maternal oxygenation, uterine blood supply, placental transfer or fetal gas transport may lead to fetal hypoxia and non-reassuring fetal status, which will present with NRFHR” (Stone *et al.*, 2017). Hence this study will assess the proportions and associated factors of non-reassuring fetal heart rate NRFHR in JOOTRH.

## **2.4 Fetal heart rate monitoring in labor**

Labor is characterized by regular uterine contractions radiating to the back, which cause intermittent transient interruptions of fetal oxygenation. Most fetuses endure this process well. The fetal heart rate (FHR) pattern helps to identify compromised fetus in distress as an indirect marker of cardiac and central nervous system responses of the fetus to blood gases, and acid-base status changes.

Heart rate is the major determinant of resuscitation of infant and also widely used to determine response to resuscitation, the most common cardiac response to hypoxia is an increase in inhibitory cholinergic nervous response to the hearts pace maker leading to reflex bradycardia, fetuses with asystole or bradycardia have worse clinical outcome (Tournier *et al.*, 2022)

The main reason for FHR monitoring is to decrease the probability of hypoxic injury or death by identifying “FHR changes theoretically associated with inadequate fetal oxygenation like changes in baseline rate, repetitive decelerations, and or absent/minimal variability, as this will enable timely intervention” (Schifrin *et al.*, 2022). In addition, correct identification of well-oxygenated fetuses is likely to prevent unnecessary intervention.

Nonstop electronic “FHR monitoring in both low risk and high risk pregnancies is not evidently superior to IA with respect to averting death or poor long-term neurologic consequence and has a high false-positive rate” (Al Wattar *et al.*, 2021).

Intrapartum FHR monitoring is essential in assessing fetal wellbeing during labor, failure to identify a NRFHR “can lead to many health risks and devastating injuries such as, nerve damage cerebral palsy, paralysis, and stillbirth” (Kassahun *et al.*, 2020) .The main aim of intrapartum FHR monitoring is to pick fetal hypoxia and metabolic acidosis early enough hence reduce operative intervention for simple hypoxia and intervene if the fetal condition worsens before it results in fetal death.

### **2.5 Benefits of intermittent auscultation**

Conducting frequent IA ensures regular contact between healthcare workers and the laboring woman, providing the opportunity for and clinical and social support. It also helps to facilitate other physical examinations and monitor vital signs and also maternal skin tone, breathing patterns, direct palpation of fetal movements, temperature, and maternal contractions” (Al Wattar *et al.*, 2021).

Intermittent auscultation allows the FHR to be monitored in numerous positions and locations and favors the mobility of laboring women, which greatly benefit the progress of labor, (Lawrence *et al.*, 2013). Another benefit of IA is the availability and sustainability of the technique, which favors its use even in the lowest resource settings.

### **2.6 Disadvantages of intermittent auscultation**

It is difficult for beginners to recognize the fetal heart sounds, and there is a slow gain in experience for the identification of accelerations and decelerations. Even for the most experienced healthcare worker, it is difficult to recognize subtle features of the FHR, such as variability. Using fetal stethoscopes, difficult positions sometimes need to be employed for effective auscultation and therefore healthcare workers should ensure acceptable position for themselves and the laboring

woman when using IA. Also, with a fetoscope, no independent record of the FHR is produced and usually no confirmation of by another healthcare worker.(Ponsiglione *et al.*, 2021)

To overcome these disadvantages the use of a handheld Doppler device can be employed. When this device displays the FHR, even low variability may be identified. It is difficult to guarantee the continued availability of a trained professional to attend to laboring women in busy hospital. (Mdoe *et al.*, 2018)

## **2.7 Cesarean section Rates**

The continental increase in CS rates is becoming a public health concern and cause of significant debate due to potential maternal and perinatal risks, cost implications and inequity in access (Vila-Candel *et al.*, 2020)

Data from 154 countries covering 94.5% of world live births shows that 21.1% of women gave birth by via CS, ranging from 5% in sub-Saharan Africa to 42. % in Latin America and the Caribbean. CS rates has increased in all countries since 1990. Sub regions with the marked increases were Eastern Asia, Western Asia and Northern Africa (44.9, 34.7 and 31.5 percentage point increase, respectively). Projections shows that “by the year 2030, 28.5% of women will give birth by CS of which 33.5 million will be in low- and middle-income countries yearly, ranging from 7.1% in sub-Saharan Africa to 63.4% in Eastern Asia” (Betran *et al.*, 2021)

While CS rates remain relatively low in most Sub-Saharan African countries, they are gradually on the rise, and socioeconomic differences in CS rates are extensive (Van Der Spek *et al.*, 2020a).According to NASCOP “in Kenya the CS rate ranges from 2.4% in the poorest group to 19% in the richest group, as estimated from a nationally representative survey conducted in 2014. While the CS can be life-saving when rightfully indicated, C-section rates above 10% at the

population level are not accompanied with improved maternal and newborn outcomes” (Van Der Spek *et al.*, 2020b)

The study aimed to address paucity of evidence-based CS rates using clinical record data in JOOTRH, Specifically, I aim to examine clinical indications with regards to NRFHR and MSAF for emergency C-section and assess the immediate outcome.

## **2.8. Meconium-Stained Liquor**

There is minimal evidence linking meconium-stained amniotic fluid to poor perinatal outcome and clear amniotic fluid is commonly considered a reassuring sign during labor. Meconium-stained liquor “remains a worry to both obstetricians and neonatologists since signs of asphyxia and meconium are linked to an increase in perinatal morbidity and mortality. Clear amniotic fluid is commonly considered a reassuring sign during labor but its presence is an undependable sign of fetal wellbeing. In the absence of a CTG, health care providers will rely on the color of meconium and intrapartum fetal auscultation to identify non-reassuring fetal status” (Odongo *et al.*, 2010b).

In Thika level five hospital the median decision to delivery interval was 248 minutes. Only 1% achieved the recommended decision to delivery interval of  $\leq 30$  minutes. Most “of the participants (40.1%) had a decision to delivery interval of more than 300 minutes. Newborn admissions and meconium aspiration syndrome accounted for 17.6%, respiratory distress syndrome 17.6% and birth asphyxia 12.0%. 1.4% perinatal deaths were recorded, fresh and macerated still births were found to be 2.6% and 1%, respectively” (Kanario *et al.*, 2021).



## **2.9. Decision to delivery interval**

The period between the time “a decision to perform EmCS is made and the actual delivery of the neonate is called decision to delivery interval. This includes patient preparation and theater preparation time, anesthetic time, and the skin entry to delivery interval” (NICE, 2022).

In Garissa Level Five Hospital “the main indications for caesarean section were found to be obstructed labor (18.5%) for mothers and non-reassuring fetal status (6.4%). Although 74% of the mothers gave consent to be operated within the recommended 30-minute guideline, only 3% underwent CS within this time period. Only 24% of the CS were conducted within one hour after the decision was made. About 38% of the women, and 30% of the babies developed complications after the CS. Bleeding was the leading complication in mothers while the main complication for babies was babies was an Apgar score of 5 and below” (Kamotho *et al.*, 2018a)

According to the Royal College of Obstetricians and Gynecologists and the American College of Obstetricians and Gynecologists, “decision to delivery interval for emergency cesarean sections should be within 30 min. It is a good indicator of quality of care in maternity service, and if prolonged, it leads to a third a third-degree delay” (Kitaw *et al.*, 2021). This study aimed to assess the decision to delivery interval and associated outcome for emergency cesarean section in JOOTRH.

## **2.10 APGAR score**

The Apgar score provides an accepted and convenient method for reporting the status of the newborn infant immediately after birth and the response to resuscitation if needed. It was originally developed in 1952 by an anesthesiologist at Columbia University, Virginia Apgar, to address the need for a standardized way to evaluate infants shortly after birth (Apgar, 1958). The Apgar score comprises five components: 1) color, 2) heart rate, 3) reflexes, 4) muscle tone, and 5) respiration,

each of which is given a score of 0, 1, or 2. Thus, the Apgar score quantitates clinical signs of neonatal depression such as cyanosis or pallor, bradycardia, depressed reflex response to stimulation, hypotonia, and apnea or gasping respirations. The score is reported at 1 minute and 5 minutes after birth for all infants, and at 5-minute intervals thereafter until 20 minutes for infants with a score less than 7 (Committee on Obstetric Practice, 2006). Monitoring of low Apgar scores from a delivery service can be useful. Individual case reviews can identify needs for focused educational programs and improvement in systems of perinatal care. Analyzing trends allows for the assessment of the effect of quality improvement interventions. (Committee on Obstetric Practice, 2006).

**Table 2.1 Shows the APGAR score interpretation adapted from (De Souza Medeiros *et al.*, 2018)**

### APGAR SCORING SYSTEM

	0 Points	1 Point	2 Points	Points totaled
<b>Activity (muscle tone)</b>	Absent	Arms and legs flexed	Active movement	↓
<b>Pulse</b>	Absent	Below 100 bpm	Over 100 bpm	
<b>Grimace (reflex irritability)</b>	Flaccid	Some flexion of Extremities	Active motion (sneeze, cough, pull away)	
<b>Appearance (skin color)</b>	Blue, pale	Body pink, Extremities blue	Completely pink	
<b>Respiration</b>	Absent	Slow, irregular	Vigorous cry	

<b>Severely depressed</b>	<b>0-3</b>
<b>Moderately depressed</b>	<b>4-6</b>
<b>Excellent condition</b>	<b>7-10</b>

### **2.11. Summary of research gaps.**

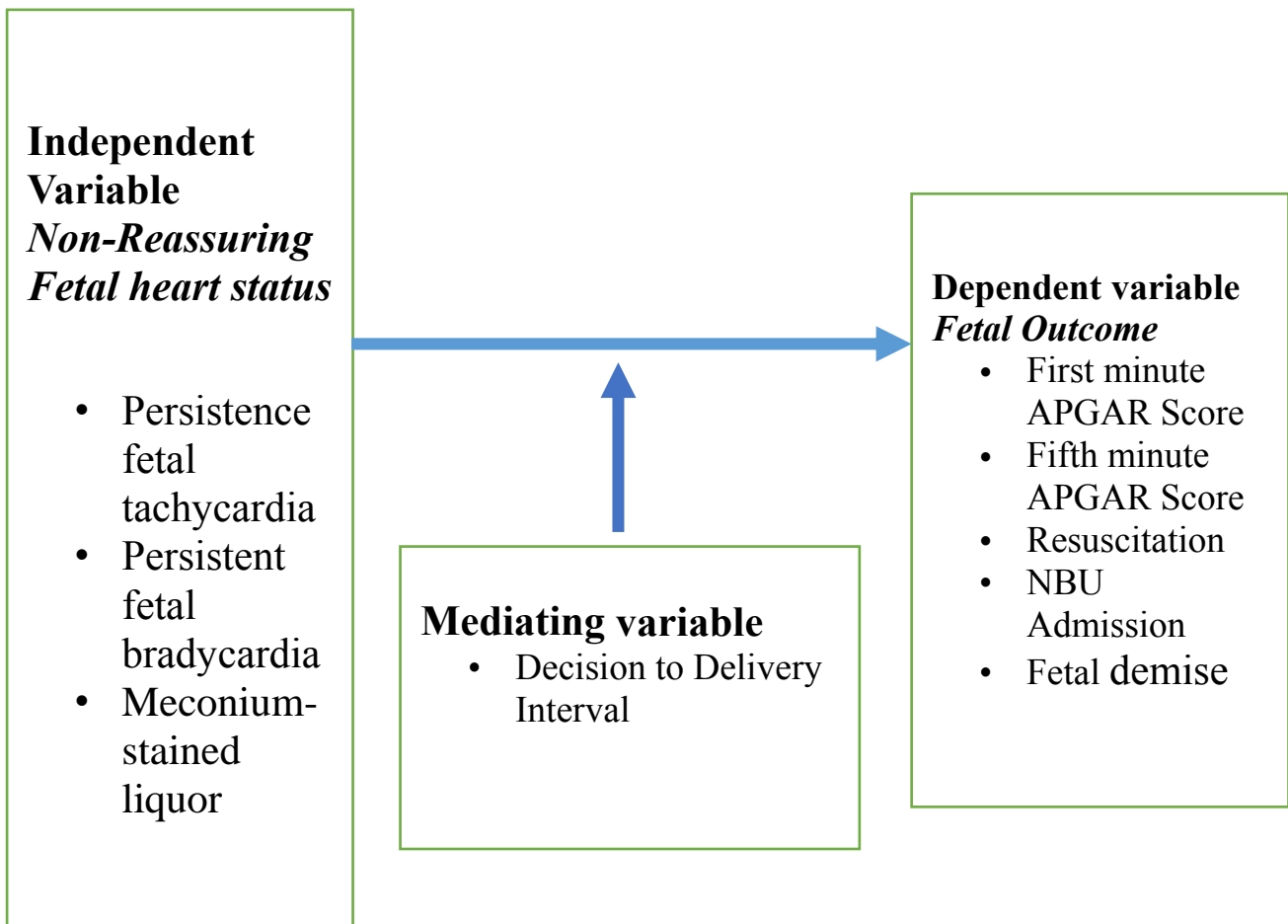
A systematic scoping review to identify methods of intermittent auscultation effects and accuracy during labor found that the FIGO guideline, WHO guidelines Swedish.

Guidelines and other 6 guidelines had different recommendations on how intrapartum fetal monitoring should be done (Blix *et al.*, 2019). In JOOTRH different guidelines are adopted based on individual preference hence different outcomes.

According to a Kenya-based African Population and Health Research Center the paucity of accurate, reliable and timely data has been a recurring issue. It continues to be a major constraint to the effective monitoring and evaluation of interventions and development programs across countries in Africa (APHRC, 2016). JOOTRH has no clear data on the outcome of emergency CS babies, hence lack clear policies on reducing bad outcomes or promoting and maintaining good outcomes.

The most common indications for primary cesarean delivery include, in order of frequency, abnormal fetal heart rate, fetal malpresentation, multiple gestation, and suspected fetal macrosomia. Safe reduction of the rate of primary cesarean deliveries will require different approaches for each of these, hence the need to have clear data on the 2<sup>nd</sup> most common indication of emergency CS” (ACOG 2018). In addition, ACOG explain that, “the rapid increase in cesarean birth rates from 2010 to 2020 without clear evidence of concomitant decreases in maternal or neonatal morbidity or mortality raises significant concerns that cesarean delivery is overused.” Hence the need to know our institutional emergency CS rates and the probable outcome of the newborns.

Decision-to-delivery interval within the recommended time is not achieved in many institutions. Factors affecting DDI includes; time of day of EmCS, type of anesthesia, time taken for client preparation and transfer to the operation theater, and the status of surgeons are associated factors of DDI (Kanario *et al.*, 2021). JOOTRH does not know its DDI, which the study seeks to determine, making it difficult to solve institutional delays.



**Figure 2.1: Conceptual framework; Source (Author, 2023)**

## **CHAPTER THREE**

### **METHODOLOGY**

#### **3.1 Overview**

This was a retrospective hospital based descriptive cross-sectional study to determine fetal outcome in cesarean deliveries for non-reassuring fetal status diagnosed by intermittent fetal auscultation in Jaramogi Oginga Odinga Teaching and Referral Hospital (JOOTRH).

#### **3.2 Study area**

This research was conducted at JOOTRH in Kisumu County. JOOTRH has a capacity of 600 beds and has an out-patient department, maternity and gynecological ward, all receiving female patients. Approximately 100 CS are performed every month at JOOTRH. NRFS is one of the leading indicators for emergency cesarean sections and in 2021 NRFS it accounted for 36.03% of CS. JOOTRH serves as a center for research studies, training for various medical students and health care workers. JOOTRH serves as the main referral Hospital in Kisumu County” (JOOTRH, 2016).

Kisumu County is located in western parts of Kenya. “Kisumu County's neighbors are Siaya County to the West, Nandi County to the North East, Vihiga County to the North, and Kericho County to the East, Its neighbor to the South is Nyamira County and Homa Bay County is to the South West” (see appendix 2). Kisumu County “covers an area of approximately 2,000 square kilometers. It comprises of 7 constituencies namely; Nyakach, Kisumu Town East, Seme, Muhoroni, Kisumu Town West, Nyando and Kisumu Central. Economic activities in Kisumu involves fishing farming sugar cane farming, farming rice and majorly trading. Kisumu County hosts Kisumu City, the third largest City in Kenya and has a population of approximately 1,155,574 “(National Census 2019).

This study was at the Department of Obstetrics and Gynaecology in Jaramogi Oginga Odinga Teaching and Referral hospital. Being a public health facility, it serves clients from both low and middle socio-economic status a diversity necessary to make objective analysis on matters related to determinants of CS.

### **3.3 Study design**

A retrospective hospital based cross-sectional study at JOOTRH.

### **3.4 Target Population**

All pregnant women above 18 years admitted after 37 weeks gestation in JOOTRH who underwent emergency caesarean section due to NRFS.

### **3.5 Sampling technique**

Patient's files of women who had a caesarean section from 1<sup>st</sup> January 2021 retrospectively to 31<sup>st</sup> December 2022, and met the inclusion criteria were identified and assigned a unique research number after which they were subjected to a simple random selection.

### **3.6 Inclusion and Exclusion Criteria**

#### **3.6.1 Inclusion Criteria**

1. Women who delivered by emergency caesarian section in JOOTRH with a diagnosis of non-reassuring fetal heart rate or meconium-stained liquor.
2. Singleton pregnancy.

#### **3.6.2 Exclusion criteria**

1. Patient files with incomplete data, patient files with no patient bio data, reason for cesarean section not indicated, diagnosis of fetal bradycardia or tachycardia does not meet the WHO classification, fetal heart rate based on ultrasound findings and fetal outcome not indicated.

### 3.7 Sample size calculation

More than 62,801 women of reproductive age reside in Kisumu County (Kisumu County Gender Data Sheet 2019). The sample size was calculated using Fisher formula (Fisher's *et al.*, 1998); -

$$n = z^2pq/d^2.$$

Where: the desired sample size

$z$  = Level of significance that corresponds to 95% confidence interval = (1.96)

$p$  = 0.145 (Based on 14.5% prevalence of non-reassuring fetal status by (Kikwai *et al.*, 2010)

$q$  = (1 –  $p$ ) = 0.855; the proportion of population without desired characteristic

$d$  = the margin of error/ precision or alpha = (Unsafe choice where the value is unknown) (5% = 0.05)  $n = 1.96^2 \times 0.145 \times 0.855 / (0.05)^2 = 191$

### 3.8 Data collection

Data was collected from medical records from 1<sup>st</sup> January, 2021 to 31<sup>st</sup> December 2022 using a paper-based data collection tool.

Variables identified included age, parity, characteristics of non-reassuring fetal status, either recorded fetal tachycardia or fetal bradycardia and meconium-stained liquor in addition the Decision to Delivery Interval were captured.

Persistent NRFHR of more than 10min and above 160 beats per minute was considered as tachycardia and bradycardia was defined by a value less than 110 beats per minute.

Neonatal outcomes included the first- and fifth-minute APGAR scores recorded in the patient file and was categorized as either low or abnormal (< 7) and reassuring or favorable ( $\geq 7$ ). In addition, neonatal admission to NBU was also captured.

### **3.9 Data Management and analysis**

The Statistical Package for Social Sciences (SPSS) version 25, Chicago IL was used to analyze quantitative data. Descriptive and inferential statistics were used to analyze the three specific objectives. Chi-square test was used to determine the association between the following dependent variables; APGAR score at 1 and 5 minutes, new born unit admission, resuscitation and fetal demise by the following independent variables; bradycardia, tachycardia and meconium stain liquor. It was also used to evaluate the mediator variable decision to delivery interval on fetal outcome among mothers with NRFHR who underwent emergency CS at JOOTRH.

### **3.10 Study Limitations**

- Intermediate and long-term outcomes of babies admitted to NBU from NRFS was not be captured.

### **3.11 Ethical considerations**

An introductory letter was obtained from School of Graduate Studies Maseno University. The ethical review and approval were obtained from the Jaramogi Oginga Odinga Teaching and Referral Hospital Institutional Scientific Ethics Review Committee and research permit obtained from National Commission for Science Technology and Innovation (NACOSTI).

Hospital medical records in charge signed the institution inform consent granting the research team permission to retrieve data from patient files. Data obtained was transferred on an electronic-based data collection tool only accessed by qualified and trained research assistants. The electronic data collection tool was handled only by the research assistant, the data was password protected. Upon completion of data collection, coding was done and data analyzed, during analysis data was protected by a password and only accessed by the statistician and the principal investigator.



## CHAPTER FOUR

### RESULTS

This study sought to assess the fetal outcome in cesarean deliveries for non-reassuring fetal status among pregnant mothers in labor at Jaramogi Oginga Odinga Teaching and Referral Hospital. In this current study, two (2) indicators (abnormal fetal heart rate and observation of meconium stain liquor) were used to describe non-reassuring fetal status. The influence of decision to delivery interval was also assessed. The indicators of fetal outcome in this study were five (5) and they included, APGAR score at 1 minute, APGAR score at 5 minutes, resuscitation of the new born, neonatal demise and NBU admission.

#### 4.1 Socio-demographic characteristics of mothers with NRFS.

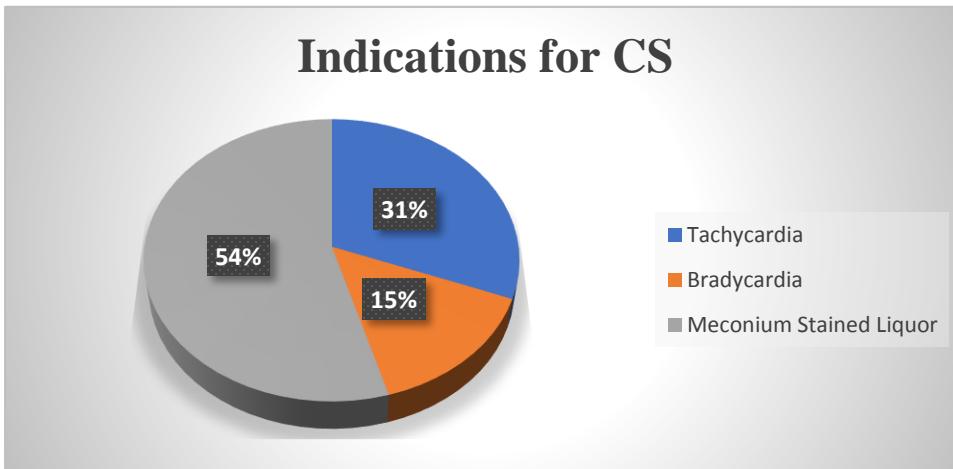
A total of 191 study subjects were recruited in this study. The median age of participants was 24 years. The majority of the respondents were nulliparous 95 (49.7%), and 156 (81.7%) had a gestational age of 37 - 40 weeks as shown in Table 4.1.

**Table 4.1: Findings of sociodemographic characteristics of mothers with NRFS (n 191)**

Variable	Categories	n (%)
Age in Years	< 20	21 (11%)
	20 – 35	158 (82.7%)
	> 35	12 (6.3%)
	Median	24
Parity	Interquartile range	8
	Nulliparous	95 (49.7%)
	Primiparous	41 (21.5%)
	Multiparous	55 (28.8%)
Gestation by date	37 – 40 Weeks	156 (81.7%)
	>40 Weeks	35 (18.3%)

#### **4.2 Immediate consequence of non-reassuring fetal heart rate on fetal outcome among mothers in labor at JOOTRH who underwent emergency CS**

This study sought to establish the effect of non-reassuring fetal heart rate on fetal outcome among pregnant mothers in labor at Jaramogi Oginga Odinga Teaching and Referral Hospital, the following observations were made; majority of mothers who presented with abnormal fetal heart rate had tachycardia 59 (30.9%), 28 (14.6%) presented with bradycardia and 104 (54.%) had meconium stained liquor as shown in Figure 4.1.



**Figure 4.1 Various categories of non-reassuring fetal status as indications for CS at JOOTRH.**

Bradycardia was largely associated with high proportion of poor outcomes; a half of infants who had bradycardia had an APGAR score of less than 7 at 1 minute. A third were resuscitated and out of the 7 deaths associated with abnormal fetal heart rate 6 (21.42%) had bradycardia pre-operative.

We found significant association between the following indicators: - APGAR score at 1 minute with a P value of < 0.0001, APGAR score at 5 minutes with a P value of < 0.002, neonatal demise with a P value of < 0.001. The descriptive analysis of non-reassuring fetal heart rate on fetal outcome among pregnant mothers' findings are summarized in table 4.2 below.

**Table 4.2: Findings of Outcomes of Non-reassuring fetal heart rate (NRFHR) on fetal outcome among pregnant mothers.**

NRFHR	n (%)	1 MINUTE APGAR SCORE		X <sup>2</sup>	df	P Value
		< 7	≥ 7			
Tachycardia	59	13 (22.03%)	46 (77.97%)	17.085	2	< 0.0001
Bradycardia	28	15 (53.57%)	13 (46.43%)			
Normal	104	17 (16.35%)	87 (83.65%)			

NRFHR	n (%)	5 MINUTE APGAR SCORE		X <sup>2</sup>	df	P Value
		< 7	≥ 7			
Tachycardia	59	3 (5.08%)	56 (94.92%)	12.989	2	0.002
Bradycardia	28	8 (28.57%)	20 (71.43%)			
Normal	104	8 (7.69%)	96 (92.31%)			

NRFHR	n (%)	RESUSCITATION		X <sup>2</sup>	df	P Value
		Yes	No			
Tachycardia	59	11 (18.64%)	48 (81.36%)	3.23	2	0.199
Bradycardia	28	10 (35.71%)	18 (64.29%)			
Normal	104	23 (22.12%)	81 (77.88%)			

NRFHR	n (%)	NBU ADMISSIONS		X <sup>2</sup>	df	P Value
		Yes	No			
Tachycardia	59	14 (23.72%)	45 (76.29%)	1.458	2	0.482
Bradycardia	28	10 (35.71%)	18 (64.29%)			
Normal	104	27 (25.96%)	77 (74.03%)			

NRFHR	n (%)	NEONATAL DEMISE		X <sup>2</sup>	df	P Value
		Yes	No			
Tachycardia	59	1 (1.69%)	58 (98.31%)	15.164	2	0.001
Bradycardia	28	6 (21.43%)	22 (78.57%)			
Normal	104	4 (0.04%)	100 (99.96%)			

The Chi-square test was used to assess the effect of NRFHR on fetal outcome among mothers with Non-Reassuring Fetal status. APGAR score at 1 minute had a chi square value of 17.85 at 2 degrees of freedom with a P value of < 0.0001, APGAR score at 5 minutes had a chi square value of 12.989

at 2 degrees of freedom with a P value of 0.002, while neonatal demise had a chi square value of 15.164 at 2 degrees of freedom with a P value of 0.001.

### 4.3 Effect of decision to delivery interval on fetal outcome among pregnant mothers in labor at Jaramogi Oginga Odinga Teaching and Referral Hospital

Our findings showed that only 1 (0.5%) of the DDI was made in under 30 minutes, 13 (6.8%) decisions were made between 30- 60 minutes and majority 177 (92.7%) of the decision made were after 60 minutes.

In my study population of 191, 45 infants had an APGAR score of <7 at one minute out of which 39 of them had a DDI of > 60 minutes and they were all resuscitated and out of the 11 fetal demise reported 10 had a DDI of more than 60 min. The descriptive analysis of decision to delivery interval on fetal outcome among pregnant mothers are shown on table 4.3.

**Table 4.3: Findings of decision to delivery interval on fetal outcome among mothers with Non-Reassuring Fetal Heart rate who underwent CS at JOOTRH**

Dependent variable	(Decision to Delivery Interval in minutes)			Chi-square value	df	P value
	<30	30-60	>60			
<b>APGAR Score at one minute</b>				5.08	2	0.079
< 7 (n=45)	1	5	39			
≥ 7 (n=146)	0	8	138			
<b>APGAR Score at five minutes</b>				10.5	2	0.005*
< 7 (n=19)	1	0	18			
≥ 7 (n=172)	0	13	159			
<b>Resuscitation status</b>				5.115	2	0.077
Resuscitated (n= 44)	1	1	42			
Not resuscitated (n= 147)	0	12	135			
<b>NBU admission status</b>						
Taken to admission (n=51)	0	3	48	0.47	2	0.792
Not taken to admission (n=140)	1	1	129			
<b>Neonatal demise</b>				17.16	2	<0.0001*
Died (n= 11)	1	0	10			
Alive (n= 180)	0	13	167			

The Chi-square test was used to assess the effect of DDI on fetal outcome among mothers with Non-Reassuring Fetal status APGAR score at 5 minutes had a chi square value of 10.5 at 2 degrees of freedom with a P value of 0.005 while fetal demise had a chi square value of 17.16 at 2 degrees of freedom with a P value of < 0.0001.

#### **4.4 Effect of meconium stain liquor on fetal outcome among pregnant mothers in labor at Jaramogi Oginga Odinga Teaching and Referral Hospital**

In this study, 126 (65.97%) out of 191 mothers had meconium-stained liquor, 58 (46.03%) babies had meconium grade three and 52 (41.27%) had meconium grade two and 16 (12.70%) had meconium grade one, MSL irrespective of the grade had no significant association to poor neonatal outcome

**Table 4.4 Findings of meconium stain liquor on fetal outcome among pregnant mothers**

MSL	n (%)	1 MINUTE APGAR SCORE		X <sup>2</sup>	df	P Value
		< 7	≥ 7			
MSL Grade 1	16	3 (18.75%)	13 (81.25%)	2.439	3	0.486
MSL Grade 2	52	9 (17.31%)	43 (82.69%)			
MSL Grade 3	58	17 (29.31%)	41 (70.69%)			
Clear liquor	65	16 (24.62%)	49 (75.38%)			

MSL	n (%)	5 MINUTE APGAR SCORE		X <sup>2</sup>	df	P Value
		< 7	≥ 7			
MSL Grade 1	16	1 (6.25%)	15 (93.75%)	0.88	3	0.83
MSL Grade 2	52	4 (7.69%)	48 (92.31%)			
MSL Grade 3	58	7 (12.07%)	51 (87.93%)			
Clear liquor	65	7 (10.77%)	58 (89.23%)			

MSL	n (%)	RESUSCITATED		X <sup>2</sup>	df	P Value
		Yes	No			
MSL Grade 1	16	1 (6.25%)	15 (93.75%)	5.06	3	0.167
MSL Grade 2	52	10 (19.23%)	42 (80.77%)			
MSL Grade 3	58	18 (31.03%)	40 (68.97%)			
Clear liquor	65	15 (23.08%)	50 (76.92%)			

MSL	n (%)	NEONATAL DEMISE		X <sup>2</sup>	df	P Value
		Yes	No			
MSL Grade 1	16	1 (6.25%)	15 (93.75%)	3.19	3	0.363
MSL Grade 2	52	3 (5.77%)	49 (94.23%)			
MSL Grade 3	58	1 (1.72%)	57 (98.28%)			
Clear liquor	65	6 (9.23%)	59 (90.77%)			

MSL	n (%)	NBU ADMISSION		X <sup>2</sup>	df	P Value
		Yes	No			
MSL Grade 1	16	3 (18.75%)	13 (81.25%)	3.299	3	0.348
MSL Grade 2	52	10 (19.23%)	42 (80.77%)			
MSL Grade 3	58	19 (32.76%)	39 (67.24%)			
Clear liquor	65	19 (29.23%)	46 (70.77%)			

The Chi-square test was used to assess the effect of MSL on fetal outcome among mothers with Non-Reassuring Fetal status. APGAR score at 1 minute had a chi square value of 2.439 at 3 degrees of freedom with a P value of 0.486, resuscitation had a chi square value of 5.06 at 3 degrees of freedom with a P value of 0.167, APGAR score at 5 minutes had a chi square value of 0.88 at 3 degrees of freedom with a P value of 0.83, while neonatal demise had a chi square value of 3.19 at 3 degrees of freedom with a P value of 0.363 and lastly NBU admission had a chi square value of 3.299 at 3 degrees of freedom with a P value of 0.348.

## CHAPTER FIVE

### DISCUSSION, CONCLUSION & RECOMMENDATIONS

#### 5.1 Discussion

One hundred and ninety-one study files were reviewed in this study, largely a young population, 158 (82.7%) were between 20 – 35 years, commonly associated with low risks of having any comorbidity. Tachycardia was the commonest presentation of NRFHR and bradycardia was associated with worst immediate neonatal outcome. The recommended DDI was not met in JOOTRH, only one EMCS was done in under 30 minutes, majority were done after 60 minutes and this was associated with poor APGAR score and the need for resuscitation. Meconium was recorded in 126 (65.97%) all had no adverse neonatal outcome.

##### **5.1.1 Immediate consequence of non-reassuring foetal heart rate on foetal outcome among mothers in labour at JOOTRH.**

Heart rate is the major determinant of resuscitation of infant and also widely used to determine response to resuscitation, the most common cardiac response to hypoxia is an increase in inhibitory cholinergic nervous response to the hearts pace maker leading to reflex bradycardia, fetuses with asystole or bradycardia have worse clinical outcome (Tournier *et al.*, 2022). Bradycardia was the most frequently observed pattern of NRFHR that was largely associated with high proportion of poor outcomes including death in 6 out of 7 deaths recorded in fetuses with NRFHR. Infant with tachycardia responded well to resuscitation.

NRFHR is an indicator of an underlying condition resulting in temporary or permanent oxygen deprivation to the fetus which may lead to fetal hypoxia and metabolic acidosis. Since fetal oxygenation is dependent upon maternal oxygenation and placental perfusion, disturbance of



maternal oxygenation, uterine blood supply, placental transfer or fetal gas transport may lead to fetal hypoxia and NRFHR. (Gravett *et al.*, 2016)

In this study, the proportion of NRFHR was found to be 87 (45.5%) the remaining 104 (54.5%) had meconium-stained liquor. This finding is in line with the study conducted in Thailand which found 30.7% with NRFH, (Boonchuan *et al.*, 2018). This might be due to the similarity in social demographic characteristics (age, parity and gestational age) and study design. This finding was higher than a study done in Ethiopia, 12.2%, (Abate E *et al.*, 2021). This may be due to JOOTRH getting more referrals from nearby facilities and a high proportion of nulliparity (49.7%) mothers were more likely to have NRFHR than multigravida mothers. The association is supported by studies conducted in Finote Selam (Kassahun *et al.*, 2020). Primigravida being first time mothers leading to stress and anxiety which causes psychological and physiologic disruption which might decreased blood flow to the fetus and cause uterine hypoxia (Belete *et al.*, 2019.) (Kassahun *et al.*, 2020). Primigravida can be a risk of several pregnancy related complications such as prolonged duration of labor, pregnancy induced hypertension and other abnormal pregnancy and labor conditions which disturbed both maternal and fetal conditions (Hashim N *et al.*, 2012,)). About 24 (32.18%) of NRFHR fetuses required NBU admission after delivery in this study. This result is similar with the study conducted in Bangladesh (28.3%) (Akhter *et al.*, 2021). The similarity may be due to methodology. In this study neonates born after developing NRFHR 21 (31.03%) required resuscitation after delivery, this finding is higher than the finding of studies done at Rwanda (17.2%) (Byingiringo *et al.*, 2018) and Tanzania (6.1%) (Mdoe *et al.*, 2018). The reason may be due to the use of CTG to diagnosis NRFHRS and prompt intervention after the diagnosis in Rwanda and Tanzania.

We observed that preoperative fetal bradycardia had a worse outcome than tachycardia. It had a higher percentage of poor APGAR score at minute, (53.57%) and even at 5 minutes, 28.57% resuscitation rate and 22.12% fetal demise, therefore fetal bradycardia should get immediate attention.

Majority of infants who scored poorly in the 1<sup>st</sup> minute APGAR score responded well to resuscitation and had significant improvement on the 5<sup>th</sup> minutes score signifying optimal resuscitative measures.

### **5.1.2 Evaluation of decision to delivery interval on fetal outcome among mothers with Non-Reassuring Fetal Heart rate who underwent emergency CS at JOOTRH.**

American College of Obstetricians and Gynecologists and the Royal College of Obstetricians and Gynecologists (RCOG) recommends that decision-to-delivery interval (DDI) in emergency cesarean delivery should be within 30 minutes, the 30-minute rule was granted by the consensus of experts (ACOG, 2010). The National Institute for Health and Care Excellence (NICE) guideline has recommended that category 1CS (immediate threat to life of the woman or fetus) and category 2 CS (maternal or fetal compromise that is not immediately life-threatening) cesarean sections should be carried out within 30 minutes and 75 minutes after the decision, respectively. They also recommend the use of 30-minute and both 30 and 75-minute intervals to measure the overall performance of an obstetric unit in category 1 and category 2 cesarean sections, respectively (ACOG, 2010).

According to AJOG expert review, when a hypoxic stress is acute, profound and sustained the body is not able to maintain central organ perfusion through peripheral vasoconstriction and centralization, AJOG expert review 2023. Prolonged DDI leads to sustained hypoxic stress hence associated with poor fetal outcomes. Many factors have been reported to affect DDI, including

staffing, team readiness, team communication, availability of operating room, time taken to clean and restock between cases, and severity of fetal-maternal complications.

This study found that only 1 (0.5%) of EmCS were performed within the recommended decision to delivery time interval. This is similar to a study conducted in Nigeria which was 0.9% and in Thika Level 5 hospital - Kenya which was 1%. This may be due to unavailability of resources including essential medical staff, pre-operation medication and operating room, time taken to clean and restock the theatres between cases (Kamotho *et al.*, 2018). This finding is less than that of studies conducted in Denmark and Oman with recommended DDIs of 87.5% and 60.8%, respectively (Tashfeen *et al.*, 2017), (Fuhrmann *et al.*, 2015). The difference may be due to general infrastructure and economic differences in general from those countries. Specifically, in Denmark, a full-scale simulation and color-based multidisciplinary operative room team training was provided over the country to shorten the DDI. In Oman, programs were designed and implemented to shorten DDIs and the use of NICE classification of Urgency of Caesarean section (Category 1 as immediate threat to life of the woman or fetus, EmCS to be done within 30 min. Category 2 as no immediate life threatening maternal or fetal compromise, EmCS to be done within 75 minutes.) In our study more than 90% of the DDI were more than 60 minutes, all had a low APGAR score and were resuscitated. JOOTRH classifies cesarean section as either emergency or elective, hence missing out on prompt management of certain obstetric emergencies like, Fetal bradycardia, placenta abruption, and cord prolapse requiring a DDI of between 15-30 minutes according to NICE guidelines (Soltanifar *et al.*, 2012).

### **5.1.3 Significance of meconium stain liquor on fetal outcome among mothers who underwent emergency CS at Jaramogi Oginga Odinga Teaching and Referral Hospital**

Meconium-stained amniotic fluid may represent the normal gastrointestinal maturation, or it may indicate an acute or chronic hypoxic event, thereby making it a potential warning sign of a fetal Compromise, infants born through a meconium-stained amniotic fluid are more likely to develop respiratory distress and are at increased risk of perinatal death due to aspiration of meconium leading to meconium aspiration syndrome.

In our study, various parameters were assessed to find out the effect of MSL on the immediate neonatal outcome. A significant association between MSAF and abnormal FHR patterns, increased rate of cesarean section, and low Apgar score has been reported in various studies (Osava *et al.*, 2017).

The proportion of MSL deliveries in our study was 126 (65.97%). 58 (46.03%) newborns had meconium grade three, 52 (41.27%) had meconium grade two and 16 (12.70%) had meconium grade 1. These findings are similar to Parween *et al.*,2022 who found that among the 100 patients with MSI, 20% patients had grade 1 meconium, 22% patients had grade 2 meconium, and 58% of the patients had grade 3 meconium (Parween *et al.*, 2022).

In this study MSL had no significant association with APGAR score at 1 and 5 minutes, the rate of resuscitation, NBU admission, and neonatal demise these findings are in agreement with earlier studies which have shown no decrease in Apgar scores in pregnancies complicated by MSL (Chettri *et al.*, 2015).

## **5.2 Conclusions**

1. Bradycardia is the least frequently observed pattern of NRFHR and is associated with high proportion of poor neonatal outcomes.
2. The average decision-to-delivery interval of emergency cesarean section is longer than the recommended target and is associated with adverse perinatal outcomes.
3. There is no association between meconium staining liquor and poor neonatal outcome.

## **5.3 Recommendations**

1. Expedited intervention be done in all cases of fetal bradycardia.
2. The hospital should investigate factors contributing to prolonged DDI with a view of reducing it to less than 30 minutes.
3. We recommend further evaluation of the inter-mediate outcomes of babies with MSL.

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## APPENDICES

### APPENDIX ONE: DATA EXTRACTION TOOL.

#### SECTION A – SOCIO-DEMOGRAPHIC DATA

1. Study number  2. Age in years  3. Parity

#### SECTION B – CURRENT OBSTETRIC HISTORY

5. GBD  GB-US

6. ANC PROFILE- HB  PITC  Blood group  Rhesus

#### SECTION D – CONCURRENT MEDICAL CONDITION

Malaria  Hypertension  Others  - specify

#### SECTION E – FETAL SURVEILLANCE METHODES ( INTERMITTENT FETAL AUSCULTATION WITH)

Fetoscope  Hand held Doppler  CTG transducer

#### Reason for emergency cesarean section

Abnormal fetal heart rate: FHR <110  FHR >160

Meconium stain liquor: Yes  No  If yes, grade 1  grade 2  grade3

Decision for CS made by: Consultant  Registrar  medical officer

Decision to delivery interval: Less than 30 min  More than 30 min

#### SECTION F – FETAL OUTCOME

- i. APGAR score at 1 minutes <7  ≥7  APGAR score at 5 minutes <7  ≥7
- ii. Resuscitation done: Yes  No
- iii. Fetal Demise: Yes  No
- iv. Admission to NBU: Yes  No
- v. Others: Specify -
- vi. Birth weight (gm): <1000  1000 – 1500  1501 – 2000  2001 -2500  2501 – 3500   
>3500

## **APPENDIX TWO: INFORMED CONSENT TITLE OF STUDY**

### **FETAL OUTCOME IN CESAREAN DELIVERIES FOR NON-REASSURING FETAL HEART RATE IN JARAMOGI OGINGA ODINGA TEACHING AND REFERRAL HOSPITAL**

#### **PRINCIPAL INVESTIGATOR**

Dr. Grievance Calvin Otieno Oyolo

Maseno University

School of Medicine

Dep. Of Obstetrics and Gynecology

0726832924

[calgoti@yahoo.com](mailto:calgoti@yahoo.com)

#### **PURPOSE OF STUDY**

The purpose of this study is to;

1. Establish fetal outcome of NRFS diagnosed using intermittent auscultation prior to an emergency CS.
2. Inform the need to develop a guideline in JOOTRH on the use of IA.
3. The study aims to establish fetal outcome of NRFS diagnosed using intermittent auscultation at JOOTRH
4. Collect data that will be used to influence policy formulation on management of NRFS at the hospital level, county and nation level.

#### **RISKS**

This is a retrospective study, therefore no risk is anticipated.

#### **CONFIDENTIALITY**

Information collected in this Study will be anonymous. Any identifying information on the patient file will not be used. Every effort will be made by the researcher to preserve confidentiality including the following:

- Assigning code names/numbers for participants files that will be used on all research notes and documents
- Keeping notes, Data collection tools and any other identifying participant information in a locked file cabinet in the personal possession of the researcher.

## **INSTITUTIONAL VOLUNTARY PARTICIPATION**

The institution participation in this study is voluntary. It is up to the institution to decide whether or not to take part in this study. If you decide to take part in this study, you will be asked to sign a consent form. After you sign the consent form, the institution is free to withdraw at any time and without giving a reason. Withdrawing from this study will not affect the relationship between the researcher and the institution, if any. If you withdraw from the study before data collection is completed, your data will be returned to you or destroyed.

---

## **CONSENT**

I have read and I understand the provided information and have had the opportunity to ask questions. I understand that patient data will be used in this study and that the institution is free to withdraw at any time, without giving a reason and without cost. I understand that I will be given a copy of this consent form. I voluntarily agree to allow institutional patient files to be used in this study.

Hospital Medical Records Officer.

Signature \_\_\_\_\_ Date \_\_\_\_\_

Investigator's

Signature \_\_\_\_\_ Date \_\_\_\_\_

### APPENDIX THREE: MAP OF KISUMU COUNTY



**APPENDIX FOUR: LETTER FROM SGS MASENO UNIVERSITY**



**MASENO UNIVERSITY**  
**SCHOOL OF GRADUATE STUDIES**  
*Office of the Dean*

**Our Ref:** MMED/SM/00012/020

Private Bag, MASENO, KENYA  
Tel:(057)351 22/351008/351011  
FAX: 254-057-351153/351221  
Email: [sgs@maseno.ac.ke](mailto:sgs@maseno.ac.ke)

Date: 25<sup>th</sup> January, 2023

**TO WHOM IT MAY CONCERN**




**RE: PROPOSAL APPROVAL FOR GRIEVANCE CALVIN OTIENO OYOLO—  
MMED/SM/00012/020**

The above named is registered in the programme of Master of Science in Obstetrics and Gynecology in the School of Medicine, Maseno University. This is to confirm that his research proposal titled **"Fetal Outcome in Cesarean Deliveries for Non Reassuring Fetal Heart Rate in Jaramogi Oginga Odinga Teaching and Referral Hospital"** has been approved for conduct of research subject to obtaining all other permissions/clearances that may be required beforehand.

  
**DEAN, SCHOOL OF GRADUATE STUDIES**



APPENDIX FIVE: LETTER FROM JOOTRH IERC

		
<b>COUNTY GOVERNMENT OF KISUMU</b> <b>DEPARTMENT OF MEDICAL SERVICES, PUBLIC HEALTH AND SANITATION</b>		
Telephone: 0724804676 E-mail: <a href="mailto:ercjootrh@gmail.com">ercjootrh@gmail.com</a> Website: <a href="http://www.jootrh.go.ke">www.jootrh.go.ke</a> When replying please quote	JARAMOGI OGINGA ODINGA TEACHING & REFERRAL HOSPITAL P.O. BOX 849 <b>KISUMU</b>	
Ref: ISERC/JOOTRH/690/23	Date: 13 <sup>th</sup> June, 2023	
<hr/>		
<b>RE: APPROVAL: STUDY TITLE:</b> <b><u>FETAL OUTCOME IN CESAREAN DELIVERIES FOR NON-REASSURING FETAL HEART RATE IN JARAMOGI OGINGA ODINGA TEACHING AND REFERRAL HOSPITAL</u></b>		
REF: ISERC/JOOTRH/690/23		
To: Grievance Calvin Oyolo		
Dear Grievance,		
<b><u>RE- STUDY TITLE</u></b>		
This is to inform you that JOOTRH ISERC has reviewed and approved your above research proposal. Your application approval number is <i>ISERC/JOOTRH/690/23</i> . The approval period is <i>13<sup>th</sup> June, 2023 – 13<sup>th</sup> June, 2024</i> .		
This approval is subject to compliance with the following requirements:		
<ol style="list-style-type: none"><li>i. Only approved documents including (informed consents, study instruments, MTA) will be used.</li><li>ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by JOOTRH - ISERC.</li><li>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 JOOTRH - ISERC within 72 hours of notification.</li><li>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 JOOTRH - ISERC within 72 hours.</li><li>v. Clearance for export of biological specimens must be obtained from relevant institutions.</li><li>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.</li><li>vii. Submission of an executive summary report within 90 days upon completion of the study to JOOTRH - ISERC.</li><li>viii. In case the study site is JOOTRH, kindly report to the Chief Executive Officer before commencement of data collection.</li></ol>		



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

Yours sincerely,

*A. ANP*  
ANTONY AYORA  
SECRETARY-ISERC  
JOOTRH- KISUMU

JOOTRH ETHICS & REVIEW  
COMMITTEE  
P.O. BOX 548 - 41102

**APPENDIX SIX: PERMIT FROM NACOSTI**  
Research Licence Number: NACOSTI/P/23/31104

  
REPUBLIC OF KENYA

  
NATIONAL COMMISSION FOR  
SCIENCE, TECHNOLOGY & INNOVATION

Ref No: 54342 Date of Issue: 05/November/2023

**RESEARCH LICENSE**



This is to Certify that **Dr. CALVIN OTIENO OYILO** of **Moi University**, has been licensed to conduct research as per the provision of the **Science, Technology and Innovation Act, 2012 (Rev. 2014)** in **Kisumu** on the topic: **FETAL OUTCOME IN CESAREAN DELIVERIES FOR NON-REASSURING FETAL HEART RATE IN JARAMOGI OGINGA ODINGA TEACHING AND REFERRAL HOSPITAL** for the period ending: **05/November/2024**.

License No: NACOSTI/P/23/31104

54342  
Applicant Identification Number

  
Director General  
NATIONAL COMMISSION FOR  
SCIENCE, TECHNOLOGY &  
INNOVATION

Verification QR Code



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See overleaf for conditions