EMERGENCY CAESAREAN SECTION TURNAROUND TIME AND ITS EFFECT ON MATERNAL AND NEWBORN HEALTH OUTCOMES AT UNIVERSITY OF NAIROBI TEACHING HOSPITALS

A dissertation submitted in part fulfillment for the award of degree of Master of Medicine in Obstetrics and Gynaecology of the University of Nairobi

PRINCIPAL INVESTIGATOR:

DR. HUSSEIN ALI HABIB,

POSTGRADUATE STUDENT

DEPARTMENT OF OBSTETRICS AND GYNAECOLOGY

UNIVERSITY OF NAIROBI
DECLARATION

This is to declare that this research is my original work and that it was done under the guidance of my supervisors. It has not been submitted in any other university for the award of a degree.

Dr. Hussein Ali Habib
Postgraduate student,
Department of Obstetrics and Gynaecology,
University of Nairobi.

Signature_________________________________ Date________________________
CERTIFICATE OF SUPERVISION

This is to certify that this research was carried out by Dr. Hussein Ali Habib under my supervision and it has been submitted with my approval.

1. Dr. Samson M. Wanjala, MBCh.B, MMed
   Senior lecturer,
   Department of Obstetrics and Gynaecology,
   University of Nairobi.

   Signature___________________________ Date__________________

2. Prof. Zahida P. Qureshi, MBCh.B, MMed
   Associate Professor and Head of Department,
   Department of Obstetrics and Gynaecology,
   University of Nairobi.

   Signature___________________________ Date__________________
DEDICATION

This book is dedicated to the hundreds of thousands of women who die each year while giving birth for their untold suffering and bravery, to my parents for their prayers and sacrifice to give me the best education and to my lovely wife Sheilah for her support and companionship.
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# TABLE OF CONTENTS

TITLE ............................................................................................................................................... i

DECLARATION .............................................................................................................................. ii

CERTIFICATE OF SUPERVISION .................................................................................................. iii

DEDICATION .................................................................................................................................... iv

ACKNOWLEDGEMENT .................................................................................................................. v

TABLE OF CONTENTS ................................................................................................................ vi

LIST OF TABLES AND FIGURES ............................................................................................... viii

LIST OF ABBREVIATIONS ........................................................................................................... ix

ABSTRACT ...................................................................................................................................... 1

INTRODUCTION ........................................................................................................................... 3

LITERATURE REVIEW .................................................................................................................. 6

JUSTIFICATION ............................................................................................................................ 12

RESEARCH QUESTION ................................................................................................................ 12

CONCEPTUAL FRAMEWORK ..................................................................................................... 13

OBJECTIVES .............................................................................................................................. 16
  Broad objective ............................................................................................................................ 16
  Specific objectives ....................................................................................................................... 16

METHODOLOGY .......................................................................................................................... 17
  Study design ................................................................................................................................. 17
  Study area .................................................................................................................................. 17
  Study population ........................................................................................................................ 18
  Sampling method ....................................................................................................................... 18
  Sample size calculation ............................................................................................................. 19
  Inclusion criteria ......................................................................................................................... 20
  Exclusion criteria ....................................................................................................................... 20
  Data collection procedure ........................................................................................................ 20
  Data collection instrument ........................................................................................................ 23
  Quality control .......................................................................................................................... 23
  Data management and analysis ................................................................................................. 23
LIST OF TABLES AND FIGURES

Table 1: Socio-demographic characteristics of the study participants ........................................ 25
Table 2: Obstetric characteristics of the study participants .........................................................26
Table 3: Indications of emergency caesarean section ................................................................. 27
Table 4: Rank, Mode of anaesthesia used, Surgeon, Day and Time of the caesarean sections ... 28
Table 5: Decision-to-delivery interval for emergency caesarean section .................................. 29
Table 6: Reasons for delay in performing emergency caesarean section ................................. 32
Table 7: Reasons for delay in performing emergency caesarean section and the DDI ........... 33
Table 8: Maternal outcomes of the study participants ............................................................... 34
Table 9: Maternal outcomes of the study participants and the DDI ........................................ 35
Table 10: Newborn outcomes of the study population .............................................................. 36
Table 11: Newborn outcomes and the DDI ............................................................................. 37

Figure 1: A diagrammatic representation of the conceptual framework .................................15
Figure 2: A flow-chart of the data collection procedure ........................................................... 22
Figure 3: Decision-to-delivery interval for emergency caesarean section ............................. 31
Figure 4: Maternal complications of emergency caesarean section ...................................... 35
LIST OF ABBREVIATIONS

ACOG ........................................ American College of Obstetrics and Gynecology
APH ................................................................. Antepartum Haemorrhage
BOH ................................................................. Bad Obstetric History
cm ................................................................ centimeters
CNST ............................................................... Clinical Negligence Scheme for Trusts
CCF ................................................................. Congestive Cardiac Failure
CPD ................................................................. Cephalopelvic Disproportion
DDI ................................................................. Decision-to-Delivery Interval
DVT ................................................................. Deep Venous Thrombosis
EOC ................................................................. Emergency Obstetric Care
HDU ................................................................. High Dependency Unit
ICU ................................................................. Intensive Care Unit
IQR ................................................................. Inter Quartile Range
IUGR ............................................................. Intra Uterine Growth Restriction
KNH ................................................................. Kenyatta National Hospital
MAS ................................................................. Meconium Aspiration Syndrome
LGA ................................................................. Large for Gestational Age
LBW ................................................................. Low Birth Weight
LW ................................................................. Labour Ward
NBU ................................................................. Newborn Ward
NICHD ......................................................... National Institute of Child Health and Human Development
NICU .............................................................. Neonatal Intensive Care Unit
NRFS .............................................................. Non-reassuring Fetal Status
PMH ................................................................. Pumwani Maternity Hospital
PNW ................................................................. Postnatal Ward
PPH ................................................................. Postpartum Haemorrhage
PROM ............................................................ Premature Rupture of Membranes
RDS ................................................................. Respiratory Distress Syndrome
RCOG ......................................................... Royal College of Obstetricians and Gynaecologists
SGA .......................................................... Small for Gestational Age
SPSS .......................................................... Statistical Package for Social Sciences
TTN .......................................................... Transient Tachypnoea of the Newborn
UK .......................................................... United Kingdom
VBAC .......................................................... Vaginal Birth After Caesarean delivery
WHO .......................................................... World Health Organization
ABSTRACT

Background: It is widely advocated that the decision-to-delivery interval (DDI) for emergency caesarean section should not exceed 30 minutes. The practicability, justification, anticipated benefit on neonatal outcome and medico-legal implications of the recommended 30-minute DDI for emergency caesarean section is questionable. Much needed local data on the causes of delay in emergency caesarean section and its effect on delivery outcomes are lacking.

Objectives: To evaluate the determinants of emergency caesarean section decision-to-delivery interval and its effect on maternal and newborn health outcomes at UON teaching hospitals.

Methods: Study design: A hospital-based comparative cross-sectional study was carried out between June and August 2012. Setting: Kenyatta National Hospital’s maternity unit and Pumwani Maternity Hospital. Population: women who underwent emergency caesarean section. Sample size: 251 women were studied. Data collection: eligible women were consented, interviewed and followed up until discharge from hospital. Medical records were also used to fill a structured questionnaire. Data analysis: data was entered into a computer, analyzed using the SPSS software and presented in figures and tables.

Results: The median DDIs were 178 and 290 minutes at KNH and PMH respectively. The interval between decision and delivery was within 30 minutes for < 1% of women, 31 – 60 minutes for 4% and more than 5 hours for 37%. Cervical dilatation of more than 4cm was associated with a significantly shorter DDI (p < 0.05). Emergency caesarean section for placenta praevia with haemorrhage returned the fastest response time of 17 minutes (p < 0.05). Unavailability of theatre space and lack of additional theatre staff to open a second theatre were significantly associated with delay in emergency caesarean delivery (p < 0.001). Wound sepsis was the commonest post-operative complication. The median duration of post-operative hospital stay was 3 days. The association between the DDI and occurrence of maternal complication, prolonged post-operative hospitalization, Apgar score of the newborn at 5 minutes, admission to the NBU or its outcome was not significant.
Conclusions: Cervical dilatation, emergency caesarean section indicated for placenta praevia with haemorrhage, availability of theatre space and additional theatre staff to open a second theatre were significantly associated with the DDI. Prolonged DDI did not significantly increase maternal complications or prolong post-operative hospital stay. Poor Apgar score and admission to the NBU were not significantly increased due to prolonged DDI.

Recommendations: Standard Operating Procedures for emergency caesarean section need to be formulated and effected. The existing infrastructure desperately requires expansion and staff shortage urgently addressed to reduce delay. Unnecessary caesarean sections should be avoided.
INTRODUCTION

Maternal mortality remains high in Kenya at an estimated 488 maternal deaths per 100,000 live births [1]. This is largely as a result of direct causes such as haemorrhage, hypertensive disorders, obstructed labour, sepsis and complications of abortion [2]. Most of these deaths are preventable with prompt and adequate medical interventions. Delay in getting adequate care in time is the overwhelming reason for high maternal mortality in developing countries [3]. Lack of care can be attributed to a delay in making the decision to seek care when complications develop; a delay in reaching an appropriate obstetric medical facility once the decision to seek care has been made; or delay in receiving adequate and appropriate care once a medical facility has been reached. Maternal death is often a consequence of a long and complex chain of delays, and only in few cases death can be attributed to a specific event [4, 5, 6]. Any one delay could be fatal to a woman with obstetric complications.

Delay in deciding to seek medical care on the part of the woman or her relative is usually regarded entirely as patient factor although it may be influenced by various factors such as the persons involved in the decision-making process, characteristics of the illness [7, 8], and experience with the health care system or distance to the health facility [9]. The tendency to act or not in the presence of a complication is influenced by the perception of illness or complication as interpreted by religious and cultural beliefs [4, 10, 11]. Women seem to avoid going to the hospital because of fear of discrimination, geographical and financial barriers, different interpretation of danger signs, bad experience with the health care system and poor provider attitude towards patients [9, 12]. Unfamiliar setting at the health facility, being attended to by strangers, lack of family support, being attended to by a male care provider, reduced autonomy, lack of empathy and understanding on the part of the health care personnel and not seeing the need for care are some of the factors contributing to non-utilization of health services during labour and child birth [5]. In Kenya, the main reasons given for not delivering in a health facility were that it was too far away or that there was no transport to get to the facility, or both (42%) and that it was not necessary (21%). Also, the delivery occurred too fast to get to a facility (18%) and that it cost too much to deliver in a facility (17%). Very few women did not deliver in a
facility because there were no female providers at the facility, it was not customary, their husband or family did not allow it, quality of service was poor, or the facility was not open [1].

Delay in reaching an appropriate medical facility is affected by the distribution of health facilities, availability of transportation, road conditions or cost of transportation. Delay in receiving adequate and appropriate care once the facility is reached is mainly due to operational difficulties in the health care delivery system. Such inadequacies may be characterized by shortages in supplies, equipment, lack of trained personnel, incompetence of the available staff, or uncoordinated emergency services. Health system failures have been identified as a major contributing factor to maternal deaths [12 – 16].

A health facility can be classified as offering either basic or comprehensive emergency obstetric and neonatal care (EmONC) based on functionality and ability to provide lifesaving emergency obstetric procedures. Facilities offering basic EmONC are expected to provide the following seven services: administration of parenteral antibiotics; parenteral oxytocic drugs; parenteral anticonvulsants for eclampsia; manual removal of retained placenta; removal of retained products of conception; assisted vaginal delivery (vacuum extraction or forceps delivery) and neonatal resuscitation with bag and mask. Comprehensive EmONC facilities are expected to provide caesarean section and blood transfusion in addition to those services provided by the basic EmONC facilities [17].

Emergency caesarean section is the most commonly performed lifesaving obstetric operation. It refers to the delivery of a fetus which has attained a viable gestational age, placenta and membranes through an abdominal and uterine incision in cases where vaginal delivery is either not feasible or would impose undue risks to the mother or baby or both [18]. It may be carried out under regional (spinal or epidural) or general anaesthesia and its indications include non-reassuring fetal status, prolapse of the umbilical cord, severe abruptio placentae, placenta praevia with haemorrhage, dystocia (cephalopelvic disproportion, poor progress of labour, obstructed labour), failed vaginal birth after caesarean section, failed induction of labour, malpresentation and failed assisted vaginal delivery.
Health facilities providing comprehensive EmONC should have the capability of beginning an emergency caesarean section within 30 minutes of the decision to operate [19]. This depends on organizational structure, institutional policies, staffing pattern, availability of equipment and supplies, processes involved in preparation of and moving the patient from the labour and delivery suite to the operating room, architectural specifications of the unit, availability of the operating team, preparation of operating room and the mode of anaesthesia used.
LITERATURE REVIEW

A caesarean section is a multidisciplinary procedure comprising many tasks, some of which are quite complex. The procedure requires a team of seven different personnel; an anaesthetist and a skilled assistant, an obstetrician and an assistant, a theatre nurse or midwife to assist with the operation, a midwife, and a paediatrician to receive the baby. The staff has to be assembled before the necessary complex tasks can be undertaken.

Once a decision to deliver by emergency caesarean section is made, the operating team has to be informed and the patient has to be prepared for the operation. This entails obtaining informed consent, establishing intravenous access, taking a blood sample for blood-typing and cross match, changing the patient into a theatre gown and attaching a label before the patient can be moved to theatre. Fetomaternal monitoring continues until the patient is transferred to the operating room.

The decision-to-delivery interval (DDI) refers to the length of time between decision-making and delivery of the neonate by emergency caesarean section. It is measured in minutes from the time a decision for emergency caesarean delivery is made to the time the baby is delivered. The recommended DDI should not exceed 30 minutes and emergency obstetric care units should be capable of beginning an emergency caesarean section within 30 minutes of the decision to operate [19 – 30].

Kenyatta National Hospital has a standardized DDI of one hour for emergency caesarean section [22].

The main sources of delay in emergency caesarean delivery according to a survey at Gravesend and North Kent Hospital in the UK were in transferring the women to the operating theatre and administration of the anaesthetic agent [31]. The time taken to transfer the patient to the operating room is critical as it represents approximately half of the interval between decision and delivery by emergency caesarean section [32]. This depends mainly on the degree of organization and architectural specifications of the unit [33]. It is considerably unlikely that the
baby will be delivered in 30 minutes if more than 10 minutes elapse between the decision to deliver by emergency caesarean section and transfer of the patient to the operating room [34].

Emergency caesarean section is performed under general or regional anaesthesia. The degree of urgency often dictates the mode of anaesthesia to be used. Anaesthetists are expected to do complex tasks under pressure of time, yet they have the primary responsibility of ensuring that the procedure they use is the safest for the mother. General anaesthesia is the fastest method but it is associated with increased maternal morbidity and mortality [35]. Regional anaesthetic techniques have been shown to be increasingly safe [36, 37], providing acceptable response times for the majority of 'urgent' caesarean sections with the administration of a general anaesthetic occasionally justified in the fetal interest [38]. Administering an epidural bolus into an already established epidural catheter that is working effectively can allow a decision-to-delivery interval almost as short as general anaesthesia [39]. Multiple attempts at spinal anaesthesia resulting in delays of greater than 50 minutes has been attributed to reluctance of some anaesthetists to resort to general anaesthesia when there is difficulty with spinal anaesthesia [34]. The 'rapid sequence spinal' has been shown to minimize anaesthetic time [35]. This consists of a no-touch spinal technique, consideration of omission of the spinal opioid, limiting spinal attempts, allowing the start of surgery before full establishment of the spinal block, and being prepared for conversion to general anaesthesia if there are delays or problems.

In his study on the pattern of caesarean section at KNH, Muriu [23] found that 13.1% of patients were delivered by caesarean section within one hour of the decision to operate. The main reason for delay in carrying out the operation was due to theatre being in use with other emergency operations.

There was no emergency caesarean delivery within 30 minutes and only 10.6% of patients were delivered within an hour of the decision to operate at KNH [22]. Emergency caesarean sections performed for cord prolapse, ruptured uterus and antepartum haemorrhage had the shortest decision-to-delivery intervals. This was due to the increased degree of urgency with which delivery had to be expedited owing to the life-threatening nature of these emergencies risking the life of the mother or baby or both.
In Nairobi, 8.6% of emergency caesarean sections at the MP Shah Hospital began within 30 minutes of the decision to operate [24]. The mean decision-to-delivery interval at the Mater Hospital was 97 minutes with just 2.2% of caesarean deliveries being accomplished within 30 minutes of the decision to operate [25]. Three out of every four emergency caesarean sections in that hospital were performed more than an hour after the decision to operate was made. At St. Mary’s Mission Hospital, the mean DDI was 77 minutes and 20.4% of patients were delivered within 30 minutes of the decision to operate [26]. Emergency caesarean sections with the shortest decision-to-delivery times were for antepartum haemorrhage followed by fetal distress.

The mean DDI for emergency caesarean delivery at The Nairobi Hospital was 71.2 minutes [27].

At Homa bay District Hospital, only 3.8% of patients were delivered by emergency caesarean section within one hour of the decision to operate while 60% were delivered within 2 hours [22].

Anaesthetic delays and difficulty in sourcing essential materials were the major causes of delay in emergency caesarean sections at two tertiary care centres in Nigeria [40]. Despite this, there was no significant correlation between the decision-to-delivery interval and perinatal outcome. This is because the perinatal outcome depends mainly on the causal pathology rather than the DDI.

The median DDI was 4.8 hours at the teaching hospital in Ivory Coast [41]. This was largely determined by the time needed to obtain a complete surgical kit, either because the family had to pay for it in advance or because the kit lacked some essential components, which had to be bought separately. The reasons for the long delays were multiple and complex, but the main factors governing them were the huge workload of severe cases and the absence of any clear policy towards ensuring prompt and adequate treatment for life-threatening emergencies.

At Tygerberg hospital in South Africa, only 15.7% of emergency caesarean deliveries were accomplished within 30-minutes of the decision to operate [42].
In Croatia, nearly 40% of emergency caesarean sections were performed within the "gold standard" period of 30 minutes [43].

Data from 24 maternity units in Norway over a period of 7 months showed the average DDI for emergency caesarean sections was 52.4 minutes [44]. Emergency caesarean sections performed at night and for indications such as abruptio placentae, cord prolapse and fetal distress were associated with significantly reduced decision-to-delivery intervals. Other factors which favoured a shorter decision-to-delivery interval were the use of general anaesthesia, seniority of the surgeon and cervical dilatation. The size of the maternity units was not a significant factor.

In the Aurore perinatal network comprising of 31 maternity units in France, the decision-to-delivery interval for emergency caesarean sections varied significantly according to the level and organization of the maternity units [45]. The DDI of 30 minutes was achieved in 67% of emergency caesarean deliveries when just the anaesthetist was always present on site and 88% in units where both the anaesthetist and obstetrician were always present. It was not significantly correlated with neonatal outcome.

Regardless of the degree of emergency, the DDI for emergency caesarean section exceeded the recommended 30-minute interval in 50% of the cases at Saint-Etienne University Hospital in France [46].

At the University Hospital in Munich, Germany, the mean DDI for emergency caesarean section was 12.8 minutes [47] due to readily available personnel with 24-hour obstetric, anaesthesia and neonatal coverage. The operation has been performed in the delivery room thus reducing the time taken to transfer the patient to the operating theatre. Intrapartum sections were quicker the more advanced the labour, and general anaesthesia was associated with shorter DDI than regional anaesthesia for emergency caesarean section for fetal distress at the University of Oxford, John Radcliffe Hospital in the UK [48]. The seniority of the surgeon managing the patient did not appear to influence the interval, nor did the time of day or day of the week when the delivery occurred.
More than one third of all caesarean sections for a non-reassuring fetal heart rate did not comply with the “30-minute” rule at multiple university-based hospitals comprising the National Institute of Child Health and Human Development (NICHD) Maternal-Fetal Medicine Units Network [49]. In these cases, adverse neonatal outcomes were not increased.

The median DDI for emergency caesarean section at The Ottawa Hospital Birthing Units in Canada was 16 minutes [50]. Implementation of the “Code 333” process during obstetric emergencies enabled 98% of emergency caesarean deliveries to be completed within the recommended 30 minutes. This is an overhead call made to activate an emergency response system which calls for resuscitative measures on a mother and or a fetus and expedited delivery of a fetus considered at high risk of demise.

The 30-minute DDI does not seem to improve neonatal outcome or worsen maternal outcomes as shown by several investigators [31, 32, 48, 49, 51 – 58]. Neonatal prognosis is more dependent on the causal pathology than on decision-to-delivery interval [33]. Since prolonged DDI may not be the cause of adverse perinatal outcome in the majority of cases, litigation on these grounds may be unjustified [45].

The positive effect of very short decision-to-delivery intervals on neonatal outcome still needs to be proven. Procedure related and infectious maternal morbidity including endometritis, wound infection and operative injury were not significantly increased with prolonged decision-to-incision intervals [56].

DDI of less than one hour was associated with a lower Apgar score at 5 minutes compared to a decision-to-delivery interval of between one and two hours [22].

Babies delivered within 30 minutes of the decision to deliver by emergency caesarean section experienced a measure of newborn compromise i.e. tended to be more acidaemic, had lower Apgar scores at 1 and 5 minutes, required intubation in the operating room and had a greater incidence of seizures and encephalopathy than those delivered after 30 minutes, irrespective of the indication for delivery [48, 49]. The degree of fetal compromise in utero dictates the urgency with which delivery is accomplished such that severely compromised fetuses are delivered
urgently hence the features of newborn compromise at birth. Furthermore, delay in delivery may provide an opportunity for resuscitation of the compromised fetus *in utero* hence these babies are better at birth. However, no significant difference in admission to the neonatal intensive care unit or length of stay was noted between the two groups [32, 51].

There is no deterioration in cord gas results after 30 minutes and most neonates delivered emergently for non-reassuring fetal status even when born after 30 minutes have normal cord gases [53]. The “30-minute” rule is merely a compromise that reflects the time it takes the fetus to develop severe metabolic acidosis which is difficult to predict accurately even with electronic fetal monitoring. In the event of sustained intrapartum fetal bradycardia however, delivery by emergency caesarean section must take place within 25 minutes to avoid long-term neurologic sequelae [54].

DDI of more than 75 minutes is associated with poorer maternal and baby outcomes and should be avoided [57]. Prolonged DDI was associated with increased incidence of birth asphyxia and longer post-operative hospital stay [26].
JUSTIFICATION

The decision-to-delivery interval (DDI) for emergency caesarean section is a measure of the preparedness of an obstetric team to respond to an emergency requiring operative abdominal delivery.

The set standards for DDI are not met in a great majority of cases due to delays in emergency caesarean delivery in many obstetric units including ours. This raises questions about the organizational efficiency of these units as well as the quality of care given to patients. Prolonged DDI is associated with maternal and perinatal morbidity and mortality, financial cost and serious medico-legal implications for health care providers in the event of adverse outcomes for the mother and newborn. Similarly, short DDI has also been associated with poor perinatal outcome.

The DDI for emergency caesarean section has been documented locally by several investigators but data on the factors that determine the DDI are lacking. Previous studies on DDI were conducted in units with vast disparities in size, workload, organization, staffing and location.

Moreover, the effect of delays in emergency caesarean delivery on maternal and neonatal outcomes is not clear with recent studies casting doubt over the recommended 30-minute decision-to-delivery interval; questioning its practicability, justification, anticipated beneficial effect on neonatal outcome and medico-legal implications.

This study aimed at finding out the causes of delay in emergency caesarean delivery and whether adverse maternal and newborn health outcomes could be attributed to the delay.

RESEARCH QUESTION

What are the determinants of the decision-to-delivery interval and its effect on newborn and maternal health outcomes of women undergoing emergency caesarean section at Kenyatta National and Pumwani Maternity Hospitals in 2012?
CONCEPTUAL FRAMEWORK

Maternal and newborn health outcomes of emergency caesarean section depend on the DDI of the procedure which is in turn dependent on a number of factors including the patient, the health system and the health care provider.

Patient factors include socio-demographic characteristics like age, level of education, marital status and occupation as well as cultural influences. The age of the patient may influence the DDI for emergency caesarean section in the case of a minor who lacks the capacity to give consent for the operation, necessitating the presence of a guardian to give consent on her behalf. Likewise, the patient’s level of education, which determines her literacy level, may hamper the consent process if she is uneducated or has a low literacy level as this will impair her capacity to understand the consent explanation and cultural influences like seeking consent from the spouse or other relatives thus prolonging the DDI. The patient’s general condition, level of consciousness and mental status also determine her ability to give consent for the operation thus influencing the DDI. The patient’s obstetric characteristics e.g. parity, previous pregnancy outcome, gestational age, mode of previous deliveries and indication for emergency caesarean delivery in the current pregnancy, all have a bearing on the DDI. Emergency caesarean section due to previous caesarean delivery, cord prolapse, placenta praevia with haemorrhage, ruptured uterus and non-reassuring fetal status, are likely to have shorter DDIs than malpresentation or failed induction of labour for example, since there is a greater urgency to expedite delivery in these instances for the obvious reason of saving the life of the mother or the newborn. Similarly, poor previous pregnancy outcome(s) may influence the urgency with which an emergency caesarean delivery is carried out. The patient’s body habitus e.g. in an obese patient, may be associated with repeated attempts at spinal anaesthesia or failed intubation in the case of general anaesthesia, which will increase the DDI of emergency caesarean section and may lead to poor maternal and newborn outcomes.

Health system factors which have a bearing on the DDI of emergency caesarean section include the organizational structure and institutional policies, level of staffing of nurses, obstetricians, anaesthetists, paediatricians and support staff; availability of medical personnel, supplies, drugs,
sterile packs and functional equipment; workload and prioritization of theatre cases as well as the availability of key support services e.g. laboratory and blood transfusion services. Poor organizational structure and unfavourable institutional policies; staff shortages, unavailability of equipment and essential supplies, all contribute to prolonged DDI and hence poor maternal and newborn health outcomes.

The DDI, hence maternal and newborn health outcomes of emergency caesarean section are also influenced by factors related to health care workers such as teamwork, good communication and interpersonal relationships; level of motivation amongst members of staff; level of training and expertise as well as competence. When trained competent members of staff are well motivated and work as a team with good interpersonal relationships, their productivity is enhanced and this leads to reduced emergency section DDI with good maternal and newborn health outcomes.
Figure 1: A diagrammatic representation of the conceptual framework

**PATIENT FACTORS**
- Sociodemographics
- Obstetric characteristics
- Physical characteristics
- Indication for Caesarean section

**HEALTHCARE PROVIDER FACTORS**
- Leadership & teamwork
- Interpersonal relationships
- Level of motivation/morale
- Level of training & expertise
- Work ethics & professionalism
- Clinical management

**HEALTH SYSTEM FACTORS**
- Level of staffing
- Availability of supplies
- Availability of equipment
- Availability of personnel
- Workload in theatre
- Laboratory support

**DDI of Emergency Caesarean Section**

**Newborn Outcome**

**Maternal Outcome**

**Recommendations**
OBJECTIVES

Broad objective

To evaluate the determinants of the decision-to-delivery interval for emergency caesarean section and its effects on maternal and newborn health outcomes at Kenyatta National and Pumwani Maternity Hospitals.

Specific objectives

1. To determine the decision-to-delivery interval for emergency caesarean section at KNH and PMH.

2. To determine the effect of the decision-to-delivery interval on neonatal outcome of emergency caesarean section at KNH and PMH.

3. To determine the effect of the decision-to-delivery interval on maternal outcome of emergency caesarean section at KNH and PMH.
METHODOLOGY

Study design

This was a hospital-based comparative cross-sectional study conducted between June and August 2012, where the DDI and maternal and perinatal outcomes of 130 women who underwent emergency caesarean section at KNH was compared with that of 121 women at PMH.

Study area

The study was conducted at Kenyatta National Hospital’s maternity unit and Pumwani Maternity Hospital. The study sites were chosen because they are both busy obstetric units in close proximity to Nairobi’s city centre and teaching hospitals for the University of Nairobi.

Kenyatta National Hospital is the largest teaching and referral hospital in Kenya with a bed capacity of 1800. It is located in Nairobi, about 4 km to the west of the city centre. The hospital records more than 10,000 deliveries per year with a caesarean section rate of about 40%. The maternity unit of the hospital comprises of a labour ward, two operating theatres, three lying-in wards and a newborn unit. The labour ward has a total bed capacity of 25 including an acute room with three beds, a post-delivery observation room with 4 beds and two delivery rooms, each with 2 delivery beds. Two Senior House Officers or Registrars man the labour ward daily, working 12-hour shifts each. Midwives work in 3 shifts with each shift having 6 midwives. There is also a consultant obstetrician on call 24 hours a day. Of the 2 operating theatres, one is operational 24 hours a day, handling emergency cases with an in-house registrar and an anaesthetist working in 2 shifts allocated to it. The other theatre handles elective cases between 8 am and 4 pm from Monday to Friday with a consultant obstetrician, registrar and anaesthetist allocated to it. There are 3 nurses allocated to each theatre per shift. The second theatre is also utilized when one operating theatre is overwhelmed with many simultaneous emergency cases, in which case additional personnel may either be deployed from other theatres or a third theatre is availed in the main operating theatres.
Pumwani Maternity Hospital is the largest obstetric health care facility in Kenya, catering exclusively for maternity patients. It is located in the eastern suburb of Nairobi city approximately 3 km from the central business district. The hospital is managed by the City Health Services Department of the Nairobi City Council. It is housed in a two-storied building with the administration block, antenatal/MCH clinics, labour ward, 2 operating theatres, newborn unit and 2 post-surgical postnatal wards on the ground floor; and an antenatal ward as well as two postnatal wards on the first floor for patients who deliver vaginally. It also has a laboratory and blood bank service. Approximately 22,000 deliveries are conducted at the facility each year with a caesarean section rate of 20%. The labour ward has a bed capacity of 48 and is manned daily by two medical officers, each working 12-hour shifts; as well as trained midwives who work in 3 shifts with 8 midwives per shift on average. There is a consultant obstetrician on call 24 hours a day. There are 2 operating theatres; one being operational 24 hours a day and handling emergency cases, allocated with a single in-house medical officer and anaesthetist, each working a 12-hour shift; the other theatre operates between 8 am and 2 pm from Monday to Friday, handling elective cases operated by the consultant obstetrician. Each theatre is allocated at least 3 nurses per shift.

**Study population**

This comprised of 251 women who underwent emergency caesarean delivery at KNH and PMH between 17th June and 1st August 2012. They were distributed as follows: KNH 130 and PMH 121 women respectively. They included women who had attained a viable gestation of at least 28 weeks at the time of delivery, admitted in the above hospitals from home or as referrals from other health facilities for delivery or management of pregnancy related complications with indications for emergency caesarean section.

**Sampling method**

Consecutive sampling method was used because it was convenient, inexpensive and not time consuming to the investigator.
Sample size calculation

The sample size was calculated using the formula below:

\[ N = \frac{(D/f)^2}{(S_1^2 + S_2^2)} \]

Where,

- \( N \) is the desired sample size
- \( D \) is the standard normal deviate at the required confidence level, taken as 1.96 at a confidence interval of 0.05
- \( f \) is the window of precision. Assuming that the DDI is to be estimated within a precision of 10 minutes; this was taken as ± 5 minutes,
- \( S_1 \) is the standard deviation for the DDI in KNH; this was taken as 15 minutes
- \( S_2 \) is the standard deviation for the DDI in PMH; this was taken as 15 minutes

Thus,

\[ N = \frac{(1.96/5)^2}{(15^2 + 15^2)} \]

\[ N = 69 \text{ patients per hospital.} \]

This gave a total sample size of 138 patients for the two hospitals.

However, since KNH and PMH are different in some respects, it was important to adjust for clustering by a design effect of 1.5.

Therefore, the corrected total sample size = 138 x 1.5 = 207 patients.
It was assumed that 8 emergency caesarean sections were performed at PMH daily and 10 at KNH respectively, the sample size for each hospital was as follows:

KNH; 10/18 x 207 = 115 patients,

PMH; 8/18 x 207 = 92 patients.

**Inclusion criteria**

Patients with complete medical records who were managed at KNH or PMH and consented to participate in the study were included.

**Exclusion criteria**

Patients who underwent scheduled elective caesarean deliveries at the two hospitals during the study period or declined to give consent to participate in the study or whose records were incomplete were excluded.

**Data collection procedure**

All patients undergoing emergency caesarean section at KNH and PMH during the study period were informed of the study procedures by the researcher or his assistants after the decision to deliver them by emergency caesarean section was made; informed consent for the operation obtained and blood samples for type and cross-match had been drawn by the attending clinician. Willing participants were then consented and interviewed by the researcher or his assistants using a structured pre-tested questionnaire. The time of decision for emergency caesarean delivery was determined from the patients’ files and recorded in the questionnaire. Subsequently, the time of being received in the operating theatre, administration of anaesthetic agent, skin incision and delivery of the baby were recorded in the questionnaire by the researcher or his assistants using the designated clocks. Details of the delivery outcome were filled in the
questionnaire from the patients’ file. The participants were followed up post-operatively in the respective postnatal wards until discharge from the hospital and any complication was recorded. Similarly, all newborns of the participants who were admitted to the newborn units were followed up until discharge from the unit or death, and the outcome was recorded.
Figure 2: A flow-chart of the data collection procedure.

1. **STUDY PROCEDURES EXPLAINED TO PATIENT & CONSENTED**

2. **TIME OF DECISION-MAKING RECORDED FROM THE PATIENT’S FILE**

3. **PATIENT TRANSFERRED TO OPERATING THEATRE & TIME OF ARRIVAL IN THEATRE RECORDED**

4. **ANAESTHETIC AGENT ADMINISTERED & TIME OF ADMINISTRATION RECORDED**

5. **OPERATION COMMENCED & TIME OF MAKING INCISION RECORDED**

6. **BABY DELIVERED & TIME OF DELIVERY RECORDED**

7. **DELIVERY OUTCOME/BABY’S CONDITION, BIRTH WEIGHT & APGAR SCORE AT 5 MINUTES RECORDED**

8. **BABY ADMITTED TO NBU**

9. **BABY FOLLOWED UP IN NBU UNTIL DISCHARGE/DEATH & OUTCOME RECORDED**

10. **MOTHER FOLLOWED UP POST-OPERATIVELY UNTIL DISCHARGE**

11. **POST-OP. MATERNAL COMPLICATION(S) RECORDED**

12. **DURATION OF POST-OP. HOSPITALIZATION RECORDED**
Data collection instrument

A structured questionnaire (Appendix 2) covering the following areas was used:

1. Socio demographic data:

2. Obstetric data:

3. Data pertaining to the emergency caesarean section:

4. Decision-to-delivery interval:

5. Maternal outcome:

6. Newborn outcome:

Quality control

The data collection assistants were trained in filling of the questionnaire correctly during its pretesting. All clinicians involved in the management of women in the study population were sensitized to record the times of interest to the investigator in the patients’ files using designated clocks of the exact same type, sourced from the one manufacturer which were placed in the labour ward and operating room at each site and synchronized at the beginning of the study and on a daily basis thereafter.

Data management and analysis

Data in the questionnaires was coded and entered into a password-protected computer database. It was then checked by the investigator for completeness and analyzed using the Statistical Package for Social Sciences (SPSS) version 13.0 software and presented in figures and tables.
Frequency distribution tables with accompanying percentages were used to obtain an insight into socio-demographic and obstetric characteristics of study participants. Chi square test was used to measure the strength of associations between the DDI and reasons for delay and outcomes of the operation. Statistical significance was defined as a p value of less than or equal to 0.05.

ETHICAL CONSIDERATIONS

Approval for the study was obtained from the Ethics and Research Committees of KNH and PMH. Participation in the study was voluntary and informed consent was sought before enrolment. Names and other participant identifier information were omitted from the questionnaires and instead a study number unique to each questionnaire was allocated for purposes of identification during data collection, analysis and presentation to ensure confidentiality of information. There were no benefits offered to participants. Patients who declined to participate in the study received the standard care without any discrimination.

STUDY LIMITATIONS

The designated clocks may not have been used to record the times of interest in some cases despite training and sensitization of doctors and midwives involved in the management of study participants and constant reminders by the investigator and his data collection assistants on the use of designated clocks.

The quality of record keeping was poor. There were some cases of incomplete medical records where the exact time of decision making or details of the delivery outcome such as the birth weight or Apgar score were missing from the patients’ file. It was possible to fill some of these gaps by interviewing the study participants and use of delivery registers. However, in seven cases the missing information could not be retrieved even from the register and these were excluded from the analysis.

Consecutive sampling method was used in this study making it prone to selection bias due to the non-random nature of this method.
RESULTS

In total, 130 women who underwent emergency caesarean section at KNH during the study period were compared with 121 women at PMH.

Table 1: Socio-demographic characteristics of the study participants.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>KNH n = 130 (%)</th>
<th>PMH n = 121 (%)</th>
<th>TOTAL n = 251 (%)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 18</td>
<td>1 (1)</td>
<td>1 (1)</td>
<td>2 (1)</td>
<td></td>
</tr>
<tr>
<td>18 – 20</td>
<td>5 (4)</td>
<td>13 (10)</td>
<td>18 (7)</td>
<td></td>
</tr>
<tr>
<td>21 – 25</td>
<td>32 (24)</td>
<td>54 (45)</td>
<td>86 (34)</td>
<td>0.001</td>
</tr>
<tr>
<td>26 – 30</td>
<td>57 (44)</td>
<td>35 (29)</td>
<td>92 (37)</td>
<td></td>
</tr>
<tr>
<td>31 – 35</td>
<td>31 (24)</td>
<td>12 (10)</td>
<td>43 (17)</td>
<td></td>
</tr>
<tr>
<td>&gt;35</td>
<td>4 (3)</td>
<td>6 (5)</td>
<td>10 (4)</td>
<td></td>
</tr>
<tr>
<td>Marital Status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>10 (8)</td>
<td>14 (12)</td>
<td>24 (10)</td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>119 (91)</td>
<td>106 (87)</td>
<td>225 (89)</td>
<td>0.578</td>
</tr>
<tr>
<td>Divorced</td>
<td>1 (1)</td>
<td>1 (1)</td>
<td>2 (1)</td>
<td></td>
</tr>
<tr>
<td>Level of education</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No formal Education</td>
<td>1 (1)</td>
<td>1 (1)</td>
<td>2 (1)</td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>31 (24)</td>
<td>66 (54)</td>
<td>97 (39)</td>
<td></td>
</tr>
<tr>
<td>Secondary</td>
<td>52 (40)</td>
<td>48 (40)</td>
<td>100 (40)</td>
<td></td>
</tr>
<tr>
<td>College &amp; above</td>
<td>46 (35)</td>
<td>6 (5)</td>
<td>52 (20)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Occupation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unemployed</td>
<td>8 (6)</td>
<td>14 (12)</td>
<td>22 (9)</td>
<td></td>
</tr>
<tr>
<td>Housewife</td>
<td>47 (36)</td>
<td>57 (47)</td>
<td>104 (41)</td>
<td>0.009</td>
</tr>
<tr>
<td>Self-Employed</td>
<td>54 (42)</td>
<td>44 (36)</td>
<td>98 (39)</td>
<td></td>
</tr>
<tr>
<td>Professional</td>
<td>21 (16)</td>
<td>6 (5)</td>
<td>27 (11)</td>
<td></td>
</tr>
<tr>
<td>Referral status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Referred</td>
<td>32 (25)</td>
<td>24 (20)</td>
<td>56 (22)</td>
<td>0.087</td>
</tr>
<tr>
<td>Not referred</td>
<td>98 (75)</td>
<td>97 (80)</td>
<td>195 (78)</td>
<td></td>
</tr>
</tbody>
</table>
Table 1 above shows that women in the study population at KNH were significantly older, with a higher level of education and in formal employment compared to their counterparts at PMH (p < 0.05). Referrals from other health facilities had a shorter DDI than those who were not referred. However, this was not statistically significant.

Table 2: Obstetric characteristics of the study participants.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>KNH n = 130 (%)</th>
<th>PMH n = 121 (%)</th>
<th>TOTAL n = 251 (%)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>47 (36)</td>
<td>51 (42)</td>
<td>98 (39)</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>46 (35)</td>
<td>43 (36)</td>
<td>89 (36)</td>
<td>0.505</td>
</tr>
<tr>
<td>2</td>
<td>20 (15)</td>
<td>15 (12)</td>
<td>35 (14)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>14 (11)</td>
<td>7 (5)</td>
<td>21 (8)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>2 (2)</td>
<td>3 (3)</td>
<td>5 (2)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1 (1)</td>
<td>2 (2)</td>
<td>3 (1)</td>
<td></td>
</tr>
<tr>
<td>Previous Live births</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>51 (39)</td>
<td>53 (44)</td>
<td>104 (42)</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>42 (32)</td>
<td>41 (34)</td>
<td>83 (33)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>22 (17)</td>
<td>16 (13)</td>
<td>38 (15)</td>
<td>0.829</td>
</tr>
<tr>
<td>3</td>
<td>12 (9)</td>
<td>8 (7)</td>
<td>20 (8)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>2 (2)</td>
<td>1 (1)</td>
<td>3 (1)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1 (1)</td>
<td>2 (1)</td>
<td>3 (1)</td>
<td></td>
</tr>
<tr>
<td>Previous Still births</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>124 (95)</td>
<td>117 (96)</td>
<td>241 (96)</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>5 (4)</td>
<td>2 (2)</td>
<td>7 (3)</td>
<td>0.538</td>
</tr>
<tr>
<td>2</td>
<td>1 (1)</td>
<td>1 (1)</td>
<td>2 (1)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0 (0)</td>
<td>1 (1)</td>
<td>1 (0)</td>
<td></td>
</tr>
<tr>
<td>Previous Abortions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>110 (85)</td>
<td>111 (91)</td>
<td>221 (88)</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>16 (12)</td>
<td>8 (7)</td>
<td>24 (9)</td>
<td>0.34</td>
</tr>
<tr>
<td>2</td>
<td>3 (2)</td>
<td>1 (1)</td>
<td>4 (2)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1 (1)</td>
<td>1 (1)</td>
<td>2 (1)</td>
<td></td>
</tr>
<tr>
<td>Gestation (weeks)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32 – 36</td>
<td>16 (12)</td>
<td>14 (12)</td>
<td>30 (12)</td>
<td></td>
</tr>
<tr>
<td>37 – 40</td>
<td>93 (72)</td>
<td>88 (73)</td>
<td>181 (72)</td>
<td>0.791</td>
</tr>
<tr>
<td>41 – 42</td>
<td>21 (16)</td>
<td>19 (15)</td>
<td>40 (16)</td>
<td></td>
</tr>
<tr>
<td>Cervical dilatation (cm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 – 2</td>
<td>26 (20)</td>
<td>27 (23)</td>
<td>53 (21)</td>
<td></td>
</tr>
<tr>
<td>3 – 4</td>
<td>46 (36)</td>
<td>44 (36)</td>
<td>90 (36)</td>
<td></td>
</tr>
<tr>
<td>5 – 7</td>
<td>40 (30)</td>
<td>35 (30)</td>
<td>77 (30)</td>
<td>0.015</td>
</tr>
<tr>
<td>8 – 10</td>
<td>16 (12)</td>
<td>10 (8)</td>
<td>26 (10)</td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td>2 (2)</td>
<td>5 (4)</td>
<td>7 (3)</td>
<td></td>
</tr>
</tbody>
</table>
Table 2 above describes the obstetric characteristics of the study population. As shown in the table, majority of respondents were of low parity (para 1 or below) and term gestation. Intrapartum emergency caesarean section was associated with a significantly shorter DDI when the cervical dilatation was more than 4cm (p < 0.05).

Table 3: Indications of emergency caesarean section.

<table>
<thead>
<tr>
<th>Indication</th>
<th>KNH</th>
<th>PMH</th>
<th>TOTAL</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NRFS</td>
<td>45 (28.5)</td>
<td>40 (29)</td>
<td>85 (28.7)</td>
<td>0.965</td>
</tr>
<tr>
<td>Placenta praevia with haemorrhage</td>
<td>4 (2.5)</td>
<td>3 (2.2)</td>
<td>7 (2.4)</td>
<td><strong>0.013</strong></td>
</tr>
<tr>
<td>Abruptio-placenta</td>
<td>1 (0.6)</td>
<td>1 (0.7)</td>
<td>2 (0.7)</td>
<td>0.631</td>
</tr>
<tr>
<td>Cord prolapse</td>
<td>0 (0)</td>
<td>1 (0.7)</td>
<td>1 (0.3)</td>
<td>0.174</td>
</tr>
<tr>
<td>Ruptured uterus</td>
<td>0 (0)</td>
<td>1 (0.7)</td>
<td>1 (0.3)</td>
<td>0.174</td>
</tr>
<tr>
<td>Dystocia</td>
<td>35 (22.2)</td>
<td>38 (27.5)</td>
<td>73 (24.7)</td>
<td>0.816</td>
</tr>
<tr>
<td>Previous uterine scar(s)</td>
<td>36 (22.8)</td>
<td>30 (21.7)</td>
<td>66 (22.4)</td>
<td>0.189</td>
</tr>
<tr>
<td>Failed VBAC</td>
<td>5 (3.1)</td>
<td>0 (0)</td>
<td>5 (1.7)</td>
<td>0.907</td>
</tr>
<tr>
<td>PROM</td>
<td>2 (1.3)</td>
<td>3 (2.2)</td>
<td>5 (1.7)</td>
<td>0.907</td>
</tr>
<tr>
<td>Malpresentation</td>
<td>9 (5.7)</td>
<td>9 (6.5)</td>
<td>18 (6)</td>
<td>0.659</td>
</tr>
<tr>
<td>Failed Induction</td>
<td>3 (1.9)</td>
<td>3 (2.2)</td>
<td>6 (2)</td>
<td>0.349</td>
</tr>
<tr>
<td>Severe pre-eclampsia/eclampsia with poor Bishop score</td>
<td>14 (8.9)</td>
<td>4 (2.9)</td>
<td>18 (6)</td>
<td>0.279</td>
</tr>
<tr>
<td>Multiple Pregnancy</td>
<td>3 (1.9)</td>
<td>4 (2.9)</td>
<td>7 (2.4)</td>
<td>0.796</td>
</tr>
<tr>
<td>Other</td>
<td>1 (0.6)</td>
<td>1 (0.7)</td>
<td>2 (0.7)</td>
<td>0.842</td>
</tr>
</tbody>
</table>

Table 3 above shows the main indications of emergency caesarean section were NRFS, dystocia and previous uterine scar(s). Dystocia included indications like prolonged labour, poor progress, CPD and obstructed labour. There was no case of failed VBAC at PMH which has a policy against the practice. Other indications included BOH in labour and IUGR with prematurity and severe oligohydramnios. Emergency caesarean section for placenta praevia with haemorrhage was associated with a significantly shorter DDI (p < 0.05).
Table 4: Rank, Mode of anaesthesia used, Surgeon, Day and Time of the caesarean sections.

<table>
<thead>
<tr>
<th></th>
<th>KNH</th>
<th>PMH</th>
<th>TOTAL</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n = 130 (%)</td>
<td>n = 121 (%)</td>
<td>n = 251 (%)</td>
<td></td>
</tr>
<tr>
<td>Rank of operation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>86 (66)</td>
<td>90 (74)</td>
<td>176 (70)</td>
<td>0.167</td>
</tr>
<tr>
<td>Repeat</td>
<td>44 (34)</td>
<td>31 (26)</td>
<td>75 (30)</td>
<td></td>
</tr>
<tr>
<td>Mode of anaesthesia used</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General</td>
<td>6 (5)</td>
<td>4 (3)</td>
<td>10 (4)</td>
<td>0.596</td>
</tr>
<tr>
<td>Spinal</td>
<td>124 (95)</td>
<td>117 (97)</td>
<td>241 (96)</td>
<td></td>
</tr>
<tr>
<td>Surgeon</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical Officer</td>
<td>2 (2)</td>
<td>119 (98)</td>
<td>121 (48)</td>
<td></td>
</tr>
<tr>
<td>Registrar</td>
<td>128 (98)</td>
<td>0 (0)</td>
<td>128 (51)</td>
<td>0.106</td>
</tr>
<tr>
<td>Consultant</td>
<td>0 (0)</td>
<td>2 (2)</td>
<td>2 (1)</td>
<td></td>
</tr>
<tr>
<td>Day of the week</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monday</td>
<td>13 (10)</td>
<td>18 (15)</td>
<td>31 (12)</td>
<td></td>
</tr>
<tr>
<td>Tuesday</td>
<td>17 (13)</td>
<td>16 (13)</td>
<td>33 (13)</td>
<td></td>
</tr>
<tr>
<td>Wednesday</td>
<td>23 (18)</td>
<td>21 (17)</td>
<td>44 (18)</td>
<td>0.709</td>
</tr>
<tr>
<td>Thursday</td>
<td>17 (13)</td>
<td>15 (12)</td>
<td>32 (13)</td>
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</tr>
<tr>
<td>Friday</td>
<td>24 (19)</td>
<td>17 (14)</td>
<td>41 (16)</td>
<td></td>
</tr>
<tr>
<td>Saturday</td>
<td>8 (6)</td>
<td>22 (19)</td>
<td>30 (12)</td>
<td></td>
</tr>
<tr>
<td>Sunday</td>
<td>28 (22)</td>
<td>12 (10)</td>
<td>40 (16)</td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day (0800 – 1959 Hrs)</td>
<td>87 (67)</td>
<td>71 (59)</td>
<td>158 (63)</td>
<td>0.089</td>
</tr>
<tr>
<td>Night (2000 – 0759 Hrs)</td>
<td>43 (33)</td>
<td>50 (41)</td>
<td>93 (37)</td>
<td></td>
</tr>
</tbody>
</table>

Table 4 describes details of the caesarean sections. As shown in the table, primary procedures were predominant with spinal anaesthesia being the preferred mode of anaesthesia for emergency caesarean section. Almost all emergency operations were performed by Medical Officers or Registrars, the majority of which were during the day. However, the association between these factors and the DDI was not significant.
Table 5: Decision-to-delivery interval for emergency caesarean section.

<table>
<thead>
<tr>
<th>Time interval (mins)</th>
<th>KNH  n = 130 (%)</th>
<th>PMH n = 121 (%)</th>
<th>TOTAL n = 251 (%)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Decision to Theatre</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 – 30</td>
<td>9 (7)</td>
<td>13 (11)</td>
<td>22 (9)</td>
<td></td>
</tr>
<tr>
<td>31 – 60</td>
<td>18 (14)</td>
<td>18 (15)</td>
<td>36 (14)</td>
<td></td>
</tr>
<tr>
<td>61 – 90</td>
<td>17 (13)</td>
<td>10 (8)</td>
<td>27 (11)</td>
<td>0.853</td>
</tr>
<tr>
<td>91 – 120</td>
<td>13 (10)</td>
<td>9 (7)</td>
<td>22 (9)</td>
<td></td>
</tr>
<tr>
<td>121 – 180</td>
<td>19 (15)</td>
<td>18 (15)</td>
<td>37 (15)</td>
<td></td>
</tr>
<tr>
<td>181 – 240</td>
<td>16 (12)</td>
<td>15 (12)</td>
<td>31 (12)</td>
<td></td>
</tr>
<tr>
<td>241 – 300</td>
<td>9 (7)</td>
<td>7 (6)</td>
<td>16 (6)</td>
<td></td>
</tr>
<tr>
<td>&gt;300</td>
<td>29 (22)</td>
<td>31 (21)</td>
<td>60 (24)</td>
<td></td>
</tr>
<tr>
<td><strong>Theatre to Anaesthesia</strong></td>
<td></td>
<td></td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>0 – 30</td>
<td>117 (90)</td>
<td>26 (22)</td>
<td>143 (57)</td>
<td></td>
</tr>
<tr>
<td>31 – 60</td>
<td>13 (10)</td>
<td>40 (33)</td>
<td>53 (21)</td>
<td></td>
</tr>
<tr>
<td>61 – 90</td>
<td>0 (0)</td>
<td>13 (11)</td>
<td>13 (5)</td>
<td></td>
</tr>
<tr>
<td>91 – 120</td>
<td>0 (0)</td>
<td>12 (10)</td>
<td>12 (5)</td>
<td></td>
</tr>
<tr>
<td>121 – 180</td>
<td>0 (0)</td>
<td>16 (13)</td>
<td>16 (6)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>181 – 240</td>
<td>0 (0)</td>
<td>4 (3)</td>
<td>4 (2)</td>
<td></td>
</tr>
<tr>
<td>241 – 300</td>
<td>0 (0)</td>
<td>6 (5)</td>
<td>6 (2)</td>
<td></td>
</tr>
<tr>
<td>&gt;300</td>
<td>0 (0)</td>
<td>4 (3)</td>
<td>4 (2)</td>
<td></td>
</tr>
<tr>
<td><strong>Anaesthesia to incision</strong></td>
<td></td>
<td></td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>0 – 5</td>
<td>39 (30)</td>
<td>76 (63)</td>
<td>115 (46)</td>
<td></td>
</tr>
<tr>
<td>6 – 10</td>
<td>41 (31)</td>
<td>35 (29)</td>
<td>76 (30)</td>
<td></td>
</tr>
<tr>
<td>11 – 15</td>
<td>31 (24)</td>
<td>8 (7)</td>
<td>39 (16)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>16 – 20</td>
<td>10 (8)</td>
<td>2 (1)</td>
<td>12 (5)</td>
<td></td>
</tr>
<tr>
<td>21 – 25</td>
<td>8 (6)</td>
<td>0 (0)</td>
<td>8 (3)</td>
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</tr>
<tr>
<td>26 – 30</td>
<td>1 (1)</td>
<td>0 (0)</td>
<td>1 (0)</td>
<td></td>
</tr>
<tr>
<td>Decision to incision</td>
<td>0 – 30</td>
<td>31 – 60</td>
<td>61 – 90</td>
<td>91 – 120</td>
</tr>
<tr>
<td>----------------------</td>
<td>--------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td></td>
<td>1 (1)</td>
<td>8 (6)</td>
<td>17 (13)</td>
<td>16 (12)</td>
</tr>
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<td></td>
<td>1 (1)</td>
<td>6 (5)</td>
<td>7 (6)</td>
<td>9 (7)</td>
</tr>
<tr>
<td></td>
<td>2 (1)</td>
<td>14 (5)</td>
<td>24 (9)</td>
<td>25 (10)</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Incision to delivery</th>
<th>0 – 5</th>
<th>6 – 10</th>
<th>11 – 15</th>
<th>16 – 20</th>
<th>21 – 25</th>
<th>26 – 30</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>71 (55)</td>
<td>34 (26)</td>
<td>15 (11)</td>
<td>6 (5)</td>
<td>3 (2)</td>
<td>1 (1)</td>
</tr>
<tr>
<td></td>
<td>96 (79)</td>
<td>19 (16)</td>
<td>5 (4)</td>
<td>1 (1)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td></td>
<td>167 (67)</td>
<td>53 (21)</td>
<td>20 (8)</td>
<td>7 (3)</td>
<td>3 (1)</td>
<td>1 (0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Decision to delivery</th>
<th>0 – 30</th>
<th>31 – 60</th>
<th>61 – 90</th>
<th>91 – 120</th>
<th>121 – 180</th>
<th>181 – 240</th>
<th>241 – 300</th>
<th>&gt;300</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 (0)</td>
<td>6 (5)</td>
<td>16 (12)</td>
<td>19 (15)</td>
<td>26 (20)</td>
<td>16 (12)</td>
<td>11 (8)</td>
<td>36 (28)</td>
</tr>
<tr>
<td></td>
<td>1 (1)</td>
<td>3 (2)</td>
<td>10 (8)</td>
<td>10 (8)</td>
<td>14 (12)</td>
<td>12 (10)</td>
<td>14 (12)</td>
<td>57 (47)</td>
</tr>
<tr>
<td></td>
<td>1 (0)</td>
<td>9 (4)</td>
<td>26 (10)</td>
<td>29 (12)</td>
<td>40 (16)</td>
<td>28 (11)</td>
<td>25 (10)</td>
<td>93 (37)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5 above shows that nearly half of all emergency caesarean sections at PMH commenced more than 5 hours after the decision to operate and only 1% started within 30 minutes. The median DDI was shorter at KNH than PMH; 170 compared to 285 minutes. The interval between arrival in theatre and administration of anaesthesia was significantly shorter at KNH (p < 0.001) while that between the administration of anaesthesia to incision was significantly shorter at PMH (p < 0.001).
Figure 3: Decision-to-delivery interval for emergency caesarean section.

The graph above shows the percentage distribution of decision-to-delivery intervals (DDI) for emergency caesarean sections at KNH and PMH. The intervals are categorized into five ranges: 0–30 minutes, 31–60 minutes, 61–90 minutes, 91–120 minutes, 121–180 minutes, 181–240 minutes, 241–300 minutes, and >300 minutes. The percentages are as follows:

- **0–30 minutes:**
  - KNH: 1%
  - PMH: 47%
  - TOTAL: 48%

- **31–60 minutes:**
  - KNH: 2%
  - PMH: 8%
  - TOTAL: 10%

- **61–90 minutes:**
  - KNH: 4%
  - PMH: 10%
  - TOTAL: 14%

- **91–120 minutes:**
  - KNH: 8%
  - PMH: 12%
  - TOTAL: 20%

- **121–180 minutes:**
  - KNH: 12%
  - PMH: 16%
  - TOTAL: 28%

- **181–240 minutes:**
  - KNH: 10%
  - PMH: 11%
  - TOTAL: 21%

- **241–300 minutes:**
  - KNH: 8%
  - PMH: 12%
  - TOTAL: 20%

- **>300 minutes:**
  - KNH: 10%
  - PMH: 10%
  - TOTAL: 20%

Figure 3 above shows that the interval between decision and delivery was within 30 minutes for less than 1% of women, 31–60 minutes for 4% and more than 5 hours for 37%. There was no delivery within 30 minutes at KNH while 47% of emergency caesarean deliveries at PMH were accomplished more than 5 hours after the decision to operate. The median decision-to-delivery interval was shorter at KNH than PMH; 178 compared to 290 minutes.
Table 6: Reasons for delay in performing emergency caesarean section.

<table>
<thead>
<tr>
<th>Reason for Delay</th>
<th>KNH</th>
<th>PMH</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>Lack of consent</td>
<td>0 (0)</td>
<td>3 (1)</td>
<td>3 (1)</td>
</tr>
<tr>
<td>Pending laboratory test results</td>
<td>2 (1)</td>
<td>1 (1)</td>
<td>3 (1)</td>
</tr>
<tr>
<td>Lack of blood</td>
<td>1 (0)</td>
<td>2 (1)</td>
<td>3 (1)</td>
</tr>
<tr>
<td>Theatre not available</td>
<td>107 (27)</td>
<td>105 (33)</td>
<td>212 (30)</td>
</tr>
<tr>
<td>Anaesthetist not available</td>
<td>5 (1)</td>
<td>40 (12)</td>
<td>45 (6)</td>
</tr>
<tr>
<td>Surgeon not available</td>
<td>2 (1)</td>
<td>34 (10)</td>
<td>36 (5)</td>
</tr>
<tr>
<td>Excessive workload</td>
<td>25 (6)</td>
<td>12 (4)</td>
<td>37 (5)</td>
</tr>
<tr>
<td>Multiple attempts at spinal anaesthesia</td>
<td>18 (5)</td>
<td>7 (2)</td>
<td>25 (3)</td>
</tr>
<tr>
<td>Lack of sterile packs</td>
<td>6 (1)</td>
<td>4 (1)</td>
<td>10 (1)</td>
</tr>
<tr>
<td>Long preparation time between operations</td>
<td>58 (15)</td>
<td>5 (2)</td>
<td>63 (8)</td>
</tr>
<tr>
<td>Lack of additional theatre staff to open a second theatre</td>
<td>69 (17)</td>
<td>46 (14)</td>
<td>115 (16)</td>
</tr>
<tr>
<td>Poor interpersonal relations between staff</td>
<td>10 (2)</td>
<td>2 (1)</td>
<td>12 (1)</td>
</tr>
<tr>
<td>Lack of motivation/low staff morale</td>
<td>23 (6)</td>
<td>18 (5)</td>
<td>41 (6)</td>
</tr>
<tr>
<td>Other</td>
<td>70 (18)</td>
<td>43 (13)</td>
<td>113 (16)</td>
</tr>
</tbody>
</table>

Table 6 above describes the reasons for delay in performing emergency caesarean section. The main reasons for delay were unavailability of theatre and lack of additional staff to open a second theatre. Poor prioritization of cases, long time taken for pre-operative preparation of patients, staff reporting on duty late or taking unscheduled breaks for meals and resting while on duty, cleaning and fumigation of the operating theatre, breakdown of the anaesthetic machine, interruptions in power supply, difficult entry due to intra-abdominal adhesions from previous operations and difficult extraction of the fetus were the other reasons for delay.
Table 7: Reasons for delay in performing emergency caesarean section and the DDI.

<table>
<thead>
<tr>
<th>Reason for Delay</th>
<th>Decision-to-Delivery Interval (minutes)</th>
<th></th>
<th></th>
<th></th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 60 (n) (%)</td>
<td>60 - 120 (n) (%)</td>
<td>&gt; 120 (n) (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of consent</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>3 (0.5)</td>
<td>0.6</td>
<td></td>
</tr>
<tr>
<td>Pending laboratory results</td>
<td>0 (0)</td>
<td>1 (1)</td>
<td>2 (0.3)</td>
<td>0.625</td>
<td></td>
</tr>
<tr>
<td>Lack of blood</td>
<td>0 (0)</td>
<td>2 (2)</td>
<td>1 (0.2)</td>
<td>0.172</td>
<td></td>
</tr>
<tr>
<td>Theatre not available</td>
<td>4 (33)</td>
<td>31 (28)</td>
<td>177 (30)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>Anaesthetist not available</td>
<td>0 (0)</td>
<td>4 (3)</td>
<td>41 (7)</td>
<td>0.019</td>
<td></td>
</tr>
<tr>
<td>Surgeon not available</td>
<td>0 (0)</td>
<td>2 (2)</td>
<td>34 (5.7)</td>
<td>0.016</td>
<td></td>
</tr>
<tr>
<td>Excessive workload</td>
<td>0 (0)</td>
<td>8 (7)</td>
<td>29 (5)</td>
<td>0.533</td>
<td></td>
</tr>
<tr>
<td>Multiple attempts at spinal anaesthesia</td>
<td>0 (0)</td>
<td>9 (8)</td>
<td>16 (2.7)</td>
<td>0.122</td>
<td></td>
</tr>
<tr>
<td>Lack of sterile packs</td>
<td>0 (0)</td>
<td>3 (2)</td>
<td>7 (1.2)</td>
<td>0.636</td>
<td></td>
</tr>
<tr>
<td>Long preparation time between operations</td>
<td>1 (8)</td>
<td>10 (9)</td>
<td>52 (8.7)</td>
<td>0.286</td>
<td></td>
</tr>
<tr>
<td>Lack of additional staff to open a second theatre</td>
<td>2 (18)</td>
<td>9 (8)</td>
<td>104 (17)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>Poor interpersonal relations between staff</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>12 (2)</td>
<td>0.249</td>
<td></td>
</tr>
<tr>
<td>Lack of motivation/low staff morale</td>
<td>1 (8)</td>
<td>6 (5)</td>
<td>34 (5.7)</td>
<td>0.842</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>4 (33)</td>
<td>26 (25)</td>
<td>83 (14)</td>
<td>0.781</td>
<td></td>
</tr>
</tbody>
</table>

Table 7 above compares the reasons for delay in performing emergency caesarean section and the DDI. As shown in the table, unavailability of the operating theatre and lack of additional theatre staff required to run a second operating theatre were significantly associated with a prolonged DDI (p < 0.001).
Table 8: Maternal outcomes of the study participants.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>KNH  n (%)</th>
<th>PMH  n (%)</th>
<th>TOTAL n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal complication</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wound sepsis</td>
<td>3 (2)</td>
<td>2 (1.4)</td>
<td>5 (2)</td>
</tr>
<tr>
<td>Puerperal sepsis</td>
<td>2 (1.4)</td>
<td>1 (0.7)</td>
<td>3 (1.2)</td>
</tr>
<tr>
<td>PPH</td>
<td>0 (0)</td>
<td>3 (2.5)</td>
<td>3 (1.2)</td>
</tr>
<tr>
<td>Obstetric fistula</td>
<td>1 (0.8)</td>
<td>0 (0)</td>
<td>1 (0.4)</td>
</tr>
<tr>
<td>Other</td>
<td>1 (0.8)</td>
<td>3 (2.5)</td>
<td>4 (1.6)</td>
</tr>
<tr>
<td>None</td>
<td>123 (95)</td>
<td>112 (93)</td>
<td>233 (94)</td>
</tr>
<tr>
<td>Post-op. hospital stay (days)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 – 3</td>
<td>124 (95)</td>
<td>75 (62)</td>
<td>199 (79)</td>
</tr>
<tr>
<td>4 – 10</td>
<td>5 (4)</td>
<td>41 (34)</td>
<td>46 (18)</td>
</tr>
<tr>
<td>11 – 14</td>
<td>0 (0)</td>
<td>5 (4)</td>
<td>5 (2)</td>
</tr>
<tr>
<td>15 – 42</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>&gt;42</td>
<td>1 (1)</td>
<td>0 (0)</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Reason for prolonged stay</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wound sepsis</td>
<td>3 (43)</td>
<td>2 (4)</td>
<td>5 (9)</td>
</tr>
<tr>
<td>Puerperal sepsis</td>
<td>1 (14)</td>
<td>2 (4)</td>
<td>3 (5)</td>
</tr>
<tr>
<td>Severe pre-eclampsia/eclampsia</td>
<td>0 (0)</td>
<td>2 (4)</td>
<td>2 (4)</td>
</tr>
<tr>
<td>Severe anaemia</td>
<td>0 (0)</td>
<td>1 (2)</td>
<td>1 (2)</td>
</tr>
<tr>
<td>Other</td>
<td>3 (43)</td>
<td>41 (86)</td>
<td>44 (80)</td>
</tr>
</tbody>
</table>

Table 8 above shows that overall puerperal morbidity was 6% with wound sepsis being the most common complication. The median duration of post-operative hospitalization was 3 days. Multiple complications including DVT, pelvic abscess, obstetric fistula and wound sepsis led to the hospitalization of one of the women in the study beyond 42 days at KNH. Severe anaemia secondary to PPH that necessitated blood transfusion was recorded in one of the study participants at PMH. Other reasons for prolonged hospitalization included mothers who were awaiting their newborns admitted in the NBU.
Figure 4: Maternal complications of emergency caesarean section.

Figure 4 above illustrates the maternal complications of emergency caesarean section. Wound sepsis was the most common complication followed by puerperal sepsis, PPH and obstetric fistula. Other less common complications included DVT and wound dehiscence. There was no maternal death recorded among the study participants during the period of hospital stay. There were two cases of ruptured uterus in women who waited to undergo emergency caesarean section.

Table 9: Maternal outcomes of the study participants and the DDI.

<table>
<thead>
<tr>
<th>Maternal outcome</th>
<th>Decision-to-Delivery Interval (minutes)</th>
<th>&lt; 60 (n (%)</th>
<th>60 - 120 (n (%))</th>
<th>&gt; 120 (n (%))</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal complication</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td>0 (0)</td>
<td>3 (6)</td>
<td>15 (6)</td>
<td>0.732</td>
</tr>
<tr>
<td>No</td>
<td></td>
<td>11 (100)</td>
<td>51 (94)</td>
<td>171 (94)</td>
<td></td>
</tr>
<tr>
<td>Post-op. hospital stay (days)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>10 (91)</td>
<td>46 (85)</td>
<td>143 (77)</td>
<td></td>
</tr>
<tr>
<td>4 – 10</td>
<td></td>
<td>1 (9)</td>
<td>7 (13)</td>
<td>35 (19)</td>
<td>0.567</td>
</tr>
<tr>
<td>&gt; 10</td>
<td></td>
<td>0 (0)</td>
<td>1 (2)</td>
<td>8 (4)</td>
<td></td>
</tr>
</tbody>
</table>

Table 9 above compares maternal outcomes of study participants and the DDI. No maternal complication was recorded among women who were delivered in less than an hour. There was no increase in the rate of maternal complications with prolongation of the DDI beyond 1 hour. The length of post-operative hospital stay increased with increase in DDI. The association between the DDI and maternal complication or duration of post-operative hospital stay was not significant.
Table 10: Newborn outcomes of the study population.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>KNH</th>
<th>PMH</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Condition at birth</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alive</td>
<td>133 (100)</td>
<td>121 (97)</td>
<td>254 (98)</td>
</tr>
<tr>
<td>FSB</td>
<td>0 (0)</td>
<td>3 (2)</td>
<td>3 (1)</td>
</tr>
<tr>
<td>MSB</td>
<td>0 (0)</td>
<td>1 (1)</td>
<td>1 (1)</td>
</tr>
<tr>
<td><strong>Birth weight (grams)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;1500</td>
<td>2 (2)</td>
<td>0 (0)</td>
<td>2 (1)</td>
</tr>
<tr>
<td>1500 – 2499</td>
<td>21 (16)</td>
<td>15 (12)</td>
<td>36 (14)</td>
</tr>
<tr>
<td>2500 – 3499</td>
<td>86 (64)</td>
<td>95 (76)</td>
<td>181 (70)</td>
</tr>
<tr>
<td>3500 – 4000</td>
<td>17 (13)</td>
<td>13 (10)</td>
<td>30 (12)</td>
</tr>
<tr>
<td>&gt;4000</td>
<td>7 (5)</td>
<td>2 (2)</td>
<td>9 (3)</td>
</tr>
<tr>
<td><strong>Apgar score at 5 minutes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 – 3</td>
<td>0 (0)</td>
<td>6 (5)</td>
<td>6 (2)</td>
</tr>
<tr>
<td>4 – 6</td>
<td>2 (2)</td>
<td>6 (5)</td>
<td>8 (3)</td>
</tr>
<tr>
<td>7 – 10</td>
<td>131 (98)</td>
<td>113 (90)</td>
<td>244 (95)</td>
</tr>
<tr>
<td><strong>NBU admission</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>33 (25)</td>
<td>64 (51)</td>
<td>97 (38)</td>
</tr>
<tr>
<td>No</td>
<td>100 (75)</td>
<td>61 (49)</td>
<td>162 (62)</td>
</tr>
<tr>
<td><strong>Indications for NBU admission</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RDS</td>
<td>17 (39)</td>
<td>28 (40)</td>
<td>45 (39)</td>
</tr>
<tr>
<td>Birth asphyxia</td>
<td>4 (9)</td>
<td>17 (24)</td>
<td>21 (18)</td>
</tr>
<tr>
<td>Prematurity</td>
<td>8 (18)</td>
<td>7 (10)</td>
<td>15 (13)</td>
</tr>
<tr>
<td>MAS</td>
<td>7 (16)</td>
<td>4 (6)</td>
<td>11 (10)</td>
</tr>
<tr>
<td>Neonatal sepsis</td>
<td>5 (11)</td>
<td>2 (3)</td>
<td>7 (6)</td>
</tr>
<tr>
<td>Congenital malformation</td>
<td>3 (7)</td>
<td>0 (0)</td>
<td>3 (3)</td>
</tr>
<tr>
<td>Other</td>
<td>0 (0)</td>
<td>12 (17)</td>
<td>12 (11)</td>
</tr>
<tr>
<td><strong>Survival in NBU</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alive</td>
<td>33 (100)</td>
<td>61 (95)</td>
<td>94 (97)</td>
</tr>
<tr>
<td>Dead</td>
<td>0 (0)</td>
<td>3 (5)</td>
<td>3 (3)</td>
</tr>
</tbody>
</table>

Table 10 above describes the newborn outcomes of emergency caesarean delivery. As shown in the table, there were 258 deliveries. These included 7 sets of twins and 3 neonates with hydrocephalus. The median birth weight was 3000 grams. Apgar score of less than 7 at 5 minutes was recorded in 5% of newborns and 38% were admitted in the NBU. The main indications for admission were RDS and birth asphyxia while other indications included SGA/LBW, LGA and presence of caput. There were 7 perinatal deaths. The causes of the neonatal deaths were prematurity, neonatal sepsis and severe birth asphyxia.
Table 11: Newborn outcomes and the DDI.

<table>
<thead>
<tr>
<th>Newborn outcome</th>
<th>Decision-to-Delivery Interval (minutes)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 60</td>
<td>60 - 120</td>
</tr>
<tr>
<td>Condition at birth</td>
<td>n   (%)</td>
<td>n   (%)</td>
</tr>
<tr>
<td>Alive</td>
<td>8   (100)</td>
<td>55 (96.5)</td>
</tr>
<tr>
<td>FSB</td>
<td>0   (0)</td>
<td>2   (3.5)</td>
</tr>
<tr>
<td>MSB</td>
<td>0   (0)</td>
<td>0   (0)</td>
</tr>
<tr>
<td>APGAR score at 5 minutes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 – 3</td>
<td>0   (0)</td>
<td>0   (0)</td>
</tr>
<tr>
<td>4 – 6</td>
<td>1   (10)</td>
<td>3   (5)</td>
</tr>
<tr>
<td>7 – 10</td>
<td>9   (90)</td>
<td>57 (95)</td>
</tr>
<tr>
<td>Admitted to NBU</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>3   (38)</td>
<td>21 (38)</td>
</tr>
<tr>
<td>No</td>
<td>5   (62)</td>
<td>34 (62)</td>
</tr>
<tr>
<td>Survival in NBU</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alive</td>
<td>3   (100)</td>
<td>20 (95)</td>
</tr>
<tr>
<td>Dead</td>
<td>0   (0)</td>
<td>1   (5)</td>
</tr>
</tbody>
</table>

Table 11 above compares the perinatal outcomes of emergency caesarean section with the DDI. There was no stillbirth when the DDI was less than 1 hour but stillbirths comprised 1% of newborns delivered after more than 2 hours. The 5-minute Apgar score was less than 7 in 10% and 5% of newborns delivered in under an hour and more than an hour respectively. The rate of admission to NBU remained the same irrespective of the DDI. There was no neonatal death recorded among the newborns delivered in less than an hour and admitted to the NBU. The association between condition of the newborn at birth, Apgar score at 5 minutes, NBU admission status or survival in the NBU and the DDI was not statistically significant.
DISCUSSION

This study shows that the interval between decision and delivery was within 30 minutes for less than 1% of women and more than 5 hours for 37%. Cervical dilatation was associated with a significantly shorter DDI and emergency caesarean section for placenta praevia with haemorrhage returned the fastest response time. Unavailability of theatre space and lack of additional theatre staff to open a second theatre were significantly associated with delay in emergency caesarean delivery. Wound sepsis was the commonest post-operative complication. The median duration of post-operative hospital stay was 3 days. The association between the DDI and occurrence of maternal complication, prolonged post-operative hospitalization, Apgar score of the newborn at 5 minutes, admission to the NBU or its survival was not significant.

The women in this study were generally young; 95% were between 18 – 34 years of age which is the optimum for child bearing. This is comparable to the findings of an earlier study by Karanja et al [60] and The Nairobi Birth Survey [61]. Women aged between 21 – 30 years formed 71% of the study population with slightly older women at KNH than PMH. This could be correlated with the fact that women who delivered at KNH had a higher level of education, were in some form of employment and of higher socioeconomic status; 35% having tertiary education compared to 5% at PMH thus delaying child bearing. Women who delivered at PMH were of lower socioeconomic status with twice as many as those at KNH being unemployed and single hence started child bearing earlier. Respondents aged below 18 years who were at higher risk for caesarean delivery due to CPD formed 1%.

Referrals from other health facilities constituted 22% of the study population. There were more referrals at KNH 25% than PMH 20%. This is because PMH mainly receives referrals from Nairobi City Council clinics and some private health facilities within the greater Nairobi area while KNH serves a large catchment area which includes nearby Central, lower part of Eastern and southern part of Rift Valley provinces. Post-operative maternal morbidity was greater in the referred group with a relatively longer hospital stay which was similar to the findings of Nyongesa et al [62]. Referred patients generally present in a poorer condition with prolonged labour and prolonged rupture of membranes, having had many vaginal examinations thus making
them more susceptible to infectious and other obstetric-related morbidity and their newborns at greater risk of perinatal death. In this study however, newborn outcomes of the referred group were not worse than those who were not referred. This could be due to there being no fetal compromise at the point of referral.

The majority of respondents were of low parity. Nulliparous women and para 1 comprised 39% and 36% of the study population respectively. This is in keeping with the findings of earlier studies [23, 25, 26, 27, 65]. The highest parity of women included in the study was para five. The gestational age of women in the study ranged between 32 - 42 weeks with 12% below 37 weeks. Intrapartum emergency caesarean sections comprised 89% of cases and patients with a dilated cervix had a significantly shorter DDI. This was comparable to the results of a Norwegian study involving 24 maternity units which was conducted over a period of 7 months [45].

Repeat caesarean section accounted for 30% of all emergency caesarean sections in this study. This figure is lower than 51.2% reported at KNH by Karanja J. G. [63] and 42.1% by Muriu [23] in 1982 and 1991 respectively. However it is comparable to 36% reported by Karanja S. K. [64] at PMH in 1991 and 35.7% reported by Chemwolo in 2007 [26].

The most common indications for emergency caesarean section were non-reassuring fetal status 29%, dystocia 25% and previous uterine scar(s) 24%. Other important indications were breech presentation 6%, hypertensive disorders of pregnancy 6% and failed induction 2%. Non-reassuring fetal status was probably over-diagnosed on the basis of intermittent auscultation of abnormal fetal heart sounds and meconium staining of amniotic fluid. Abnormal fetal heart pattern tracings obtained through intermittent electronic fetal monitoring at KNH without evidence of derangement in fetal blood gases not analyzed at this hospital may have also contributed to this. Whilst the leading indications of emergency caesarean section remained the same as in previous studies by other investigators [25, 26], the findings of this study are in contrast to Muriu’s study in which previous uterine scar(s) accounted for 41.5% [23]. The large number of repeat emergency caesarean sections was due to the high prevalence of CPD in our obstetric population which is a contraindication to VBAC and institutional policy at PMH which prohibits it. APH was responsible for 3% of all emergency caesarean sections in this study and
placenta praevia with haemorrhage was associated with a significantly short response time of 17 minutes. This mirrors the findings of Chemwolo et al [26] at St. Mary’s Mission Hospital and could be attributed to the urgent nature of this indication. There was only one case of cord prolapse during the study period making it insignificant for statistical analysis.

Spinal anaesthesia was the preferred mode of anaesthesia for emergency caesarean section 96% which was comparable to 97.4% reported previously. This mode of anaesthesia has been shown to be increasingly safe and effective, providing acceptable response times in the majority of urgent cases [36, 37]. It is much cheaper and less labour intensive. General anaesthetic was administered to 10 of the respondents in this study. This was due to failed spinal anaesthesia, unavailability of spinal needles or Bupivacaine for spinal anaesthesia and contraindication to spinal anaesthesia due to hypotension in a patient with haemorrhage. General anaesthesia is faster than spinal anaesthesia, however the number of caesarean sections performed under general anaesthesia was very small to make any comparison.

Medical Officer Interns in training operated 2% of women at KNH under the supervision of Registrars. Consultant Obstetricians hardly ever performed any emergency caesarean section because Medical Officers and Registrars performed the bulk of emergency operations at PMH and KNH respectively. A small percentage of women in the study were operated on by Consultants at PMH who interrupted their elective theatre on weekdays when the Medical Officer was not available or overwhelmed with too many emergencies. The seniority of the surgeon operating the patient did not seem to influence the DDI. However, number of operations performed by consultants was too small for comparison.

Most emergency caesarean sections were performed on Wednesdays, Fridays and Sundays. The number of caesarean sections performed during the daytime was more than at night. However, there were more delays during the day as elective cases also done during the day, occupied the second operating theatre and emergency operations were interrupted by frequent change in shifts of theatre staff who work shorter hours during the day. Time of the day or day of the week when delivery occurred did not seem to influence the DDI, similar to the findings of another study at University of Oxford in the UK [50].
The interval between decision and delivery was within 30 minutes for less than 1% of women in this study. This was comparable to the figure of 2.2% reported by Ngare at The Mater Hospital [25] but in contrast to 13.1% and 20.4% reported at KNH and St. Mary’s Mission Hospital by Muriu [23] and Chemwolo respectively [26]. There was no emergency caesarean delivery within 30 minutes of the decision to operate at KNH as Chege’s study showed in 2007 [22]. This study showed that unavailability of theatre and lack of additional theatre staff to open a second theatre was significantly associated with delay in emergency caesarean delivery. This mirrors the findings of Muriu’s study [23].

The time taken to transfer the patient to the operating room is critical as it represents approximately half of the interval between decision and delivery by emergency caesarean section. Less than half of the women in this study (43%) were transferred to theatre within 2 hours. This was due to the long preparation time largely associated with excessive workload and staff shortage in the labour wards where the midwife to patient ratio is 1:7. Other factors which contributed to delay in transferring the patient to theatre included lack of consent where the patient’s spouse or other relative not present at the time of decision making had to be informed and give consent on behalf of the patient, lack of blood which was deemed necessary before the patient who had APH could be operated and delay in obtaining test results of laboratory investigations which were required for patients with severe pre-eclampsia prior to the operation.

The interval between arrival in theatre and administration of anaesthetic agent was significantly shorter at KNH with 90% of respondents anaesthetized within 30 minutes of arrival in theatre compared to 22% at PMH. This is due to the fact that patients for emergency caesarean section at KNH were not received in theatre while another operation was still in progress until the theatre was vacant and the operating team was complete unlike PMH where patients were received in theatre and taken to a waiting area if the theatre was in use or if some members of the operating team were not present. Delay in administration of anaesthetic agent was also caused by multiple attempts at spinal anaesthesia in 3% of the study population. Interruption in power supply was implicated in one case where the operation had to be delayed as the patient’s vital signs could not be monitored because the monitor was not functional without any power back-up while
breakdown of the anaesthetic machine contributed to delay in another case. The long time taken to clean and prepare the operating theatre between operations was also responsible for this delay.

It took a significantly shorter time to commence an emergency caesarean section once the anaesthetic agent had been administered at PMH. Lack of preparation for catheterization of the urinary bladder and shaving of skin at the incision site by theatre nurses who scrubbed for the procedure and set instrument only after the patient had been anaesthetized contributed to this delay. Conversion to general anaesthesia after failed spinal anaesthesia also delayed the start of the operation.

Prolonged interval between incision and delivery of the newborn was mainly caused by adhesions from previous operations which delayed entry into the abdomen in 22 patients with a previous uterine scar and 15 cases of difficult delivery of the newborn due to impaction of the fetal head in the maternal pelvis or malpresentation.

Other factors responsible for delay included poor prioritization of cases, low staff morale and lack of discipline with staff reporting on duty late or taking unscheduled breaks for meals and resting while on duty. Unavailability of anaesthetist and surgeon were also implicated.

From the foregoing, most women undergoing emergency caesarean section wait beyond the recommended interval for up to 5 hours. Once the decision for emergency caesarean delivery is made, there is no fetomaternal monitoring and women waiting to be operated are forced to starve for many hours, not receiving intravenous fluids either. Nothing much is done about pain for those in labour. This adds to the anxiety of not knowing what the outcome will be since they were told they urgently need the operation.

The overall puerperal morbidity in this study was 6% with the most common post-operative complication being wound sepsis (2%). This was much lower than 16.6% and 13.3% reported by Chemwolo [26] and Wanjohi respectively [65]. This may be due to the use of prophylactic antibiotics which has been shown to reduce sepsis. Wound sepsis was associated with a longer hospital stay and other complications like wound abscess and wound dehiscence. Many factors
predispose to wound sepsis including poor aseptic technique, poor surgical technique with excessive trauma to tissues, inadequate haemostasis with haematoma formation, long operating time, prolonged rupture of membranes, increased number of pelvic examinations among others. Prolonged DDI did not significantly increase the incidence of wound sepsis or any other maternal complication. There was one case of obstetric fistula at KNH in an under aged nulliparous patient who had been referred for emergency caesarean section due to prolonged obstructed labour who later went on to develop a wound abscess and was hospitalized beyond 42 days. Other less common complications included DVT and wound dehiscence.

The median duration of post-operative hospitalization was 3 days. Patients with wound sepsis stayed longer in hospital with a mean duration of 14.6 days but this was not statistically significant. Majority of respondents whose stay in hospital was prolonged were awaiting discharge of their newborns from the NBU.

There were 258 newborns delivered through emergency caesarean section during the study period. This included 7 sets of twins, 3 newborn infants with hydrocephalus and 4 still births. The median birth weight was 3000 grams with a range of 1330 – 4700 grams. The LBW rate was 15%. This was comparable to previous studies [23, 27]. The 5 minute Apgar score was less than 7 in 5% of newborns. This figure is comparable with that reported by other investigators [25, 26, 27]. The percentage of newborns admitted to NBU was higher than in previous studies (38%) [23, 26] because many newborns with Transient Tachypnoea of the Newborn (TTN) were misdiagnosed as having RDS and admitted to NBU for observation since there was no Paediatrician in attendance at birth. The main indications for admission to the NBU were RDS 39%, birth asphyxia 18% and prematurity 13%. Other indications for NBU admission were LBW/SGA, LGA and the presence of a large caput. Newborn infants delivered more than an hour after the decision for emergency caesarean section did not significantly have lower 5 minute Apgar scores or higher rates of NBU admission [32, 33, 49, 51]. This is in keeping with other studies [32, 33, 49, 51] and may be explained by the fact that neonatal outcome is more dependent on the causal pathology rather than the DDI [33]. There were 7 perinatal deaths including 3 fresh still births, one macerated still birth and 3 neonatal deaths among the newborns admitted to NBU. There was no association between these deaths and the DDI.
CONCLUSIONS

1. The median decision-to-delivery interval was 178 and 290 minutes at KNH and PMH respectively. Less than 1% of women in this study were delivered within the recommended DDI of 30-minutes.

2. Prolonged DDI did not significantly increase maternal complications or prolong hospital stay.

3. Apgar score of less than 7 at 5 minutes, admission to the NBU and perinatal mortality were not significantly increased due to prolonged DDI.

4. Advanced cervical dilatation was associated with a significantly shorter DDI.

5. Emergency caesarean section for placenta praevia with haemorrhage returned a significantly shorter response time.

6. Unavailability of theatre space and lack of additional theatre staff significantly delayed emergency caesarean section.
RECOMMENDATIONS

1. The DDI should be revised from the current standard of 30 minutes. It should be individualized based on the indication for emergency caesarean section.

2. There is need to develop Standard Operating Procedures (SOPs) for emergency caesarean section which will provide guidelines for prioritization of urgent cases and reduce time spent on pre-operative preparation.

3. The existing infrastructure in these two hospitals desperately requires expansion to enable an additional operating theatre for emergency caesarean sections to function round the clock.

4. Staff shortage needs to be addressed through recruitment of additional staff and the existing staff should be better motivated through welfare, incentives and training opportunities.

5. Caesarean section should only be performed when indicated to increase the availability of theatre.
REFERENCES


22. Chege MJ. To evaluate the decision to delivery interval for emergency caesarean section at Kenyatta National Hospital and Homa-bay District Hospital and its effect on foetal and maternal outcome. MMed. Thesis, University of Nairobi, 2007.


APPENDICES

APPENDIX 1: CONSENT

(1) CONSENT EXPLANATION:

Title of the study:
Emergency caesarean section turn around time and its effect on maternal and newborn health outcomes at University of Nairobi teaching hospitals.

Principal Investigator:
Dr. Hussein Ali Habib.

Introduction:
Dr. Hussein A. Habib is a postgraduate student in the Department of Obstetrics and Gynaecology at the University of Nairobi. He is carrying out a study to find out the causes of delay in emergency caesarean delivery and its effects on the health of the mother and the newborn baby at Kenyatta National Hospital and Pumwani Maternity Hospital. You are being requested to participate in this study.

Purpose of the study:
The study will evaluate the factors that determine the emergency caesarean section turn around time and describe its effect on maternal and newborn health outcomes at Kenyatta National Hospital and Pumwani Maternity Hospital. It also aims at making recommendations on reducing the emergency caesarean section turn around time with a view of improving maternal and newborn health.

Procedure:
If you agree to participate in the study, you will be interviewed by the principal investigator or his assistant after having been attended to by your health care provider. The interviewer will complete a questionnaire by verbally asking you questions, the nature of which will be about
your particulars, previous pregnancy outcome(s) and current delivery including details of your newborn baby. Your name will be omitted from the questionnaire to ensure your anonymity at all times. The interviewer will also access your medical records/file to obtain any additional information required which you may not be privy to. The information gathered will be stored safely under lock and key by the principal investigator who will then code and enter it into a password-protected computer database prior to analysis.

**Benefits:**
There is no direct benefit to you by participating in this study. However, you will have a greater opportunity of interacting with your health care provider, hence a better chance to learn more about your condition and contribute to the better health of mothers who are delivered by caesarean section and their newborn babies.

**Risks:** There is no associated danger to your health or well being by participating in the study. You may be asked questions which could be of a disturbing nature as they touch on personal matters. However, you are not obliged to answer such questions if you so wish.

**Confidentiality:**
Any information you provide will be treated as confidential. Your confidentiality will be maintained at all times by omitting your names from the questionnaire and instead, each questionnaire will be randomly assigned with a study number for purposes of identification in the study. The completed questionnaires will be stored in a lockable filing cabinet only accessible to the principal investigator and his research assistant. Data from the questionnaire will be entered into a password-protected computer database for storage which will be accessible only through the principal investigator. Only the study numbers will be used during data analysis and report writing of the study and at no point will any detail that might identify an individual be provided. There shall be no mention of names or identifying information in the report or publication which may arise from the study. The information obtained will be used only for the purpose of the study.
Compensation:
There will be no compensation for participation in the study.

Voluntarism:
Your participation in the study is voluntary and you are free to withdraw from participating in the study at any time if you so wish. Should you decline to participate or withdraw from participating in the study, you will not be denied any service by the hospital.

Contact Information:
If you have any questions regarding the study, you may contact Dr. Hussein A. Habib through telephone number 0722808808.

In case of any concern about ethics, please contact:

KNH/UON - ERC,
P.O. Box 19676 – 00202,
Nairobi.
Telephone number (254 – 020) 2726300 Ext 44355.
Email: uonknh_erc@uonbi.ac.ke

(2) CONSENT FORM

I _______________________________, the undersigned, acknowledge that I have been provided with detailed information about the nature of the study by Dr/Mr/Mrs/Ms _____________. I have read and understood the explanation above and have been given adequate opportunity to ask questions about the study. I hereby agree to participate in the study without any coercion whatsoever. I am aware that my participation in the study is voluntary and that I can withdraw from the study at any time.

Signature of Participant ______________________________ Date ________________

Signature of Researcher/Assistant ________________________ Date ________________
APPENDIX 2: QUESTIONNAIRE

Study number……………………………

Date……………………………………

Was the patient referred to this hospital in labour from another health care facility? □ Yes □ No

Part A: Socio-demographic data:

1. Age of the patient ……………………………………………….……………….. Years

2. Marital status: □ Single
□ Married
□ Divorced
□ Widowed

3. Level of education: □ No formal education
□ Primary school level
□ Secondary school level
□ College/University level

4. Occupation: □ Unemployed
□ Housewife
□ Self-employed
□ Professional
Part B: Obstetric data:

1. Parity at the time of delivery: Para .................................................................
2. Number of children previously delivered alive .................................................

3. Number of still births delivered previously ......................................................
4. Number of abortions ........................................................................................

5. Gestational age at the time of delivery ............................................................ Weeks
6. Cervical dilatation at the time of decision for emergency caesarean delivery ........cm

Part C: Information pertaining to the emergency caesarean section:

1. Rank of emergency caesarean section:  □ Primary
                                            □ Repeat

2. Indication for emergency caesarean section:

□ Non-reassuring fetal status
□ Placenta praevia with haemorrhage
□ Abruptio placenta
□ Cord prolapse
□ Ruptured uterus
□ Dystocia (Prolonged labour/poor progress of labour, CPD and Obstructed labour)
□ One or more previous uterine scars
□ Failed VBAC
□ PROM
□ Malpresentation
□ Failed induction of labour
□ Pre-eclampsia/Eclampsia
□ Multiple pregnancy
☐ Failed assisted vaginal delivery
☐ Other

3. Mode of anaesthesia administered:
☐ General anaesthesia
☐ Spinal anaesthesia

4. Seniority of the operator:
☐ Medical officer
☐ Registrar
☐ Consultant

5. Day of the week when caesarean section was performed:

☐ Monday
☐ Tuesday
☐ Wednesday
☐ Thursday
☐ Friday
☐ Saturday
☐ Sunday

6. Time of the clock when caesarean section was performed:

☐ 0800Hrs – 1959Hrs
☐ 2000Hrs – 0759Hrs
Part D: The decision-to-delivery interval:

1. Time of decision to operate  
   ............. Hrs

2. Time of receiving patient in theatre  
   ............. Hrs

3. Time of administration of anaesthetic agent  
   ............. Hrs

4. Time of delivery of the baby  
   ............. Hrs

5. Time interval between:

   (i) decision making and arrival in theatre  
       ....... minutes

   (ii) arrival in theatre and administration of anaesthesia  
        ....... minutes

   (iii) administration of anaesthesia and delivery of the baby  
          ....... minutes

6. Decision-to-delivery interval  
   ............. minutes

7. If decision-to-delivery interval > 30 minutes, reason(s) for delay in carrying out the operation:

   □ Lack of consent
   □ Results of laboratory investigations deemed necessary before the operation were not ready
   □ Blood deemed necessary prior to the operation was not available
   □ Theatre was being used for another emergency operation
   □ Unavailability of anaesthetist
   □ Unavailability of obstetrician
   □ Unavailability of paediatrician
   □ Delay in moving the patient to theatre due to the huge workload and staff shortage
Lack of anaesthetic drugs and or medical gases
Lack of medical supplies
Unavailability of sterile packs
Delay in anaesthetizing the patient due to multiple attempts at spinal anaesthesia or difficult intubation
Shortage of personnel to open a second theatre
Long turn-around time for preparation of theatre between operations
Poor interpersonal relations and lack of communication between members of the various teams in labour ward and theatre
Lack of motivation/low morale amongst theatre staff
Other

Part E: Maternal outcome:

1. Maternal complication:

None
Ruptured uterus
Post partum haemorrhage
Acute renal failure
Severe anaemia
Congestive Cardiac Failure
Pulmonary oedema
Fever
Obstetric fistula
Wound sepsis
Puerperal sepsis
Poor reversal from general anaesthesia
Death
Other
2. Duration of post-operative hospitalization ................................... Days

3. If post-operative hospital stay > 3 days, reason(s) for prolonged hospital stay:

☐ Admission to HDU or ICU
☐ Dialysis
☐ Severe Pre-eclampsia/Eclampsia
☐ Severe anaemia/CCF
☐ Cardiac disease
☐ Wound sepsis
☐ Puerperal sepsis
☐ Other...........................................................................................................

Part F: Newborn outcome:

1. Condition of the baby at delivery:

☐ Alive
☐ Fresh still birth
☐ Macerated still birth
☐ Congenital anomaly

2. Birth weight of the baby ............................................................... Grams

3. Apgar score at 5 minutes ..............................................................

4. Baby admitted to NBU:  ☐ Yes
                          ☐ No
5. If baby admitted to NBU, reason for admission:

- Prematurity
- Respiratory Distress Syndrome
- Birth asphyxia
- Meconium Aspiration Syndrome
- Neonatal sepsis
- Neonatal jaundice
- Congenital malformation
- Mother’s condition
- Other ..........................................................................................................................

6. Fate of the newborn in NBU:

- Discharged
- Early neonatal death