
**THE UNIVERSITY OF ZAMBIA**

**SCHOOL OF MEDICINE**

# DECISION DELIVERY INTERVAL FOR EMERGENCY CAESAREAN SECTIONS AT THE UNIVERSITY TEACHING HOSPITAL, LUSAKA.

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**The University of Zambia**

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# ABSTRACT

**BACKGROUND:** To help improve the foetal outcome, many professional bodies recommend the decision delivery interval (DDI) for emergency caesarean sections should be within 30 minutes. However, studies have not been conclusive to state whether delivering within 30 minutes would significantly improve neonatal and maternal outcome. Though many reports show that the standard decision delivery interval may not be attainable, a workable approach would be to conduct a local study evaluating outcomes from emergency caesarean sections and recommending locally the optimal decision to delivery interval.

**OBJECTIVES:** To determine the decision delivery interval for emergency caesarean sections at the University Teaching Hospital, Lusaka Zambia and the factors that contributed to the interval**.**

**DESIGN AND SETTING:** An observational cross sectional study carried out at the University Teaching Hospital, Lusaka Zambia in January 2014. A total of 355 patients undergoing emergency caesarean sections were enrolled into the study.

**Methods:** This was an observational cross sectional study conducted between January 2014 to March 2014 at the University Teaching Hospital, Lusaka Zambia. Women were recruited from the labour ward after a decision for an emergency caesarean section was made by the doctors on call. Information on decision delivery interval by indication is presented in tabular form and histogram. The timings of various steps and processed decision delivery interval was tabulated and shown as a histogram. Fetal outcome (whether stillbirth, poor Apgar score (AS<7) and admission to neonatal intensive unit) tabulated against mean DDI for each indication**.**

**RESULTS:** A total of 355 women scheduled for an emergency caesarean section were enrolled. The mean DDI was 304 min and only 1 was delivered within 30 minutes of decision; the majority of the babies (n=341, 96.1%) were delivered beyond 60 minutes and 67 (18.9%) beyond 8 hours. The longest delay was attributed to decision to trolley arriving in labour ward (when theatre was free) and this accounted for a mean of 252 minutes (86.2% of DDI). Cord prolapse had the shortest mean DDI (99.9mins). The worst perinatal outcome was in those with pre-eclampsia (33.1%) and cord prolapse (28.6%)

**CONCLUSION:** The DDI for emergency caesarean sections at UTH was found to be 304.3 minutes. Few emergency caesarean sections (n=85, 23.9%) are done within 120 minutes (2 hours). Only 0.3% of the cases were done within 30 min and 3.9% within 1 hour. Most of the DDI for emergency sections was accounted for by lack of theatre availability. Prolonged delay from decision to arriving in theatre attributed to long waiting list for surgery. Although the 30 minute DDI should remain the gold standard, achieving it may not be feasible at UTH in the current situation

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# ABBREVIATIONS

| | |
|---|---|
| APH | Antepartum hemorrhage |
| ASHRM | American Society of Health care Risk Management |
| BWT | Birth weight |
| CDH | Cancer Diseases Hospital |
| CPD | Cephalopelvic disproportionate |
| DDI | Decision delivery interval |
| HMIS | Health information systems |
| JRMO | Junior resident medical officer |
| NICE | National Institute of Clinical Excellence (UK) |
| NICU | Neonatal intensive care unit |
| OT | Operating theatre |
| RCOG | Royal College of Obstetrician and Gynaecologists (UK) |
| SRMO | Senior resident medical office |
| UNZABREC | University of Zambia Biomedical Research Ethics Committee |
| UTH | University Teaching Hospital |
| USA | United States of America |

# DEDICATION

This dissertation is a special dedication to my dear wife, Nedah and our daughters Tsepo and Zaneta who have always been my inspiration.

It's a dedication also to all the women that have had a caesarean delivery and to all those yet to be delivered by emergency caesarean section.

# INTRODUCTION

Caesarean delivery is birth of a viable fetus through surgical incisions made through the abdomen and the uterine wall [Williams Obstetrics, 2010]. It is usually performed when vaginal delivery would put the health or life of the baby or mother at risk and in recent times performed also on maternal request.

An emergency caesarean delivery is performed in an obstetric emergency when complications of pregnancy onset suddenly during the process of labour and swift action are required to prevent poor outcome in the mother, baby or both. To help improve the fetal outcome, many professional bodies such as the Royal College of Obstetrics and Gynaecologists, the Royal College of Midwives and the National Institute for Clinical Excellence in the United Kingdom, and the American College of Obstetricians and Gynaecologists in the USA recommends that decision to delivery interval should be within 30 minutes for emergency caesarean sections, while the Germany Society of Obstetrics and Gynecologists recommends 20 minutes.

The decision to delivery interval is the time period between making the decision to perform the caesarean delivery and delivering the baby. Report of a 2004 national survey in England and Wales demonstrated that in emergency caesarean sections, maternal and perinatal outcomes deteriorate measurably when the decision to delivery interval exceeds 75 minutes. [Thomas. et al 2004]. To preserve perinatal health, a shorter time interval is required in most urgent situations. However, evidence is not conclusive to state whether the introduction of a 30 - minute decision to delivery interval would significantly improve neonatal and maternal outcome as current analysis and data do not prove or disprove the existence of such a protective time interval. [Thomas. et al 2004]

The 30-minute bench-mark standard is not evidence based and there is much debate as to whether it is a realistic target to aim for all obstetric units [Helmy et al, 2002]. Livermore and co-workers in 2006 reported that the standard was met in only 11.1% of the one thousand emergency caesarean deliveries studied in London.

Though reports from various studies have shown that in reality a standard 30 minute decision to delivery interval may not be feasible, a workable approach would be to

conduct a local study evaluating fetal outcomes from emergency caesarean sections and make recommendations locally regarding optimal decision to delivery interval.

The study aimed at establishing the decision to delivery interval for emergency caesarean sections at the University Teaching Hospital in Lusaka, Zambia and its association with neonatal outcome, and factors influencing the decision to delivery interval.

## STATEMENT OF THE PROBLEM AND STUDY JUSTIFICATION

The rate of caesarean section is rising globally, with almost one-third of infants born by caesarean delivery in high resource nations. [Cavallaro et al 2013, Boyle and Reddy 2012] In emergency caesarean deliveries, swift action is recommended to prevent poor outcome in the mother, baby or both. (Thomas et al 2000). However, swift action remains a challenge to achieve in resource-limited settings like the University Teaching Hospital [UTH] in Lusaka. Anecdotal observations suggested that the decision to delivery time for caesarean section varied widely, and exacerbating factors include lack of adequate staffing for midwives, theatre nurses and anesthetists. It also resulted from lack of blood products for high risk cases, laboratory delays, anesthetist delay, lack of theatre space, and shift/change over period for labour ward and theatre staff, and scarce trolleys to transport patients. However, the factors affecting the timing of decision to delivery and the neonatal outcomes of such prolonged timing have not been established and published in our institution.

The study intended to lay a foundation for future research in the area of quality improvement within the department of obstetrics and gynaecology, help formulate evidence based protocols and plan an important step in improving maternal services with regard to timely provision of caesarean deliveries at the UTH.

## RESEARCH QUESTION

What are the factors that affect the decision delivery interval for emergency caesarean sections at UTH, Lusaka?

## OBJECTIVES

**Main objective:** To determine the factors affecting the decision delivery interval for emergency caesarean sections at UTH, Lusaka.

**Specific objectives**:

1. To determine the decision to delivery interval for emergency caesarean deliveries by indication.
2. To establish the factors that contributed to the decision to delivery interval at the UTH.
3. To document neonatal outcomes from emergency caesarean deliveries by indication and decision to delivery interval.

## LITERATURE REVIEW

The decision to conduct a caesarean delivery is based upon the benefits for the mother, foetus or both outweighing the risk of the procedure for the mother. An emergency caesarean delivery is done to avoid adverse neonatal and maternal outcome and this calls for expeditious delivery.

The decision to delivery interval is the duration from the time the decision to perform a caesarean delivery to the time of the delivery of the baby. In emergency caesarean deliveries, the outcome for the mother, baby and/or both are dependent on the decision to delivery interval. Though there is no consensus on the acceptable decision to delivery interval, the ultimate aim of emergency caesarean deliveries is to improve and result in best possible outcome.

The Royal College of Obstetricians and Gynecologists, the Obstetric Anesthetists Association, the Royal College of Midwives, the Clinical Negligence Scheme for Trusts and Controls Assurance Standards recommends that emergency caesarean delivery should be ready to be performed within 30 minutes. [Wilkinson et al, 1998]. In cases of confirmed or suspected acute fetal compromise, the National Institute of Health and Clinical Excellence recommends delivery should be accomplished within 30 minutes. [RCOG, 2001]. Even in high resource areas, this goal is difficult to achieve. In the national sentinel caesarean section audit [2001], only 63% of UK obstetric units were able to deliver over half of their most urgent cases within 30 minutes. [Paranjothy et al 2001].

Katz et al in 1986 in a retrospective study analyzed neonatal outcomes in maternal cardiac arrest and concluded that for fetal salvage, less than 5 minutes decision to delivery interval is ideal and rarely helpful after 15minutes. Extrapolated from this condition that would give a more severe form of fetal hypoxia, minimal decision to delivery interval would be beneficial for emergency caesarean delivery.

In England, Mackenzie et al, in 1996 undertook a study to determine how long it took from the decision to achieve delivery by non elective caesarean delivery and the influence of this interval and impact on the neonatal condition at birth. They collected data for all the caesarean deliveries, recorded the indication, the day and time of the decision and the interval until delivery, including seniority of the surgeon and condition at delivery. The

mean time from decision to delivery for 100 emergency intrapartum caesarean deliveries was 42.9 minutes for fetal distress and 71.1 minutes for 230 without fetal distress [p<0.0001]. For crash sections, the mean time was 27.4 minutes, 124.7 minutes for 13 urgent antepartum deliveries for fetal reasons and 97.4 minutes for 21 with maternal reasons. The seniority of the surgeon managing the patient did not appear to influence the interval nor did the time of the day or day of the week when the delivery occurred. Fewer than 40% intrapartum deliveries by caesarean section for fetal distress were achieved within 30 minutes of the decision despite that being the unit standard. There was however no evidence to indicate that overall an interval up to 120 minutes was detrimental to the neonates unless the delivery was an emergency caesarean delivery.

In a similar study in 2006, Bloom et al studied decision to incision intervals and related maternal and neonate outcomes in a cohort of women undergoing emergency caesarean deliveries at multiple University based hospitals comprising the National Institute of Child Health and Human Development Maternal- Fetal Medicine Units Network. Women undergoing a primary caesarean delivery at Network centre during a two year time span were prospectively studied. Emergency procedures were defined as those performed for cord prolapsed, placental abruptio, placenta previa with hemorrhage, non reassuring fetal heart rate pattern or uterine rupture. 2,808 procedures were performed for emergency indication, of these 1,814 [65%] began within 30 minutes of the decision to operate. Measure of new born compromise included umbilical artery pH less than 7 and intubation in the delivery room. 95% did not experience a measure of newborn compromise. Approximately one third of primary caesarean deliveries performed for emergency indications were commenced more than 30 minutes after the decision to operate and the majority was for non reassuring heart rate traces. In these cases, adverse neonatal outcomes were not encountered.

In a prospective observational study in Nigeria, Onal et al, 2005 determined the decision to delivery interval at Nigerian hospitals and the effect of interval on the perinatal outcome and factors causing the delay. None of the 224 emergency caesarean deliveries done in the 8 months study period were done within 30 minutes with no significant poor outcome and found the interval up to 3 hours may not be incompatible with poor fetal outcome. Yakasai et al, in Nigeria found similar results when they undertook a study to determine the decision to delivery interval among women undergoing emergency caesarean delivery at

the Aminu Kano Teaching Hospital and its impact on maternal and fetal outcome. The mean decision to delivery interval was 137 minutes. 12.6% were delivered within the recommended 30 minutes interval. The decision to delivery interval had no impact on the fetal and maternal outcome for the major indications of emergency caesarean sections

A National Cross Sectional Survey in the United Kingdom was carried in 2000 to determine whether the decision to delivery interval is critical in emergency caesarean deliveries and the study examined the association between decision to delivery interval and maternal and baby outcomes. 17,780 singleton births delivered by emergency caesarean sections in England and Wales between 1st May 2000 and 31st July 2000 were reviewed. Compared with babies delivered within 15 minutes, there was no difference in maternal and baby outcomes for decision to delivery interval between 16 and 75 minutes. After 75 minutes, however, there was a significant higher odds of a five minute Apgar score of < 7 [odds ratio1.7, 95% confidence interval 1.2 to 2.4] and 50% increase in odds of special care, additional to routine care for the mother. They concluded that prolonged decision to delivery interval for emergency caesarean delivery of more than 75 minutes could result in poor maternal and baby outcomes.

In Nigeria, EC Inyang-Etol studied the decision to delivery interval for emergency caesarean deliveries and perinatal outcomes at the University of Calabar Teaching Hospital. In this analytical study on women who had an emergency caesarean delivery over a seven month period, none of the 150 parturients in the study population was delivered within 30 minutes. Of these, only seven [4.7%] of the parturients were delivered within 1 hour. The mean decision delivery interval was 3.4 hours. The perinatal mortality rate among the study population was 73 per 1000 births. Parturients with fetal distress had a mean decision to delivery interval of 2.8 hours with 21.9 % having moderate to severe birth asphyxia. The mean decision to delivery interval of 3.4 hours was attained in parturients with obstructed labour with 50 % having moderate to severe birth asphyxia. Parturients with failure to progress in labour had a mean decision to delivery interval of 3.2 hours with 3.5% having moderate to severe birth asphyxia.

An emergency caesarean delivery is an important procedure in the current obstetric practice, and the decision to delivery interval is an important factor to consider achieving the desired result of avoidance of adverse neonatal outcome through expeditious delivery.

Though research has been unable to prove that standard 30 minute decision to delivery interval has uniformly improved neonatal outcomes, there are clinical situations that require immediate or emergent operative intervention for fetal or maternal wellbeing. The OB Pearls Committee of the American Society of Health Care Risk Management (ASHRM ) does not streamline the decision to delivery interval to a time limit rather addresses based on the institutional capability providing obstetric care.

## METHODOLOGY

**Study design**
Observational cross-sectional study

**Study site**
The study was carried out at the labour ward and the operating theatre in the department of obstetrics and gynecology of the University Teaching Hospital, in Lusaka Zambia.

**Target population**
Any women in whom a decision for caesarean delivery was made

**Study population**
Women who had a caesarean section and met the eligibility criteria

**Inclusion criteria**

1. Admitted to UTH labour ward.
2. Women in whom a decision to perform an emergency caesarean delivery was made during the study period.
3. Singleton pregnancy at 37 weeks gestation or above (gestation established by best dating measures or an ultrasound)
4. Able to provide informed consent to participate in the study. For those below 18 years of age, or unable to sign, guardian provided consent on their behalf.

**Exclusion criteria**

1. Documented intrauterine fetal death at the time of labour ward admission.
2. Documented congenital fetal anomaly.
3. A woman having a caesarean that was not an emergency
4. Under the age of 18 unless guardian provided consent

**Study duration**

The study duration was three months; January 2014 – March 2014.

**Sampling methods**

All participants planned for emergency caesarean sections were invited to participate in the study.

**Sample size**

There is a 12.5% risk of 5 minute Apgar score to be less than 7 if decision delivery interval is less than 75 minutes compared to 25% risk if decision delivery interval is more than 75 minutes.

Sample size was calculated using Open Epi software, based on a 2-sided confidence level of 95% and 80% power. The following assumptions were made:

- Unexposed sample is emergency caesarean deliveries with decision delivery interval less than 75 minutes.
- Exposed sample is emergency caesarean deliveries with decision delivery interval more than 75 minutes.
- Ratio of exposed to unexposed is 1.0
- Outcome is 5 minute Apgar score
- Odds ratio is 2.3
- Risk/ prevalence ratio is 2
- Risk/ prevalence difference is 12.5 %

Using Fleiss formula, sample size was 338 women, 169 per group.

To account for 5% loss to follow up and incomplete responses, minimum sample size = 355.

Presuming that 22 (13.0%) of 169 newborns who are born less than 75 minutes after the decision is made for caesarean delivery have a 5-minute Apgar score less than 7, the estimation of this sample ranges from 8.8 to 18.9%. If 43 (25.4%) of 169 newborns who are born more than 75 minutes after the decision is made for caesarean delivery have a 5-minute Apgar score less than 7, the estimation varies from 19.5 to 32.5%.

**Participant recruitment**

Women were recruited from the labour ward at the UTH. Recruitment of participants was done 24 hours per day, 7 days per week in order to decrease any selection bias or bias due to the practice of different units. The decision to perform the caesarean delivery was made by the unit doctors and was not in any way influenced by the researcher. Only after the decision to perform a caesarean delivery was made was the woman approached about the study. For those who were eligible to participate, details of the study were then explained and written informed consent obtained using a consent form. (Appendix 1).

**Data collection**

Information was obtained from patients' medical records from those who consented.

Trained research assistants who were midwives and theatre nurses were given a structured check list to follow that was used to collect data on the timing in the steps from decision to perform a caesarean section to delivering the baby and operating theatre utilization. (Appendix 2-5).

**Follow up**

Participants were seen by research assistants and followed up:

**a.** During enrolment

**b.** At caesarean section in theatre up to five minute Apgar score for the baby

**Measuring exposure and outcome**
Exposure: Time interval and indication.

Primary outcome: Apgar score at 5 minutes < 7

Secondary outcomes: fresh stillbirth, need for NICU admission,

**Dependent and independent variables**

| **Primary dependent (or outcome) variable** | **Type** | **Notes** |
|---|---|---|
| **Apgar score at 5 min** | Continuous variable | Subsequently was categorised as <7 at 5 min or ≥7 at 5min. |
| **Secondary dependent (outcome) variables** | | |
| **Fetal outcome at birth** | Categorical | Alive or fresh still birth |
| **Admission to NICU** | Categorical | Categorised as yes or no. |
| **Independent (or exposure) variables** | **Type (continuous or categorical** | **Notes** |
| Time to delivery | Continuous | Categorised into discrete categories( e.g. <30 min, 30 min- 75 min, 76-90min,etc) |
| Birth weight | Continuous | Categorised into discrete categories (e.g.2000g to 2499g, 2500g to 2999g). |
| Indication for caesarean delivery | Categorical | Categorised into discrete categories e.g. fetal distress, cord prolapsed, uterine rupture etc |
| Gestational age | Continuous | Categorised into discrete categories (e.g.34 to 36, 37 to 38, 39 to 42, over 42). |
| Liquor foul smelling- intra op | Categorical (dichotomous) | Categorised as yes or no. |
| Immediate ventilation | Categorical (dichotomous) | Categorised as yes or no. |
| Duration of stay in labour ward before decision to do emergency caesarean section | Continuous | Categorised into discrete categories e.g. <30min, 30-75 min, 76min-4hrs, 4-6hrs. |
| Type of anaesthesia | Categorical (dichotomous) | Categorised as general or spinal |

**Data Analysis**

Information on DDI by indication was presented in tabular form and histogram. The timings of various steps and processed DDI tabulated and shown as a histogram. Fetal outcome (whether stillbirth, poor Apgar score (AS<7) and admission to neonatal unit) tabulated against mean DDI for each indication.

Data were analyzed using the statistical software package SAS, version 9.3 (SAS Institute, Inc., Cary, North Carolina) and SPSS version 21. All statistical tests were at 5% significance level. Independent samples T-test and ANOVA were used to compare mean values between groups accordingly, and the Pearson's chi-squared test was used for comparison of proportions between groups. Study variables were checked for evidence of co linearity based on a Spearman correlation coefficient > 0.8. The study was approved by the institutional review board of the University of Zambia and UTH management.

**ETHICAL CONSIDERATIONS**

This was an observational cross-sectional study in which the interaction with the participants was at enrolment and that all received the standard UTH care from the respective medical team on call. The team comprised of consultants, senior registrars, registrars, senior resident medical officers and junior resident medical officers.

The decision to perform a caesarean delivery was made by the attending doctors usually the consultants, senior registrars and registrars. All women designated for caesarean delivery were approached about the study, and written informed consent was obtained prior to enrolment. It was made clear to the patients that their participation in the study was purely voluntary and that they were allowed to withdraw from the study at any time without any prejudice to further medical care if they so wished.

Permission was sought from the UTH management through the Head of department of obstetrics and gynecology to carry out the research at the institution. Approval was sought from the University of Zambia Biomedical Research Ethics Committee.

Patient confidentiality was assured as no names were used. Each participant was assigned a study identification number with a separate matching hospital file number for the purpose of cross referencing data. Publication and scientific presentations of the research findings will be presented in aggregates and without the identities of individual

participants. Research assistants (midwives and theatre nurses) were trained on how to maintain confidentiality on the data collected. The questionnaire was designed in English, Bemba and Nyanja which are the main languages spoken in Lusaka.

# RESULTS

## 1. DELIVERIES AND DECISION DELIVERY INTERVAL

Total number of deliveries conducted during the study period was 7,604 out of which 1,235 were delivered through a caesarean section giving a caesarean section rate of 16.2%.

A total of 355 clients were enrolled to the study. There was 88/355 (25%) caesarean deliveries conducted in the morning shift, 78/355 (22%) done in the afternoon shift and the majority 188/355 (53%) were conducted at night.

A midwife was present with the attending doctor at the bedside at the time for decision for caesarean section was being made in 212/355 cases (60%). The midwife was attending to other patients in the majority of the cases 101/143 (70.6%) when not present at the time when decision for caesarean section was made. In others, midwife was out of labour ward to either NICU/theatre 29/143 (20.3%) or taking a break 13/143 (9.1%)

The mean decision delivery interval (DDI) for all indications was 304.3 minutes (5 hours 4minutes). The shortest mean DDI was seen in cord prolapse at 99.9 minutes and longest with 1 previous caesarean section in labour at 449.5 minutes and median 230 minutes. The minimum DDI was 23 minutes and maximum 1345 minutes (approx 22hours).

A DDI of 30 minutes or less was only seen in 1/355 (0.3%) cases at 23 minutes for antepartum hemorrhage (APH). Only 14/355 (3.9%) were done within 1 hour and 141/355 (39.7%) were done within 3 hours. More than 67(18.9%) of the caesarean sections were done 8 hours after the decision for caesarean section was made.

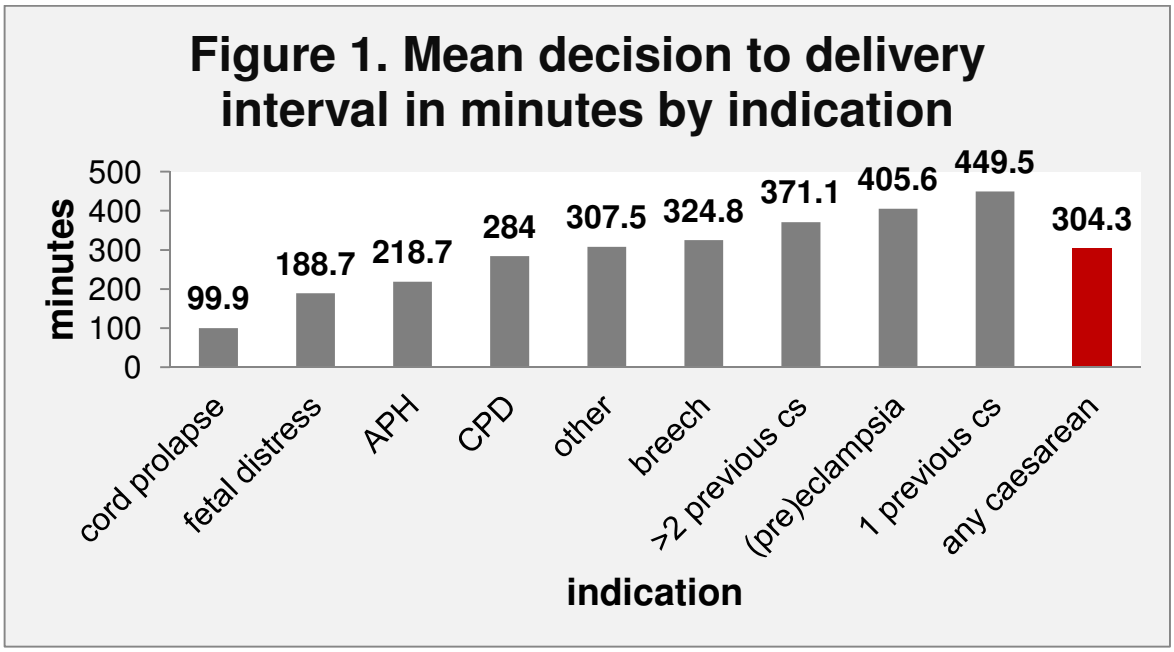
The night shift had the highest mean DDI at 320 minutes and afternoon shift the lowest mean DDI at 273 minutes. There was no significant difference between the groups by one way variance test analysis, (P=0.315)

**TABLE 1: Decision to delivery interval (DDI) (timings categorized)**

| | | N (%) |
|---|---|---|
| **DDI** (categorical) | 0-59 mins (<1hr) | 14 (3.9) |
| | 60-119 mins(1-2hrs) | 71 (20.0) |
| | 120-179 mins (2-3hrs) | 56 (15.8) |
| | 180-239 mins(3-4hrs) | 41 (11.5) |
| | 240-299 mins (4-5hrs) | 42 (11.8) |
| | 300-359 mins (5-6hrs) | 22 (6.2) |
| | 360-419 mins (6-7hrs) | 27 (7.6) |
| | 420-480mins (7-8hrs) | 15 (4.2) |
| | >8hrs | 67 (18.9) |
| | | **355 (100)** |
| **DDI** (Cumulative) | <1 hr | 14 (3.9) |
| | <2 hrs | 85 (23.9) |
| | <3 hrs | 141 (39.7) |
| | <4 hrs | 182 (51.3) |
| | <5 hrs | 224 (63.1) |
| | <6 hrs | 246 (69.3) |
| | <7 hrs | 273 (76.9) |
| | <8hrs | 288 (81.1) |
| | Any (up to 22.4 hrs) | 355 (100) |

Table 2. Decision to delivery interval in minutes by indication

| | mean | SD | min. | max. | median | n | % |
|---|---|---|---|---|---|---|---|
| cord prolapse | 99.9 | 80.5 | 40 | 337 | 56 | 14 | 3.9 |
| fetal distress | 188.7 | 157.9 | 52 | 683 | 150 | 41 | 11.5 |
| APH | 218.7 | 219.8 | 23 | 803 | 91 | 22 | 6.2 |
| CPD | 284 | 205.5 | 50 | 971 | 225 | 109 | 30.7 |
| other | 307.5 | 255.2 | 62 | 1071 | 243 | 31 | 8.7 |
| breech | 324.8 | 158.6 | 36 | 657 | 309 | 27 | 7.6 |
| >2 previous cs | 371.1 | 291.5 | 53 | 975 | 243.5 | 56 | 15.8 |
| pre-eclampsia/eclampsia | 405.6 | 417.3 | 40 | 1345 | 256.5 | 16 | 4.5 |
| 1 previous cs | 449.5 | 266.1 | 106 | 1163 | 375 | 39 | 11.0 |
| **any caesarean** | **304.3** | **248.3** | **23** | **1345** | **230** | **355** | 100 |



## 2. TIME INTERVALS

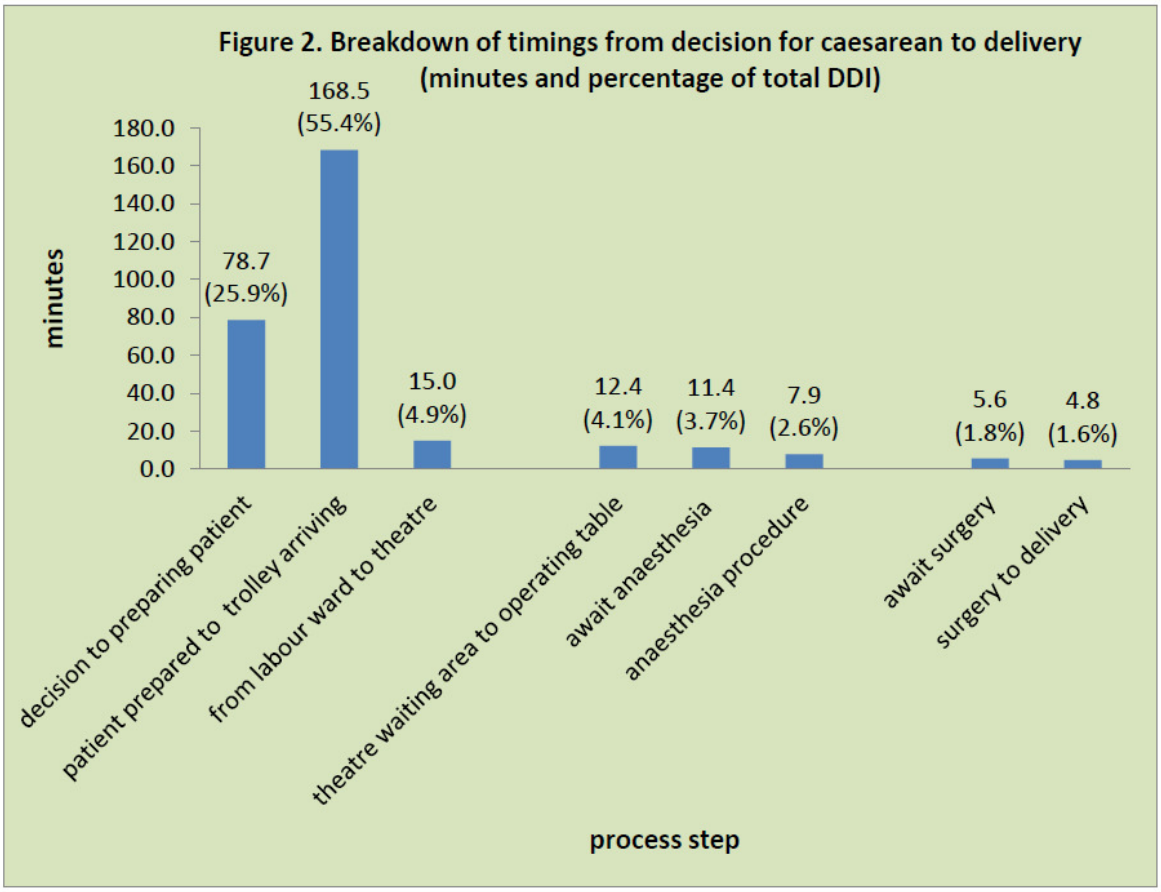
Decision delivery interval was divided into 4 sub intervals. Interval 1 was time taken from decision for caesarean delivery to shifting the patient to pre operating area of the OT. This interval involved preparing the patient for theatre with procedures like having in place an intravenous line and catheterizing, sending blood for heamogram estimations, group and saving or cross matching, signing the consent form and then waiting for pick up by the trolley sent from theatre including the transit time from labour ward to the theatre. The trolley was only sent when the theatre was ready for a case. Interval 2 was the time taken from receiving the patient by OT team and shifting the patient onto the OT table and involves the midwife handing over patient to theatre crew and then shifting patient to the theatre table. Interval 3 was the time for giving anaesthesia but also involved waiting time before commencement of anaesthesia. Interval 4 was the time from completing anaesthesia to delivering the baby.

Interval 1 was the longest interval with a mean of 262.2 minutes. It accounted almost 80% of the delay. It took an average 78.7 minutes to prepare patient for theatre, 168.5 minutes to have the trolley come to pick the patient after the patient was prepared and on average 15.0 minutes transit time from labour ward to theatre. Interval 2 had a mean of 12.4 minutes. Interval 3 had a mean 19.3 minutes; 11.4 minutes waiting for commencement of giving anaesthesia and 7.9 minutes mean time for completion of giving anaesthesia. Interval 4 had mean time of 10.4 minutes; 5.6 minutes for scrubbing and cleansing/draping patient and 4.8 minutes incision to delivery time.

The anesthetic and surgical procedures were short (mean 7.9 and 4.8 minutes respectively). Even in theatre patients waited for an average 29.4 minutes.

**Table 3. Breakdown of timings of processes in decision to delivery**

| | mean (minutes) | percent time |
|---|---|---|
| decision to preparing patient | 78.7 | 25.9% |
| patient prepared to trolley arriving | 168.5 | 55.4% |
| from labour ward to theatre | 15.0 | 4.9% |
| theatre waiting area to operating table | 12.4 | 4.1% |
| await anaesthesia | 11.4 | 3.7% |
| anaesthesia procedure | 7.9 | 2.6% |
| await surgery | 5.6 | 1.8% |
| surgery to delivery | 4.8 | 1.6% |
| total decision to delivery interval (DDI) | 304.3 | 100.0% |




## 3. FACTORS CONTRIBUTING TO THE LENTGH OF DECISION DELIVERY INTERVAL

There was only 1 case out of the 355 enrolled (0.3%) where there was no delay in DDI done within 30 minutes. In all the rest, there was a delay. Prolonged delay was noted in interval 1

1. In majority of the cases, delay was attributed to long waiting list for surgery caused by
    I. Limited number of operating theatre rooms
    II. Non availability of theatre space due to ongoing surgery or theatre not being ready after previous surgery
2. Transportation delays into shifting the patient from labour ward to the operating theatre
    I. Limited numbers of trolleys to pick up patients
    II. Delays in picking up patients from the OT to the postnatal wards making the already limited number of trolleys unavailable to pick up patients

3. Inadequate staffing levels among midwives in labour ward and this resulted in patient preparation for theatre taking long. A trolley could arrive on time to pick up patients but would be delayed if the midwife was found busy with attending to other patients. There were also shortages among theatre nurses and anesthetists.

## 4. NEONATAL OUTCOMES

A large number of the babies 325/355 (92%) had an Apgar score of > 7. There were 40/355 (11%) babies admitted to NICU and 18/355 (5%) were still births.

The highest proportion with poorer Apgar score was observed for APH indication with 7/21 (33.3%) of the babies having Apgar score < 7. Breech indication had the lowest proportion of poor Apgar score with only 1/27 (3.7%) of the babies having Apgar score <7. Apgar score was associated with caesarean indication with a P-value = 0.001.

There was a total of 40/355 (11.3%) babies admitted to NICU. The highest proportion with NICU admission was observed for Cord prolapse indication with 4/14 (28.6%) of the babies being admitted to NICU. Breech indication had the lowest proportion of NICU admission with only 1/27 (3.7%) of the babies admitted to NICU. There were 8/41 (19.5%) babies with Fetal distress indication admitted to NICU, and 19/158 (12%) of the babies with CPD were admitted to NICU. The association of NICU admission and caesarean indication was marginal with P-value = 0.054.

There were 18/355 (5.1%) still births at caesarean. The highest proportion of stillbirth was observed for APH indication with 6/21 (28.6%). Cord prolapse and fetal distress indication had the lowest proportion of stillbirths at 0/14 and 0/41 respectively. There was an association of stillbirth and caesarean indication with P-value <0.001.

### 4.1. BAVARIATE ANALYSIS

DDI, caesarean indication and NICU admission were significantly associated with Apgar score at 5% significance level. Presence of midwife at bedside was marginally associated with Apgar score, P-value = 0.05. Level of surgeon, shift, and type of anaesthesia, were not associated with Apgar score at 5% significance level.

DDI, caesarean indication and rupture were significantly associated with stillbirth at 5% significance level. Oxytocin was marginally associated with stillbirth, P-value = 0.05.

Duration of labor, level of surgeon, shift, and type of anaesthesia, NICU admission and presence of midwife at bedside were not associated with stillbirth at 5% significance level. Level of surgeon, oxytocin, and type of anaesthesia were associated with NICU admission at 5% significance level. DDI, caesarean indication, nature of liquor, duration of labor, shift, midwife at bedside, and rupture of membrane were not associated with NICU admission at 5% significance level.

**Table 4. Bivariate analysis for Apgar score**

| Variable | APGAR Score < 7 | | APGAR Score ≥7 | | P-Value |
|---|---|---|---|---|---|
| | n | Percent | n | Percent | |
| **Decision for Caesarean to Time of Delivery** | | | | | |
| ≤75 | 7 | 23.30% | 25 | 7.70% | 0.01 |
| >75 | 23 | 76.70% | 300 | 92.30% | |
| **Caesarean indication** | | | | | |
| 2 or more previous c/s | 3 | 10.00% | 61 | 18.80% | 0.04 |
| CPD | 9 | 30.00% | 149 | 45.80% | |
| Fetal distress | 4 | 13.30% | 37 | 11.40% | |
| Other | 14 | 46.70% | 78 | 24.00% | |
| **Midwife at bedside** | | | | | |
| Yes | 23 | 76.70% | 189 | 58.20% | 0.05 |
| No | 7 | 23.30% | 136 | 41.80% | |
| **Rupture** | | | | | |
| Yes | 13 | 43.30% | 2 | 0.60% | <0.001 |
| No | 17 | 56.70% | 323 | 99.40% | |
| **Level of surgeon** | | | | | |
| JRMO | 1 | 3.30% | 37 | 11.40% | 0.48 |
| SRMO | 13 | 43.30% | 109 | 33.50% | |
| Registrar | 13 | 43.30% | 143 | 44.00% | |
| SR/Consultant | 3 | 10.00% | 36 | 11.10% | |

| Variable | APGAR Score < 7 | | APGAR Score ≥7 | | P-Value |
|---|---|---|---|---|---|
| | n | % | n | % | |
| **Shift** | | | | | |
| Morning | 7 | 23.30% | 82 | 25.20% | 0.18 |
| Afternoon | 3 | 10.00% | 75 | 23.10% | |
| Evening | 20 | 66.70% | 168 | 51.70% | |
| **Type of Anaesthesia** | | | | | |
| Spinal | 25 | 83.30% | 274 | 84.30% | 0.80 |
| General | 5 | 16.70% | 51 | 15.70% | |
| **Oxytocin** | | | | | |
| Yes | 3 | 10.00% | 57 | 17.50% | 0.29 |
| No | 27 | 90.00% | 268 | 82.50% | |
| **NICU** | | | | | |
| Yes | 12 | 40.00% | 28 | 8.60% | <0.001 |
| No | 18 | 60.00% | 297 | 91.40% | |

**Table 5. Bivariate analysis for stillbirth**

| | Still Birth | | | | |
|---|---|---|---|---|---|
| | Yes | | No | | |
| **Variable** | **n** | **Percent** | **n** | **Percent** | **P-Value** |
| **Decision for Caesarean to Time of Delivery** | | | | | |
| ≤75 | 5 | 27.80% | 27 | 8.00% | 0.02 |
| >75 | 13 | 72.20% | 310 | 92.00% | |
| **Caesarean indication** | | | | | |
| 2 or more previous c/s | 3 | 16.70% | 61 | 18.10% | 0.02 |
| CPD | 5 | 27.80% | 153 | 45.40% | |
| Fetal distress | 0 | 0.00% | 41 | 12.20% | |
| Other | 10 | 55.60% | 82 | 24.30% | |
| **Oxytocin** | | | | | |
| Yes | 0 | 0.00% | 60 | 17.80% | 0.05 |
| No | 18 | 100.00% | 277 | 82.20% | |
| **Rupture** | | | | | |
| Yes | 13 | 72.20% | 2 | 0.60% | <0.001 |
| No | 5 | 27.80% | 335 | 99.40% | |

| | Still Birth | | | | |
|---|---|---|---|---|---|
| | Yes | | No | | |
| **Variable** | **n** | **Percent** | **n** | **Percent** | **P-Value** |
| **Midwife at bedside** | | | | | |
| Yes | 15 | 83.30% | 197 | 58.50% | 0.34 |
| No | 3 | 16.70% | 140 | 41.50% | |
| **Level of surgeon** | | | | | |
| JRMO | 1 | 5.60% | 37 | 11.00% | 0.25 |
| SRMO | 10 | 55.60% | 112 | 33.20% | |
| Registrar | 5 | 27.80% | 151 | 44.80% | |
| SR/Consultant | 2 | 11.10% | 37 | 11.00% | |
| **Type of Anaesthesia** | | | | | |
| Spinal | 14 | 77.80% | 285 | 84.60% | 0.50 |
| General | 4 | 22.20% | 52 | 15.40% | |
| **NICU** | | | | | |
| Yes | 0 | 0.00% | 40 | 11.90% | 0.24 |
| No | 18 | 100.00% | 297 | 88.10% | |

**Table 6. Bivariate analysis for NICU Admission**

| | NICU | | | | |
|---|---|---|---|---|---|
| | Yes | | No | | |
| **Variable** | **n** | **Percent** | **n** | **Percent** | **P-Value** |
| **Decision for Caesarean to Time of Delivery** | | | | | |
| ≤75 | 3 | 7.50% | 29 | 9.20% | 0.72 |
| >75 | 37 | 92.50% | 286 | 90.80% | |
| **Caesarean indication** | | | | | |
| 2 or more previous c/s | 3 | 7.50% | 61 | 19.40% | 0.13 |
| CPD | 19 | 47.50% | 139 | 44.10% | |
| Fetal distress | 8 | 20.00% | 33 | 10.50% | |
| Other | 10 | 25.00% | 82 | 26.00% | |
| **Level of surgeon** | | | | | |
| JRMO | 0 | 0.00% | 38 | 12.10% | 0.02 |
| SRMO | 10 | 25.00% | 112 | 35.60% | |
| Registrar | 25 | 62.50% | 131 | 41.60% | |
| SR/Consultant | 5 | 12.50% | 34 | 10.80% | |
| **Oxytocin** | | | | | |
| Yes | 12 | 30.00% | 48 | 15.20% | 0.02 |
| No | 28 | 70.00% | 267 | 84.80% | |
| **Rupture** | | | | | |
| Yes | 0 | 0.00% | 15 | 4.80% | 0.39 |
| No | 40 | 100.00% | 300 | 95.20% | |

| | NICU | | | | |
|---|---|---|---|---|---|
| | Yes | | No | | |
| **Variable** | **n** | **Percent** | **n** | **Percent** | **P-Value** |
| **Shift** | | | | | |
| Morning | 13 | 32.50% | 76 | 24.10% | 0.48 |
| Afternoon | 7 | 17.50% | 71 | 22.50% | |
| Evening | 20 | 50.00% | 168 | 53.30% | |
| **Midwife at bedside** | | | | | |
| Yes | 20 | 50.00% | 192 | 61.00% | 0.18 |
| No | 20 | 50.00% | 123 | 39.00% | |
| **Type of Anaesthesia** | | | | | |
| Spinal | 29 | 72.50% | 270 | 85.70% | 0.03 |
| General | 11 | 27.50% | 45 | 14.30% | |

5. **Logistic regression analysis predicting lower Apgar score (<7)**

Adjusting for caesarean indication and NICU admission, deliveries conducted > 75minutes had 70% reduced odds for lower Apgar score compared to deliveries conducted within 75minutes (OR=0.30, CI=0.10 – 0.86, P-value = 0.03). DDI was, however, not significantly associated with Apgar score when treated as a continuous variable. Adjusting for DDI and caesarean indication, babies admitted to NICU had 8.5 times increased odds for lower Apgar score (OR=8.48, CI=3.46 – 20.77). Fetal distress and 2 or more previous c/s indications was not significantly associated with lower apgar score, however, compared to other indications, CPD indications had 63% reduced odds for lower apgar score (OR=0.37, CI=0.14 – 0.99, P-value =0.05).

Compared to DDI within 75minutes, deliveries conducted >75minutes had about 4 times increased odds for stillbirth (OR=4.42, CI=1.46 – 13.32, P-value = 0.008). DDI was not significantly associated with stillbirth when treated as a continuous variable.
Adjusting for confounders, compared to Registrar or SR/Consultant level of surgeon, the odds of NICU admission if the level of surgeon was JRMO or SRMO were 3 times greater (OR=3.15, CI=1.41 – 7.02, P-value <0.01). The odds for NICU admission were 3 times greater if Spinal anaesthesia was used compared to general anaesthesia (OR=3.22, CI=1.39 – 7.45, P-value <0.01). DDI both as categorical variable and continuous variable was not independently associated with NICU admission.

A lower Apgar score was observed at approximately 242 minutes (4 hours), NICU admission at approximately 320 minutes (5.3 hours), and stillbirth at 226 minutes (3.7 hours).

**Table 7. Logistic regression analysis predicting lower Apgar score**

| Variable | Unadjusted Odds Ratio (95% CI) | Adjusted Odds Ratio (95% CI) | P-value |
|---|---|---|---|
| | | | |
| **DDI** | | | |
| ≤75 | 1 | 1 | |
| >75 | 0.27 (0.12 - 0.70) | 0.30 (0.10 - 0.86) | 0.03 |
| **Caesarean indication** | | | |
| Other | 1 | 1 | |
| 2 or more previous c/s | 0.27 (0.08 - 1.00) | 0.38 (0.10 - 1.46) | 0.16 |
| CPD | 0.34 (0.14 - 0.81) | 0.37 (0.14 - 0.99) | 0.05 |
| Fetal distress | 0.60 (0.19 - 1.96) | 0.41 (0.11 - 1.50) | 0.17 |
| **NICU** | | | |
| No | 1 | 1 | |
| Yes | 7.07 (3.10 - 16.17) | 8.48 (3.46 - 20.77) | <0.001 |

**Table 8. Logistic regression analysis predicting NICU admission**

| Variable | Unadjusted Odds Ratio (95% CI) | Adjusted Odds Ratio (95% CI) | p-value |
|---|---|---|---|
| | | | |
| **Level of surgeon** | | | |
| Registrar or SR/Consultant | 1 | 1 | |
| JRMO or SRMO | 2.73 (1.29 - 5.77) | 3.15 (1.41 - 7.02) | <0.01 |
| **Oxytocin** | | | |
| No | 1 | 1 | |
| Yes | 0.42 (0.20 - 0.88) | 0.46 (0.19 - 1.15) | 0.10 |
| **Type of Anaesthesia** | | | |
| General | 1 | 1 | |
| Spinal | 2.28 (1.06 - 4.88) | 3.22 (1.39 - 7.45) | <0.01 |

# DISCUSSION

The average DDI was 304.3 minutes (5hours 4.3 minutes), minimum DDI of 23 minutes and maximum 1,345 minutes. The mean DDI of 304.3 minutes is far much higher than the recommended 30 minutes recommended by many professional bodies such as NICE/RCOG for emergency caesarean sections. It is also higher than that found in other studies such as 52.4 minutes reported by Kolas et al, 39.5 minutes by Sayegh et al and Mackenzie et al 27.4 minutes for crash sections, 42.9minutes for fetal distress and 71.1 minutes for cases without fetal distress. It is however comparable to that found in similar poor resource settings. It is lower than that found by Onal et al in Nigeria with DDI of 511 minutes at the University of Nigeria Teaching Hospital. According to the Hospital records, UTH HMIS of 2014, the hospital conducted 21,995 deliveries out of which 3,658 were by caesarean sections; caesarean section rate of 16.6%. The majority of emergency caesarean sections at UTH were done for CPD 44.5% and fetal distress 11.5%.

In the study, the DDI of 30 minutes was achieved in only 0.3% and that 14(3.9%) done within 1 hour and 39.9% done within 3 hours and 67(18.9%) done over 8 hours after the decision was made. This by far is less achievement compared to other findings from other studies. Bloom et al had a 30 minute DDI achievement of 98%, Jacobs et al 44%, Tufnell et al 41% and Livermore et al 11.1%.Our results are however comparable to those from poor resource settings like Ghana where Mooney et al found a 30 minute DDI achievement of 1.7%.

The recommended DDI was not achieved in 99.7% of the cases. DDI was not significantly associated with Apgar score, still birth and NICU admission when treated as a continuous variable. This is similar to findings from other studies; Bloom et al in 2006 found that more than 30% of the cesarean sections were done with DDI more than 30 minutes and didn't encounter adverse neonatal outcomes. Onal et al in 2005 in Nigeria found similar findings were none of the 224 emergency caesarean sections the studied was delivered within the recommended DDI; none had any significant poor outcome. A lower Apgar score was observed at approximately 242 minutes, NICU admission 320 minutes and still

birth 226 minutes. This is far much higher than that found by Thomas et al who found significant complications when DDI exceeded 75 minutes.

The indications for the emergency caesarean sections had an influence on the mean DDI. The shortest DDI was found for cord prolapse at 99.9 minutes, fetal distress 188.7 minutes, APH 219.5 minutes and CPD 339.7 minutes. With a prior knowledge of the indication, there is awareness of the probable outcome with regard to the duration of the DDI and hence the cord prolapse had the shortest mean DDI to obtain the best fetal outcome. Bloom et al also found that cord prolapse had the shortest mean DDI. Kolas et al found a difference in the mean DDI dependent on the indications.

Maximum contribution to the prolonged DDI was from the time the caesarean section was made to taking the patient to the operating theatre- interval 1. This accounted for 86.8% of the entire DDI- mean time for interval 1 was 262.3 minutes. The first interval involves informing theatre, preparing the patient for theatre, theatre crew sending trolley to pick up patient and trolley back to theatre.

The average time it took to prepare patient for theatre was 78.8 minutes. In 40.3% of the times, there was no midwife accompanying the doctor when decision for caesarean section was made and in 35.5% the midwife was not aware of the decision for caesarean section until the trolley came to pick up patient. This delay was attributed to inadequate midwife staffing levels that were always busy with deliveries and majority started patient preparation upon seeing the trolley to pick up the patient.

It took another 170.1 minutes on average from the time the patient was ready for theatre to arrival of the trolley in labour ward. This was attributed to the long waiting list for surgery. There is limited theatre space; only one theatre room specifically reserved for caesarean sections against a total of 21,995 deliveries in 2014 with a caesarean section rate of 16.6% (UTH HMIS records, 2015). This further was worsened by transportation delays due to lack of trolleys to transport patients. The mean time interval from arrival of patient in labour ward to patient arrival in theatre was 17.85 minutes. This was mainly attributed to patient preparation by midwife who usually started the preparation upon seeing the trolley. These findings are similar to those found by Radhakrishnan et al who found that maximum delay happened in interval 1 and accounted for 72% of the entire DDI and the major reason was non availability of OT in 73.5%. This also has been reported by Sayegh

et al who observed that maximum delay occurred in interval 1 and the delay was inversely proportional to the urgency of the caesarean indication.

From this and many other studies, it is obvious that it is difficult to achieve a DDI of 30 minutes and that any interventions targeted at reducing DDI should be aimed at interval 1. It is also possible that the cases diagnosed at UTH as fetal distress are not truly fetal distress as there is poor fetal heart rate monitoring, no facility to document fetal acidosis and as such these may not be truly fetal distress that despite long DDI, the fetal outcomes were good. There was also a tendency to stop monitoring the fetus once decision for caesarean section was made especially for CPD. Some babies from mothers that initially were CPD could have had fetal distress without realizing it that could have contributed to poor outcomes under CPD.

Though the Apgar score may not be a particularly reliable assessment of neonatal wellbeing at the time of delivery nor a good predictor of long term neurological outcome, this data does not correlate with perinatal outcome and thus while it may be a standard worth striving to achieve a DDI of 30 minutes it is not necessarily of benefit to the fetus. A workable approach then would be to recommend locally the optimal DDI.

## STUDY LIMITATIONS

The results of this study cannot be generalised to other local hospitals as this was a tertially hospital based study which is the national referral hospital. The number of patients seen is much higher than that seen at district hospitals.

The outcomes Apgar score and NICU admission were very subjective with inter and intra observer variations. Some babies could have been given a wrong Apgar score or wrongly admitted to NICU which could have affected the results.

## CONCLUSION

The DDI for emergency caesarean sections at UTH was found to be 304.3 minutes. Few emergency caesarean sections (n=85, 23.9%) are done within 120 minutes (2 hours). Only 0.3% of the cases were done within 30 min and 3.9% within 1 hour. Most of the DDI for emergency sections was accounted for by lack of theatre availability. Prolonged delay from decision to arriving in theatre attributed to long waiting list for surgery. Although the 30 minute DDI should remain the gold standard, achieving it may not be feasible at UTH in the current situation

## RECOMMENDATIONS

1. To locally adopt an acceptable decision delivery interval for emergency caesarean sections. This would then be used as a measure of standard of quality of care for provision of emergency obstetric services at UTH.
2. Management to come up with a deliberate policy for mandatory opening up of more theatre space after completion of elective cases done in gynecological theatre rooms.
3. As a long term solution, efforts to reduce the DDI should be directed at reducing time for interval 1 which mainly was as a result of long waiting patient OT list due to lack of theatre space. It is anticipated that with the completion of the Cancer diseases hospital (CDH), cancer disease patients from B21 will be relocated to CDH. Patients from surgical premium ward C13 should then be taken to B21 and then C13 should be turned into an emergency obstetric theatre.

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**Appendices**

## APPENDIX 1: Participant information sheet

NAME OF STUDY: DECISION TO DELIVERY INTERVAL AND ITS CORRELATION WITH NEONATAL OUTCOME AT UTH, LUSAKA

Principal Investigator: Dr MULETA KUMOYO

Sponsor: GRZ

Dear Participant,

I invite you to take part in this study being conducted by Dr Muleta Kumoyo as part of the requirement for the award of a Masters Degree in Medicine.

The study is looking at decision to delivery interval for caesarean deliveries factors associated with the interval, fetal outcomes and the correlation of the interval to the fetal outcome at UTH. You have been chosen in this study because your doctors recommend you undergo a caesarean delivery. Research assistants will interview you and will get other information from your medical records and files. The findings of this study will help us determine the decision to delivery interval for caesarean deliveries, and the effect of this interval on the fetal outcome. The results from the study will help us plan for future caesarean deliveries. There are no monetary or material benefits in being part of our study. The study will not in any way affect your plan of management of your condition. We anticipate no risks to participating in this study.

We will ask you a few questions and note some information from your file. If you agree to take part, please sign the consent form attached to allow us see if you choose to be part of this study. If you have any questions later, please contact Dr Kumoyo Muleta, cell 0966966079 in the maternity wing, UTH. You may also contact the secretary, UNZA Biomedical Research Ethics Committee, Ridgeway Campus, phone 0211 256067.

PARTICIPANT CONSENT FORM.

DECISION TO DELIVERY INTERVAL AND ITS CORRELATION WITH NEONATAL OUTCOMES FOR EMERGENCY CAESAREAN DELIVERIES AT UTH LUSAKA, ZAMBIA.

STUDY ID __ __ __ __ __ / __ _

I, the undersigned, understand all that has been explained to me as above. The purpose of the study and participation in the study is clear to me. I voluntarily consent to take part in the study. I agree to participate in the study on my own without coercion.

Name of participant ----------

Signature of participant or thumb print----------Date ----------

Name of witness _____Signature of witness_____ Date_____

## APPENDIX 2: Questionnaire for midwifery staff

**DECISION TO DELIVERY INTERVAL AND ITS CORRELATION WITH NEONATAL OUTCOMES FOR EMERGENCY CAESAREAN DELIVERIES AT UTH, LUSAKA.**

NAME OF PATIENT: _____ DATE: _____

**A)** ***Instructions: Please answer, tick or enter in the appropriate space.***

1) Shift under evaluation : (1)Morning (11)afternoon (111)night
2) Indication for caesarean delivery: _____
3) Number of midwives on duty during the shift: _____
4) Number of patients in the labour ward at the time of decision for caesarean delivery: _____
5) Was the midwife present [at the bedside] when the decision to do caesarean delivery was made by the doctor**?** *Circle one:* Yes or No
6) How did the doctor communicate about the decision for caesarean delivery?
    1. Direct ( )
    2. Found it written in file ( )
    3. Was not aware of decision until trolley came ( )
7) When did patient preparation start after the decision was made? __hrs__ minutes
8) If there was a delay, please indicate why**:**
    1. Was busy with other patients [ ]
    2. Was out of labour ward [ ]
    3. Didn't know about the decision [ ]
    4. Patient was not fit for theatre [ ]
    5. No consumables to prepare the patient with [ ]
    6. There was no delay in the opinion of the midwife [ ]

## B) Timing of steps from decision to delivery

*Directions: Fill in the date and time each task was completed. For each task. Write legibly.*

| # | Task | Date (dd/mm/yy) | Time (hr:min) |
|---|---|---|---|
| 1 | Decision made that patient needs Caesarean delivery (CD) | __ __ / __ __ / __ __ | __ __ : __ __ |
| 2 | Theatre informed of CD | __ __ / __ __ / __ __ | __ __ : __ __ |
| 3 | Patient prepared and Consent completed | __ __ / __ __ / __ __ | __ __ : __ __ |
| 4 | Trolley arrives to take patient from ward to OT | __ __ / __ __ / __ __ | __ __ : __ __ |
| 5 | Patient is in pre operative holding area of OT | __ __ / __ __ / __ __ | __ __ : __ __ |
| 6 | Patient moved into OT | __ __ / __ __ / __ __ | __ __ : __ __ |
| 7 | Start of giving anaesthesia to patient | __ __ / __ __ / __ __ | __ __ : __ __ |
| 8 | Anaesthesia completed | __ __ / __ __ / __ __ | __ __ : __ __ |
| 9 | Starting time of operation | __ __ / __ __ / __ __ | __ __ : __ __ |
| 10 | Delivery of infant | __ __ __ __ | |

C) **Fetal outcome**

*Instructions: Please answer, tick or enter in the appropriate space.*

**1.** Gestational age of pregnancy_____ weeks

**2.** Nature of duration of labour before decision to do emergency CD:

I. Normal latent phase ( )

II. Prolonged latent phase ( )

III. Normal active phase ( )

IV. Prolonged active phase ( )

**3.** Type of anaesthesia: ( 1) spinal ( 11) general

**4.** Nature and colour of liquor intra OP

I. Clear ( )

II. Meconium stained ( )

III. Foul smelling liquor ( )

IV. Bloody or blood stained ( )

**5.** APGAR score at (1) 1 min_____ ( 11) 5 min_____.

**6.** Birth weight: _____ kg.

**7.** Need for newborn ventilation: *Circle one:* Yes or No

**8.** Admission to NICU after delivery: *Circle one:* Yes or No

**9.** If applicable, reason for admission to NICU: *(tick all that are mentioned)*

I. Low Apgar score/birth asphyxia ( )

II. Grunting/ nasal flaring ( )

III. Other (Specify _____) ( )

**10.** Is the outcome a stillbirth? *Circle one:* Yes or No

**11.** If applicable, what type of stillbirth? *Circle one:* Macerated or Fresh or Unknown

**12.** Ruptured uterus present? *Circle one:* Yes or No

**13.** Was the woman on oxytocin prior to caesarean delivery? *Circle one:* Yes or No

**14.** Did the woman receive misoprostol? *Circle one:* Yes or No

**15.** List any pre-existing maternal medical condition(s):

I. Hypertensive disorders [ ]

II. Diabetes mellitus [ ]

III. Other (Specify _____) [ ]

**16.** Level of primary surgeon:

I. JRMO [ ]

II. SRMO [ ]

III. Registrar [ ]

IV. Senior Registrar/ Consultant [ ]

## APPENDIX 3: OT Utilization for caesarean delivery

**DECISION TO DELIVERY INTERVAL AND ITS CORRELATION WITH NEONATAL OUTCOMES FOR EMERGENCY CAESAREAN DELIVERIES AT UTH LUSAKA**

Name of patient:_____ Date: __ __ / __ __ / __

***A) Directions : answer or tick in the appropriate space***

1. Shift: (1) morning (11) afternoon (111) night
2. Number of OT rooms in use for CD during this shift: 1/2/3
3. Theatre nurse available: yes / no.
4. Anaesthetist available: yes / no
5. Surgeon available : yes / no
6. Type of anaesthesia: spinal / general
7. Porters available : yes/ no
8. Indication for CD_____

***B) Directions: Fill in the date and time each task was completed.***

| _____ | | | |
|---|---|---|---|
| # | Task | Date (dd/mm/yy) | Time (hr:min) |
| 1 | Room is empty (last patient is out of room) | __ __ / __ | __ __ : __ __ |
| 2 | Theatre ready for next procedure | __ __ / __ __ / __ __ | __ __ : __ __ |
| 3 | Trolley sent from OT to labour ward | __ __ / __ __ / __ __ | __ __ : __ __ |
| 4 | Patient is in pre operative holding area of OT | __ __ / __ __ / __ __ | __ __ : __ __ |
| 5 | Patient moved into OT | __ __ / __ __ / __ __ | __ __ : __ __ |
| 6 | Start of giving anaesthesia to patient | __ __ / __ __ / __ __ | __ __ : __ __ |
| 7 | Anaesthesia completed | __ __ / __ __ / __ __ | __ __ : __ __ |

| | | | |
|---|---|---|---|
| 8 | Surgery start time | __ __ / __ __ / __ __ | __ __ : __ __ |
| 9 | Surgery end time | __ __ / __ __ / __ __ | __ __ : __ __ |
| 10 | Patient taken out of OT | __ __ / __ __ / __ __ | __ __ : __ __ |