

https://dspace.org/

# Indications and immediate outcomes of caesarean section deliveries at a national referral hospital in Botswana

**Kula, Onteletse Cathrine**

**2019**
https://hdl.handle.net/10539/29730

Downloaded from a DSpace repository. https://dspace.org/

# INDICATIONS AND IMMEDIATE OUTCOMES OF CAESAREAN SECTION DELIVERIES AT A NATIONAL REFERRAL HOSPITAL IN BOTSWANA


**NAME:** **ONTELETSE CATHRINE KULA (MS.)**

**SUPERVISORS:** **DR. JULIET NYASULU (MAIN SUPERVISOR)**

**MRS. H.T. MATLEELANE (CO-SUPERVISOR)**


**YEAR:** **2019**

**A Research Report Submitted to the Faculty of Health Sciences, School of Public Health, University of the Witwatersrand, Johannesburg, in Partial Fulfillment of the Requirements for the Degree of Master of Public Health in Maternal and Child Health**

**August 2019**

**DECLARATION**

I declare that this research report hereby submitted to the University of the Witwatersrand, Johannesburg, for the degree of Master of Public Health in Maternal and Child Health is my own work in design and in execution; and all materials contained in this report has been appropriately acknowledged. It has not previously been submitted by me or any other person for any degree or examination at this or any other university.

Signature:  Date: 15th August 2019

Onteletse Cathrine Kula (Ms.)

**DEDICATION**

I dedicate this study to my daughter Gloria and my son Pako, for being so understanding during my hectic training period as most of the time I was not available when you needed me. Your support, motivation and encouragement made me to survive this taxing period; and I hope and believe that this achievement will serve as an encouragement to you. I also dedicate this study to my classmate and younger sister Ms. Gofaone Jessica Mosweu for her encouragement and motivation. You were always there for me when I felt exhausted, drained out and helpless.

## ABSTRACT

### Background

Caesarean section (CS) is a major obstetric intervention, performed by obstetricians and doctors for saving lives of women and their newborns from pregnancy and childbirth related complications. There is great concern about the increasing rise in the rate of CS deliveries in both developed and developing countries as unnecessary CS may have adverse impact upon maternal and neonatal health outcomes. The World Health Organization (WHO) considers CS rates of 5-15% to be the optimal range for targeted provision of this life saving intervention. Although Botswana has not done any research on CS rates, it was identified through health facility reports that it has high rates of CS. The aim of this study was to establish the rate, indications and immediate outcomes of CS deliveries for women who delivered at Princess Marina Hospital (PMH) in Botswana.

### Method

This was a descriptive cross-sectional retrospective study. Maternity registers were reviewed, and there were 6737 deliveries of which 1918 were delivered through CS from January to December 2016. Out of the 1918 CS deliveries, 794 records were sampled. Data were collected using a data extraction tool, entered in Epi-Info version 3.3.3 for cleaning, and was then transported into STATA software version 14 for statistical analysis. Appropriate measures of description such as mean, frequencies and percentages were utilized to describe the different variables under study. Indications of CS were presented as frequency distribution. Categorical variables were compared using chi-square test, with 95% confidence levels considered to verify significant difference between variables with a pvalue of $<0.05$ considered as significant. Records of women who delivered by CS were stratified into quarters (quarter 1-4) and comparisons were also made between obstetric variables and indications of CS.

## Results

The rate of CS deliveries was 28.5%. The most frequent indication of CS deliveries was fetal distress (23.6%), and 145 (18.3%) were adverse outcomes. Maternal complications accounted for 13.1% of all the adverse outcomes and the most common maternal complication was postpartum haemorrhage (95%). There were 30 stillbirths which accounted for 3.8% of the fetal mortalities. Fetal complications were 126 which accounted for 86.9% of all the adverse outcomes, and the most frequent fetal complication was low APGAR score with 74%.

## Discussion

The CS rate identified in this study was higher than the WHO standard recommendation. The high rate of fetal distress diagnosed might be due to over-diagnosis. Therefore, there is need to avail and improve fetal monitoring technological devices such as Cardiotocograph (CTG) that will reduce the over-diagnosis of fetal distress. Furthermore, this high rate of CS deliveries could be a resultant of poor utilization of instrumental vaginal delivery. Therefore, clinicians should be encouraged and motivated to perform instrumental vaginal delivery such as, vacuum and forceps, when appropriate. The policy makers should also consider developing national policy and guideline on appropriate justification of indications for CS deliveries. The considerable maternal complications can be reduced through strengthening antenatal care and family planning services including community health education programmes. Furthermore, it is essential to re-enforce emergency neonatal resuscitative measures in order to reduce the high rate of perinatal morbidities.

**ACKNOWLEDGEMENTS**

I would like to acknowledge the following people for their contributions in this research report:

- My main supervisor Dr. Juliet Nyasulu for the guidance, support, motivation, encouragement and patience throughout the study. You were always readily available to give guidance and assistance; and responding well in time irrespective of your hectic and tight work schedule. Thank you very much. Your dedication to this research is truly appreciated.
- My co-supervisor Mrs. H. T. Matleelane for encouragement and support.
- My statistician Mr. Akeem Ketlogetswe who patiently assisted me in statistical analysis and designing of tables, figures and graphs.
- My colleague, friend and sister Ms. Itumeleng Rasetshwane who assisted me in taking care of my children during my school days and gave me encouragement during times of despair and dark hours when I felt like quitting.
- Intrapartum care (Labour) ward manager (Maternity Department, PMH) Ms. Goratileone Rapitse for granting me permission to access maternity registers in her unit. She also facilitated a well-coordinated interaction with staff and availed maternity registers to me ensuring that I was able to gather the required data for completion of this research.
- Lastly but not least, I would like to thank the Almighty GOD for keeping me healthy and for giving me strength and sound mind to produce this valuable research.

**LIST OF ABBREVIATIONS**

| | |
|---|---|
| ANC | Antenatal Care |
| APGAR | Appearance, Pulse, Grimace, Activity and Respirations |
| APH | Antepartum Haemorrhage |
| BFHS | Botswana Family Health Survey |
| BOH | Bad Obstetric History |
| CPD | Cephalopelvic Disproportion |
| CS | Caesarean Section |
| CTG | Cardiotocograph |
| EmONC | Emergency Obstetric and Newborn Care |
| GDM | Gestational Diabetes Mellitus |
| HELLP | Haemolysis Elevated Liver Enzymes Low Platelets |
| IOL | Induction of Labour |
| IUD | Intrauterine Death |
| IUGR | Intrauterine Growth Retardation |
| MMRI | Maternal Mortality Reduction Initiative |
| NND | Neonatal Death |
| NRH | Nyangabgwe Referral Hospital |
| PET | Pre-eclamptic Toxaemia |
| PMH | Princess Marina Hospital |
| PPH | Postpartum Haemorrhage |
| PPROM | Preterm Premature Rupture of Membranes |
| PROM | Premature Rupture of Membranes |
| SDG | Sustainable Development Goal |
| SROM | Spontaneous Rupture of Membranes |
| SSA | Sub-Saharan Africa |
| UK | United Kingdom |
| VP Shunt | Ventriculo-peritoneal Shunt |
| US | United States |
| USA | United States of America |
| WHO | World Health Organization |

**TABLE OF CONTENTS**

TITLE PAGE ---------- 1
DECLARATION ---------- 2
DEDICATION ---------- 3
ABSTRACT ---------- 4
Background ---------- 4
Method ---------- 4
Results ---------- 5
Discussion ---------- 5
ACKNOWLEDGEMENTS ---------- 6
LIST OF ABBREVIATIONS ---------- 7
TABLE OF CONTENTS ---------- 8-10
**CHAPTER ONE: INTRODUCTION** ---------- 11
1.1 Description of CS delivery ---------- 11
1.2 An overview of CS rates ---------- 11-12
1.3 An overview of CS indications ---------- 12
1.4 An overview of CS outcomes ---------- 12-13
1.5 An overview of CS in Botswana ---------- 13
1.6 PROBLEM STATEMENT ---------- 13-14
1.7 JUSTIFICATION ---------- 14-15
1.8 STUDY AIM ---------- 16
1.9 STUDY OBJECTIVES ---------- 16
**CHAPTER TWO: LITERATURE REVIEW** ---------- 16
2.1 Global and regional rates of CS delivery ---------- 16-17
2.2 Global and regional indications of CS delivery ---------- 18-21
2.3 Global and regional outcomes of CS delivery ---------- 21-22
2.4 Botswana's context regarding CS delivery ---------- 22
**CHAPTER THREE: METHODOLOGY** ---------- 23
3.1 STUDY DESIGN ---------- 23
3.2 STUDY SETTING ---------- 23-24
3.3 STUDY POPULATION AND SAMPLE ---------- 24

3.4 SAMPLE SIZE ---------- 24-25
3.5 DATA COLLECTION ---------- 25
3.5.1 DATA COLLECTION TOOL ---------- 25
3.5.2 DATA COLLECTION PROCESS ---------- 26
3.5.3 CLASSIFICATION OF INDICATIONS OF CS DELIVERIES ---------- 26-27
3.6 PILOT STUDY ---------- 27
3.7 DATA MANAGEMENT AND ANALYSIS ---------- 27-28
3.8 ETHICAL CONSIDERATIONS ---------- 28
**CHAPTER FOUR: RESULTS** ---------- 29
INTRODUCTION ---------- 29
4.1 Demographic characteristics of CS delivery participants ---------- 29
4.2 Determinants of CS delivery ---------- 30
4.3 Indications for CS deliveries ---------- 30-31
4.3.1 Maternal age and indications for CS delivery ---------- 31-32
4.3.2 Obstetric characteristics and indications for CS deliveries ---------- 33-34
4.3.3 Parity, CPD and Malpresentation ---------- 34
4.4 Immediate outcomes of CS deliveries ---------- 35
4.4.1 Parity, Gestation and CS outcomes ---------- 35-36
4.4.2 Maternal adverse outcomes ---------- 36-37
4.4.3 Fetal adverse outcomes ---------- 37-38
**CHAPTER FIVE: DISCUSSION** ---------- 39
INTRODUCTION ---------- 39
5.1 SUMMARY OF MAIN FINDINGS ---------- 40
5.2 DISCUSSION OF MAIN FINDINGS ---------- 40
5.2.1 Rates of CS deliveries ---------- 40-41
5.2.2 Indications of CS Deliveries ---------- 41-42
5.2.3 Immediate Outcomes of CS deliveries ---------- 42-43
5.3 STRENGTHS OF THE STUDY ---------- 44
5.4 IMPLICATIONS OF STUDY ---------- 44-45
**CHAPTER SIX** ---------- 45
6.1 CONCLUSION ---------- 45-46

6.2 LIMITATIONS ---------- 46
6.3 RECOMMENDATIONS ---------- 46-47
**REFERENCES** ---------- 47-51
APPENDIX ONE ---------- 52
APPENDIX TWO ---------- 53
APPENDIX THREE ---------- 54
APPENDIX FOUR ---------- 55
APPENDIX FIVE ---------- 56
APPENDIX SIX ---------- 57-58

**LIST OF TABLES AND FIGURES**

Table 1 ---------- 29
Table 2 ---------- 30
Figure 1 ---------- 31
Figure 2 ---------- 32
Table 3 ---------- 33
Table 4 ---------- 34
Table 5 ---------- 35
Table 6 ---------- 36
Figure 3 ---------- 37
Figure 4 ---------- 37
Table 7 ---------- 38
Table 8 ---------- 39

# CHAPTER 1: INTRODUCTION

This introductory chapter presents the contextual background and literature review for this study. The background section includes a description of CS delivery, and an overview of CS rates, indications and CS delivery outcomes. An overview of CS delivery in Botswana is also briefly highlighted.

## 1.1 Description of CS delivery

Caesarean section (CS) is a surgical procedure, whereby a woman's abdomen and uterus are incised in order to deliver her baby (1). It is necessary to perform CS when delivery complications such as, obstructed or prolonged labour, malpresentation and fetal distress arise (2, 3). This means that, it is performed when vaginal delivery is unlikely, and / or when the life and health of the mother and / or the baby is at risk. Effective and efficient use of CS as a vital intervention increases access to care and reduces undesirable outcomes (2). Access to comprehensive emergency obstetric interventions including CS is essential to reduce both maternal and perinatal morbidity and mortality, and reaching the realization of sustainable development goal 3 (2). As a result, the World Health Organization (WHO) had found it fit to appeal, and recommend all countries to adopt and implement emergency obstetric care services including CS intervention (4). Botswana has adopted emergency obstetric care services including CS in order to manage and treat complications of pregnancy, labour and delivery (5, 6).

## 1.2 An overview of CS rates

The WHO and Pan American Health Organization have considered the ideal rate of CS delivery for a country to be 5-15% of the total deliveries (2, 4, 7). The global average rate of CS deliveries, however, increased from 12.4% to 18.6% between 1990 and 2014 (8). Furthermore, another study (9) had shown that "worldwide rise in caesarean deliveries rates increased dramatically from 12% in 1990 to 24% in 2008 with a peak reached in industrialized countries". It further revealed that, more than one quarter of all births (26.1%) in US were by caesarean deliveries. High rates of CS deliveries are found to be more evident in developed countries while

the lower rates are mostly in lower and middle income regions (9). Studies on CS deliveries conducted in health facilities across several African countries, revealed that the rate of CS deliveries ranged from 2.3% to 27.3% with a median rate of 13.5% (10, 11). These studies, further showed that, majority of the health facilities that had low CS rate were those in rural settings where CS resources were inadequate, and those health facilities that were within the cities which mostly referred their patients to tertiary hospitals (10, 11). In addition, the high rates of CS deliveries were more apparent in the health facilities that had adequate CS resources, as well as, in nongovernmental and private health facilities and where economic incentives were available (10, 11).

### 1.3 An overview of CS indications

The most commonly accepted indications of CS delivery included but are not limited to the following; fetal distress, malpresentations, cephalopelvic disproportion (CPD), previous CS, antepartum haemorrhage, pre-eclampsia and eclampsia (10). Majority of the studies conducted globally and regionally had revealed aforementioned indications of CS deliveries. But, these indications had different rates between regions and countries (4, 10, 12-14). Furthermore, it was also observed that performance of CS delivery is now influenced by other socio-demographic factors such as; wealth, class and level of education particularly in developed countries (2, 15).

### 1.4 An overview of CS outcomes

CS delivery when conducted based on valid medical justification can effectively prevent both maternal and perinatal morbidities and mortalities (16). That is, CS deliveries are effective in saving maternal and fetal lives (16). In addition, CS deliveries are essential as they aid in the avoidance of birth trauma for the neonates, and preserve the mothers' perineum (17). On the other hand, CS when compared with vaginal delivery can cause significant complications for the mother, such as; infections, disability or death particularly in settings with inadequate resources needed to conduct safe surgeries or manage probable complications (3, 7). Furthermore, CS deliveries that are conducted inappropriately have been identified as contributory to some cases of maternal deaths. But, according to WHO CS intervention is vital to improve health outcomes

of women and babies hence, no woman who undergoes CS should die or become sick (10). Again CS when compared to vaginal delivery is more costly to the mother, family, community and the country in terms of funds, time spend in hospital, expensive and complex equipments used, drugs, and more health personnel needed to perform the operation (10). Furthermore, a study conducted by Tanyi et al. (2016) at the Limbe and the Buea regional hospitals in Cameroon, had indicated that caesarean delivery has adverse neonatal outcomes such as low APGAR score, resuscitations, birth injury, pulmonary hypertension and respiratory distress (11). It further revealed that of all the neonates that were born by caesarean deliveries, 26.1% had at least one adverse neonatal outcome with respiratory distress being the most frequent (46.2%) (11).

### 1.5 An overview of CS in Botswana

Although Botswana has conducted no scientific research to establish CS rates, indications and immediate of CS delivery outcomes, it has been observed through the health facility reports and the Botswana "Maternal Mortality Reduction Initiative" (MMRI) technical report that the rate of CS deliveries is high. The Botswana MMRI technical report revealed that, tertiary and district hospitals had CS delivery rates of 25% and 12% respectively in 2015 (3). It further showed that, Princess Marina hospital (PMH) and Nyangabgwe referral hospital (NRH) had CS delivery rate of 25% and 24% respectively (3). PMH is one of the three tertiary hospitals in Botswana located in Gaborone district. In addition, Botswana Medical Aid Society (BOMAID), a medical insurance company, reported 61% rate of CS deliveries among the insurance members in 2015 which is fourfold the WHO recommendation (15). The company alluded that, though it hopes these CS performed were informed by medical necessity, it appears like majority of them were motivated by non-reassuring indications such as personal and societal preferences.

### 1.6 Problem statement

WHO states that CS is an essential intervention that is used to save the lives of mothers and neonates when used appropriately at an ideal rate of not less than 5% nor more than 15% (16). WHO further stated that countries that have less than 5% rate of CS deliveries reflect inadequate

access of its population to this vital intervention. On the other hand, countries that have more than 15% rate of CS deliveries might reflect unnecessary utilization of this intervention, which can result in adverse health outcomes of mothers and neonates (16). Worjoloh et al. also highlighted that, excess use of CS without valid medical reason has been seen to have adverse effects on the mother, baby, family, community and the nation at large (18). Therefore, this means that, the proportion of CS at the population level is a measure to the level of access to and use of this intervention. It can serve as a guideline for policy makers and governments in evaluating progress in maternal and infant health and in monitoring emergency obstetric care and resource use (8). Since Botswana has limited scientific research in the area of CS rate or proportion, it is unlikely to measure the level of access to and use of CS intervention at the population level. In addition, Botswana is still striving to improve availability and accessibility to emergency obstetric care, including CS intervention in order to reduce both maternal and neonatal mortality, and it also aims at performing quality and safe CS. This quality CS can be measured through both maternal and neonatal health outcomes. But, since Botswana has limited scientific research in the area of CS outcomes, it is unlikely to measure maternal and neonatal health outcomes. Furthermore, the country lacks scientific guidelines that can assist policy makers and the government to effectively evaluate the progress of maternal and infant health, and monitor emergency obstetric care and resource use.

### 1.7 Justification

The world is concerned about the increasing rate of CS deliveries. In Africa, the rate of CS deliveries ranges from 2.3% to 27.3% (10) while in the Latin Carribean and America ranges from 25% to 65% (4). In addition, majority of these CS deliveries are performed based on non-reassuring indications such as; maternal preferences, wealth, level of education and class (2, 15). Furthermore, unnecessary CS deliveries had been found to have adverse maternal and neonatal effects such as; slower recovery for the women, increased risk of complications like infection, PPH, need for blood transfusion, need for high cost special care, or treatment of severe morbidities for both the mother and the baby, increased risk of unpleasant effects in subsequent pregnancies, disability and death, and high costs of surgery (19). On the other hand, if CS deliveries are performed based on valid medical diagnosis can effectively prevent both maternal

and neonatal morbidities and mortalities (16). That is, CS is effective in saving maternal and fetal lives. For example, CS deliveries are effective in saving fetal lives in complications such as fetal distress and hypoxia. They are also important as they aid in the avoidance of birth trauma for preterm neonates, and thus preventing neonatal morbidity. CS deliveries are also important as they assist in prevention of trauma in the maternal birth canal in conditions such as CPD, and they also enhance prevention of maternal death whereby the woman has pre-eclampsia (16). Therefore, it is critical for the country to conduct a scientific research about CS rate, indications and immediate outcomes in order to monitor the utilization of this vital intervention. In addition, there is need to conduct a research project to come up with evidenced based information, that is needed by policy makers to plan and develop policies and guidelines to cater for women who really need CS deliveries. Although it is essential to conduct a research on CS rates, indications and immediate outcomes, Botswana has not conducted such study. The country only relies on the health facility reports, and the Botswana maternal mortality reduction initiative technical report. This study was therefore aimed to establish rate, indications and immediate outcomes of CS deliveries in Botswana, hence the target of this research project primarily focused on various stake holders.

While Botswana is striving to improve availability and accessibility to maternal and child health services, it also aims at delivering quality health services in order to reduce maternal mortality which can be measured through both maternal and perinatal health outcomes. Therefore, reduction of maternal morbidity and mortality depends on a greater extent on efficient and cost effective emergency obstetric care, including CS intervention. These interventions need to be implemented accordingly and appropriately with valid medical justification. As a result, this could enable ministry of health and stakeholders in future to scale-up sustainable obstetric emergency interventions to other parts of the country, hence this would contribute to the realization of Sustainable Development Goal (SDG) 3 which aims at “ensuring healthy lives and promoting well-being for all at all ages”, thus achieving the health target 3.1 and 3.2 by 2030. The research findings would also contribute to the existing body of knowledge within the midwifery profession in Botswana but also regionally.

### 1.8 Study aim

The aim of the study was to determine the rate, indications and immediate outcomes of CS deliveries at a national referral hospital in Botswana from January to December 2016.

### 1.9 Study objectives

1. To establish the rate of CS deliveries from January to December 2016 at a national referral hospital in Botswana.
2. To establish the indications of CS deliveries from January to December 2016 at a national referral hospital in Botswana.
3. To determine the immediate outcomes of CS deliveries from January to December 2016 at a national referral hospital in Botswana.

## CHAPTER 2: LITERATURE REVIEW

This chapter describes global and regional CS rates, indications and outcomes of CS deliveries. It also briefly explains Botswana's context regarding CS delivery rate, indications and outcomes.

### 2.1 Global and regional rates of CS deliveries

Several studies conducted globally have revealed that, many regions and countries have CS delivery rates that are higher than the one recommended by WHO of 5-15% (2, 4, 8-12, 20). The average global rate of CS is 18.6%, ranging from 6.0% to 27.2% in the least and more developed regions, respectively (8, 10, 16, 21). The lowest rates of CS with the average rate of 7.3% are found in Africa; and more specifically in Western Africa which has an average rate of 3% with a range of 1.4% to 11.4% (8). But according to Shah et al. Northern Africa has the highest CS rate of 27.8% (10). Latin American and the Caribbean have CS rates of 40.5% each. The highest average CS rate in the world of 42.9% is found in South American sub-region (8, 21).

In addition, to show the high rates of CS in the world, another study revealed a range of 25% to 65%, but the rates were varying between countries and regions (4). The same study revealed a worldwide caesarean delivery rate increase from 12% in 2002 to 24% in 2008 (4). This study also showed that, highest ranges were seen in the developed countries while the lowest ranges were found in the lower and middle income countries (4). Some of the regions were reported to have experienced drastic increase, while others had gradual increase (10, 12). Other studies showed that, the regions had CS delivery rates as follows; United States of America (USA) 32.2%, Central America 31%, North America 24%, Europe 25%, Asia 19.2%, Sub-Saharan Africa 3% (8, 10, 16, 21). The same studies (8, 16, 21) further revealed that CS rate in Germany increased from 15.3% in 1991 to 31.7% in 2012.

Furthermore a study that investigated "changes in CS delivery rate and indications in two rural hospitals in China" found that, CS delivery rate increased from 28% and 43% in 1997 to 54% and 65% in 2003 respectively (20). Furthermore a study conducted at Matlab in Bangladesh, revealed CS rate increase from 4% in 2004 to 23% in 2014 (22). Idoko et al. conducted another study at the Edward Francis Small Teaching Hospital in the Gambia that showed CS delivery rate of 24.0% (13). Some of the African countries experienced a rise in CS rates while others maintained the same rates for some years. For example CS rates in Egypt rose from 4.6% to 51.8% over the 24 year period, and Zimbabwe maintained the CS rate at 6% (8). In addition, a study conducted by Prah et al. in Ghana showed CS rate of 26.9% (21). The rate of CS at Limbe and Beau in Cameroon, was 13.3% which is within the WHO recommendation rates (11).

The research conducted at East African referral hospital in Tanzania, had shown CS delivery rate that ranged from 29.9% to 35.5% between 2005 and 2010 (18). Lastly but not least another study that was conducted at a secondary level care hospital of Cameroon, had shown CS delivery rate of 20.4 % (23). Majority of these studies looked at women of all ages, races, geographic area, social class, gravidity, parity and gestational age; and they have reported significant increase across all these characteristics.

## 2.2 Global and regional indications of CS deliveries

According to Chu (2012), the major challenge is that, there is no standard classification system for CS indications that exists (12). Furthermore, definitions of CS indications are not standardized, and CS indications can be multiple or related (12). For example CS indications such as; prolonged labour, obstructed labour, poor progress and CPD can be combined and be used for one patient, or can be used interchangeably by different authors referring to the same patient (12). Therefore the non-standardized classification of CS indications pose a great challenge in identifying the appropriate most common indications for CS deliveries (12).

Even though there is no standardized classification system for indications of CS deliveries, the International Classification of Diseases, Tenth Revision (ICD 10) has grouped diseases, and health related problems including problems for pregnancy, labour, delivery and puerperium (24). This grouping is further categorized into several sub-groups. But, this grouping is complex, and not clear if it is the classification system for indications of CS deliveries. However, some of the authors use this ICD 10 grouping, while others use their expertise. Despite the fact that, there is no appropriate standard classification system for CS indications, it was observed that majority of authors had similar classification system for CS indications in their studies (8, 10-12, 18).

The indications that were outlined by many studies and considered to be appropriate are; fetal distress, obstructed labour, prolonged labour, previous CS, malpresentation, APH, placenta praevia, severe pre-eclampsia, failed induction of labour, fetal asphyxia and fetal acidosis, just to mention a few (8, 10-12, 18, 21, 22, 25). But, some of the latter mentioned studies also considered other indications of CS deliveries such as; mother's preference, maternal age, class and wealth. These indications had different rates between regions and countries (8). For example, mothers' preference accounted for 17% rate of CS deliveries in Australia, 11% in USA, 8% in Northern Europe and 6% in United Kingdom (UK). Increased maternal age (35 years and above) accounted for 22% of CS deliveries, while previous pregnancies accounted for 24% of CS deliveries in Germany. In addition, in UK fetal compromise constituted 22% of CS deliveries, failure to progress 20%, one previous CS 14% and breech presentation 11% (8, 10). Moreover,

in Bangladesh repeated CS accounted for 24%, fetal distress 21%, prolonged labour 16%, and malpresentation as well as hypertensive disorders constituted 3% each (22).

A study conducted in Sub-Saharan African countries had shown that, out of 1276 women who delivered by CS, obstructed labour contributed 31%, malpresentation 18%, and previous CS 14% (12). But, the one that was done in Tanzania (East Africa) revealed that, previous CS was the leading indication and it accounted for 35% of the total CS deliveries, and obstructed labour was attributable to 23% (18). Furthermore, a study at Felegrhiwot referral hospital in Northwest Ethopia in 2016 revealed that, obstructed labour accounted for 30.7% rate of CS deliveries, while fetal distress and abnormal presentation accounted for 15.9% and 13.4% respectively (26). In addition, an audit report done at a specialist private practice clinic at Kwazulu-Natal in South Africa, had shown that one previous CS was the most frequent CS indication and it constituted 46.8% of CS deliveries, followed by two or more previous CS with 11.9%. CS on request accounted for 8.3%, CPD and HIV constituted 7.13% rate of CS deliveries each (25).

In a study conducted by Tanyi et al. (2016), CPD was the most frequent indication accounting for 32.2% of all the CS deliveries, followed by previous CS, breech, fetal distress, big baby, placenta praevia, eclampsia and severe pre-eclampsia (11). Another study (21) revealed that, the overall leading CS indication was previous CS with 23.1%. Big baby, failure to progress and fetal distress followed with 17.2%, 13.2% and 10.7% respectively.

Some of the indications were found to be influenced by geographic location and the demographic status of the participants. For example, in rural China, CPD was the most indication that contributed to the increasing rise of CS delivery rates accounting for more than 50% of all the CS deliveries that were performed in 1997 at Anxian County hospital in China (20). Generally, it was noted that, majority of the researchers had identified the same four most common indications for CS deliveries and these are; previous CS, CPD, fetal distress and malpresentations (8, 12, 13, 18, 20-22, 25, 26).

It was noticed that, most of the researchers that identified common indications that were considered to be appropriate or commonly accepted as reasons for CS deliveries, discussed the classification of indications with the experts such as midwives and obstetricians before they conducted the study. Hence they had a common understanding, and as a result, they came up

with same indications (12, 18). Furthermore, most of the researchers utilized the same methodology. They used hospital or institutional maternity and theatre registers as well as patients' records to extract data hence they managed to find similar indications. Although, they found similar indications, some researchers had a challenge whereby more than three indications were listed for the same patient, and then they decided to take the first three indications and use them in the analysis and leave the rest (7, 18, 20). For example, if prolonged pregnancy, fetal distress, failed induction and CPD were documented as indications for one woman, the researcher would take fetal distress, prolonged pregnancy and failed induction and use them for analysis, and would leave out CPD (7, 18, 20). But, this could be considered as researcher's bias hence it might have had some influence on the results (7, 18, 20).

Few studies have shown that, some regions had different and inconsistent indications that were not recommended as valid medical reasons, while others performed CS without medical indication. In Germany 13% of CS deliveries were performed without medical indication (8). In addition some studies that were conducted in Sub-Saharan African countries indicated that maternal or family preference accounted for some CS deliveries, hence contributed to increasing CS delivery rates (9, 12). Non-valid clinical indications such as non-reassuring fetal status were attributable to larger proportions of CS deliveries as compared to maternal-fetal and obstetric conditions such as malpresentation, cord prolapse, and placenta praevia (18). The other challenge was inconsistent ranking of indications for certain regions and countries because they had no standard classification model of conditions that was approved either globally or nationally (12).

Furthermore, socio-demographic risk factors were found to aid the escalating of CS delivery rates in certain populations. That is, probability of using CS delivery increased with better socio-economic status, higher education of women, increasing age and decreasing birth order (22). It further revealed that, women from richest quintile households were two and a half times more likely to deliver by CS compared to women from the poorest quintile households. Women with higher secondary and above education were two times more likely to deliver by CS than women with no education (26). Furthermore, a study conducted in Nigeria revealed that, area of residence is associated with rates of CS. It showed that women who lived in an urban setting had CS rate of 12.0% as compared to women who reside at a rural setting (27). Women older and

who have given three or more birth were 68% less likely to deliver by CS than women with first birth (22).

On the other hand few studies revealed that many countries have increased accessibility and availability of emergency obstetric care including CS intervention hence this had contributed to the increase of CS deliveries. Again majority of the deliveries occur in the hospitals and this had also contributed to the rise of CS deliveries as compared with the past twenty decades (20).

### 2.3 Global and regional outcomes of CS deliveries

There were few studies that determined the outcomes of CS deliveries. A research study entitled "The indications for and risks of elective caesarean section" which was conducted in Germany had shown that, morbidity in elective caesarean deliveries was slightly higher than that for vaginal deliveries (28). It also revealed that caesarean section deliveries before 39 weeks of gestation, compared to vaginal deliveries, led to notably higher respiratory morbidity in the newborn, requiring intensive medical care. Neonates born via elective CS, had a higher risk of respiratory complications such as respiratory distress syndrome or transitory tachypnea of the newborn (28). Moreover, this study revealed that, when compared to vaginal deliveries CS had intra-operative and postoperative complications as well as risk for subsequent pregnancies. For example, intra-operative complications included; infections, organ injuries (bladder, intestine, ureter), risk associated with anaesthesia, need for blood transfusion and hysterectomy as treatment of severe bleeding. Postoperative complications included; embolism, thrombosis, adhesions and persistent pain. Risks for subsequent pregnancies were highlighted as intrauterine growth retardation (IUGR), preterm delivery, ectopic pregnancy, spontaneous abortion, uterine rupture and placenta praevia (28).

In addition, two studies conducted in Africa indicated that high rates of CS deliveries were associated with high maternal and perinatal morbidities and mortalities (9, 10). The results showed that "the risk of a woman dying after she underwent CS was almost three-folds the risk of maternal death after vaginal delivery (9, 10). Haemorrhage was the number one cause of death after CS delivery. The other outcome morbidities included damage to pelvic organs, thromboembolism and hypovolemia (9). Out of 10000 CS deliveries conducted, haemorrhage

accounted for a rate of 5.5 deaths. When compared with vaginal delivery, hypovolemic shock and embolism were 4.8 and 4.5 times more likely to occur respectively after CS delivery (9). Maternal outcomes that resulted from CS were maternal deaths before discharge from hospital, postpartum fistula, hysterectomy and severe morbidity that led to admissions to intensive care unit (10). Perinatal outcomes included fresh stillbirth, neonatal death before discharge from hospital, APGAR score of less than four in five minutes. As a result, these severe neonatal morbidities were referred to special baby care unit, hence exacerbating the resources that were already limited (10).

CS is essential to reduce maternal and neonatal mortality; therefore these deaths and complications could not necessarily mean that CS is a bad intervention but could simply reflect that the complications arose due to substandard care such as delayed decision making, lack of resources e.g. blood; and some of CS being performed by doctors who lacked surgical skill (9).

### 2.4 Botswana's context regarding CS delivery rate, indications and outcomes

Even though there is no research conducted on CS rates in Botswana, BOMAID, medical insurance company reported 61% rate of CS among its insurance members in 2015, which is fourfold the WHO recommendation (9). The Botswana MMRI technical report revealed that out of 49481 deliveries CS delivery rate was 15% (3). The report further showed that Princess Marina hospital and Nyangabgwe referral hospital had CS delivery rate of 25% and 24% respectively (3). Since there is no research conducted in Botswana regarding CS deliveries, the most common or frequent CS indications are unknown. But according to the Botswana MMRI technical report elective CS accounted for 20% of the total CS deliveries in 2015 (3). Immediate outcomes of CS deliveries in Botswana, are not known as there is no research carried out in this area. Therefore this study is aimed to establish the rate, indications and immediate outcomes of CS deliveries in Princess Marina hospital.

# CHAPTER 3: METHODOLOGY

## INTRODUCTION

This chapter provides a description of the study design and the procedural methods used in data collection. The research sample is described in terms of the sample frame and the sampling process. In addition data management and statistical analysis procedures utilized to analyze data and the ethical considerations of the study have been outlined.

### 3.1 Study design

This is a descriptive, cross-sectional, retrospective study on rates, indications and immediate outcomes of CS deliveries at a national referral hospital in Botswana.

### 3.2 Study setting

The study was conducted at Princess Marina hospital, Maternity department, labour ward. Princess Marina hospital is the Botswana's major tertiary and national referral hospital located in Gaborone, South-East District, Botswana. It has 581 beds and it was established in 1966 and it started operating in April 1967; that is, it has been inexistence since 52 years ago (31). Its catchment population is 231592 (32). It caters for its staff, and it receives referred patients and clients from district and primary health facilities as well as self-referrals. The hospital plays a major role in delivering promotion, preventative, curative, diagnostic and rehabilitative health services. As a national referral hospital, it provides these services in a more complex standard when compared to district hospitals. It also acts as an academic center for student midwives and doctors. It has the maternity department which has three divisions or units namely high risk antepartum care ward, intrapartum care (labour) ward and postpartum care ward. All of these wards are staffed with midwives who provide midwifery care to the patients. The hospital provides comprehensive emergency obstetric care services, including CS intervention which is performed by obstetricians and general doctors. Although there is no scientific research on rates, indications and immediate outcomes of CS deliveries conducted in this hospital, in 2015 the

Botswana MMRI technical report showed that it had the highest rate (25%) of CS deliveries as compared to other health facilities (3). In addition it had CS rate that was higher than the one recommended by WHO of 5-15%.

### 3.3 Study population and sample

The study population for this study included all women who delivered at Princess Marina hospital between January and December 2016. Those who delivered by CS were included in the study irrespective of an individual's age, residence, gravidity, parity and gestational age. The study excluded all women who had normal, vacuum and forceps deliveries during the time of the study. Using above criteria, maternity registers were utilized to ensure that a representative sample was drawn. That is, it consisted sampling records of every woman who met the eligibility criteria from maternity registers until the required sample size was reached.

### 3.4. Sample size

The sample size estimation for women who delivered through CS was determined using the formula below (33):

$$n = \frac{Z^2_{(1-\propto/_2)} \times pq}{d^2}$$

Where

n is the minimum sample size needed to be collected for the number of caesarean sections.

Z = 1.96 from the z-tables the reliability coefficient for two -sided 95% confidence interval.

α =0.05, the probability of making a type I error (5%).

p is the proportion of caesarean section estimated from the April 2014 to July 2015 program data report from Ministry of Health and Wellness, Botswana. Therefore the exact "p" is 7422 caesarean section deliveries and the source of "p" is the technical report on Botswana maternal mortality reduction initiative that utilized reports from hospitals in December 2015.

q is 1 - p.

d is the level of precision (margin of error) that is expected.

Therefore, based on the above formula the calculated sample size became 794.

Then based on the above sample size, the researcher used strata to sample participants. Participants were stratified according to quarters. There are four quarters in a year; therefore, participants were stratified into four quarters which consisted three months each. After stratification, then stratified random sampling was used to select a specific number of participants from each quarter to make a total sample size of 794. That is, all CS deliveries were listed per quarter according to their dates of occurrence. Since these four quarters had different number of CS deliveries, then, the aforementioned sample size estimation was utilized to calculate the number of records that were supposed to be picked from each quarter and included in the sample. It was identified that, the number of records that needed to be picked from quarter one, two, three, and four equaled to 215, 198, 194 and 187 respectively, which made a total of 794 sample size. Then "n" was calculated as the number to identify which records in the lists of these four quarters should be picked. When calculating "n", it gave three (3). Therefore, every third record in the list of each quarter was picked and included in the sample size (794).

### 3.5 Data collection

#### 3.5.1 Data collection tool

A structured data collection tool was developed (Appendix Six) to extract data from maternity registers. Literature review was done and it was utilized to inform the development of this tool. In addition, the type of variables that were documented in maternity registers was also used to complement the development of this structured data collection tool. The tool was utilized to maximize the authenticity and fairness of data collected as well as, to minimize the researcher's biasness. The tool was using codes in order to strengthen anonymity and confidentiality of information collected from maternity registers. This structured data collection tool provided participants' socio-demographic characteristics such as; maternal age and residence; antenatal care data like gravidity, parity and gestational age, as these were the variables that were documented in the maternity registers. In addition, this tool was also designed to cater for maternal and fetal risk indications of CS deliveries for example CPD, previous CS, fetal distress and malpresentations, as well as; immediate maternal and fetal outcomes such as maternal deaths, still births; maternal and fetal complications or morbidities.

### 3.5.2 Data collection process

The principal investigator reviewed the maternity registers, to gather relevant information for women who delivered by CS at Princess Marina hospital from January to December 2016. Specific data needed by the researcher was extracted from the maternity registers, and entered in structured data collection tool. Data collection took place in the clinical setting or at the hospital where the study was conducted. The indications and outcomes of CS deliveries were documented in the maternity registers immediately after CS delivery had been performed; hence data regarding these variables were extracted from the maternity registers as recorded. Each case of CS delivery was reviewed independently from the maternity registers, and where need arose, patient's file / record of the concerned case was retrieved and reviewed, to verify and compliment the missing data in the registers. Exposure variables such as maternal age, residence, gravidity, parity and gestational age were also documented.

### 3.5.3 Classification of indications of caesarean section deliveries

There were many types of indications for CS deliveries written in the maternity registers. Since the country has no standardized classification model for indications of CS deliveries that is approved either globally or locally, the researcher utilized literature review to group up these indications for analysis purposes. In addition, the researcher consulted the obstetrician who has expertise in the field to assist in grouping these indications, as a way of complimenting literature reviewed. Therefore, the grouping of CS indications, and the diagnosis included under each group was done as follows;

Fetal distress- this group included; fetal bradycardia, fetal tachycardia and fetal distress.

Malpresentation- included; breech, footling breech, transverse lie, oblique lie, compound presentation, cord presentation, cord prolapsed, hand prolapsed, face presentation and malpresentation.

CPD- included; contracted pelvis, big baby, hydrocephalus, macrosomia as well as CPD.

APH- included; placenta praevia, placenta abruption and APH.

Labour related- this group included; cervical dystocia, obstructed labour, prolonged labour, poor progress, delayed second stage and preterm labour.

Hypertensive disorders- included; PIH, chronic hypertension, eclampsia, severe PET and HELLP syndrome.

One previous CS

Two previous CS

Failed induction of labour

Others- this group included; three previous CS, BOH, elderly primigravida, grandmultipara, uterine fibroids, uterine rupture, PPROM, PROM, prolonged SROM; genital, vulval and vaginal warts; severe oligohydraminous, polyhydraminous, twin pregnancy, post dates, congenital abnormality, IUGR, IUD, GDM, thrombocytopenia, cardiac patient, paraplegia and VP shunt. In addition, indications of CS that were included in this group were mostly the ones that had occurred once or twice.

### 3.6 Pilot study

The data collection tool was tested at the tertiary hospital that was not used for study setting. Maternity register was reviewed, and simple random sampling was used to select ten records of CS deliveries. Data was extracted from these ten records and entered in this tool. This was done before the commencement of the study, so that the tool could be checked if it had catered for all the necessary information / variables of interest that were documented in the maternity registers. After pilot test, it was identified that some of the socio-demographic characteristics / variables (education, marital status and employment) that were included in the data extraction tool were not catered for in the maternity registers. Therefore the tool was adjusted accordingly by removing the aforementioned variables.

### 3.7 Data management and analysis

During the time of data collection, completeness of information was checked. Check codes were utilized for consistence purposes. Data were double entered in Epi-Info version 3.3.3 using different computers in order to ensure its quality. Data were kept in Epi-Info, then cleaned and transported to STATA software version 14 for statistical analysis. In order to ensure completeness of variables some consistent checks were performed, and descriptive analysis was

done. Analysis focused on identifying socio-demographic and obstetric determinants of CS deliveries. The exposure variables included maternal age, residence, gravidity, parity and gestational age. Baseline characteristics such as; indications of CS deliveries for example, labour related complications, CPD, fetal distress and malpresentation were described using counts, frequency, proportions, mean, and percentages. Comparison of categorical variables was done using chi-square test reported with 95% confidence levels to determine significant difference between the variables, p-value <0.05 was regarded as significant.

### 3.8 Ethical considerations

This study was conducted after the University of the Witwatersrand, School of Public Health Committee and the Ethical Committee for Research on Human Subjects (Medical) gave the researcher ethical clearance certificate number R14/49: M180217 (Appendix Two). Permission to conduct the study in Botswana was sought out from Health Research and Development Division, Ministry of Health and Wellness (Appendix Three), and the Princess Marina hospital Research and Ethics Committee (Appendix Four), Botswana. In addition, the manager of Intrapartum care (labour) ward, Maternity Unit, Princess Marina hospital was consulted as a gate keeper to allow the researcher access to maternity registers in her unit and access was permitted (Appendix Five). Since this study was based on routinely collected data, consent for individual participants was not obtained separately. To ensure anonymity and confidentiality of information patients' identifiers were not included in the data extraction tool.

## CHAPTER 4: RESULTS

## INTRODUCTION

This chapter provides a description of the study results. The purpose of the study was to establish the rate, indications and determine the immediate outcomes of CS deliveries at Princess Marina hospital. There were a total of 6737 deliveries during the study period of which 28.5% were CS deliveries, 0.76% were vacuum extractions, 0.04% were forceps deliveries and 70.7% were normal vaginal deliveries.

### 4.1 Demographic characteristics of CS delivery participants

Maternal age and residential area were the available demographic data extracted from the registers as shown in the table below:

**Table 1: Demographic characteristics of CS delivery participants**

| **Maternal age (years)** | **n / N (%)** |
|---|---|
| 15-24 | 226 (28.5%) |
| 25-34 | 402 (50.6%) |
| 35+ | 166 (20.9%) |
| **Total** | **794 (100.0%)** |
| **Residence** | |
| City | 471 (59.3%) |
| Town | 161 (20.3%) |
| Village | 162 (20.4) |
| **Total** | **794 (100.0%)** |

The age range for mothers who delivered by CS was 15-45 years with a mean of 28.76 years. The age group 25-34years had the highest CS deliveries of 402 (50.6%), followed by 15-24 and 35+ with 226 (28.5%) and 166 (20.9%) respectively. More than half of the participants were from the city 471 (59.3%).

### 4.2 Determinants of CS deliveries

This study was interested in finding out the determinants of CS deliveries which are reflected in the table below:

**Table 2: Determinants of CS deliveries**

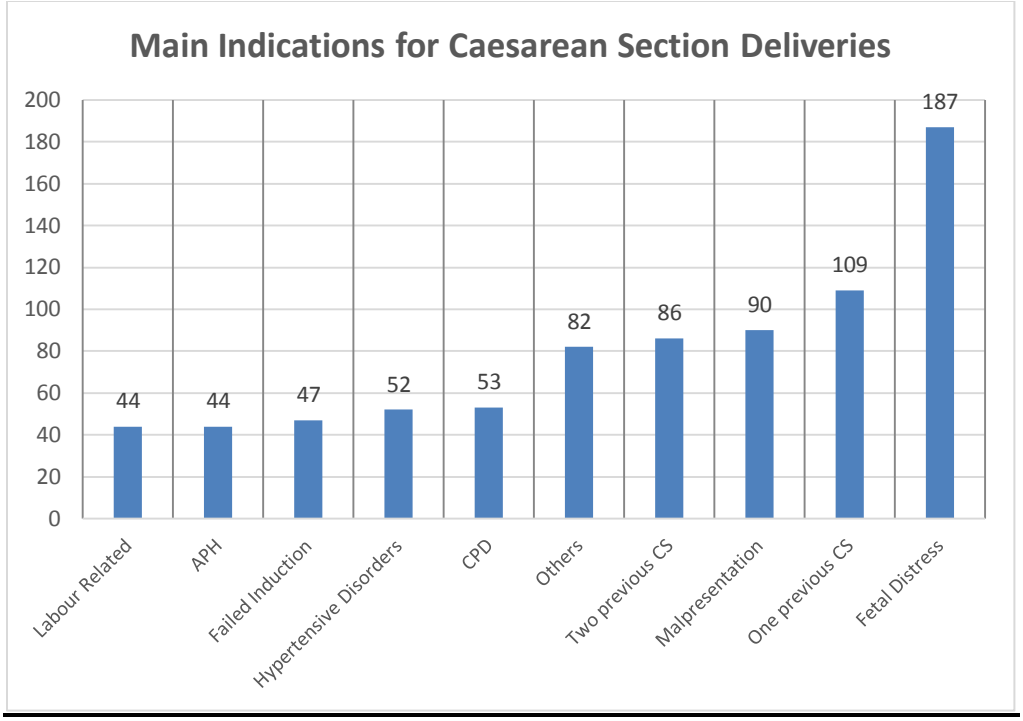
| CHARACTERISTIC | n / N (%) |
|---|---|
| **GRAVIDITY** | |
| Primigravida (1) | 261 (32.9%) |
| Multigravida (>1) | 533 (67.1%) |
| **Total** | **794 (100.0)** |
| **PARITY** | |
| Primipara (1) | 277 (34.9%) |
| Multipara (>1) | 517 (65.1%) |
| **Total** | **794 (100.0%)** |
| **GESTATION (WEEKS)** | |
| <37 | 169 (21.3%) |
| ≥37 | 625 78.7%) |
| **Total** | **794 (100.0%)** |

As shown in the above table, multigravidas, multiparas and women who had gestational age of ≥37 weeks were seen to have higher CS deliveries than their counterparts 67.1%, 65.1% and 78.7% respectively.

### 4.3 Indications for CS deliveries

This study established the main indications of CS deliveries as documented in the maternity registers as causes of CS deliveries, diagnosed by the doctors and obstetricians who were conducting CS deliveries. The figure below outlines the main indications for CS deliveries.

**Figure 1: Main indications for CS deliveries**

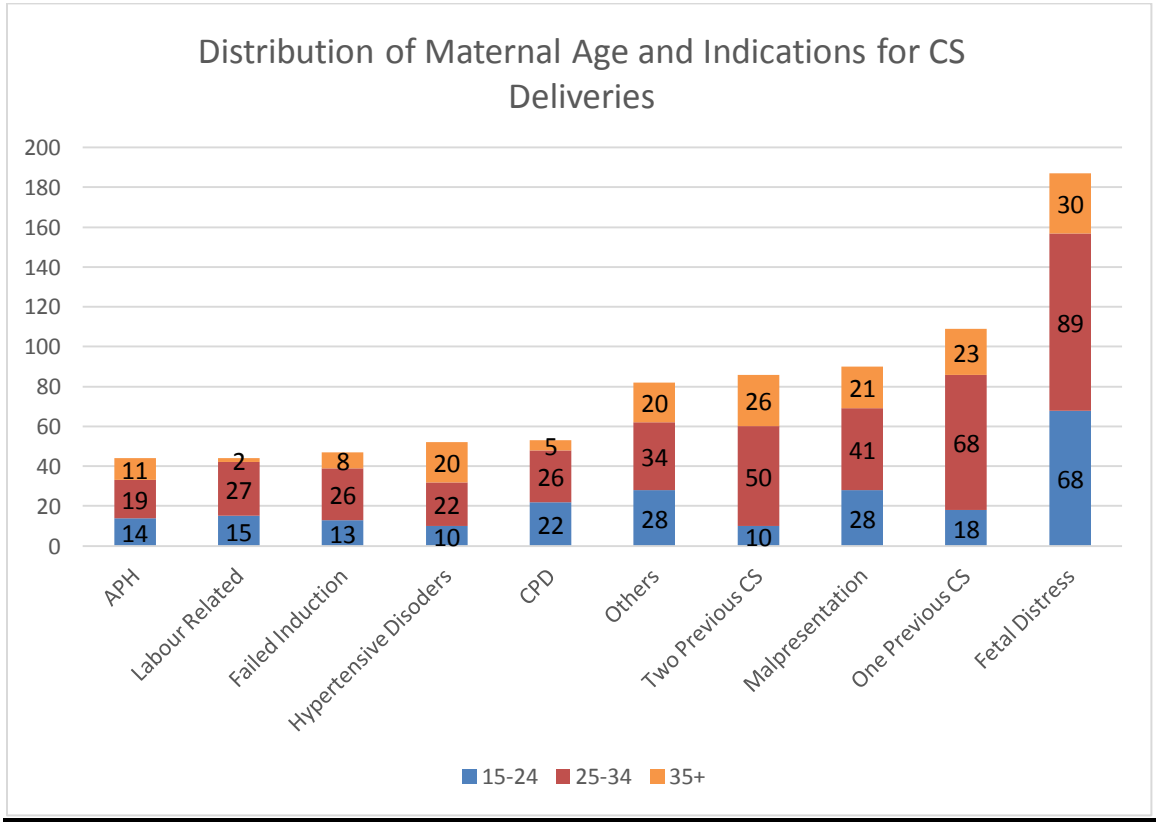



The most frequent indication for CS was fetal distress 23.6%, followed by one previous CS 13.7%, malpresentation 11.4%, two previous CS 10.8% and CPD 6.7%.

### 4.3.1 Maternal age and indications for CS deliveries

The study was looking at the maternal age against the type of indications for CS deliveries as shown in the figure below:

**<u>Figure 2</u>: Distribution of maternal age and indications for CS deliveries**




Fetal distress (30.1%) was the most frequent CS indication for age group 15-24 years, followed by malpresentation (12.4%) and CPD (9.7%). In age group 25-34 years, fetal distress (22.1%) was still the leading indication for CS deliveries. One previous CS (17.0%) and two previous CS (12.4%) followed in the second and third place respectively. In age group ≥35years fetal distress (18.1%) was still the most frequent indication for CS, followed by two previous CS (15.7%), one previous CS (13.9%) and malpresentation (12.7%).

### 4.3.2 Obstetric characteristics and indications for CS deliveries

This study examined the obstetric characteristics in relation to indications for CS deliveries.

**Table 3: Distribution of obstetric characteristics and indications for CS deliveries**

| Gravidity | CPD | Labour Related | Failed IOL | APH | One previous CS | Two previous CS | HPT | Fetal distress | Malpresentation | Others | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Primigravida (1)** | 33<br>12.6% | 22<br>8.4% | 22<br>8.4% | 15<br>5.8% | 0<br>0% | 0<br>0% | 15<br>5.6% | 98<br>37.6% | 28<br>10.3% | 28<br>10.3% | 261<br>100% |
| **Multigravida (>1)** | 20<br>3.8% | 22<br>4.1% | 25<br>4.7% | 29<br>5.4% | 109<br>20.5% | 86<br>16.1% | 37<br>6.9% | 62<br>11.6% | 89<br>16.7% | 54<br>10.1% | 533<br>100% |
| **Total** | 53<br>6.7% | 44<br>5.5% | 4.7<br>5.9% | 44<br>5.5% | 109<br>13.7% | 86<br>10.8% | 52<br>6.6% | 160<br>20.2% | 117<br>14.7% | 82<br>10.3% | 794<br>100% |
| **Parity** | | | | | | | | | | | |
| **Primipara (1)** | 103<br>37.2% | 23<br>8.5% | 24<br>8.7% | 16<br>5.8% | 0<br>0% | 0<br>0% | 16<br>5.8% | 34<br>12.3% | 30<br>10.8% | 31<br>11.2% | 277<br>100% |
| **Multipara (>1)** | 19<br>4.0% | 20<br>3.8% | 24<br>4.6% | 28<br>5.4% | 86<br>16.6% | 84<br>16.2% | 36<br>7.0% | 94<br>18.1% | 109<br>21.1% | 51<br>9.8% | 517<br>100% |
| **Total** | 122<br>15.3% | 43<br>5.5% | 48<br>5.9% | 44<br>5.5% | 86<br>16.6% | 84<br>16.2% | 52<br>6.6% | 163<br>20.5% | 139<br>17.5% | 82<br>10.3% | 794<br>100% |
| **Gestation (Weeks)** | | | | | | | | | | | |
| **<37** | 0<br>0% | 2<br>1.2% | 7<br>4.1% | 24<br>14.2<br>% | 10<br>5.9% | 16<br>9.5% | 27<br>16.0<br>% | 27<br>16.0% | 23<br>13.6% | 33<br>19.5% | 169<br>100% |
| **≥37** | 52<br>8.3% | 42<br>6.7% | 41<br>6.6% | 20<br>3.2% | 99<br>15.8% | 70<br>11.3% | 25<br>4.0% | 160<br>25.6% | 67<br>10.7% | 49<br>7.8% | 625<br>100% |
| **Total** | 52<br>6.6% | 44<br>5.5% | 48<br>6.0% | 44<br>5.5% | 109<br>13.7% | 86<br>10.8% | 52<br>6.6% | 187<br>23.6% | 90<br>11.3% | 82<br>10.4% | 794<br>100% |

Primigravidas experienced fetal distress (37.6%) as the most frequent indication for CS deliveries, followed by CPD with 12.6%. Multigravidas experienced one previous CS (20.5%) as the most dominant indication of CS deliveries, followed by malpresentation and two previous CS with 16.7% and 16.1% respectively. In terms of parity CPD (37.2%) was the most dominant indication of CS delivery for primiparas. Malpresentation (21.1%) was the leading CS indication for multiparas. One previous CS (16.6%) and two previous CS (16.2%) followed on the second

and third positions respectively. Hypertensive disorders and fetal distress (16.0% each) were the overall leading indications of CS deliveries for women with gestation less than 37 weeks. Women with gestation of 37 weeks and above had fetal distress (25.6%) as the most occurring indication for CS deliveries.

### 4.3.3: Parity, CPD and malpresentation

This study further examined if parity had any association with CPD and malpresentation. Therefore the study further grouped participants with CPD and those without CPD as well as, participants with malpresentation and those with no malpresentation; and chi square test for association was performed, and the findings are presented in table 4 below.

**Table 4: Association between parity, CPD and malpresentation**

| PARITY | CPD | | | | MALPRESENTATION | | | |
|---|---|---|---|---|---|---|---|---|
| | No | Yes | Total | Pvalue | No | Yes | Total | Pvalue |
| Primipara | 243<br>32.8% | 34<br>64.2% | 277<br>34.9% | = 0.0001 | 247<br>35.0% | 30<br>33.3% | 277<br>34.9% | = 0.743 |
| Multipara | 498<br>67.2% | 19<br>35.8% | 517<br>65.1% | | 457<br>65.0% | 60<br>66.7% | 517<br>65.1% | |
| Total | 741<br>100% | 53<br>100% | 794<br>100% | | 704<br>100% | 90<br>100% | 794<br>100% | |

The above findings show that the likelihood of having CPD as a CS indication is higher in primiparas than multiparas (Pvalue= 0.001). No differences were observed between the primiparas and multiparas regarding malpresentation as a CS indication (Pvalue= 0.743).

### 4.4 Immediate outcomes of CS deliveries

The study determined both maternal and fetal immediate outcomes of CS deliveries. It needed to find out the number of mothers who were alive, dead and those who had complications during or immediately after delivery. It was also interested in determining the number of newborns born alive, dead or those who had birth complications during or immediately after delivery.

**Table 5: Immediate outcomes of CS deliveries**

| | | **n (N%)** |
|---|---|---|
| **Maternal outcome** | Alive | 794 (100.0%) |
| | Mortality | 0 (0.0%) |
| | Complication / morbidity | 19 (13.1%) |
| **Perinatal outcome** | Alive | 764 (96.2%) |
| | Mortality | 30 (3.8%) |
| | Complication / morbidity | 126 (86.9%) |
| **Adverse outcome** | Yes | 145 (18.3%) |
| | No | 649 (81.7%) |

Out of the 794 CS deliveries, there were 81.7% normal outcomes and 18.3% adverse outcomes. All mothers (100%) were alive, but maternal complications were at 13.1%. 96.2% babies were born alive, while 3.8% were still births, and 86.9% newborns had perinatal complications or morbidities.

#### 4.4.1 Parity, gestation and CS outcomes

The study also looked at association between parity and immediate CS outcomes as shown in the table below:

**Table 6: Association of parity, gestation and CS outcomes**

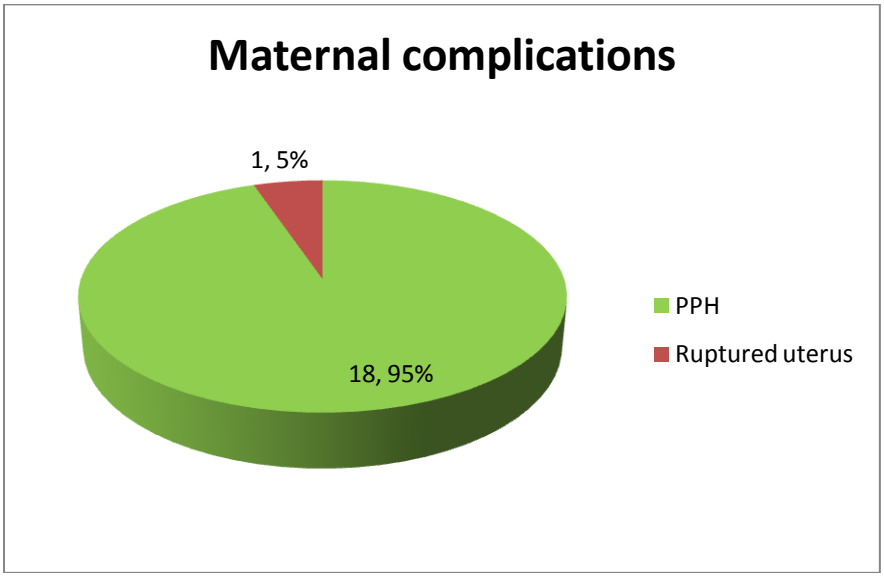
| | Maternal adverse outcomes | | | P Value | Fetal adverse outcomes | | | P Value |
|---|---|---|---|---|---|---|---|---|
| | **No** | **Yes** | **Total** | | **No** | **Yes** | **Total** | |
| **PARITY** | | | | | | | | |
| Primiparity | 273 (98%) | 4 (2%) | 277 | = 0.200 | 223 (81%) | 54 (19%) | 277 | = 0.082 |
| Multiparity | 502 (97%) | 15 (3%) | 517 | | 441 (85%) | 76 (15%) | 517 | |
| **GESTATION** | | | | | | | | |
| **<37** | 164 (97%) | 5 (3%) | 169 | = 0.588 | 124 (73%) | 45 (27%) | 169 | = 0.0001 |
| **≥37** | 611 (98%) | 14 (2%) | 625 | | 540 (86%) | 85 (14%) | 625 | |

The above table shows that there were no differences in maternal and fetal outcomes between primparas and multiparas. CS at gestational age of **<**37 had shown to have higher risk of fetal adverse outcomes than ≥37 weeks gestational age in this study.

### 4.4.2 Maternal adverse outcomes

The study examined maternal complications that occurred during and immediately after delivery as shown in the figure below:

**Figure 3: Maternal complications of CS deliveries**

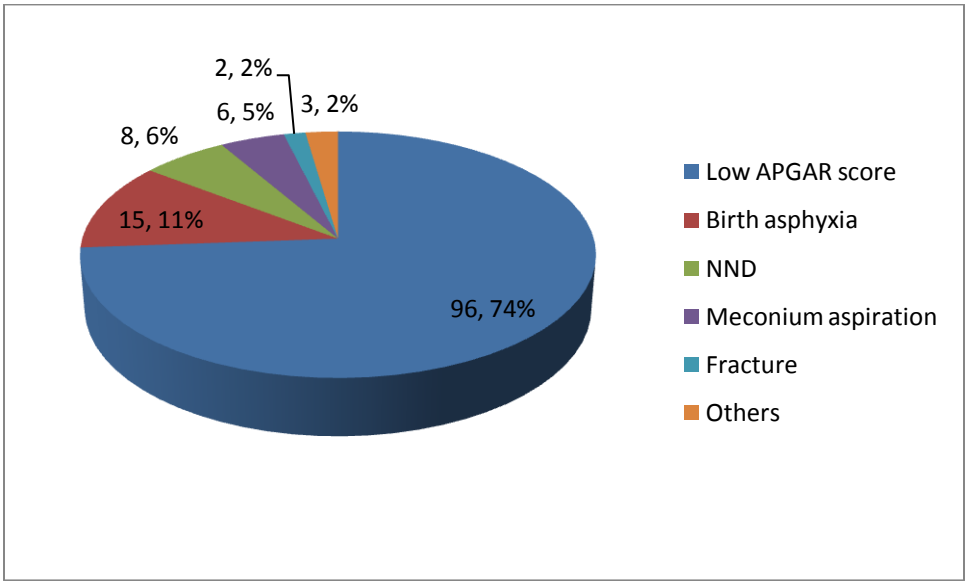



There were a total of 19 maternal adverse outcomes, of which 95% was PPH and 5% was ruptured uterus.

### 4.4.3 Fetal adverse outcomes

The study explored fetal complications as shown in the figure below:

**Figure 4: Fetal complications of CS deliveries**



The major fetal complication recorded was low APGAR score with 74.0%, followed by birth asphyxia (11.0%) and NND (6.0%).

**Table 7: Distribution of maternal complications and indications of CS deliveries**

| Maternal complications | CPD | Labour Related | Failed IOL | APH | One previous CS | Two previous CS | HPT | Fetal distress | Malpresentation | Others | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **PPH** | 0<br>0.0% | 1<br>5.6% | 3<br>16.7% | 3<br>16.7% | 2<br>11.1% | 4<br>22.2% | 0<br>0.0% | 1<br>5.6% | 2<br>11.1% | 2<br>11.1% | 18<br>100% |
| **Ruptured uterus** | 0<br>0.0% | 0<br>0.0% | 0<br>0.0% | 0<br>0.0% | 0<br>0.0% | 1<br>100% | 0<br>0.0% | 0<br>0.0% | 0<br>0.0% | 0<br>0.0% | 1<br>100% |
| **Total** | 0<br>0.0% | 1<br>5.3% | 3<br>15.8% | 3<br>15.8% | 3<br>15.8% | 5<br>26.3% | 0<br>0.0% | 1<br>5.3% | 2<br>10.5% | 2<br>10.5% | 19<br>100% |

Two previous CS (22.2%) was the most CS indication which contributed to PPH. Followed by failed IOL and APH with 16.7% each. Two previous CS was the contributory factor to ruptured uterus.

**Table 8: Distribution of fetal complications and indications of CS deliveries**

| Fetal complications | CPD | Labour Related | Failed IOL | APH | One previous CS | Two previous CS | HPT | Fetal distress | Malpresentation | Others | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Birth asphyxia** | 1<br>6.7% | 0<br>0.0% | 0<br>0.0% | 1<br>6.7% | 1<br>6.7% | 0<br>0.0% | 0<br>0.0% | 5<br>33.3% | 5<br>33.3% | 2<br>13.3% | 15<br>100% |
| **Low APGAR score** | 7<br>7.6% | 6<br>6.5% | 2<br>2.3% | 6<br>6.5% | 6<br>6.5% | 6<br>6.5% | 8<br>8.7% | 28<br>30.4% | 15<br>16.3% | 8<br>8.7% | 92<br>100% |
| **Meconium aspiration** | 0<br>0.0% | 1<br>16.7% | 0<br>0.0% | 0<br>0.0% | 0<br>0.0% | 1<br>16.7% | 1<br>16.7% | 3<br>50% | 0<br>0.0% | 0<br>0.0% | 6<br>100% |
| **Fracture** | 0<br>0.0% | 0<br>0.0% | 0<br>0.0% | 0<br>0.0% | 0<br>0.0% | 0<br>0.0% | 0<br>0.0% | 0<br>0.0% | 2<br>100% | 0<br>0.0% | 2<br>100% |
| **NND** | 0<br>0.0% | 0<br>0.0% | 0<br>0.0% | 1<br>12.5% | 1<br>12.5% | 0<br>0.0% | 1<br>12.5% | 3<br>37.5% | 2<br>25.0% | 0<br>0.0% | 8<br>100% |
| **Others** | 1<br>33.3% | 0<br>0.0% | 0<br>0.0% | 0<br>0.0% | 0<br>0.0% | 1<br>33.3% | 0<br>0.0% | 0<br>0.0% | 1<br>33.3% | 0<br>0.0% | 3<br>100% |
| **Total** | 9<br>7.1% | 7<br>5.6% | 2<br>1.6% | 8<br>6.4% | 8<br>6.4% | 8<br>6.4% | 10<br>7.9% | 39<br>30.9% | 25<br>19.8% | 10<br>7.9% | 126<br>100% |

Fetal distress and malpresentation, both at 33.3% were the major contributory CS indications that resulted to birth asphyxia. Furthermore fetal distress (30.4%) contributed mostly to low APGAR score followed by malpresentation (16.3%). More than one third of NNDs had fetal distress (37.5%).

# CHAPTER 5: DISCUSSION

## INTRODUCTION

This chapter discusses the result of the study entitled "indications and immediate outcomes of CS deliveries at a national referral hospital in Botswana", that aimed at establishing and determining rate, indications and immediate outcomes of CS deliveries during the study period. The findings are presented and discussed as per each specific objective. The strengths and implications of the study are highlighted.

## 5.1 SUMMARY OF MAIN FINDINGS

The study revealed that the rate of CS deliveries at Princess Marina hospital was 28.5%. The most frequent indication for CS delivery in this study was fetal distress. Out of 794 CS deliveries, there were 18.3% adverse outcomes. There were no maternal deaths, but there were 19 maternal complications which resulted in maternal morbidity rate of 13.1%. Furthermore, there were 3.8% still births and 86.9% fetal complications.

## 5.2 DISCUSSION OF MAIN FINDINGS

### 5.2.1 Rate of CS deliveries

The CS delivery rate of 28.5% revealed in this study, is higher than the one recommended by WHO that is 5-15% (2). This result was more than the CS delivery rate of 25% that was reported by the Botswana MMRI technical report in the same hospital (Princess Marina hospital), and it is similar to as well as, different from the findings of other studies conducted at health facilities regionally (9, 12, 20, 21, 23). This might not necessarily mean over diagnosis for, and / or unnecessary CS deliveries, but, maybe due to the fact that, majority of complicated cases are referred to this hospital increasing the CS rate. On the other hand, this may reflect that this hospital has adequate CS resources for the referrals, because other studies (2, 12, 20) had also found that, high rates of CS deliveries were more apparent in the health facilities that have increased accessibility and availability of emergency obstetric care including CS intervention.

Since CS deliveries can rarely be conducted at majority of primary and district hospitals due to inadequate theatre facilities and expects (obstetricians, surgeons, neonatologists, paediatricians and anaesthesiologists), it therefore means that, the authorities at ministry of health and wellness should strive in the planning of CS services at different levels of care. This can be achieved by upgrading primary and district hospitals, and refurbish them with facilities that are essential for CS intervention. These can include improving theatre facilities and equipments; recruitment and / or further training of health care workers for vital expertise such as obstetrics, surgery, neonatology and paediatrics.

On the other hand, the high CS rate in this study might also be due to the fact that, there is minimal utilization of instrumental vaginal delivery in Princess Marina hospital. That is, out of 6737 total deliveries 0.76% were vacuum extractions and 0.04% were forceps deliveries during the study period. This practice where the rate of instrumental vaginal deliveries is very low had been also found in other studies to increase CS rates (21, 23). This inadequate and insufficient conduction of instrumental vaginal deliveries may be due to lack of policies that address this area, and it may also be due to lack of clinician expertise and motivation. Therefore it is essential to develop informed policies that can effectively address the use of instrumental vaginal deliveries. Moreover, it is also critical to assess skills of doctors in instrumental vaginal delivery in order to enhance them accordingly, thus would reduce the use of CS intervention as a means of delivery for women who could not have spontaneous vaginal delivery. Furthermore, the use of instrumental vaginal delivery could not only significantly reduce the rate of CS deliveries, but could also reduce health expenditure (23). In addition, it is vital that evidenced based information is provided to assist the policy makers to plan and develop policies and guidelines to cater for women who really need CS delivery in order to reduce unnecessary CS deliveries.

### 5.2.2 Indications of CS deliveries

The most frequent indication for CS delivery among the study population was fetal distress (23.6%) similar to other studies (21, 26). This could be due to the fact that, in this health facility under study, there is lack of continuous electronic fetal monitoring systems called cardiotocographs that are essential for accurate diagnosis of fetal distress. As a result doctors and midwives rely on simple measures such as; fetal tachycardia and bradycardia as well as; fresh and old meconium stained liquor to diagnose fetal distress. This practice would result in more than necessary women to be diagnosed fetal distress (21). It is therefore critical to ensure that, cardiotocographs are available in order to reduce over diagnosis of fetal distress hence avoid unnecessary CS and save resources (21).

Furthermore, the study had shown that, the most frequent indications of CS delivery for primigravidas and primiparas were CPD and fetal distress. According to scientific literature, CPD could be the overall leading indication of CS delivery for both primigravidas and

primiparas due to the fact that, these populations tend to have their first pregnancies and children at an early age; when their bodies are not yet fully mature and well developed to withstand the strenuous effects of labour and delivery. Consequently, they experience labour related complications such as obstructed labour, poor progress of labour and prolonged labour that are termed CPD (35-37). Therefore, strengthening antenatal care services for both primigravidas and primiparas through assessment of pelvic adequacy is critical for early diagnosis of CPD.

### 5.2.3 Immediate outcomes of CS deliveries

The study also revealed that PPH was the most frequent maternal complication, and it occurred in the multiparas, similar to national audits findings (38), and consistent with other findings of studies conducted elsewhere (4, 8-10, 12, 16). These studies had shown that haemorrhage was the most complication that occurred following CS deliveries, and it was the major cause of maternal deaths (4, 8-10, 11, 12, 16). Since it has been observed through the Botswana Family Health Survey (39) that, majority of women in Botswana attend ANC and deliver in the hospitals, then, this complication may not necessarily be due to contributory factors related to patients. But it may be due to key factors which are within the health system; such as inadequate quality of care or delay in providing the required interventions. Therefore, there is need to strengthen the capacity of all health care workers regarding the provision of midwifery services. Despite the fact that majority of women attend ANC, and deliver at the health facilities; on the other hand, this complication might mean that, these women present late at the health facilities. Therefore, it is critical to strengthen community health education, to promote early booking for early identification and management of this complication.

In addition, the study had shown that multiparous CS women had higher numbers of maternal morbidity similar to other studies (13). According to scientific literature, this could be due to the fact that, this population has decreased uterine muscle tonality. Then, after delivery there might be ineffective uterine contraction and retraction to achieve haemostasis (37). As a result, there is need to increase accessibility to family planning services, and reduce the unmet needs for contraception, and also to improve ANC services, thus reducing morbidity in this group (13).

Furthermore it is essential to strengthen health education to community regarding the importance of family planning, early ANC booking, and the dangers of being a multipara.

The other point is that, in this study low APGAR score was the highest (74.0%) perinatal complication which usually led to birth asphyxia and eventually NND. Although this observation is consistent with other studies, its rate is relatively high when compared with the findings of those studies which had shown that, low APGAR score was the overall leading fetal complication of CS deliveries, with 52% which eventually resulted to NNDs (10, 12). Therefore, this high rate of low APGAR score with poor prognosis in this hospital might be due to the fact that, Neonatal Intensive Care Unit (NICU) has inadequate essential resources, and it is staffed with health care workers like general nurses and doctors who have no expertise in neonatology. This reason had been found in another study which revealed that, lack of appropriate facilities in NICU, absence of neonatologist and neonatology nurses, and shortage of paediatricians, were seen as contributory factors to high rates of low APGAR score (10, 12). This means that, it is critical for Princess Marina hospital to accentuate the importance of intensifying neonatal resuscitative measures, and train health care workers on intensive neonatal care. As a result this may contribute to the reduction of neonatal morbidities and mortalities in Princess Marina hospital.

On the other hand, this high rate might be attributed to high referral number of complicated cases from lower level health facilities, or might also reflect ineffective management of labour, delayed decision making and / or delayed transfer of women from home or a referring health facility to the referral hospital (10, 13). Therefore, in order to reduce these complications, it is essential for Princess Marina hospital to institute quality antenatal care services, and upscale comprehensive Emergency Obstetric and Newborn Care (EmONC) at the lower level health facilities. Furthermore, it is important to health educate the community about the importance of early ANC booking, and prompt seeking of medical help in case of emergencies.

### 5.3 Strengths of the study

This study is the first one to be conducted in women who delivered by CS in Princess Marina hospital. The results of this study are similar to other studies conducted outside this country. This research report is a clear indication that, analyzing the indications of CS deliveries can help health policy makers to adjust programs and guidelines regarding CS intervention. Additionally, this study had identified that, there is need for the country to develop a standard classification model / system for the indications of CS deliveries. The study results can also assist clinicians to improve the quality of care regarding midwifery services. The findings observed in this study, will provide evidence based information policy and guidelines as well as protocols that address and meet the needs of women who really need CS delivery in Botswana. They will further build a foundation for further studies to be conducted in this same health facility regarding this population and / or other population groups. This study had revealed the importance of reviewing the over diagnosis of fetal distress as the most frequent indication of CS delivery. The study had also discovered that, it is essential to consider utmost utilization of instrumental vaginal deliveries.

### 5.4 Implications of the study

There are policies and guidelines at national level that are intended to address antenatal care, labour and delivery, and postpartum care services as well as emergency management of obstetric complications including CS as a life saving intervention. The study findings have implications on the interpretation and implementation of policy for CS intervention as an emergency obstetric care within Ministry of Health and Wellness. Moreover it was identified that;

The document of policy guidelines, service standards and the (EmONC) training manual which includes CS intervention only outlined the procedural steps on how to prepare for and conduct CS. But promotion of quality and safe CS intervention is essential in improving both maternal and neonatal health outcomes.

Furthermore, there are no policy guidelines or standard classification system / model that have documented the acceptable valid medical indications for CS intervention. As a result clinicians may have challenges in making appropriate diagnosis for CS

intervention. Therefore their decisions regarding the conduction of CS may be based on their individual preference influenced by skills acquired during training.

Moreover, CS intervention is a good life saving procedure. For this reason, its adverse outcomes do not necessarily mean that, CS is unpleasant intervention, but, the main contributory factors of this situation may be poor quality of services offered, which include; delayed decision making, poor monitoring and inadequate equipment. Therefore one of the strategies that need to be prioritized by the Government of Botswana is to strengthen the capacity of health care workers in management of obstetric emergencies, including CS intervention.

The existing policies and guidelines focus on conducting CS as a life saving procedure, whereas the emphasis on early identification and appropriate management of risks can significantly promote maternal and neonatal health status.

In addition Princess Marina hospital also has protocols and guidelines to address emergency obstetric care including CS intervention in order to curb complications related to labour and delivery, hence their implementation needs to be strengthened.

# CHAPTER 6

## 6.1 CONCLUSSION

This study has established high CS delivery rate of 28.5% among women who delivered at Princess Marina hospital during the study period, higher than the national average of 15% and WHO recommendation. CS is more expensive than instrumental vaginal deliveries therefore this hospital has to strive to reduce this high rate by training clinicians on instrumental vaginal deliveries. Furthermore over diagnosis of fetal distress was the overall leading indication to CS deliveries. Therefore the reduction of over diagnosis of fetal distress can be achieved through the utilization of cardiotocograph. The study also showed that PPH and low APGAR score were the most occurring adverse outcomes of CS deliveries. It is therefore critical to continuously train

health care workers in basic emergency obstetric and newborn care. It is also essential to ensure access to lifesaving drugs and supplies to address the current situation.

Most importantly CS delivery should be conducted only when clear, valid, well-supported medical justifications are made. This could be achieved through the correct use of partograph for appropriate decision to perform CS. Consequently this will promote in performing cost effective CS intervention as a measure of emergency obstetric care. Furthermore CS that is conducted based on valid medical indications will enable the country to scale-up basic emergency obstetric and newborn care services including CS intervention to different levels of care hence this will result in off-loading the congestion of women in Princess Marina hospital who really need CS delivery.

## 6.2 LIMITATIONS

In considering the findings of this study it is important to note the following limitations;

This study was retrospective hence it only used available data as documented in the maternity registers and few records had missing data; and it was difficult to retrieve the patients' files to confirm or supplement the missing data, hence it is not known how much the missing data have biased the results.

The study was conducted in a tertiary hospital (PMH) as a result the findings will best be applicable in tertiary service delivery levels.

## 6.3 RECOMMENDATIONS

Since majority of women attend antenatal care services and deliver in health facilities, further research is needed to explore factors associated with quality of care being provided in different levels of care.

CS has proved to be more expensive compared to instrumental vaginal deliveries and deplete the allocated health resources. Therefore in order to reduce the rate of CS delivery in the study population, it is recommended that;

Clinicians should be encouraged to perform instrumental vaginal deliveries, and conduct vaginal breech deliveries when appropriate. This is due to the fact that this study had identified that there is very minimal utilization of instrumental vaginal deliveries.

Over diagnosis of fetal distress can possibly be reduced by using cardiotocograph which is more accurate compared to fetoscope and Dopplersonicaid.

Despite the fact that majority of women attend ANC and deliver in health facilities, it was identified that some of them appear late at the health facilities, therefore, it is still essential to strengthen public health education on the importance of early antenatal care booking for early identification and management of high risk women in order to improve both maternal and neonatal health outcomes.

Multiparas had higher CS rate compared to primiparas. Therefore it is critical to strengthen access and utilization of family planning services through community health education in order to reduce the unmet needs.

Since this was the first study of its own kind in this area, it is therefore recommended that future research study can be conducted whereby there will be a comparison between two groups regarding maternal and neonatal outcomes. That is, future research in this area needs to consider logistic regression analysis to make the study stronger.

## REFERENCES


1. Burroughs A, Leifer G. **Maternity Nursing: An Introductory Text.** 8th ed. United States of America W. B. Saunders Company; 2001 2001. 419 p.

2. Newman M, Alcock G, Azad K, Kuddus A, Osrin d, More NS, et al. **Prevalence and determinants of caesarean section in private and public health facilities in underserved South Asian communities: Cross-sectional analysis of data from Bangladesh, India and Nepal**. BMJ OPEN 2014;4e005982. 2014.

3. Simvula M, Insua M. **Botswana Maternal Mortality Reduction Initiative**. Final Report. Published by the USAID Applyinf Science to Strengthen and Improve Systems (ASSIST) Project. Bethesda, MD: University Research Co., LLC (URC). 2015.

4. Gibbons L, Belizan JM, Lauer JA, Betran AP, Meraldi M, Althabe F. **The Global Numbers and Costs of Additional Needed and Unnecessary Caesarean Sections Performed per Year: Overuse as a Barrier to Universal Coverage**. World Health Report (2010) Bacground Paper, 30.

5. Ministry of Health MoH. **Emergency Obstetric and Newborn Care Training Manual** 2010. 2010.

6. Ministry of Health MoH. **Guidelines for Antenatal Care and the Management and Prevention of Obstetric Emergencies and Prevention of Mother to Child Transmission of HIV**. The Safe Motherhood Initiative. 2015.

7. Buowari YB. **Indications for Caesarean Section in a Nigerian District Hospital.** The Nigerian Health Journal, vol12, No 2, April- June , 2012. 2012.

8. Pilar BA, Jianfeng Y, Anne-Beth M, Jun Z, Metin GA, Regina TM. **The Increasing Trend in Caesarean Section Rates: Global, Regional and National Estimates:** 1990-2014. PLoS One 2016; 11:e0148343. 2016.

9. Harrison MS, Goldenberg RL. **Caesarean Section in Sub-Saharan Africa**. Maternal Health, Neonatology, and Perinatology (2016) 2:6. 2016.

10. Shah A, Fawole B, M'Imunya JM, Amokrane F, Nafiou I, Wolomby J-J, et al. **Caesarean section delivery outcomes from the WHO global survey on maternal and perinatal health in Africa.** International journal of Gynaecology and Obstetrics. 2009.

11. Tanyi TJ, Atashili J, Fon PN, Robert T, Paul KN. **Caesarean delivery in the Limbe and Buea regional hospitals, Cameroon:Frequency, indications and outcomes**. Pan African Journal. 2016;24(227).

12. Chu K, Cortier H, Maldonado F, Mashant T, Ford N, Trelles M. **Caesarean Section Rates in Sub-Saharan Africa: A Multi-Country study from Medecins sans frontieres** PLOS ONE 7(9):e44484. 2012.

13. Idoko P, Anyanwu M. **Outcome of caesarean section at the Edward Francis Small Teaching Hospital, Banjul The Gambia**. Afri Health Sci 2018;18(1): 157-165. https://dx.doi.org/10.4314/ahs.v18i1.20

14. Grace L, Greer RM, Kumar S. **Perinatal Consequences of a Category 1 Caesarean Section at Term.** BMJ Open 2015; 5:e007248doi:101136/bmjopen-2014-007248. 2015.

15. Reporter S. **Bomaid Concerned With Growing Ceasarean Sections Deliveries:** The Patriot on Sunday - Wednesday 13 April 2016. 2016.

16. World Health Organization (WHO). **WHO statement on caesarean section,** Geneva: WHO;2015. 2015.

17. Gregory K, Jackson S, Korst L, Fridman M. **Caesarean Section versus Vaginal Delivery: Whose Risks? Whose Benefits?** American Journal Perinatology 29(1):7-18 (2011). 2011.

18. Worjoloh A, Manongi R, Oneko O, Hoyo C, Daltvelti AK, Westreich D. **Trends in Caesarean Section Rates at a Large East African Referral Hospital from 2005-2010** open Journal of Obstetrics and Gynaecology, 2012, 2,255-261. 2012.

19. Barber EL, Lundsberg L, Belanger K, Pettker CM, Funai EE, Illuzzi JL. **Contributing Indications to the Rising Caesarean Delivery rate**. Obstet Gynecol 2011 July; 118(1):29-38. 2011.

20. Qin C, Zhou M, Callagham WM, Posner SF, Zhang J, Berg CJ, et al. **Clinical Indications and Determinants of the rise of Caesarean Sections in Three hospitals in rural China.** Maternal Child Health J(2012) 16:1484-1490. 2011.

21. Prah J, Kudom A, Afrifa A, Abdulai M, Sirikyi I, Abu E. **Caesarean section in a primary health facility in Ghana: Clinical indications and feto-maternal outcomes.** Journal of Public Health in Africa 2017;8(704):155-9.

22. Begum T, Rahman A, Nababan H, Hoque DM.E, Khan AF, Ali T, et al. (2017) **Indications and determinants of caesarean section delivery: Evidence from a population-based study in Matlab, Bangladesh.** PLoS ONE 12(11): e0188074. https://doi.org/10.1371/journal.pone.0188074

23. Njim T, Choukem S-P, Mbu R. **Caesarean Section in a Secondary Level Care Hospital of Cameroon: an analysis of their six-year trends and adverse neonatal outcomes.** 2017.

24. WHO. **International Statistical Classification of Diseases and Related Health problems** 10th Version Volume 1 fifth edition 2016. 2016.

25. Naidoo RP, Moodley J. **Rising rates of caesarean sections: an audit of Caesarean Sections in a specialist private practice. KwaZuluNatal, South Africa.** South Africa Family Practice Journal. 2009;51(3):254-8.

26. Abede FE, Gebeyehu AW, Kidane AN, Eyassu GA. **Factors leading to caesarean section delivery at Felegehiwot referral hospital, Northwest Ethopia: a retrospective record review.** Reproductive Health 2016. 2016;13(6).

27. Ugwa E, Ashimi A, Abubakar MY. **Caesarean sections and perinatal outcomes in a sub-urban tertiary hospital in Northwest Nigeria** Nigeria Medical Journal 2015;56(3):180-4.

28. Mylonas I, Friese K: **The indications for and risks of elective cesarean section.** Dtsch Arztebl Int 2015; 112:489–95. DOI: 10.3238/arztebl.2015.0489

29. Naeem M, Khan MZUI, Abbas SH, Khan A, Adil M, Khan MU. **Rate and Indications of Elective and Emergency Caesarean Section: A study in Tertiary Care Hospital of Peshawar**. J Ayub Med Coll Abbottabad 2015;27(1):151-4. 2015.

30. **Population and Housing Census Report:** Gaborone Central Statistics Office. 2012.

31. **Statistics Botswana** 2016: Central Statistics Office December 2016.

32. **Population and Housing Census** 2011/ National Statistics Tables report [Internet]. Statistics Botswana. 2011 [Cited 2019 Feb 09]. Available from: http://www.cso.gov.bw/images/national_statisticsreport.pdf.

33. Ehrlich R, Joubert G. **Epidemiology: A Research Manual for South Africa.** 3rd ed. South Africa: OXFORD University Press; 2014.

34. Kalisa R, Rulisa S, Roosmen Jv-, Akker Tv-d. **Maternal and Perinatal Outcome After Previous Caesarean Section in Rural Rwanda.** BMC Pregnancy and Childbirth Open Access. 2017.

35. Fraser DM, Cooper MA, Nolte AGW. **Myles Textbook for Midwives:** African Edition.Second Edition Churchill Livingstone, London New York. 2014.

36. McKinney ES, James SR, Murray SS, Nelson KA, Ashwill JW. **Maternal Child Health Nursing. Fourth Edition.** Elsevier Inc Saunders St Loius. 2013.

37. SteppGilbert E. **Mannual of High Risk Pregnancy** Fourth Edition Mosby Elsevier 11830 Westline IndustrialDrive St.Loius Missouri631462007.

38. Ministry of Health and Wellness; WHO; CDC; UNFPA. 5 Year Maternal Mortality Report 2007 - 2011. Exploring Causes of Maternal Mortality. 2014

39. Statistics Botswana - Ministry of Finance and Development Planning. Botswana Family Health Survey 2007 - 2008. Report generated on September 28, 2016
http://botswana.microdatahub.com/index.php

## APPENDIX ONE: PLAGIARISM DECLARATION REPORT

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

FACULTY OF HEALTH SCIENCES

PLAGIARISM DECLARATION TO BE SIGNED BY ALL HIGHER DEGREE STUDENTS

SENATE PLAGIARISM POLICY: APPENDIX ONE

I Onteletse Cathrine Kula (Student number: 1422734) am a student registered for the degree of Master of Public Health in the academic year 2016.

I hereby declare the following:

- I am aware that plagiarism (the use of someone else's work without their permission and / or without acknowledging the original source) is wrong.
- I confirm that the work submitted for assessment for the above degree is my own unaided work except where I have explicitly indicated otherwise.
- I have followed the required conventions in referencing the thoughts and ideas of others.
- I understand that the University of the Witwatersrand may take disciplinary action against me if there is a belief that this is not my own unaided work or that I have failed to acknowledge the source of the ideas or words in my writing.

Signature:  Date: 15th August 2019

**APPENDIX TWO: HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL) CLEARANCE CERTIFICATE**

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

R14/49 Ms Onteletse Kula

**HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)**

**CLEARANCE CERTIFICATE NO. M180217**

| | |
|---|---|
| **NAME: (Principal Investigator)** | Ms Onteletse Kula |
| **DEPARTMENT:** | School of Public Health<br>Princess Marina Hospital, Botswana |
| **PROJECT TITLE:** | Indications and immediate outcomes of caesarean section deliveries at a national referral hospital in Botswana |
| **DATE CONSIDERED:** | 23/02/2018 |
| **DECISION:** | Approved unconditionally |
| **CONDITIONS:** | |
| **SUPERVISOR:** | Dr Juliet Nyansulu |
| **APPROVED BY:** | Prof C Penny, Chairperson, HREC (Medical) |
| **DATE OF APPROVAL:** | 02/07/2018 |

**This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.**

**DECLARATION OF INVESTIGATORS**

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary in Room 301, Third floor, Faculty of Health Sciences, Phillip Tobias Building, 29 Princess of Wales Terrace, Parktown, 2193, University of the Witwatersrand. I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report**. The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. In this case, the study was initially reviewed in February and will therefore be due in the month of February each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature _____ Date _____

**PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES**

**<u>APPENDIX THREE</u>: Health Research and Development Division, Ministry of Health and Wellness, Botswana**

PRIVATE BAG 0038
GABORONE
BOTSWANA
REFERENCE:

REPUBLIC OF BOTSWANA
MINISTRY OF HEALTH AND WELLNESS

TEL: (+267) 363 2500
FAX: (+267) 391 0647
TELEGRAMS: RABONGAKA
TELEX: 2818 CARE BD

**REFERENCE NO: HPDME 13/18/1** **9th May 2018**

Health Research and Development Division

Notification of IRB Review: **New application**

Ms Onteletse Cathrine Kula
P.O. Box 21902
Gaborone

Dear Ms Onteletse Cathrine Kula

**Protocol Title:** **INDICATIONS AND IMMEDIATE OUTCOMES OF CAESAREAN SECTION (CS) DELIVERIES AT PRINCESS MARINA HOSPITAL (PMH) IN BOTSWANA**

| | |
|---|---|
| **HRDC Approval Date:** | 09 May 2018 |
| **HRDC Expiration Date:** | 08 May 2019 |
| **HRDC Review Type:** | Full Board |
| **HRDC Review Determination:** | Approved |
| **Risk Determination:** | Minimal risk |

Thank you for submitting new application for the above referenced protocol. The permission is granted to conduct the study.

This permit does not however give you authority to collect data from the selected sites without prior approval from the management. Consent from the identified individuals should be obtained at all times.

The research should be conducted as outlined in the approved proposal. Any changes to the approved proposal must be submitted to the Health Research and Development Division in the Ministry of Health for consideration and approval.

Furthermore, you are requested to submit at least one hardcopy and an electronic copy of the report to the Health Research, Ministry of Health and Wellness within 3 months of completion of the study. Approval is for academic fulfillment only. Copies should also be submitted to all other relevant authorities.

**Continuing Review**

In order to continue work on this study (including data analysis) beyond the expiry date, submit a Continuing Review Form for Approval at least three (3) months prior to the

PLOT 1836 HOSPITAL WAY
TELEPHONE: 3621400
FAX: 3973776

RE PUBLIC OF BOTSWANA

PRINCESS MARINA HOSPITAL
P. O. BOX 258
GABORONE
BOTSWANA

**REF: PMH 5/79(440-1-2018**

**April 12, 2018**

**Onteletse Catherine Kula**

**Dear Ms Kula**

**RE: Indications and Immediate Outcomes of C-Section Deliveries at a National Referral Hospital in Botswana**

The Research and Ethics Committee (REC) of Princess Marina Hospital met and discussed your request to conduct a study with the aforementioned title. Full approval has been granted.

Please observe following:

1. Please obtain permission from head of department in the unit that you intend to do your research.
2. At all times obtain informed consent from all participants used in this study.
3. You will not change any aspect of your research without permission from the Research and Ethics Committee (REC).
4. You need to report any unforeseen circumstances including the termination of the study to the REC.
5. You must allow the REC access to the study at any time for purposes of auditing.
6. This permit is valid for a period of one year; from April 12 , 2018 to April 11, 2019.
7. At the end of the study you should give the research and ethics committee a hard copy and a soft copy of your report

Thank you

Sincerely,

Gladness O. Tlhomelang
Secretary Research and Ethics Committee
For Hospital Superintendent

TELEPHONE: 363 1400
FAX: 397 3776
TELEGRAMS: RABONGAKA
TELEX: 2818 CARE BD

Republic of Botswana

PRINCESS MARINA HOSPITAL
P.O. Box 258
GABORONE

**REF: PMH 2/11 A VII**

**19th April 2018**

Onteletse Cathrine Kula

Dear Madam,

Window Snip

**RE: PERMISSION TO ACCESS MATERNITY REGISTERS IN LABOUR WARD**

As the Unit Manager of Labour Ward, I have read your letter requesting permission to access maternity registers for the purpose of your study. Therefore, permission has been granted.

Please observe the following:-

- Allow the manager access to the study at any time for the purpose of auditing.
- At the end of the study, you should give the unit manager a soft copy of your report.

Thank you.

Yours faithfully

GRpse

.....

**Goratileone Rapitse Labour Ward Manager**
**for/ HOSPITAL SUPERINTENDENT**

## APPENDIX SIX: DATA EXTRACTION TOOL

**Indications and immediate outcomes of caesarean section deliveries**

**Data Extraction Tool**

**Date: _____ Case Number: _____**

### A. Demographic data

1. Maternal age (years): _____

2. Place of residence:

| | |
|---|---|
| City | |
| Town | |
| Village | |

3. Employment:

| | |
|---|---|
| Yes | |
| No | |

4. Medical condition:

| | |
|---|---|
| Yes | |
| No | |

5. If Yes: Type:_____

6. Surgical condition:

| | |
|---|---|
| Yes | |
| No | |

7. If Yes: Type: _____

### B. Obstetric data

8. Gravidity: _____

9. Parity: _____

10. Abortions:

| | |
|---|---|
| Yes | |
| No | |

11. If Yes: Number of abortions: _____

12. Gestation (weeks): _____

13. Indication for CS: _____

14. Maternal outcome:

| | |
|---|---|
| Alive | |
| Mortality | |
| Morbidity / Complication | |

15. If morbidity / complication: Type: _____

16. Perinatal outcome:

| | |
|---|---|
| Alive | |
| Mortality | |
| Morbidity / Complication | |

17. If morbidity / complication: Type: _____

18. Adverse outcome:

| | |
|---|---|
| Yes | |
| No | |