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Caesarean section indications and outcomes at a tertiary level hospital in South Africa

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Abstract
Caesarean section rates have increased over the past 30 years and there has been lack of understanding of the drivers of these increased rates. The World Health Organisation has recommended the use of the Robson ten group classification as a system for assessing, monitoring, and comparing caesarean section rates at all levels.
Aim
The aim of this study was to determine the indications and caesarean section rate at a tertiary referral hospital.
Methods
This was a retrospective analysis of deliveries between 1 January 2014 and 31 December 2018 at a tertiary level hospital in Pretoria, South Africa. The Robson's 10 group classification was used in classifying the caesarean sections.
Results
A total of 15 295 deliveries took place during the study period: 6 883 women delivered vaginally (NVD) and 8 412 women by caesarean sections (CS). The average CS rate was 55%. Robson's 10 Group 5 (all multiparous, ≥1 previous CS, ≥ 37 weeks, single cephalic pregnancy) was the greatest contributor to the CS rate (29%). Most women who delivered were between the ages 20-35yrs (n= 12000, 78.6%), with majority delivering via CS deliveries (n=6616, 55.1%) compared to NVDs (n=5388, 44.9%). The CS rate for women with underlying medical disease was 19% and women with hypertensive disorders of pregnancy were the largest contributor to this group (n=1241, 14.8%). The caesarean section rate for women classified as a maternal near miss was 69.6%. There was no statistically significant difference in the rate of postpartum haemorrhage between women who delivered vaginally NVD (n=173) compared to those who delivered by CS (n=245) p=0.132).
Conclusion
Strategies to reduce the primary caesarean deliveries and steps to improve VBAC success rates should be considered and implemented. In a tertiary hospital, Robson's 10 group classification alone does not give a full description of the caesarean section rate; other causes like medical conditions need to be considered. Health care workers should follow local guidelines to reduce the risk of complications related to hypertensive disorders in pregnancy.

Introduction
In 1985, the World Health Organization (WHO) recommended a caesarean section (CS) rate of 10-15% for all births.[1] This recommendation followed the publication of two studies that found that CS rates higher than 10% at population level were not associated with reductions in maternal and neonatal mortality rates. The WHO also highlighted the need for CS and rather than focussing on achieving a specific rate, stated that very effort should be made to provide a CS to a woman who needs it.[1]

A Caesarean section (CS) can be defined as the surgical ending of a pregnancy, or delivering a baby by opening of the uterus during an operation.[2] Over the past 30 years, caesarean section rates have increased well above the WHO recommendation. The International Federation of Gynaecology and Obstetrics (FIGO) analysed global CS rates in 2015.[3] This study analysed births in 169 countries (98.4% of the world's births) and found that 29.7 million (21.1%) births occurred through CS.[3] This rate was much higher than the rate of 12.1% in 2000. The average annual rate of increase in CS use globally was 3.7% between 2000–2015.[3]

A caesarean section does not only pose risk to the current pregnancy but also has implications for future pregnancies. Major short-term complications include haemorrhage that may require hysterectomy or transfusion, puerperal infection, wound disruption, wound haematoma, venous thromboembolism as well as anaesthetic risk.[4] Long-term risks of caesarean section include stillbirth, placenta accreta spectrum disorders, uterine rupture and scar pregnancy.[4]

In an effort to curb rising caesarean sections rates, several studies have analysed indications for caesarean sections.[5] These include maternal, family and community, health professional factors

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and health system factors. Maternal indications for CS include: maternal request, fear of labour pains, convenience and previous bad experiences with normal vaginal delivery.[5] Increasing maternal age was also found to be associated with higher rates of CS with women over 40 years having rates of 43.1%.[6] Risk factors for CS reported by Yale Academic Hospital include none reassuring fetal status, preeclampsia, suspected macrosomia and other maternal and fetal conditions such as placental attachment disorders and congenital anomalies.[7] Health professional reported factors such as fear of litigation and work convenience were cited as causes for increased CS rates.[5]

Optimising the use of CS is of global interest. One of the methods adopted to reduce the epidemic worldwide is the use of Robson's 10-group classification. This is a system where women who deliver are stratified into 10 groups based on various categories: gestational age, parity, fetal number, fetal presentation, onset of labour and prior caesarean section.8 The Robson's 10-group classification monitors rates of caesarean sections in healthcare facilities over time. From this classification, the most common indications may be identified thus allowing one to direct efforts to reduce CS rates at specific groups.[9] This system of analysis also allows one to consider the obstetric management of an individual. A population-based study in Australia found that Robson's class 5 (all multiparous women with at least one previous uterine scar, with a single cephalic pregnancy, ≥37 weeks gestation) was the most common indication for CS (76.3 %).10 This group was followed by Robson's class 2 (nulliparous women with a single cephalic pregnancy ≥37 weeks gestation who either had labour induced or were delivered by caesarean section before labour) with a rate of 39.7 %.[10] In a systematic review on optimising CS rates, the Robson groups that made the largest contribution to overall CS frequency in China and Brazil were group 1 (39·9% in China and 35·4% in Brazil) and group 5 (33·9% in China and 32·7% in Brazil).[3] An increase in CS rates for group 5 (29% to 61%) was observed from 1996 to 2014.

The aim of this study was to establish the rate, indications, and immediate outcome of women delivered by caesarean section.

Methods

This was a retrospective study conducted at Steve Biko Academic Hospital (SBAH), a tertiary level hospital in Pretoria, South Africa. SBAH is the primary referral hospital for a district and regional hospitals in the Tshwane District. Mamelodi Regional Hospital refers all tertiary cases to SBAH while Tshwane District Hospital does not perform any caesarean sections after hours or on weekends. In addition, these two hospitals do not offer vaginal birth after caesarean sections.

Delivery data from 1 January 2014 to 31 December 2018 was analysed. An existing database used for reporting maternity statistics at Steve Biko Academic hospital was used in this study. This database has been in existence since the 1990s as part of the obstetric unit records and as required by the Department of Health for maternal morbidity and mortality statistics.

Information obtained from data sheets include maternal obstetric information: maternal demographics, gravidity and parity, gestational age, fetal number and presentation, previous caesarean sections as well as onset of labour. Any inaccurately entered information was taken as missing data and the entry excluded from data analysis. There was no contact with patients.

For the caesarean section rate, the following formula was used: (Number of caesarean sections ÷ total number of deliveries) X 100. The result was expressed as a percentage. The caesarean section rate per year was also analysed. The Robson's 10 group classification was used to classify each delivery. This system classifies caesarean sections into ten mutually exclusive and exhaustive groups and consists of 10 groups based obstetric characteristics: parity, previous caesarean section, gestational age, onset of labour, fetal presentation and the number of fetuses. From this allocation, the most common groups were established.

The Robson's 10 group classification is shown below:

1. Nulliparous, single cephalic, ≥37weeks in spontaneous labour.
2. Nulliparous, single cephalic, ≥37weeks, induced or CS before labour.
3. Multiparous, no previous scar, single cephalic, ≥37 weeks in spontaneous labour.
4. Multiparous, no previous scar, single cephalic, ≥37 weeks, induced or CS before labour.
5. All multiparous, ≥1 previous CS, ≥ 37 weeks, single cephalic pregnancy.
6. All nulliparous with single breech pregnancy.
7. All multiparous with single breech pregnancy including women with previous scars.
8. All multiple pregnancies, including women with previous scars.
9. All women with transvers or oblique lies, including women with previous scars.
10. All women with single cephalic pregnancy < 37 weeks gestation, including women with previous scars.

Indications and immediate outcomes of CS were assessed using multivariable logistic regression. These included:

i. Maternal demographics.
ii. Presence or Absence Postpartum haemorrhage associated with the caesarean section.

This study was approved by the University of Pretoria Health Sciences Research Ethics Committee (Protocol 696/2019).

Results

The total number of deliveries over the 5-year study period was 15295; 6883 women delivered vaginally and 8412 by caesarean section. The overall caesarean section rate over the 5 years was 55%. The trend along the 5 years was 56.3% for 2014, 56.6% for 2015, 52.8% for 2016, 53.0% for 2017 and 55.8% for 2018. The age group of women with the highest caesarean section rate was 20-35 years (n= 6616, 78.7%). This was followed by the age group > 35years (n=1508, 17.9%) and lastly < 20 years (n=280, 3.3%).

The largest contributor to the Robson-10 classification was group 5 - multiparous women with at least one previous uterine scar, with a single cephalic pregnancy, ≥37 weeks gestation (n=2432, 29%). This was followed by group 10, women with a single cephalic pregnancy <37 weeks gestation including women with previous scars (n=1841, 22%). Table 1 shows the contributions to caesarean sections according to Robson's 10 group classification. There were 34 inaccurately entered data which were taken as missing values.

Table 1: Robson's 10 group classification among women who delivered by caesarean section at Steve Biko Academic Hospital 2014-2018.

Robson's 10 Group	Total Caesarean sections (n)	Robson's 10 group contribution to overall caesarean section number (%)
1	823	9.8
2	671	8.0
3	864	10.3
4	849	10.1
5	2432	29.0
6	83	0.9
7	317	3.7
8	426	5.1
9	72	0.9
10	1841	22
Total CS	8412	100

The contribution of underlying medical disease to the CS number was determined. Eighty-one percent (n=6809) of caesarean deliveries were performed for obstetric indications while 1592 (19%) of caesarean deliveries were performed for maternal medical disease.

The medical condition associated with the highest CS number was hypertensive disorders (n=1241, 14.8%). Table 2 illustrates the medical conditions and corresponding caesarean section rate. Eleven entries contained inaccurately entered information and these were taken as missing values.

Table 2: Medical conditions associated with caesarean sections.

Medical Condition	Number of CS for medical condition	Contribution to medical condition CS number (%) (n/1592)	Contribution to overall CS number (%) (n/8412)
Hypertensive disorders	1241	78.0	14.8
Cardiac	165	10.4	2.0
Diabetes	156	9.8	1.9
Asthma	5	0.3	0.1
Cancers	4	0.3	0.0
Epilepsy	3	0.2	0.0
Thyroid disorders	2	0.1	0.0
Others	16	1	0.2
Total	1592	100	10

The incidence of postpartum haemorrhage (PPH) between women who delivered vaginally and those who delivered by caesarean section was compared. Two hundred and forty-five (2.9%) mothers developed postpartum haemorrhage in the caesarean section group compared with 173 (2.5%) in the vaginal delivery group. There was no statistically significant difference between these two groups (p=0.132).

A sub-group analysis of maternal near misses was undertaken for a 12-month period from January 2018 to December 2018. There were 3 331 deliveries during this period and 46 (1.2%) women fulfilled the criteria for a maternal near miss over this 12-month period. [11] The caesarean section numbers for women classified as a maternal near misses was 69.6%. Table 3 below shows the diagnoses and caesarean section numbers for the near miss cases.

Table 3: Near miss data and caesarean section numbers

Diagnosis	Total Near Misses	Number of CS per near miss	Number of CS per near miss over total number of near misses n/46 (%)
Hypertensive disorders	20	17	36
Obstetric Haemorrhage	12	9	19.5
Medical condition	8	2	4.3
Sepsis	5	3	6.5
Extrauterine pregnancy	1	1	2.1
Total	46	32	69.6

Discussion

This study includes 15 295 deliveries over a 5-year study period at a tertiary referral hospital. The average caesarean section rate over the study period remained relatively constant and ranged between 52.8%-56.3% (mean 55%). This rate is higher than the rate of 50.6% reported in 2018 by another tertiary institution in South Africa.[12] The higher rate reported in our study probably reflects the increased proportion of high-risk cases managed at our institution. The major contributors to the caesarean section numbers were group 5 (all multiparous, ≥1 previous CS, ≥ 37 weeks, single cephalic pregnancy) and group 10 (all women with single cephalic pregnancy < 37 weeks gestation, including women with previous scars) and women with hypertensive disorders in pregnancy. The CS percentages in these groups were 29.0%, 22.0% and 14.8% respectively. The age group associated with most deliveries was 20-35 years. Our findings were similar to research published previously from Ethiopia where 86.7% of participants were between the ages 20-35years [13].

Previous caesarean delivery is an important contributor to CS rates.[8,12] It is common practice for women with a previous CS to opt for an elective repeat CS.[8] The Royal College of Obstetricians and Gynaecologists (RCOG), advises that women be counselled that the chance of successful VBAC is approximately 70%,[14] however lower success rates have been reported in women of African ancestry. [15,16-18] The VBAC success rate at our institution for 2013-2018 was 36%. [15] Reasons for failed VBAC in this study included poor progress of labour, fetal distress as well as cephalo-pelvic disproportion.[15] The VBAC complication rate at our institution was low. No women attempting VBAC during the 2013-2018 study was admitted to the intensive care unit and there were no cases of uterine rupture following attempted vaginal birth. The authors reported that the low complication rate observed was most likely due to the strict VBAC protocol followed.[15]

The second highest contributor to the caesarean section number was group 10, which represents the group of women who deliver preterm. The CS rate contribution from this group was 22%. The preterm birth rate over the study period at our institution was 33.6% (n=5 127). The preterm birth rate at our institution is significantly higher than the average rate in South Africa (15%) as we are a tertiary institution.[19] We will need to critically assess the causes of preterm birth at our institution, and this would possibly assist in lowering the CS rate in this group.

The sub-group analysis on near miss data from January 2018 to December 2018 revealed a 69.6% CS rate among women classified as a maternal near-miss. Studies have shown that near misses are associated with increased CS rates.[20] A secondary analysis of the WHO Global and multi-country surveys showed that, compared with vaginal delivery, CS was associated with significantly increased odds of maternal intensive care unit admission, maternal near miss, and neonatal intensive care unit admission.[21] The WHO study further found that 90% of near-miss cases in obstetric haemorrhage group had caesarean sections. Maswime et al, in a study on near-miss maternal morbidity, found that prior caesarean section was a dominant risk for maternal near miss due to obstetric haemorrhage.[22] It is therefore prudent to address the two important Robson's 10 groups (5 and 10) contributing to high caesarean section rates.

We analysed the contribution of maternal medical disease to our CS numbers. Nineteen percent of caesarean sections were performed for women with underlying medical condition. The medical condition associated with most caesarean sections was hypertensive disease (14%). Looking at data from other academic hospitals, Yale showed that risk factors of CS included preeclampsia, suspected macrosomia and other maternal and fetal conditions such as placental attachment disorders and congenital anomalies.[7] A study done in Durban, South Africa, showed that preterm pre-eclampsia was associated with an increased incidence of caesarean sections. [23] In Brazil, a study done on indications for caesarean section rate saw a high rate of CS being done for severe pre-eclampsia (57%), followed by fetal distress (15%).[24] Prevention of hypertensive disorders in pregnancy is therefore prudent in reducing caesarean section rates. Both the South African Department of Health and the American College of Obstetricians and Gynaecologists recommend the use of low dose aspirin (81mg/day) in patients at risk of pre-eclampsia. The use of calcium supplementation in patients with low calcium intake has also shown benefit in reducing pre-eclampsia. In a 2018 systematic review of 27 randomized control trials, calcium use from mid-pregnancy (20weeks), to delivery approximately halved the risk of pre-eclampsia.[25] Ensuring that these strategies are implemented widely may reduce the incidence of pre-eclampsia and the subsequent caesarean section rate.

Based on findings from this study, the caesarean section rate remains high with most caesarean sections performed on women with previous scars. Indications for primary caesarean deliveries need to also be explored further. The American college of Obstetricians and Gynaecologists as well as the Society for Maternal and Fetal medicine have outlined strategies to reduce primary CS. These include operative vaginal delivery in the second stage and not using prolonged latent phase as an indication for CS. In addition, before diagnosing arrest of labour in second stage of labour, and if maternal and fetal conditions permit, allow for following: at least 2 hours of pushing in multiparous women and at least 3 hours of pushing in nulliparous women.[26]

The strength of our study is the sample size and that we looked at deliveries over several years. Limitations of the study include its retrospective nature, with some missing data. However, measures were put into place to exclude these missing data.

Conclusion

The average caesarean section rate was 55% with Robson's group 5 and group 10 as the greatest contributors. Reducing primary caesarean sections and encouraging VBAC may be a solution to this high rate. In a tertiary hospital, Robson's 10 group classification alone does not give a full description of the caesarean section rate; other causes like medical conditions need to be considered. Hypertensive disorders in pregnancy were the medical condition associated with the highest caesarean section rate and was also the largest contributor of CS to the near miss category. Contrary to other data, our data showed no statistically significant difference in the rate of PPH between the NVD and caesarean section groups. More studies should still be done on the Robson's classification to help hospitals formulate strategies to reduce the caesarean section rate and reach the WHO recommendations.

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