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**An Analysis of the Caesarean Section Rate at
Mowbray Maternity Hospital using Robson's Ten
Group Classification System**

By

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DECLARATION

I, Tracey Anne Horak, hereby declare that the work on which this dissertation is based is my original work (except where acknowledgements indicate otherwise) and that neither the whole work nor part of it has been, is being, or is to be submitted for another degree in this or any other university.

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LIST OF ABBREVIATIONS

CEOC	Comprehensive emergency obstetric care
CI	Confidence interval
CPD	Cephalopelvic disproportion
DHS	Demographic and Health Surveys
ECV	External cephalic version
HIV	Human immunodeficiency virus
ICU	Intensive care unit
MMH	Mowbray Maternity Hospital
MOU	Midwife obstetric unit
NICE	National Institute for Health and Clinical Excellence
NICHD	National Institute of Child Health and Human Development
RDS	Respiratory distress syndrome
RR	Relative risk
TGCS	Ten group classification system
TTN	Transient tachypnoea of the newborn
VBAC	Vaginal birth after caesarean
WHO	World Health Organization

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SYNOPSIS

Background:

Caesarean section is one of the most frequently performed surgical operations in the world today. Over the past four decades, there has been a dramatic increase in the caesarean section rates of both developed and developing countries. This increase has been the subject of considerable debate, not only between health care professionals, but also amongst women and society as a whole.

In order to interpret and explain increasing caesarean section rates, it is first essential to identify which subgroups of women are undergoing caesarean section, and in which subgroups the caesarean section rate can be considered to be too high or too low, taking all relevant outcome factors into consideration. This is best achieved using a classification system that would enable caesarean section rates to be audited, analyzed, and compared in a standardized, consistent, and action-orientated manner. Effective targeted strategies could then be implemented to optimize caesarean section rates where necessary. A recent systematic review concluded that women based classification systems in general, and Robson's Ten Group Classification System in particular would be best suited for this purpose.

Aims and Objectives

The principal aim of this study is to implement the Robson Ten Group Classification System (TGCS) at Mowbray Maternity Hospital, Cape Town.

Specific objectives are:

1. To determine the caesarean section rate for the year 2009.
2. To identify the main contributors to the caesarean section rate as identified by the TGCS.
3. To compare our data with that from other units, in order to identify groups possibly in need of intervention.
4. From these findings to form a reference point in the process of ongoing audit and feedback at Mowbray Maternity Hospital.

Methods:

A descriptive, retrospective audit was performed, reviewing all caesarean sections and deliveries that took place in 2009 at Mowbray Maternity Hospital (MMH) and at the four Midwife Obstetric Units (MOUs) that operate in Mowbray's catchment area, namely Liesbeck MOU, Gugulethu MOU, Khayelitsha MOU, and Mitchell's Plain MOU.

Labour ward registers at MMH and the four MOUs, theatre delivery registers at MMH as well as the computerized databank CRADLE, was reviewed to obtain the data necessary to categorize each delivery, whether vaginal or by caesarean section, into the Robson Ten Group Classification System. Any incomplete or erroneous content in the data was corrected by conducting a manual review of the relevant patient folder. The data collected was entered onto an excel spreadsheet, and analyzed using the STATA statistical program with the help of a statistician.

Results:

In total, 19094 women gave birth to 19355 babies between 1 January 2009 and 31 December 2009 at Mowbray Maternity Hospital and its four catchment MOUs. During this period, 3949 caesarean sections were performed, resulting in an overall caesarean section rate of **20,7%**.

Groups 1 and 3 made the most significant contribution to the overall number of deliveries, with 5498 and 8255 deliveries in Groups 1 and 3 respectively. These groups represent nulliparous and multiparous women in spontaneous labour at term, and are therefore considered to be relatively low risk. Groups 5 (previous caesarean section) and 10 (preterm delivery) also made significant contributions to the overall number of deliveries.

The highest caesarean section rates were seen in Groups 9 (96,7%), 6 (87,9%), 7 (82,5%), and 5 (81,4%). Group 5 made the most significant contribution to the overall caesareans section rate, contributing 6% of the total 20,7%. Groups 9, 6, and 7 represent women with malpresentations, and despite the high caesarean section rates observed in these cases, the low number of deliveries in each of these groups resulted in a combined contribution of less than 2% to the overall caesareans section rate. In contrast, the high number of deliveries in Groups 1 and 3 resulted in them each making a considerable contribution to the overall caesarean section rate, at 4,8% and 3,0% respectively.

Conclusion

By implementing Robson's Ten Group Classification System at Mowbray Maternity Hospital, we were able to identify the fact that Groups 1, 3, and 5 made the greatest contribution to the caesarean section rate. Although the rates in these groups were similar to those observed in another South African unit, they were significantly higher than rates observed in units from developed countries. The impact of the HIV epidemic on obstetric practice is perhaps central to this.

It would be useful to implement the Robson Ten Group Classification System at MMH on a continuous basis, so that trends in caesarean section rates could be monitored, and changes implemented where necessary. From our experience, the absence of a reliable maternity software program makes the retrospective collection of data extremely labour intensive and time consuming. It would be beneficial to implement this classification system on a prospective basis.

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An Analysis of the Caesarean Section Rate at Mowbray
Maternity Hospital using Robson's Ten Group
Classification System.

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INTRODUCTION

Caesarean section is one of the most frequently performed surgical operations in the world today. It is a potentially life saving procedure for both mother and baby, and is medically much safer than when first introduced.¹ Over the past four decades, there has been a dramatic increase in the caesarean section rates of both developed and developing countries. This increase has been the subject of considerable debate, not only between health care professionals, but also amongst women and society as a whole.

The striking increase in the rate of caesarean section observed in many developed countries contrasts sharply with the very low rates reported in several developing countries, where access to emergency obstetric care is limited.² Whilst well-resourced countries such as the United States of America, the United Kingdom, Australia, and China have reported rates of 20 -30%, rates of less than 2% have been documented in many areas in Sub-Saharan Africa.³ In 1985, The World Health Organization (WHO) issued recommendations about appropriate technology for birth, and stated that there is no justification to have a caesarean section rate of higher than 10%. This was subsequently increased to 15%, taking into consideration the higher incidence of cephalopelvic disproportion (CPD) and human immunodeficiency virus (HIV) found in many developing countries.⁴

Caesarean section rates cannot be considered in isolation from other important health care indicators such as maternal and perinatal morbidity and mortality, local resources and expertise, and perhaps most importantly, maternal satisfaction. In order to interpret and explain increasing caesarean section rates, it is first essential to identify which subgroups of women are undergoing caesarean section, and in which subgroups the caesarean section rate can be considered to be too high or too low, taking all relevant outcome factors into consideration. The reasons for different trends in different settings can be investigated, and potential solutions proposed and implemented to adjust caesarean section rates where necessary.⁵

The process of medical audit and feedback has been shown to be an effective method in reducing caesarean section rates.⁶ Various classification systems have been proposed for this purpose. These include indication based classification systems, urgency based classification systems, women based classification systems, and other systems that address questions such as where, how, and by whom the caesarean sections are

performed. Whilst much useful information can be obtained through the use of these systems, they are limited by the inclusion of groups that are not totally inclusive or mutually exclusive, and most critically, by poor reproducibility.⁷ More recently, the Robson Ten Group Classification System (TGCS) has been described. This system divides all obstetric deliveries into one of ten groups, so that the caesarean section rate can be calculated for each individual subgroup of women. The groups are clearly defined, totally inclusive, mutually exclusive, and have the advantage of being prospectively identifiable. Classification of caesarean section using this system not only determines the percentage contribution that each subgroup makes to the overall caesarean section rate, but also allows comparison to be made between specific subgroups of women within the same unit over different time periods, and between different units.⁸

Mowbray Maternity Hospital (MMH), is a secondary level, public maternity hospital, and is part of Metro West, Cape Town. The caesarean section rate at Mowbray Maternity Hospital has increased considerably over the last fifteen years. Currently there is no system in place for classifying caesarean section into component groups other than distinguishing Emergency caesarean section from Elective caesarean section. It will be useful to apply the Robson criteria to identify the different subgroups who require caesarean section as a way of providing a better understanding of the determinants of the caesarean section rate and for devising strategies to reduce caesarean section rates where necessary. In addition, it will be important to evaluate whether the Robson Classification is a feasible one to use in our setting and, if so, it could provide a baseline for ongoing monitoring. This constitutes the subject matter of the research being proposed.

LITERATURE REVIEW

History

Caesarean section has been part of human culture since ancient times. Perhaps the first reference to caesarean delivery is recorded in Greek mythology, where the Sun God Apollo is believed to have ripped his son Asclepius from his dying mother's belly. Several other references are also found in Egyptian, Grecian, Hindu, and other European folklore. An accurate history of caesarean section in early times, however, remains elusive.⁹

For many centuries, it was believed that the procedure took its name from the Roman emperor Julius Caesar, who was allegedly removed from his mother Aurelia's womb through a surgical cut. Roman law at the time required that a child be cut from the womb of a mother who was dead or dying in childbirth. This had begun as a religious requirement that mothers not be buried pregnant, but later evolved in an attempt to save the life of the child. As Aurelia lived to serve Caesar as an advisor well into his adulthood, it seems doubtful that he was delivered in this way.¹⁰

The first woman to survive a caesarean delivery was in the fifteenth century, when Jacob Nufer, a Swiss pig farmer, performed the operation on his wife following a prolonged labour. The accuracy of the story however has been questioned, as it was only reported many decades later.¹¹ In America, the first successful caesarean section to be performed was in 1794 by Dr. Jesse Bennet, and in the British Empire, Dr. James Miranda Barry performed the first successful caesarean whilst masquerading as a male doctor in the British army. This took place sometime between 1815 and 1821.¹²

The mortality rate after caesarean section remained at almost 100% until 1850. The leading causes of death were haemorrhage and infection, and perhaps understandably, the procedure remained rare and often dreaded. Significant medical advances helped reduce the mortality rate to as low as 10% in the early nineteenth century, with the Netherlands reporting a rate of 4% in 1910.¹ These life saving advances included the introduction of anaesthesia by Jackson and Morton in 1846, the advancement of aseptic techniques by Ignaz Semmelweis in 1861 and of antisepsis by Lord Lister in 1876. Ferdinand Kehrer introduced the transverse lower-segment uterine incision to minimize bleeding in 1881, and Max Sänger, the technique of closing the uterine incision with silver wires in 1882.¹³ The Second World War advanced the use of both penicillin and blood transfusion, and this

again was associated with a reduction in maternal morbidity and mortality following abdominal delivery.

As caesarean section became safer, obstetricians increasingly argued against delaying the surgery, and the caesarean delivery rate slowly began to rise. At the turn of the twentieth century, a marked increase in the rate of caesarean section was seen when rickets began to plague many malnourished families in overcrowded cities. The skeletal disorder led to malformed bones, including the pelvis, and often made vaginal delivery impossible. By the 1930s, rickets had been linked to a vitamin D deficiency, and was virtually eliminated by the introduction of fortified milk. The caesarean section rate, however, never returned to the low levels experienced before rickets.⁹

Caesarean Section Rate

Over the past twenty years the caesarean section rate has continued to increase dramatically, both in developed and developing countries. In the United Kingdom, the caesarean section rate increased from 4,5% in 1970 to over 20% in 2005.¹⁴ In 2007, the average rate of caesarean deliveries in Europe was recorded at 19%, with Italy showing the most marked increase from 11,2 % in 1980 to 36% in 2007.¹⁵ Relatively low rates of between 14% and 17% have been sustained in the Netherlands, as well as many of the Nordic countries (Finland, Iceland, Norway, and Sweden).¹⁶ Meanwhile, in the United States, the caesarean section rate rose from 5,5% in 1970 to 21% in 1996, and reached an all time high of 32% in 2007.^{17, 18} In Australia the caesarean delivery rate is 21,6%, and similarly, in Canada 22,5%. Whilst the average caesarean section rate for Asia is reported at 15,9%, rates in excess of 40% have been estimated for China.³

In the developing world, reliable data is often absent or incomplete. The Demographic and Health Surveys (DHS) provide the most representative and widely available source of information for birth by caesarean section in these countries. Data analyzed from 42 countries in Sub-Saharan Africa, South and Southeast Asia, Latin America and the Caribbean between 1998 and 2002 found that fourteen countries had overall caesarean section rates of less than 2,0%, with all except Nepal and Haiti being in Sub-Saharan Africa. A further thirteen countries had caesarean rates between 2,0% and 4,9%, and the remaining fifteen countries above 5,0%. Strikingly, rates of above 25% were reported in Colombia, the Dominican Republic and Brazil.² Rates approaching 70% have subsequently been reported in certain areas in Latin America.¹⁹

This alarming trend has been the subject of considerable debate – not only in the world literature, but also amongst women. In 1985, the World Health Organization issued recommendations about appropriate technology for birth and stated: ‘There is no justification for any region to have caesarean section rates higher than 10 – 15%’.⁴ The recommendation of 10% was based on the caesarean section rates of countries with the lowest maternal and perinatal mortality rates at the time. As these countries were essentially developed countries, the recommendation was extended to 15%, taking into consideration the fact that developing countries had a larger proportion of patients at risk that could benefit from caesarean delivery.²⁰

It is important when measuring and comparing caesarean section rates to get population based rates. This is especially so for tiered systems of maternity care in developing countries where low risk women deliver at community based midwife units and all complicated patients are referred to a hospital. The hospital rate would then be significantly more than that for the whole obstetric population because such hospitals concentrate complicated cases needing caesarean section, for example, obstructed labour, malpresentations, and fetal distress.

Maternal Morbidity and Mortality

The correlation between caesarean section rate and maternal and neonatal outcomes has been the subject of much research. The provision of essential obstetric and neonatal care by skilled attendants during pregnancy and childbirth can ensure good maternal and perinatal outcomes. In many impoverished settings, however, access to quality care and potentially life saving interventions is often limited. This is highlighted in Afghanistan, where the WHO estimates that nearly 86% of births are not attended by a skilled health care worker. The maternal mortality rate in Afghanistan is among the highest in the world, with recent estimates ranging from 400 to 6500 per 100 000 births. Similarly, the perinatal mortality rate is 96 per 1000 births, of which approximately 56% are stillbirths.²¹ Caesarean section has become a marker for the availability and utilization of obstetric services in these settings.

One of the objectives of the Millennium Development Goals is to improve maternal health, and more specifically, to reduce maternal mortality by 75% between 1990 and 2015. The provision of comprehensive emergency obstetric services (CEOS), which includes access to parenteral oxytocics, antibiotics, anticonvulsants, assisted deliveries, manual extraction

of the placenta, and removal of retained products, as well as to caesarean sections and blood transfusions, has been proven to be an effective strategy in achieving this objective. Access to these services, with emphasis on timely caesarean delivery, form a key component of the WHO Making Pregnancy Safer program.²²

In contrast, data from the United Kingdom Confidential Enquiries into Maternal Deaths indicates that an elective caesarean section with no emergency present is associated with a 2,84 times greater chance of maternal death than if she had vaginal birth.²³ Comparable results were found in the Netherlands where, following a nationwide enquiry into the causes of maternal death, it was determined that birth by caesarean section was seven times more hazardous than a vaginal delivery.²⁴

Several publications have examined the maternal risks and benefits associated with delivery by caesarean section compared to vaginal birth. In 2004, the National Institute for Health and Clinical Excellence in the United Kingdom (NICE) published the results from a systematic review comparing the outcomes of elective caesarean section with those of vaginal delivery. Although limited by the inclusion of observational studies, the relative risk (RR) of adverse maternal outcomes was found to be significantly higher with delivery by caesarean section than with vaginal birth. For maternal mortality, the relative risk for caesarean delivery compared with vaginal birth was 4,9 with a 95% confidence interval (CI) of 3,0 – 8,0. For emergency caesarean section the relative risk was reported to be 12 (95% CI 6,32 – 22,65), and for elective caesarean section 2,3 (95% CI 0,88 – 5,86).²⁵

The 2004 – 2008 WHO Global Survey on Maternal and Perinatal Health evaluated short-term maternal outcomes following caesarean section compared to vaginal birth, and demonstrated a consistently increased trend towards an increased risk of death, blood transfusion, hysterectomy, and admission to the Intensive Care Unit (ICU). Notably, when caesarean section was performed without medical indication, the risk of short-term adverse outcomes increased considerably, with an adjusted odds ratio of 5,93 (95% CI 3,88 – 9,05) when the caesarean section was performed prior to the onset of labour, and 14,29 (95% CI 10,91 – 18,72) when performed after the onset of labour.²⁶ These figures suggest that when population caesarean section rates rise above medically indicated levels, the risks may outweigh the benefits.

Other well recognized adverse events following caesarean section include surgical injury to bladder, ureter, uterus and blood vessels, as well as thromboembolism and paralytic

ileus. In the long term, NICE reported an increased risk of abdominal pain [RR 1,9 (95% CI 1,3 – 2,8)], placenta praevia in future pregnancy [RR 1,6 (95% CI 1,3 – 2,0)], and an increased risk of uterine rupture in future pregnancy [RR 42,2 (95% CI 31,1 – 57,2)]^{25, 27}

It is important to acknowledge that mortality and morbidity associated with caesarean section is often difficult to distinguish from that due to the indication for the caesarean section. For example, if an eclamptic woman has a caesarean section and dies, death was probably due to the eclampsia and not a direct complication of the caesarean section, however, if a woman has caesarean section for fetal distress and bleeds to death after the surgery, this is suggestive of more direct complication of the caesarean section, as would be thromboembolism.

Caesarean section may provide some maternal benefit. Villar et al (2007) demonstrated a protective effect of caesarean section on the incidence of third/ fourth degree perineal lacerations and postpartum fistulae, with an odds ratio of 0,1 (0,03 – 0,30) for elective caesarean section and 0,07 (0,01 – 0,97) for intrapartum caesarean section.²⁸ Similarly, the risk of pelvic organ prolapse was found to be significantly reduced following caesarean section compared to vaginal birth in a large study of 1,4 million women by Larsson et al (2009). In this study, the adjusted odds ratio for caesarean section was found to be 0,18 (95% CI 0,16 – 0,20), compared to 1,00 for vaginal deliveries only, and 0,75 (95% CI 0,69 – 0,81) for the group that had undergone both vaginal delivery and caesarean section.²⁹

The effect of caesarean section on urinary and anal incontinence is more complex. While several studies have demonstrated a protective effect of caesarean section on symptoms of urinary incontinence in the short term,^{20, 31} there is a growing body of evidence to suggest that this effect does not persist in the long term.^{32,33, 34} Likewise, several studies have failed to demonstrate any convincing evidence that caesarean section is protective against the development of subsequent anal incontinence.^{35,36,37,38} After analysis of 21 studies including 31698 women, the most recent Cochrane review concluded, “Without demonstrable benefit, preservation of anal incontinence should not be used as a criterion for choosing primary caesarean delivery.”³⁹ Furthermore, a prospective trial by Connolly et al (2003) demonstrated no beneficial effect of caesarean delivery on postpartum sexual function.⁴⁰

Perinatal Morbidity and Mortality

A common perception is that a decrease in perinatal morbidity and mortality is a justification for higher caesarean section rates. In the United Kingdom and the United States, however, the perinatal mortality rate has remained relatively unchanged, despite the alarming rise in the caesarean section rate. Analysis of data from Zimbabwe found that the increased use of caesarean section was not associated with a reduction in the perinatal mortality rate.⁴¹ Likewise, in Iceland, a significant increase in the rate of caesarean section was not associated with a reduction in the perinatal mortality rate.⁴² Other developed countries such as the Netherlands and Sweden have maintained consistently low perinatal mortality rates with no significant rise in the rate of caesarean section.⁴³

The 2005 WHO global survey on maternal and perinatal health in Latin America reported that an increase in the rate of caesarean section was associated with an increase in the rate of fetal mortality as well as in the number of babies requiring admission to intensive care for seven days or longer. These findings were statistically significant, even after adjustment for preterm delivery. Furthermore, when the rates of caesarean section exceeded 10%, the rates of preterm delivery and neonatal mortality were also shown to increase.^{44, 45}

Neonatal respiratory morbidity is one of the most important contributors to prolonged neonatal stay in intensive care units in hospitals with high caesarean section rates. It is defined as the combined rate of respiratory distress syndrome (RDS) and transient tachypnea of the newborn (TTN). Three large observational studies, pooling data from over 90 000 deliveries, have demonstrated an increased risk of neonatal respiratory morbidity among term infants delivered by caesarean section when compared with vaginal birth.⁴⁶ A similar trend was reported in a study by The National Institute of Child Health and Human Development (NICHD), where the incidence of TTN in elective repeat caesarean section was reported as 3,6% versus 2,6% for planned vaginal birth after caesarean section (RR 1,40; 95% CI 1,23 – 1,59).⁴⁷ A widespread perception is that much of the respiratory morbidity associated with elective caesarean delivery is the result of iatrogenic prematurity. This observation has been refuted in a study by Fogelson et al (2005) which excluded all poorly dated pregnancies as well as deliveries occurring at gestations less than 39 weeks. Transient tachypnea remained more prevalent in the elective caesarean group, occurring in 6,0% of cases versus 1,7% of cases in the intended vaginal delivery group (RR 3,84; 95% CI 3,16 – 3,81). This finding supports the theory that

the physiological process of labour may confer benefit in terms of neonatal respiratory morbidity.⁴⁸

A further potential consequence that caesarean section imposes on the newborn is that of accidental laceration by the surgeon's knife. Smith et al (1997) reported a 1,9% chance that the surgeon's knife will accidentally lacerate a baby in the vertex position, and a 6% chance for a baby in a non-vertex position. This risk is often underestimated, as was shown in one study where only one in seventeen fetal lacerations were recognized and documented by the Obstetrician.⁴⁹

In Africa, the WHO Global Survey on Maternal and Perinatal Health demonstrated that increased emergency caesarean section rates, after adjustment for other risk factors, such as pre-eclampsia, multiple pregnancy, breech, previous caesarean section and induced labour, were associated with a higher incidence of fresh stillbirths, neonatal deaths, and severe neonatal morbidity. In contrast, increased elective caesarean section rates were associated with fewer perinatal deaths. As the majority of emergency caesarean sections were performed for fetal distress and dystocia, it is probable that a significant proportion of the perinatal morbidity and mortality resulted from intrapartum asphyxia. In these settings, where availability and access to adequate staff and facilities are limited, caesarean sections are often performed too late to reduce poor perinatal outcomes.⁵⁰

Maternal Request

Despite indisputable evidence that caesarean section rates above the recommended 10 – 15% are not associated with a reduction in maternal and perinatal morbidity and mortality, caesarean section rates continue to rise. Part of this escalation is explained by an increase in the number of women requesting caesarean delivery, often in the absence of medical or obstetric indications. Estimates of caesarean sections performed on maternal request range from 4 – 18% of all caesarean deliveries.⁵¹

In the United Kingdom, the publication of two major reports may have influenced this change. The Changing Birth Report in 1993 encouraged women to make their own decisions regarding pregnancy and delivery, and The Audit Commission Report in 1997 proclaimed that maternity services need to become more women-centered.^{52,53} In Italy, a law has been ratified in the Regione Marche that “warrants the active participation of pregnant women in decision making during all the stages of labour and delivery, and in

the choice of the route of delivery.” This has resulted in a significant number of women electing to deliver by caesarean section.⁵⁴

There are a number of reasons why women request delivery by caesarean section. In Sweden, Hildingsson et al (2002) found that the request for caesarean section was related to a previous history of caesarean section, fear of giving birth, and of having a previously negative birth experience.⁵⁵ Similarly, in a survey conducted in Cincinnati (2008), almost half of the respondents requesting caesarean section had previously delivered by this method. Other reasons cited included the belief that caesarean section was a less painful mode of delivery, less likely to affect sexual function, and less likely to injure the infant. The majority of respondents in this survey, however, preferred vaginal delivery (89,6%), with reasons being reduced recovery pain, surgical scarring, and bleeding.⁵⁶

A systematic review and meta-analysis of observational studies evaluating women’s preference for caesarean section found that across a range of countries, the overall pooled preference for caesarean section was 15,6% (95% CI 12,5 – 18,9). As the preference for caesarean section was shown to vary across heterogeneous subgroups (ranging from 7,2 to 29,4%), the value of the overall pooled preference should be considered with caution. Consistent with previous studies, greater preference for caesarean section was reported in women with a previous caesarean section (29,4%; 95% CI 24,4 – 34,8) versus women without a previous caesarean section (10,1%; 95% CI 7,5 – 13,1), and in women living in a middle-income country (22%; 95% CI 17,6 – 26,9) versus those living in a high-income country (11,8%; 95% CI 8,9 – 15,1). Importantly, the summarized studies document women’s preferences, and not actual requests. Caesarean section rates resulting from maternal request can therefore not be inferred from this data.⁵⁷

In certain low-income countries, where maternal and perinatal mortality and morbidity rates are inevitably high, there is often poor acceptance of obstetric intervention, including caesarean section. A study conducted in Gweru Provincial Hospital in Zimbabwe indicated that women who experience a caesarean section have reduced compliance to health care during subsequent pregnancies compared to those without a previous caesarean section. It was found that more frequently, women with a previous caesarean section would not attend antenatal clinic, and would present to the maternity hospital in a more advanced stage of labour. Furthermore, these patients would often default elective repeat caesarean section dates, and even opt for unsupervised home delivery.⁵⁸ A Nigerian survey reported similar findings, where women who had previously undergone a

caesarean section tended to avoid antenatal care and hospital delivery in subsequent pregnancies.⁵⁹

In other developing countries, most notably Latin America and South Asia, caesarean section rates have risen dramatically. Leone et al (2008) explored possible socio-economic and community influences on this trend, and found that women who exchange reproductive health information with friends and family are less likely to experience a caesarean section, and that women of higher socio-economic background, with better access to antenatal care are more likely to experience a caesarean section. This article highlighted the pivotal role that social interactions have on influencing a woman's choice regarding mode of delivery.⁶⁰ Torloni et al (2011) conducted a twenty-year review on the portrayal of caesarean section in Brazilian women's magazines. Whilst the information regarding mode of delivery was generally balanced, not explicitly favouring either caesarean section or vaginal delivery, there was a marked emphasis placed on the benefits of caesarean section, with less than 70% of the articles reporting on potentially life threatening complications such as haemorrhage or infection, and even fewer commenting on potential long term risks.⁶¹

Medical Opinion

Obstetricians and midwives undoubtedly play a central role in the determination of the caesarean section rate. Several publications have investigated the knowledge, opinions and practice patterns related to caesarean section among obstetrician-gynaecologists. In an American study by Bettes et al (2007), 58,4% of obstetrician-gynaecologists reported an increase in maternal requests for caesarean section without indication. The majority of the respondents attributed the increase to various sources of information, including the media, popular press, the internet, and childbirth education. Although most of the respondents believed that the risks of caesarean section without indication outweighed the benefits, more than half had performed at least one caesarean delivery on maternal request alone.⁵¹

In an anonymous postal survey of obstetricians in the United Kingdom, respondents were asked to answer as though they or their partners were pregnant for the first time in an otherwise uncomplicated pregnancy. Of the respondents, 31% of females and 8% of males disclosed that they would request an elective caesarean section if they were given the

option. Fear of perineal damage, long term stress incontinence and anal sphincter injury from vaginal delivery were the most commonly cited explanations.^{62, 63}

Wu et al (2005) compared the attitudes of urogynaecology and maternal-fetal medicine specialists regarding elective primary caesarean section in the United States. A significantly higher percentage of urogynaecology specialists would agree to perform an elective caesarean section than would the maternal-fetal medicine specialists. (80,4% versus 55,4%, respectively, $p < 0,001$). Moreover, the urogynaecology specialists were more likely to believe that a woman has the right to an elective caesarean section (84,6% versus 67,6%, $p < 0,001$), and to choose/ recommend an elective caesarean section for themselves or their partners (45% versus 9,5%, $p < 0,001$).⁶⁴

In South Africa, where two systems of health care exist, one provided by the State, and the other based on private practice, findings from a study by Chalmers et al (1992) indicate that private obstetricians are more likely to perform caesarean sections even though they have good facilities available to monitor or manage difficult deliveries. In this context, reasons cited for performing caesarean sections include convenience for the doctor, lack of training in the management of difficult deliveries, fear of litigation, inadequate facilities, maternal request, and financial incentives. Fear of litigation was expressed by 75,3% of respondents, with 95,1% carrying malpractice insurance.⁶⁵

Litigation

Defensive obstetrics indisputably plays a role in rising caesarean section rates.⁶⁶ In Ireland, medical negligence claims rose 450% during the time period 1990 – 1998, with obstetrics and gynaecology accounting for nearly half of the payouts.⁶⁷ In the United Kingdom, individual compensation for birth-related neurological handicap now exceeds £3 million. It is not surprising therefore, that in one study, as many as 82% of physicians performed caesarean deliveries to avoid negligence claims, with the phrase “The only caesarean you ever get sued for is the one you don’t do” being quoted time and time again.⁶⁸

Intervention Strategies

It is evident from reviewing the literature that caesarean section rates remain controversial. Several intervention strategies have been proposed to either decrease or

increase caesarean section rates whilst maintaining or improving maternal and fetal outcomes.

In the 1980's, O'Driscoll proposed a package of care that included antenatal education, correct diagnosis of labour, early amniotomy and augmentation with oxytocin.⁶⁹ Two randomized control trials concluded that this active management of labour safely reduces the duration of labour as well as the incidence of fever and chorioamnionitis. One of these trials also demonstrated a reduction in the rate of caesarean section for dystocia, although as a reduction was also observed in the control arm, the end result was not statistically significant.^{70, 71}

The introduction of the partogram by Philpott in the early 1970's improved the referral of women in labour from midwife units in rural areas to more central hospitals where more advanced management, including oxytocin augmentation and caesarean section were available. The use of the partogram reduced the caesarean section rate, the incidence of obstructed labour, and the perinatal mortality rate.^{72, 73} Interestingly, in 1988, when the WHO adopted the main elements of Philpott's partogram, Philpott was excluded from the WHO workshop that produced the partogram, as it took place during the apartheid era.¹³

Electronic fetal heart rate monitoring is sensitive but poorly specific in the diagnosis of fetal distress. It was originally intended as a screening tool for fetal hypoxia, with fetal blood sampling used as the confirmatory test, however, due to the high prevalence of HIV in many populations, the use of fetal blood sampling is limited. A meta-analysis, dominated largely by the inclusion of The Dublin Study, confirmed a significant increase in the caesarean section rate associated with electronic fetal monitoring (OR 1,53; 95% CI 1,17 – 2,01). Although there was no reduction in the overall perinatal mortality rate, a significant reduction in deaths attributable to hypoxia was noted in the electronic fetal monitoring group.^{74, 75} These findings were confirmed in a similar meta-analysis by Thacker et al (1995), except that they also reported on a significant reduction in the incidence of neonatal seizures in the group where electronic fetal monitoring had been used.⁷⁶ Intermittent auscultation for low risk pregnancies, and adequate, training in the analysis of fetal heart rate tracings where indicated have been proposed as strategies to reduce unnecessary caesarean sections for suspected fetal distress.

The Term Breech Trial by Hannah et al (2000) showed that there was a significant reduction in perinatal mortality and neonatal mortality or serious morbidity with planned

caesarean section for breech presentation at term compared with planned vaginal delivery. (RR 0,33; 95% CI 0,19 – 0,56).⁷⁷ On the basis of this evidence, many professional bodies recommend elective caesarean section for delivery of a term breech. External cephalic version (ECV) is an effective strategy for lowering the incidence of breech at term ((RR 0.55; 95% CI 0.33–0.91), and thereby contributes to a reduction in the rate of caesarean deliveries for this indication.⁷⁸ As breech presentation only accounts for 3 -4% of all deliveries however, it's overall contribution to the caesarean section rate is relatively minor.

The continuous presence of a supportive companion or *doula* during labour and delivery has been shown by two Guatemalan studies to shorten the duration of labour and reduce the need for caesarean section and other interventions. These findings have been subsequently been confirmed in an American study which reported a caesarean section rate of 8% in the supported group versus 18% in the control/ unsupported group (p 0,004).⁷⁹

A meta-analysis by Chaillet et al (2007) assessed the effectiveness of several intervention studies, and concluded that caesarean section rates can safely be reduced by interventions that involve health care workers in analyzing and modifying their practice. A variety of intervention strategies including education of medical staff, practice guidelines for the management of labour, policy for active management of labour, continuity of midwifery care, and physician peer review and feedback were all found to effectively reduce the caesarean section rate when combined with the process of audit and feedback.⁸⁰

Classification Systems

Audit and feedback should form the cornerstone of any intervention aimed at assessing or altering caesarean section rates. In order to propose or suggest any such interventions however, it is essential to first identify which specific groups of women are undergoing caesarean section, and to investigate possible explanations for trends in different settings. This requires the use of a classification system that can analyze and compare caesarean section rates in a consistent, standardized, reliable, reproducible, and action-orientated manner. The principles of an ideal classification system are simplicity, clinical relevance, accountability, reproducibility, and verifiability. The use of a single classification system that meets all of these criteria, can facilitate audit, analysis and comparison of caesarean

section rates across different settings, and help establish and implement effective strategies specifically targeted at optimizing caesarean section rates where necessary.

Classification systems construct specific groups or categories using different parameters or characteristics. These groups or categories share a defined property, feature or quality, and can be used to assess a variety of outcomes. A number of classification systems have been proposed and implemented in different settings. Examples of such classification systems include those based on indications for caesarean section, on the degree of urgency, and on individual woman characteristics. Other types of classifications address questions such as where the caesarean section is being performed, by whom, and under what conditions or circumstances.

Traditionally, the most frequently used classification systems for caesarean sections have been based on **indication for caesarean section**. The main question answered by this type of classification system is “why” the caesarean section is being performed. A large study in the United States demonstrated that most caesarean sections can be related to one of four indications, namely, fetal distress, dystocia, breech presentation, and previous caesarean section.⁸¹

Van Zyl et al (2006) conducted a ten-year retrospective audit of the caesarean section rate at Mowbray Maternity Hospital, and grouped the caesarean sections into one of five categories, namely, fetal indications, failure to progress, malpresentations, previous caesarean section, and other.⁸² Indication based classification systems have the advantage of being easy to implement, as they use information that is collected routinely at most maternity units. Additionally, they can provide information on maternal versus fetal indications, and absolute versus relative indications. On the negative side, however, the categories have low reproducibility, are not mutually exclusive, and are only made totally inclusive by the inclusion of the category ‘other’, which makes the analysis of data difficult and is not often clinically useful.

Classification systems based on the **degree of urgency** were originally proposed by the anaesthetists and answer the question of “when” the caesarean section should be performed.⁸³ Whilst the reduced number of categories make these classification systems easy to understand and implement, the lack of clear definitions for each category limits the reproducibility as well as the amount of clinically useful information obtained.

Classification systems based on **women characteristics** answer the question of “who” is being submitted for caesarean section. Most of these systems are conceptually easy, using clearly defined categories that are totally inclusive and mutually exclusive. As with indication-based classifications, the information required is routinely collected in most maternity units, making these systems easy to implement. The categories have good reproducibility, and offer the additional advantage of being prospectively identifiable. These systems have been tested in large datasets in different countries, and have been shown to be clinically useful, with their only shortcoming being the lack of information provided on indication for caesarean section.

Other classification systems answer the question of “where”, “how”, and “by whom” the caesarean section is being performed. Although these systems address important details often overlooked by other classification systems, many of them are still only theoretical, requiring information not always routinely collected in all maternity units.

A recent systematic review by Torloni et al (2011) analyzed the advantages and deficiencies of the above-mentioned existing classification systems for caesarean section. Results showed that while woman based classification systems performed the best, classification systems based on indications and degree of urgency were limited by several shortcomings such as low reproducibility and the inclusion of categories that were not mutually exclusive. Women-based classification systems, in particular a classification system developed by Robson, were found to be conceptually easy, totally inclusive, mutually exclusive, reproducible, and allowed prospective identification of categories. It is evident that the use of a single internationally applicable classification system for caesarean section would facilitate the process of audit, analysis, and comparison of caesarean section rates across different settings and thereby help to create and implement effective strategies specifically targeted at optimizing caesarean section rates where necessary. The review concluded that women-based classification systems in general, and Robson’s classification in particular, were best suited for this purpose.⁷

The Robson Classification System

The Robson Ten Group Classification System (TGCS), as described in Table A1 of the appendix, provides a framework for auditing and analyzing caesarean section rates. It is based on four key obstetric concepts, the combinations of which have been combined to

create ten clinically relevant groups of women. The ten groups are well defined, mutually exclusive and totally inclusive, each comprising different groups of women that share some predefined quality, feature, or characteristic. The groups are simple to understand and organize, and importantly, can be prospectively determined.

The four obstetric concepts that have been used to create the Robson Ten Group Classification System are shown in Tables A2, A3, A4, and A5 of the appendix. They include the category of the pregnancy, the previous obstetric record of the pregnancy, the course of labour and delivery, and the gestational age of the pregnancy. The parameters within each of the categories are clearly defined, with no ambiguity. For instance, when determining the category of the pregnancy, it can only be single cephalic, single breech, multiple, or a transverse or oblique lie. Likewise, a woman's previous obstetric record can only be nulliparous, multiparous without a previous scar, or multiparous with at least one previous scar. Through the use of these four obstetric concepts, women can be placed into one of Robson's ten clinically distinct groups. Caesarean section rates can then be determined, not only as a whole, but also within each group, thereby providing insight into the precise makeup of the overall caesarean section rate. Comparisons can be made within one unit, as well as between different units, and where necessary, changes in the management of pregnancy and labour can be implemented, targeting specific groups of women.⁸

Many obstetric units around the world have successfully implemented Robson's Ten Group Classification System. Brennan et al (2009) conducted a comparative analysis of caesarean section rates from nine different countries using the TGCS. His analysis included 47 402 deliveries, and reported that Groups 1, 2, and 5 of the TGCS consistently made the most significant contribution towards the overall caesarean section rate, contributing an average 45- 60% when combined.⁸⁴ Similar findings have been reported in other studies, including an audit performed at the Kalafong Hospital in South Africa, where caesarean section rates of 15,1%, 48,4%, and 85,2% were reported in Groups 1, 2, and 5 respectively, contributing 48% towards the overall caesarean section rate of 22,5%.⁸⁵ Identification of the groups that make significant contributions to the overall caesarean section rate is important in the process of audit, as even small changes to the caesarean section rate within each of these groups may result in significant changes to the overall caesarean section rate.

Rationale for current study

This literature review shows that caesarean section rates remain a contentious issue for doctors, midwives, women and society as a whole. It is apparent that caesarean section rates cannot be considered in isolation from other important indicators, such as maternal and perinatal morbidity and mortality, local resources and expertise, and perhaps most importantly, maternal satisfaction.

It is evident that good obstetric practice would involve the process of audit and feedback using a standard classification system. This process of continuous critical review would allow comparisons to be made within one unit and between different units, it would facilitate possible improvements to be implemented where necessary, and ultimately, each individual unit would be able to determine its own appropriate caesarean section rate.

As stated by Robson, “ *The aim in the future should not be to worry whether the caesarean section rate is too high or too low, but rather what it is, why, and whether it can be considered to be appropriate, taking into consideration all the relevant outcome factors*”.⁵

The caesarean section rate at Mowbray Maternity Hospital has increased dramatically over the past fifteen years. It would be useful to apply Robson’s Ten Group Classification System to the deliveries at Mowbray Maternity Hospital, as not only would this provide information on the precise makeup of the caesarean section rate, but would also allow for comparison with other units, and possible targeted intervention where appropriate.

AIMS AND OBJECTIVES

The principal aim of this study is to implement the Robson Ten Group Classification System for auditing caesarean section at Mowbray Maternity Hospital, Cape Town.

Specific objectives are:

- i. To determine the caesarean section rate for the year 2009.
- ii. To identify the main contributors to the caesarean section rate as identified by the TGCS, in order to identify groups possibly in need of intervention.
- iii. From these findings to form a reference point in the process of ongoing audit of the caesarean section rate at Mowbray Maternity Hospital.

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METHODS

Study Design

A descriptive, retrospective audit was performed, reviewing all caesarean sections and deliveries that took place in 2009 at Mowbray Maternity Hospital (MMH) and at the four Midwife Obstetric Units (MOUs) that operate in Mowbray's catchment area, namely Liesbeck MOU, Gugulethu MOU, Khayelitsha MOU, and Mitchell's Plain MOU.

Study Setting

The Midwife Obstetric Units are primary care units, providing antenatal care and delivery facilities to patients who are considered to be low risk. These patients are predominantly from a lower socio economic background. The MOUs are staffed exclusively by midwives, with support provided by doctors from Mowbray Maternity Hospital who attend a weekly antenatal problem based clinic. Mowbray Maternity Hospital (MMH) is a secondary level, public maternity hospital. It is situated in the southern suburbs of Cape Town in the Western Cape, South Africa. It is an extremely busy hospital, conducting approximately 9000 deliveries per year. Mowbray is staffed by midwives, interns, registrars, and specialists, and receives referrals of complicated patients from the four Midwife Obstetric Units. The labour ward comprises twenty-three beds, and is subdivided into an admission suite, a first stage section, and a second stage section. There are two operating theatres, of which one is available for after-hours emergencies. The obstetric service is well supported by a tertiary level neonatal unit, based at Mowbray Maternity Hospital. Women requiring tertiary care are referred to Groote Schuur Maternity Centre.

Study Population

All women who gave birth at Mowbray Maternity hospital and its four catchment MOUs during 2009 were included.

Deliveries of fetuses less than 500 grams were excluded as these are considered to be miscarriages in our setting.

Study Subjects

All women who had a caesarean section at MMH during 2009

Methodology

Labour ward registers at MMH and the four MOUs, theatre delivery registers at MMH as well as the computerized databank CRADLE, was reviewed to obtain the data necessary to categorize each delivery, whether vaginal or by CS, into the Robson Ten Group Classification System, as shown in Table A1. (Appendix)

Any incomplete or erroneous content in the data was corrected by conducting a manual review of the relevant patient folder. This applied specifically to multiparous patients, where it was often unclear from the registers as to the previous mode of delivery. Information regarding induction of labour was obtained from the misoprostol and prandin registers, as well as from the databank CRADLE. Again, any incomplete or uncertain data was confirmed by reviewing the patient folder.

Data Collection and Analysis

Data pertaining to the four obstetric concepts, as defined by Robson, was collected and analyzed. The data is presented in tables and graphs. Where appropriate, 95% Confidence Intervals are presented for proportions. The Fisher exact method was used for these estimates. The data represents a complete year of deliveries for the Regional Hospital (Mowbray Maternity Hospital) and its referring maternity units. It therefore represents a complete analysis of an entire geographical area.

These four obstetric concepts are depicted in Tables A2, A3, A4, and A5. (Appendix). The first obstetric concept, the **category of the pregnancy** (Table A2), is subdivided into single cephalic pregnancy, single breech pregnancy, single oblique or transverse lie, and multiple pregnancy, whilst the second obstetric concept provides detail of the **previous record of pregnancy**, namely nulliparous, multiparous without a uterine scar, or multiparous with a uterine scar (Table A3). The third obstetric concept describes the **course of labour and delivery** as either spontaneous labour, induced labour, or caesarean section before labour (Table A4), and the fourth obstetric concept records the gestational age of the pregnancy (Table A5). By applying these four obstetric concepts,

each delivery, be it vaginal birth or caesarean section, could be categorized into one of Robson's ten groups (Table A1).

The data collected was entered onto an excel spreadsheet, and analyzed using the STATA statistical program with the help of a statistician.

Sample Size

In 2008, there were 18,870 deliveries at MMH and the four MOUs; and 3694 Caesarean sections performed. It was anticipated that if all deliveries and caesarean sections were analyzed for 2009, the numbers would be similar and would be a sufficiently large sample to be representative and on which to interpret results. The audit encompasses a calendar year and the sample size is therefore a practical sample. The data and confidence intervals provide strong statistical power because of the large sample.

Ethical Considerations

All information was treated confidentiality and in accordance with the *Helsinki declaration*.⁸⁶

Permission was obtained from the Department of Obstetrics and Gynaecology Research Committee and the University of Cape Town Ethics Committee. Since the study is a retrospective review of registers and records, there was no need for individual consent forms.

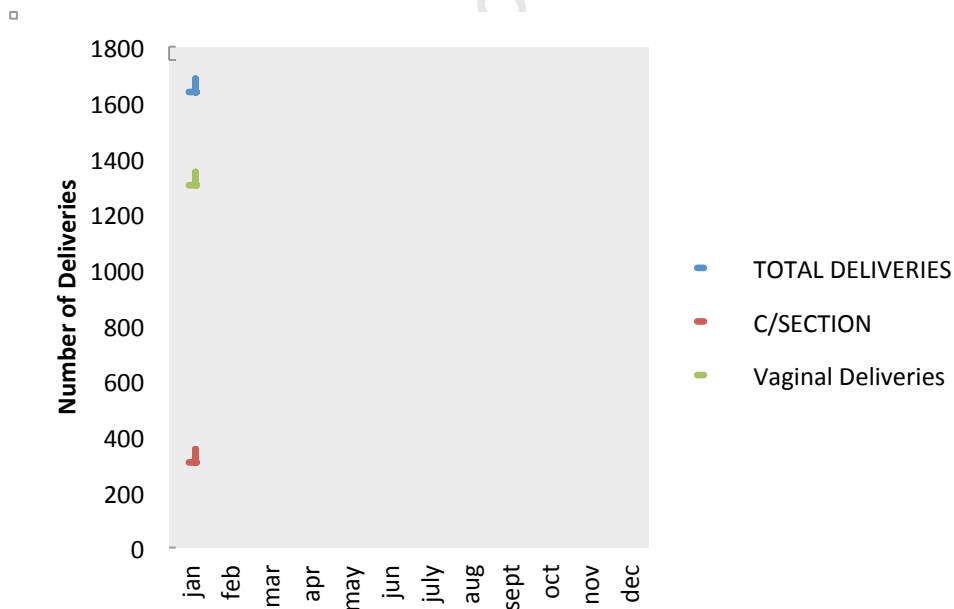
RESULTS

Annual Statistics

In total, 19094 women gave birth to 19355 babies between 1 January 2009 and 31 December 2009 at Mowbray Maternity Hospital and its four catchment MOUs. During this period, 3949 caesarean sections were performed, resulting in an overall caesarean section rate of **20,7%**. The total number of vaginal deliveries was 15,145 of which 633 were instrumental. There were 2 maternal deaths, resulting in a maternal mortality ratio of 10,5 per 100 000 live births, and a total of 436 perinatal deaths, resulting in a perinatal mortality rate of 22,5 per 1000 deliveries.

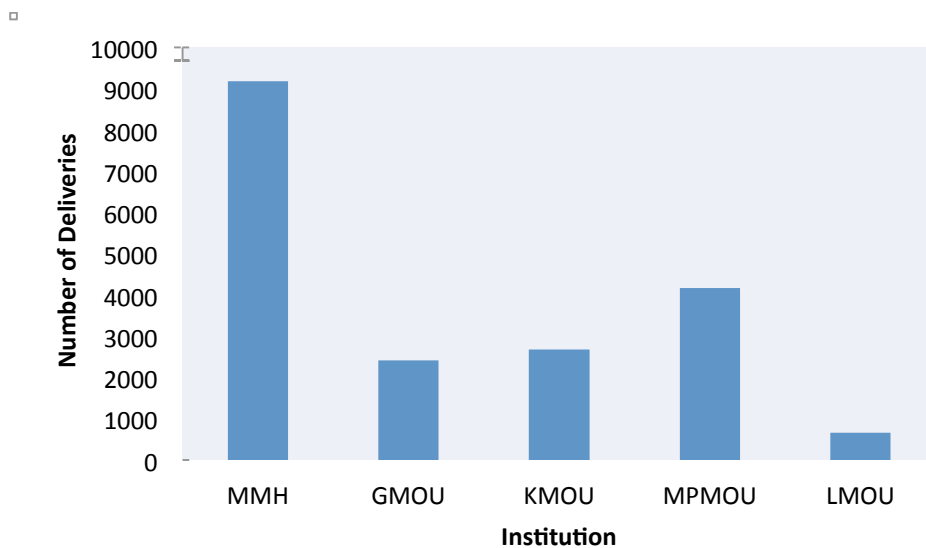
Figure 1 represents the distribution of deliveries across the year, with August recording the most deliveries at 1685, and February the fewest at 1438. The number of caesarean sections performed each month remained relatively stable, ranging from 304 – 354.

Figure 1: Distribution of Deliveries across the Year



Overall, 9175 women delivered at Mowbray Maternity Hospital, 2414 at Gugulethu MOU, 2677 at Khayelitsha MOU, 664 at Liesbeck MOU, and 4164 at Mitchell's Plain MOU. This is represented in **Figure 2**.

Figure 2: Distribution of Deliveries between the Institutions



The study population comprised 7098 nulliparous women, 10415 multiparous women without a previous uterine scar, and 1581 women with a previous uterine scar. There were 2332 deliveries at a gestational age of < 37 weeks gestation, and 16762 deliveries at \geq 37 weeks gestation. **Table 1** represents the distribution of the deliveries based on the category of the pregnancy.

Table 1: The Category of the Pregnancy

Category	Number of Deliveries
Single cephalic pregnancy	18507
Single breech pregnancy	296
Single oblique or transverse lie	30
Multiple pregnancy	261

The above-mentioned parameters, namely, the previous obstetric record, the gestational age, and the category of the pregnancy, have been used to place each of the 19094 deliveries into one of Robson's ten mutually exclusive, yet totally inclusive groups.

Robson's Ten Group Classification System

The ten groups of women that comprise Robson's Ten Group Classification System are described in **Table A1** of the Appendix.

Table 2 shows the total number of caesarean sections, the number of vaginal deliveries, and the overall total number of women who delivered in the study population during the year 2009. These totals are then subdivided to display the distribution of deliveries between the different groups

Table 2: The Distribution of Deliveries across the Ten Groups

Groups	Caesarean Sections	NVDs	Total Deliveries
1	921	4577	5498
2	283	277	560
3	567	7688	8255
4	241	439	680
5	1136	259	1395
6	94	13	107
7	156	33	189
8	156	105	261
9	29	1	30
10	366	1753	2119
TOTAL	3949	15145	19094

It is evident that Groups 1 and 3 contribute the most to the overall number of deliveries, with 5498 deliveries in Group 1, and 8255 deliveries in Group 3.

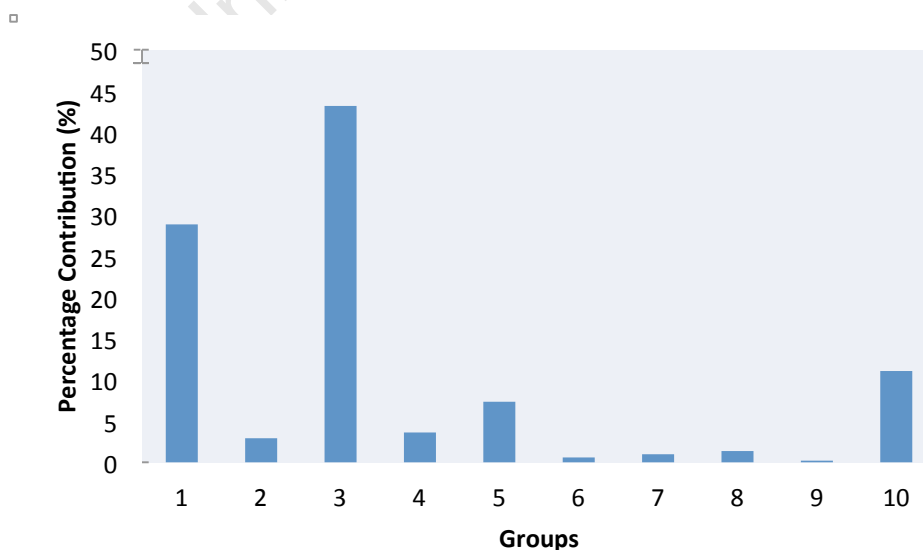
Group 1 includes all nulliparous women with a single pregnancy, at ≥ 37 weeks gestation in spontaneous labour. Likewise, Group 3 includes all multiparous women with a single cephalic pregnancy at ≥ 37 weeks gestation in spontaneous labour. Both of these groups therefore represent relatively uncomplicated labours.

Groups 5 and 10 also make significant contributions to the overall number of deliveries, with 1395 deliveries in Group 5 and 2119 deliveries in Group 10. Group 5 consists of all women with at least one previous uterine scar and a single cephalic pregnancy at ≥ 37 weeks gestation, and Group 10 consists of all women with a single cephalic pregnancy at ≤ 36 weeks gestation, including women with previous scars.

Relative Size of the Groups

Figure 3 shows the proportions of total deliveries within each of the ten groups. It reflects that relatively low risk nulliparous and multiparous women form the majority of our study population

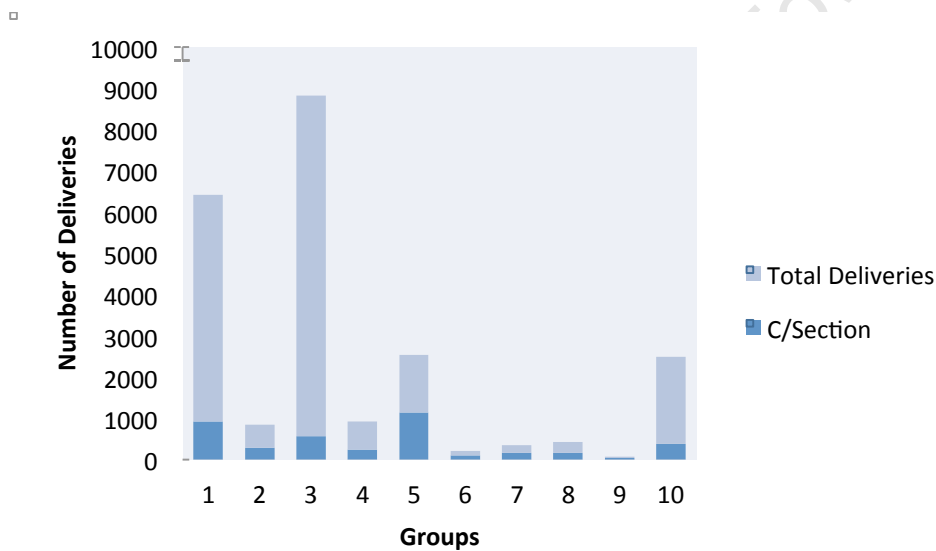
Figure 3: The proportion of deliveries within each of the ten groups



Aside from Groups 1, 3, 5, and 10, which contribute 29%, 43%, 7%, and 11% respectively, the remaining groups together contribute less than 10% to the overall total number of deliveries. Groups 6,7,8, and 9 include malpresentations and multiple pregnancies. Groups 2 and 4 include nulliparous and multiparous women where induction of labour or caesarean section was performed prior to labour. It is interesting how small these two groups are when seen as a proportion of all deliveries.

Figure 4 depicts the proportion of deliveries that were caesarean births within each of the ten groups.

Figure 4: Distribution of Caesarean sections within each of the ten groups



Again, it reflects that relatively low risk nulliparous and multiparous women form the majority of our study population.

Caesarean Section Rates

The overall caesarean section rate for our study population in 2009 is **20,68%**.

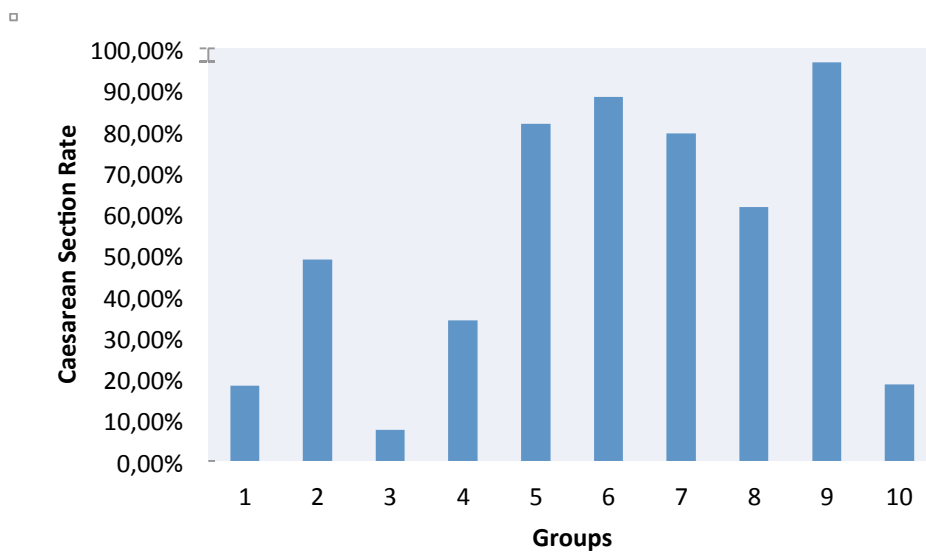
Table 3 shows the caesarean section rate for each of Robson's ten groups, calculated by dividing the number of caesarean sections by the number of deliveries in each individual group.

Table 3: Caesarean Section Rates within the Ten Groups

Groups	Percentage	95% Confidence Interval
1	16,8%	15,8 - 17,8
2	50,5%	46,3 - 54,8
3	6,9%	6,3 - 7,4
4	35,4%	31,8 - 39,2
5	81,4%	79,3 - 83,4
6	87,9%	80,1 - 93,0
7	82,5%	76,4 - 87,7
8	59,8%	53,6 - 6,8
9	96,7%	82,8 - 99,9
10	17,3%	15,7 - 18,9
TOTAL	20,7%	20,1 - 21,3

Figure 5 gives a graphic representation of these values.

Figure 5: Caesarean Section Rates within the Ten Groups



The highest caesarean section rates are seen in Groups 9, 6, 7, and 5.

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Percentage Contribution of each Group to the Overall Caesarean Section Rate

Table 4 represents the percentage contribution that each group makes to the overall caesarean section rate. It takes into account the cesarean section rate in each group, as well as the relative size of each group.

Table 4: Contribution of each Group to Overall Caesarean Section Rate

Groups	Percentage	95% Confidence Interval
1	4,8%	4,52 - 5,14
2	1,5%	1,32 - 1,66
3	3,0%	2,73 - 3,22
4	1,3%	1,11 - 1,43
5	6,0%	5,62 - 6,29
6	0,5%	0,40 - 0,60
7	0,8%	0,69 - 0,96
8	0,8%	0,69 - 0,96
9	0,2%	0,10 - 0,22
10	1,9%	1,73 - 2,12

From these results, it is evident that Groups 5, 1, and 3 contribute the most to the overall caesarean section rate.

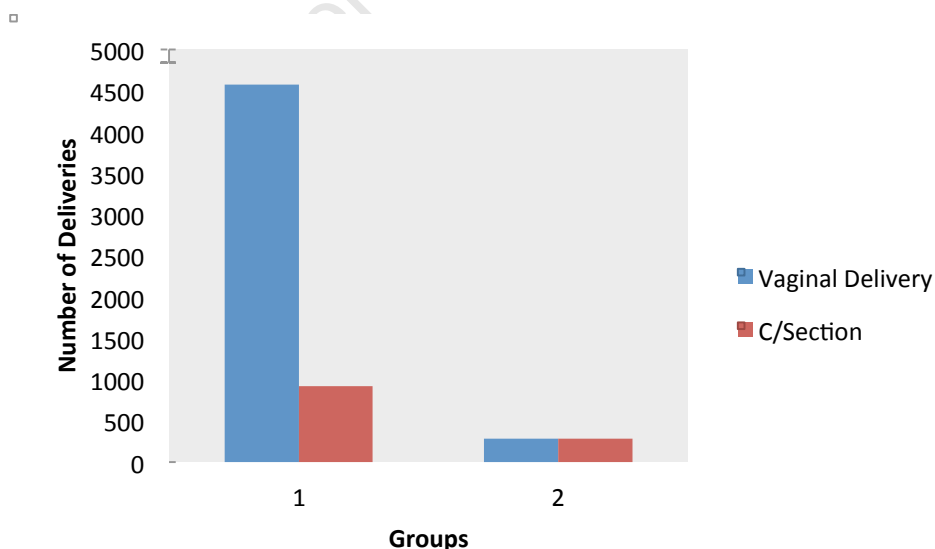
As mentioned previously, Group 5 consists of all multiparous women with at least one previous uterine scar and a single cephalic pregnancy at ≥ 37 weeks. Although this group only comprises 7% of the overall deliveries, the caesarean section rate is high at 81,4%, resulting in a majority contribution of 6% to the overall caesarean section rate of 20,7%. This group is therefore the largest contributor to the overall caesarean section rate.

Further analysis of each Robson group

Groups 1 and 2:

Groups 1 and 2 include all nulliparous women with a single cephalic pregnancy at ≥ 37 weeks gestation. In Group 1, the labour is spontaneous, and in Group 2 the labour is either induced or a caesarean section is performed before the onset of labour. There were 5498 deliveries in Group 1, and 560 deliveries in Group 2. Of the deliveries in Group 2, 548 were induced, and 12 had a caesarean section prior to the onset of labour. Together, these nulliparous women of Groups 1 and 2 contribute almost 32% of the total deliveries, with a combined caesarean section rate of 19,9%. When this is broken down further, the caesarean section rate in the spontaneous labour group (1) is 16,8%, and in the induced labour and caesarean section before labour group (2) is 50,5%. Of the 548 women who underwent induction of labour in this group, 271 required an emergency caesarean section, resulting in a caesarean section rate of 49.5% when labour is induced in nulliparous singleton pregnancies. This is represented in **Figure 6**. As the majority of women are categorized in Group 1, 5498 versus 560 in Group 2, Group 1 ultimately makes the more significant contribution to the overall caesarean section rate.

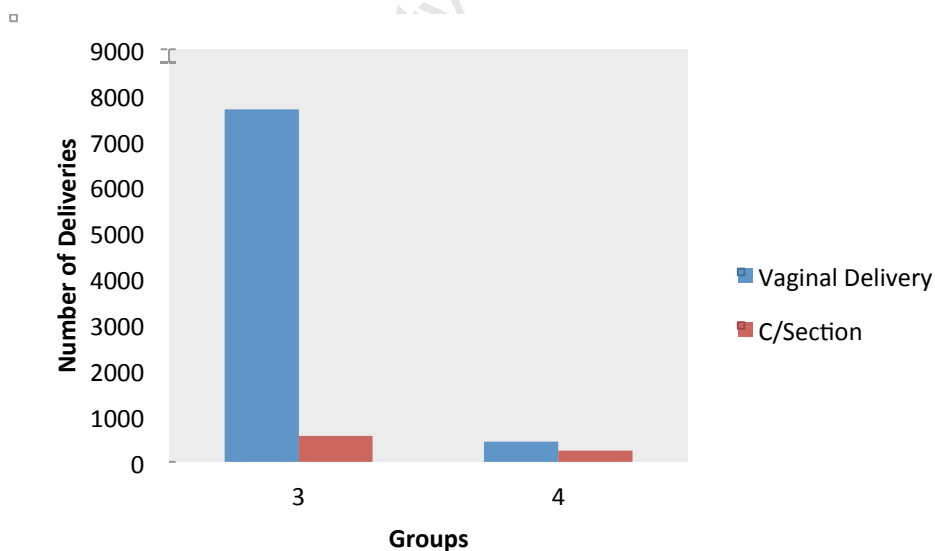
Figure 6: Deliveries in Groups 1 and 2



Groups 3 and 4

Similarly, Groups 3 and 4 include all multiparous women, without a previous uterine scar, with a single cephalic pregnancy at ≥ 37 weeks gestation. In Group 3, the labour is spontaneous, and in Group 4, the labour is induced or a caesarean section was performed before labour. Together, Groups 3 and 4 contribute 8255 and 680 deliveries respectively, amounting to a total of 8935 deliveries, which forms 46,8% of the overall total number of deliveries. In Group 4, there were 45 deliveries where a caesarean section was performed prior to the onset of labour, whilst the remaining 635 had labour induced. The combined caesarean section rate for these groups is 9%, but again with a marked discrepancy of 6,9% for the spontaneous labour group (3), and 35,4% for the induced labour/caesarean section before labour group (4). Of the 635 multiparous patients who had labour induced in Group 4, 196 required an emergency caesarean section, resulting in a caesarean section rate of 30.9% in multiparous singletons undergoing induction of labour. Despite the lower rate in Group 3, the relatively larger number of women categorized in this group, make it a more significant contributor to the overall caesarean section rate. See **Figure 7**.

Figure 7: Deliveries in Groups 3 and 4



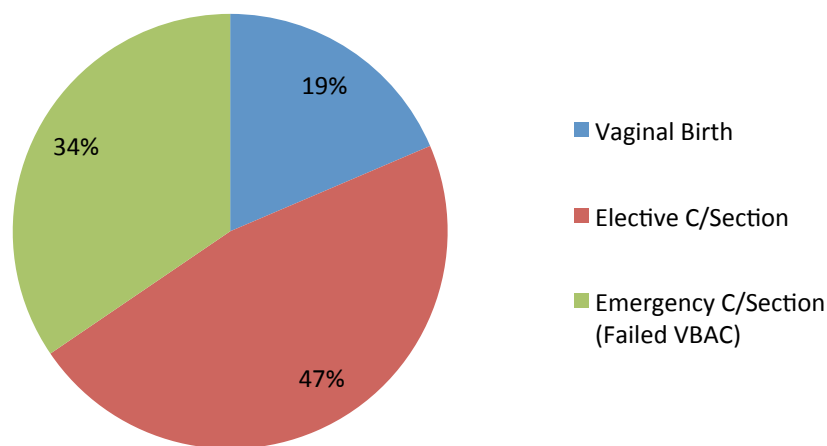
Group 5: Previous Caesarean Delivery

Group 5 represents all multiparous women with at least one previous uterine scar, and a single cephalic pregnancy at greater than or equal to 37 weeks gestation. There were 259 vaginal deliveries, and 1136 caesarean sections in this group, resulting in an overall caesarean section rate of 81,4%. Of the 1136 caesarean sections, there were 654 elective caesars, 481 emergency caesarean sections following the onset of spontaneous labour, and 1 induction of labour.

The overall success rate for vaginal birth after caesarean section was **18,6%**, although the denominator for this figure includes women with two or more previous caesarean sections. These results are represented in **Figure 8**.

Figure 8: Group 5 - Delivery following Previous Caesarean Section

□



A total of 740 women attempted vaginal birth after caesarean section, and 259 were successful, resulting in a success rate of 35% of those attempting VBAC.

Groups 6 and 7: Breech Presentation

Group 6 represents nulliparous women with a single breech pregnancy. There were 94 caesarean sections out of a total of 107 deliveries in this group, giving an overall caesarean section rate of 87,9%. Of the 94 caesarean sections, 13 were elective, and 63 emergency caesarean sections. One patient inadvertently underwent an induction of labour prior to having an emergency caesarean section.

Group 7 represents all multiparous patients with a single breech pregnancy, including women with previous uterine scars. The caesarean section rate in this group is 82,5%. Of the 156 caesarean sections, 67 were elective caesarean sections, and 68 emergency caesarean sections.

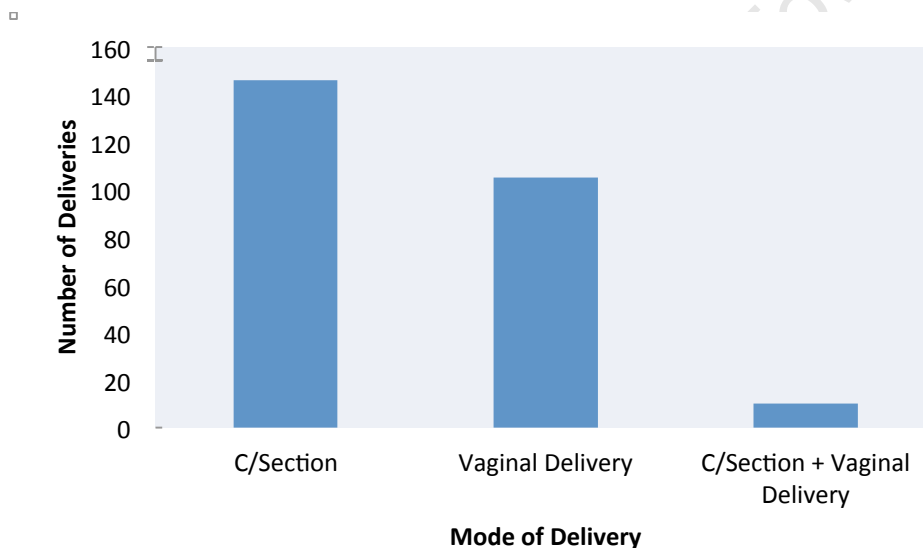
The combined caesarean section rate for nulliparous and multiparous women with a breech pregnancy is 84,5%. Unfortunately, there was no data regarding the practice of external cephalic version available for the year 2009.

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Group 8: Multiple Pregnancies

Although the caesarean section rate in Group 8 is relatively lower than that seen in the above-mentioned groups, it is still in excess of 50%. Group 8 includes all women with multiple pregnancies, including women with previous scars. There were a total of 261 twin pregnancies in our study group in 2009, of which 105 had both babies delivered vaginally, 146 had both babies delivered by caesarean section, and 10 women delivered one twin via the vaginal route, and the other via caesarean section. This is shown in **Figure 9**.

Figure 9: Group 8 - Multiple Pregnancies



Of the 156 caesarean sections performed in Group 8, 46 were elective cases, 99 were emergency caesarean sections following the spontaneous onset of labour, and 11 were emergency caesarean sections following induction of labour.

Group 9: Transverse Lie

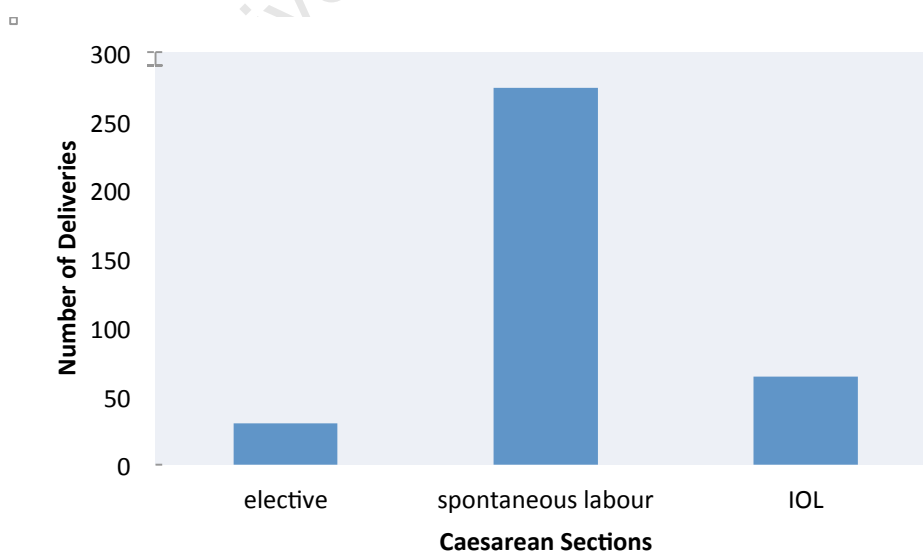
Group 9 comprises all women with a single pregnancy with a transverse or oblique lie, including women with previous uterine scars. The caesarean section rate in this group is 96,7%.

Groups 9,6, and 7 all have caesarean section rates over 80%. It must be noted, however, that the relatively small size of each of these groups results in an overall combined contribution of less than 2% to the total deliveries in the study population.

Group 10: Preterm Delivery

Group 10 includes all women with a single cephalic pregnancy at less than or equal to 36 weeks gestation. In this group, there were 366 caesarean sections, and 1753 vaginal deliveries, resulting in an overall caesarean section rate of 17,3%, which contributed just fewer than 2% of the overall caesarean section rate. Of the 366 caesarean sections, 30 were elective, 274 following the spontaneous onset of labour, and 62 following induction of labour. This is represented in **Figure 10**.

Figure 10: Caesarean Sections in Group 10



DISCUSSION

Mowbray Maternity Hospital, together with its four MOUs, Gugulethu, Khayelitsha, Liesbeck, and Mitchell's Plain, accounted for 19 094 deliveries in the year 2009. This has increased from the 14 000 deliveries reported in the same population in 2003. The caesarean section rate increased significantly from 9,9% in 1994 to 19,5% in 2003, but remained relatively stable at 20,7% in 2009. Despite this, the increasing numbers make it imperative that a process of ongoing audit be implemented so that comparisons and improvement of care can take place where necessary.

Caesarean section rates cannot be considered in isolation from other important health indicators. There were 2 maternal deaths in the study population in 2009, which compares favourably with the 3 reported in 2003. At the time of this study, however, there was no system in place for the regular reporting of maternal complications resulting from caesarean section such as postpartum haemorrhage, injury to bladder, ureter or bowel, puerperal sepsis, or thromboembolism. Subsequently, the Best Care Always initiative has been introduced at MMH as a way of monitoring surgical site sepsis. It would be useful to introduce similar processes of audit for the analysis of other complications.

The perinatal mortality rate of 28/ 1000 deliveries in 1994 decreased to 23,4/ 1000 deliveries in 2003, and remained relatively stable at 22,5/ 1000 in 2009. Although this trend seems to suggest that an increase in caesarean section rate may account for a decrease in perinatal mortality rate, changes in perinatal mortality rate are multifactorial, and it is possible that a further rise in caesarean sections would no longer confer benefit. It would be imperative to document and analyze other indicators of neonatal morbidity, such as hypoxic ischemic encephalopathy and complications of prematurity, before drawing any conclusions relating caesarean section rate to neonatal outcome.

Previously, most comparisons of caesarean section rates have used either overall caesarean section rates or other classification systems that are not totally inclusive or mutually exclusive, and suffer from poor reproducibility. This has limited the comparison of caesarean section rates between different units, as the obstetric populations were not always comparable. Robson's Ten Group Classification System has the advantage of analyzing the caesarean section rate in well-defined sub-groups of women that are totally inclusive and mutually exclusive. Comparative analysis of data using this classification

system helps to overcome the problem of comparing clinical outcomes, rates and ratios in diverse geographical settings and differing risk categories, as the classification works regardless of these factors. For example, Group 1 will always refer to nulliparous women with a single cephalic pregnancy at greater than or equal to 37 weeks gestation in spontaneous labour, regardless of geographical location or level of care. This justifies comparison of caesarean rates in the ten groups not only in the same unit over time, but also between different units of varying levels of care and in different geographical locations.

Tables 5 and 6 demonstrate this by comparing the relative sizes of the ten groups (Table 5), and the caesarean section rates within the ten groups (Table 6) between 5 different units. The units include Mowbray Maternity Hospital in South Africa, Kalafong Hospital in South Africa ⁸⁵, Wycombe Hospital in the United Kingdom, ⁸ the Royal Woman's Hospital (RWH) in Australia, ⁸⁷ and the University of Campinas in Brazil. ⁸⁸

Table 5: Comparison of Relative Sizes of the ten Robson Groups between Different Units

Group	Mowbray	Kalafong	Wycombe	RWH	Campinas
1.	28,8%	25,6%	24,3%	27%	22,7%
2.	2,9%	3,6%	10,8%	13,7%	7,5%
3.	43,2%	38,3%	37,4%	25,6%	26,9%
4.	3,6%	4,2%	9,6%	8,5%	7,2%
5.	7,3%	5,5%	6,8%	9,1%	21,3%
6.	0,6%	0,9%	1,9%	2,2%	1,3%
7.	1,0%	1,5%	1,5%	1,8%	1,9%
8.	1,4%	1%	1,9%	2,0%	1,9%
9.	0,2%	0,4%	0,2%	0,3%	0,6%
10.	11,1%	15%	5,7%	8,2%	8,6%

Table 6: Comparison of Caesarean Section Rates between Different Units using Robson's Ten Group Classification System

Group	Mowbray	Kalafong	Wycombe	RWH	Campinas
Nr of Deliveries	19094	5375	2876	5833	628
1.	16,8%	15,1%	7,2%	15,4%	25,2%
2.	50,5%	48,4%	23,0%	42,6%	63,8%
3.	6,9%	8,3%	1,6%	3,7%	20,7%
4.	35,4%	44,2%	12,0%	23,1%	51,1%
5.	81,4%	85,2%	62,4%	77,0%	70,1%
6.	87,9%	68,0%	92,6%	86,8%	100%
7.	82,5%	64,6%	81,0%	78,3%	100%
8.	59,8%	53,9%	57,4%	62,6%	58,3%
9.	96,7%	30,0%	100%	100%	100%
10.	17,3%	29,3%	32,1%	34,7%	42,6%
TOTAL	20,68%	22,5%	16,3%	28,7%	43,3%

By examining **Table 5**, it is evident that Groups 1 and 3 form the majority of the study population at Mowbray Maternity Hospital. This is also true of the other hospitals. Thereafter, Group 10 is the next most important contributor to the population at MMH. This is consistent with the findings at the other South African unit, Kalafong Hospital. Medical and obstetric complications such as preeclampsia and intrauterine growth restriction often necessitate delivery before term. As these deliveries would fall into Group 10, it is this group that is often considered representative of the extent to which these conditions affect a certain population.

The caesarean section rates reported from the University of Campinas in Brazil are considerably higher across the ten group categories when compared to rates reported from other international units. The notable exception however, is in Group 5, where caesarean section rates in excess of 80% have been reported from both South African units. The caesarean section rates between the rest of the ten groups are also relatively consistent between the two South African Units. Of note, the caesarean section rate for the two South African units is notably more for groups 1 and 3 than for the UK Wycombe unit.

The combination of Groups 1, 3, and 5 contribute an average of 66,7% to the overall caesarean section rate at Mowbray Maternity Hospital. It would therefore be useful to examine these groups in more detail.

As mentioned previously, Groups 1 and 3 include women with a single cephalic pregnancy at ≥ 37 weeks gestation in spontaneous labour in nulliparous and multiparous women respectively. Both of these groups represent relatively large numbers of women, therefore even small changes in the caesarean section rate within these groups will ultimately lead to a substantial increase in the overall rate. A further consequence of this, is a resultant increase in the number of women with a previous caesarean section in subsequent pregnancies, most of which would then be categorized into Group 5. This is evidenced in Table 5, where a high overall caesarean section rate in the Brazilian population over time has resulted in Group 5 comprising 21,3% of the obstetric population. Vaginal birth after caesarean section remains a contentious issue. It is therefore important that the factors influencing the management of labour in relatively uncomplicated pregnancies are examined and optimized where possible.

The influence of the HIV epidemic on the management of pregnancy and labour in South Africa cannot be over emphasized. In 2010, the WHO estimated that 34 million people worldwide were living with HIV, almost 70% of whom were in sub-Saharan Africa.⁸⁹ In South Africa, the national HIV infection rate among pregnant women attending antenatal clinics increased from $< 1\%$ in 1990 to 32,2% in 2012, with the Western Cape reporting the lowest rates at 18,5%, and KwaZulu Natal the highest rates at 39,5%.⁹⁰ In 2009, approximately 18-20% of women delivering at Mowbray Maternity Hospital were HIV positive. In the absence of intervention, one third of pregnant HIV positive women will transmit HIV to their child. With the use of antiretroviral therapy and scheduled caesarean section, however, perinatal transmission rates can be reduced from 20-30% to 1-2%.

Although Robson's Ten Group Classification does not identify the indication for caesarean section, previous research by Van Zyl et al (2003) reported that caesarean sections performed for fetal distress, failure to progress and malpresentations contributed the most to the increased caesarean section rate at MMH.⁸² HIV has an impact on each of these indications.

At Mowbray Maternity Hospital, the diagnosis of fetal distress is made following analysis of cardiotocographic recordings. As discussed previously, electronic fetal heart rate monitoring is sensitive but poorly specific in the diagnosis of fetal distress, and was originally intended as a screening tool only, with fetal blood sampling to be used as the confirmatory test. HIV precludes the utilization of fetal blood sampling in the confirmation of fetal distress due to the risk of maternal-fetal transmission. Concerns regarding seroconversion during pregnancy have also restricted the use of this test in patients thought to be HIV negative. The inevitable result has been an increase in the number of caesarean sections in cases where fetal well-being cannot be assured.

Artificial rupture of membranes is a well-recognized and effective technique in the induction and augmentation of labour. Rupture of membranes, however, is associated with a higher risk of perinatal transmission of HIV, with the risk doubling after 4 hours, and then increasing incrementally by 2% for every hour after the rupture of membranes.⁹¹ These statistics prohibit the use of artificial rupture of membranes in cases where imminent delivery cannot be guaranteed. This results in many caesarean sections being performed for poor progress in labour that might otherwise have responded to artificial rupture of membranes.

Instrumental deliveries play an important role in the management of the delayed second stage of labour. Potentially difficult second stage caesarean sections can be avoided when either forceps or ventouse are used for the correct indication by a skilled birth attendant. The instrumental delivery rate at MMH decreased from 5,9% in 1996 to 2,1% in 2003, and remained relatively stable at 3,3% in 2009. It is generally accepted that forceps result in less fetal trauma, making them the instrument of choice in known HIV positive patients where an assisted vaginal delivery is indicated. Additionally, forceps deliveries have become a logbook requirement for registrars training in obstetrics and gynaecology.

The impact of maternal HIV infection on the way labour is managed could be the reason why the caesarean section rate for groups 1 and 3 are so much greater in our study and in South Africa, than in the United Kingdom unit which has a lower prevalence of HIV.

The Baltimore Group on Caesarean suggested that the high caesarean section rate observed in Groups 1, 3, and 5 at the Kalafong unit in South Africa could be attributed to poor pain relief in labour.⁸³ At MMH, patients are offered the use of entonox gas, morphine, or epidural anaesthesia for this purpose. Unfortunately, however, the availability of epidural anaesthesia is limited by a shortage of trained nursing staff and the constant demand for the anaesthetist in the operating theatre, especially after hours. As shown by the Guatemalan and American studies, the continuous presence of a supportive companion during labour not only shortens the duration of labour, but may also reduce the need for caesarean section.⁷⁷ Recent policy change at MMH, allows for the continuous presence of a companion in both the first and second stages of labour, and hospital *doulas* are available in cases where family members or friends are unable to attend.

Due to the risks associated with vaginal birth after caesarean section, high caesarean section rates can often be anticipated in Group 5 of Robson's classification. At both the South African units, the caesarean section rate was notably higher than at the other international sites. Also disturbing, is the decreasing success rate of those women attempting vaginal birth. At MMH, this has declined from 62% in 1994 to 40% in 2003, and even further to 35% in 2009.

The current policy at MMH regarding women with one previous caesarean section is to offer them a choice of mode of delivery following comprehensive antenatal counseling and an ultrasound for estimated fetal weight at 36 weeks gestation. Again, HIV may play a role in this group of women. The Royal College of Obstetricians and Gynaecologists have issued guidelines recommending that no women with a viral load of ≥ 50 copies/ml should undertake a vaginal birth.⁸⁷ This is perhaps even more relevant to women with a previous caesarean section where the chance of success is guarded. The rollout of antiretroviral drugs to all women with a CD4 count of ≤ 350 is an effective strategy in the reduction of viral load, but is dependent on factors such as starting viral load, duration of therapy, and compliance. Due to budget constraints, it is not currently the policy at MMH to measure viral loads on all HIV positive patients. Introduction of this in the future, however, will allow for more comprehensive counseling and informed decision making with regards to

mode of delivery, and may ultimately help reduce the caesarean section rate in those women with low viral loads.

Groups 2 and 4 represent nulliparous and multiparous women in whom labour has been induced at ≥ 37 weeks gestation or who had caesarean section prior to labour. Together, they contribute less than 3% of the overall caesarean section rate. More relevant, however, is the discrepancy between the caesarean section rates in women in whom labour has been induced when compared with those in whom labour has occurred spontaneously. For nulliparous women, the caesarean section rate of 16,8% for spontaneous labour increases to 49,5% when labour is induced. Similarly, in multiparous women, the caesarean section rate rises from 6,9% with spontaneous labour to 30,9% when labour is induced. It is evident, therefore, that the decision for induction of labour incurs a higher risk of caesarean section than when the onset of labour is spontaneous. Initiatives focusing on the reduction of induction of labour rates may ultimately help to reduce caesarean section rates. These two groups also include women who had caesarean section before labour and would be where 'caesarean section on maternal request' would be categorized. The small numbers in this group therefore also reflect the lack of policy at MMH that allows caesarean section on maternal request or without medical indication

Prolonged pregnancy is one of the most frequent indications for induction of labour at MMH. Confounding this, however, is that many of these inductions are performed on pregnancies where the gestational age is uncertain or cannot be ascertained. Reasons for this uncertainty include lack of facilities for routine early ultrasound, as well as the fact that many patients book late. Potential strategies to try and reduce the number of inductions for suspected prolonged pregnancy would include the more widespread availability of routine early ultrasound for dating purposes, and the ongoing education of women regarding the importance of early antenatal clinic booking.

Groups 6 and 7 include all breech presentations, regardless of the gestational age. Although together these groups comprise less than 2% of the overall caesarean section rate, the caesarean section rate within each of these groups remains high. This is most likely the consequence of the Term Breech Trial published by Hannah et al (2000). External cephalic version (ECV) is an effective method in reducing the number of caesarean sections needed for this indication. ECV is offered to all women with a breech presentation at ≥ 36 weeks gestation at MMH, provided there are no contraindications. HIV again plays a role, as the risk of perinatal transmission increases during the

procedure. ECV is therefore contraindicated in these patients, and in most cases results in the need for an elective caesarean section. It would be useful to audit ECV at MMH. Data concerning women's acceptance of the procedure, exclusion from the procedure due to contraindications such as HIV, the success of the procedure, and possible missed opportunities would help to provide a comprehensive overview of the management of breech presentations at MMH, and allow for improvements/ interventions to be implemented where necessary.

An increasing proportion of caesarean sections are being performed in response to maternal request, with many of these being in the absence of medical indication. In November 2011, The National Institute for Health and Clinical Excellence (NICE) issued a revised guideline on 'Caesarean Section', in which it states that women may be granted a planned caesarean section in the absence of medical indication, if, following extensive counseling regarding the overall risks and benefits of caesarean section compared to vaginal birth, the option of vaginal birth is still unacceptable to the woman. In this guideline, the importance of exploring the underlying reasons behind the request is emphasized, with particular importance placed on provision of perinatal mental support to those women with anxiety/ fear of childbirth.⁹² It is not currently the policy at MMH to offer caesarean section on maternal request alone. The reasons for this are multifactorial, but mostly determined by restrictions on theatre time, postnatal bed availability, and concerns about the additional morbidity associated with caesarean section. Women in whom tocophobia (fear of childbirth) is suspected or diagnosed are offered counseling via the Perinatal Mental Health Project.

Study Limitations

This study was retrospective in design, depending on the availability of delivery registers and the computerized data bank, CRADLE. At MMH as well as the MOUs, it was found that there was a discrepancy between the data recorded in the delivery registers and the data captured by CRADLE, with delivery entries missing from both systems. Extensive time was required to correlate the two systems before data could be captured for the study. Additionally, the CRADLE system was often 'off-line' for prolonged periods, resulting in extended time delays in acquiring the data. In instances where necessary information was missing from either system, the relevant folders had to be obtained from the Records Department. This was also a time consuming exercise, as unreliable and erratic staffing in the Records Department has resulted in an unsystematic user-unfriendly system.

Robson's Ten Group Classification System was designed with the intention of it being used as a prospective classification system. This would certainly be beneficial, as all the necessary information would be immediately available for capture and analysis. Given the total inclusivity and mutual exclusivity of the ten groups, the system is easy to follow and would therefore be easy to implement with minimal training. The current systems in place at MMH for the collection and storage of data do not include all the information necessary for the assignment of each delivery to one of Robson's ten groups. In particular, details of the previous mode of delivery and the onset of labour (spontaneous or induced) are not included in the delivery register. Data capture on CRADLE is unreliable, and often incomplete, which would again result in the need to retrieve folders.

Since this is the first time the Ten Group Classification System has been used at MMH, and previous caesarean section audits used different classifications, it was not possible to identify which categories contributed to the increasing caesarean section rate at MMH. Since there are no standards for caesarean section rate in each Robson group it is difficult to judge MMH stats and whether the rates of some are too high or too low.

Recommendations

Given the inherent problems in performing a retrospective audit, it would be beneficial to implement Robson's Ten Group Classification System on a prospective basis. Not only would this provide a longitudinal overview of the overall caesarean section rate, but it would also help identify the trends within each subcategory of women.

Detailed folder reviews of women in groups 1 and 3 who had caesarean section delivery would be useful to identify if there are any ways in which labour could be managed differently so as to avoid the primary caesarean section being performed in this relatively low risk group of women.

The relatively high caesarean section rates observed when labour is induced compared to when it occurs spontaneously, suggest that a review of indications for induction of labour and audit of practice may be beneficial. Additionally, an audit of labour ward management may help identify potentially unnecessary caesarean sections being performed in labour – especially in multiparous patients.

Although caesarean section rates for breech make a relatively small contribution towards the overall caesarean section rate, it would be useful to audit the practice of external cephalic version at MMH, to see if there are any missed opportunities.

The low success rate with which women with a previous caesarean section achieve vaginal birth is of concern. Although the reasons for this are multifactorial, it would be prudent to analyze this group in more depth, and to institute training around the issue of vaginal birth after caesarean section – both antenatally and in labour.

CONCLUSION

By implementing Robson's Ten Group Classification System at Mowbray Maternity Hospital, we were able to identify the fact that Groups 1, 3, and 5 made the greatest contribution to the caesarean section rate. Although the rates in these groups were similar to those observed in another South African unit, they were significantly higher than rates observed in units from developed countries. The impact of the HIV epidemic on obstetric practice is perhaps central to this.

It would be useful to implement the Robson Ten Group Classification System at MMH on a continuous basis, so that trends in caesarean section rates could be monitored, and changes implemented where necessary. From our experience, the absence of a reliable maternity software program makes the retrospective collection of data extremely labour intensive and time consuming. It would be beneficial to implement this classification system on a prospective basis.

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Appendix

TABLE A1:

Table A1: Robson's Ten Group Classification System
1. Nulliparous women with a single cephalic pregnancy, at greater than or equal to 37 weeks gestation in spontaneous labour
2. Nulliparous women with a single cephalic pregnancy, at greater than or equal to 37 weeks gestation who either had labour induced or delivered by caesarean section before labour
3. Multiparous women, without a previous uterine scar, with a single cephalic pregnancy at greater than or equal to 37 weeks in spontaneous labour
4. Multiparous women, without a previous uterine scar, with a single cephalic pregnancy at greater than or equal to 37 weeks gestation who either had labour induced or were delivered by caesarean section
5. All multiparous women, with at least one previous uterine scar and a single cephalic pregnancy at greater than or equal to 37 weeks gestation
6. All nulliparous women with a single breech pregnancy
7. All multiparous women with a single breech pregnancy including, women with previous uterine scars
8. All women with multiple pregnancies, including women with previous uterine scars
9. All women with a single pregnancy with a transverse or oblique lie, including women with previous uterine scars
10. All women with a single cephalic pregnancy at less than or equal to 36 weeks gestation, including women with previous scars

TABLE A2:

Table A2: The Category of the Pregnancy
Single cephalic pregnancy
Single breech pregnancy
Single oblique or transverse lie
Multiple pregnancy

TABLE A3:

Table A3: The Previous Record of Pregnancy
Nulliparous
Multiparous (without a uterine scar)
Multiparous (with a uterine scar)

TABLE A4:

Table A4: The Course of Labour and Delivery
Spontaneous labour
Induced labour
Caesarean section before labour (emergency or elective)

TABLE A5

Table A5: The Gestation of the Pregnancy
The gestational age in completed weeks at the time of delivery