ANALYSIS OF CAESAREAN SECTIONS BASED ON ROBSON CLASSIFICATION AT A TERTIARY HOSPITAL IN GHANA: A CROSS-SECTIONAL PRE- AND POST-INTERVENTION STUDY.

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Abstract

Background: Globally, caesarean section (CS) rates are rising progressively in low- and middle-income countries (LMICs) similar to high-income countries creating huge clinical and public health concerns. The WHO recommends the use of Robson classification system as a global standard in an attempt to understand the determinants of the increasing caesarean births.

Objective: To determine baseline analysis of CS using Robson classification and to identify the trends and determinants of the rising CS rate

Methods: A cross sectional study was conducted with a pre-intervention (prior to implementation of Robson caesarean classification) and post-intervention (after implementation) phases at a tertiary maternity unit in Ghana

Results: The study included 20270 deliveries comprising 9890 (48.8%) and 10380(51.2%) in the years 2012 and 2013 respectively with mean (±SD) maternal age of 28.6±5.8 years. Caesarean birth occurred in 8121 (40.1%). Caesarean rate was highest and lowest among Robson group 9 and 3 in both the pre-intervention (92.5% and 8.4%) and post-intervention (90.9% and 12.0%) phases respectively. Robson groups 5 and 9 had the highest (32.0%) and lowest (3.2%) relative contributions to the burden of CS in the pre-intervention period respectively. There were mixed findings regarding the patterns of relative contribution of the Robson groups to the burden of CS with an increase in groups 1,3,6,7 and 10, and reduction in groups 2,4,5,8 and 9 in the post-intervention year. There was statistically significant increase in the CS rate in Robson groups 1 (17.2% to 26.5%; OR=1.735, 95%CI 1.482-2.031), group 3 (8.4% to 12.0%; OR=1.478, 95%CI 1.237-1.768) and group 10 (33.8% to 38.7%; OR=1.236, 95%CI 1.056-1.449) in the post intervention phase.

Conclusion: Implementation of Robson classification into the maternity care resulted in identification of characteristics of women associated with caesarean birth: nulliparous or multiparous women with spontaneous labour and no uterine scar (group 1 and 3) and preterm gestation including previous uterine scar (group 10). We recommend further research into the clinical integration of Robson's caesarean classification with special focus on predicting maternal and perinatal outcomes.

Key Words: *Robson, caesarean section, classification, Ghana*

Introduction

Globally, caesarean section (CS) rates are rising progressively in low- and middle-income countries (LMICs) in a similar but at lower level compared with the reported high rates in the high-income countries. The rising caesarean rate is a major clinical and public health concern and a cause of global debate due to the associated potentially high maternal and perinatal risks.[1-4] However, there is considerable disagreement on the consensus concerning the appropriate caesarean rate for a given population. It is generally established that the rising rates is an issue that needs further investigation and continuous discussion to regulate the trends worldwide.[5] The World Health Organization (WHO) recommended caesarean rates of 5–15% as the optimal range that is considered life-saving for the mother and infant, and emphasized that lower rates suggest unmet need whereas higher rates indicate inappropriate patient selection for the intervention.[6]

Concerns have been expressed that caesarean sections are being over utilized in the absence of clinically acceptable indications. The CS rate at Korle Bu Teaching Hospital (KBTH), where the study was conducted, is high (approximately 40%) although the overall national rate is about 16%.[7-9] Globally, several interventions and strategies have been implemented with the overall objective of reducing the non-medically indicated CS. Accordingly, various classification systems for CS have been described in an attempt to objectively identify reasons for the progressively increasing CS rates but none has been universally accepted, due to significant intra- and inter- institutional variations.[1,5] In the process, the ten-group caesarean classification system was described by Michael Robson in 2001. This classification provides a framework for monitoring, auditing and analysing CS rates at the facility level and it is consistently applicable with

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minimal resources.[10,11] The Robson's classification model (Table 1) is mutually exclusive, totally inclusive, clinically relevant and these unique features allow reporting and analysis of data in a clinically meaningful manner in relevant groups of women.[10-12]

A systematic review on the classification systems for caesarean delivery conducted by the WHO identified 27 classifications based on the indications, degree of urgency and women's characteristics.[1] The review determined that there is no ideal classification system for CS but a hybrid system using the Robson classification, based on women's characteristics could prove very helpful in understanding caesarean trends and the differences between diverse settings. In 2015, the WHO recommended the use of the Robson classification system for CS as a global standard for assessing and comparing of caesarean deliveries in and between health facilities[4] and this statement has been supported by other international organizations.[13,14]

The primary objective of this study was to provide baseline analysis of CS performed at the KBTH by using Robson classification and to identify the pattern and main determinants of the rising CS rate following its formal implementation in the routine clinical data collection.

Methods

This was a cross sectional study conducted at the Maternity of the Korle-Bu Teaching Hospital (KBTH), the largest teaching hospital in Ghana conducting about 10,000 annual deliveries. Korle-Bu Teaching Hospital is a tertiary referral centre situated in the capital, Accra and serves a population of over three million inhabitants. The national free childbirth health insurance scheme covers most of the pregnant women obtaining maternity services in this hospital.

The study consisted of prospective data collection on women who obtained delivery services at the maternity unit of KBTH from January 2012 to December 2013. The study design was two-fold comprising the pre-intervention phase, (from 1st January 2012 to 20th December 2012) and the post-intervention phase, (from 1st January 2013 to 31st December 2013). The Robson classification system (Table 1) was first introduced at the maternity unit in 2011 as part of a larger study titled "Validating Women's Self-Report of Emergency Caesarean Sections in Ghana and the Dominican Republic".[15] The data collection was systematically done routinely at the Biostatistics unit of the Maternity block following formal training of the Research Assistants at the unit. The preliminary findings of the initial pre-intervention research were presented during a scheduled clinical meeting at the Department of Obstetrics and Gynaecology in December 2012. The prospects and clinical advantages of the Robson system were discussed, and the healthcare providers were encouraged to actively participate in the integration of the Robson classification at the department.

Further training of the Research Assistants was carried out and prospective data collection was continued with active supervision by one obstetrician in the team. More and more medical staff in the Department had then become aware of the data collection on the Robson Ten Group classification system for caesarean section and its potential usefulness in contemporary obstetric practice. The issue of high CS rates was discussed and the potential of identifying specific determinants of the rising caesarean delivery via the use of the Robson classification was reiterated. Data collection during the year 2013 was considered post-intervention following the initial passive data collection in the year 2012 prior to its formal introduction and integration in the department, followed by creation of awareness of the potential benefits of the Robson classification. The study included all women who give birth at KBTH after foetal viability, defined as gestational age of 28 weeks or more. We excluded women who are referred to KBTH after delivery and those whose gestational ages were below 28 weeks at the time of termination of the pregnancy. The maternal variables extracted from the medical records included the demographic characteristics of the women (including maternal age), mode of childbirth, onset of labour, indication for CS, timing of the decision to perform the CS (emergency or elective). Other obstetric characteristics collected included parity, history of a previous caesarean, gestational age, multiple pregnancy, spontaneous or induced labour and foetal presentation.

The Ethical and Protocol Review Committee of the College of Health Sciences, University of Ghana approved the protocol of the study (Protocol ID number: MS-Et/M.11-P3.9/2012-13). Written informed consent was not be obtained from the participants since the data extraction was undertaken only from the medical records without any direct contact with patients whose clinical data were utilized in the study.

Data analysis

The data were analysed using SPSS version 20 (Statistical Package for Social Sciences version 20.0, SPSS Inc.; Chicago, USA). Descriptive analysis was performed and findings were presented in percentages. Chi square was used to determine the association between the CS rates in between pre-intervention and post-intervention years. P-value of <0.05 was considered statistically significant.

Results

During the study period, 21,464 deliveries were conducted at the hospital out of which 1,194 (5.6%) were excluded from the analysis on account of incomplete data resulting in 20270, comprising 9890 (48.8%) and 10380 (51.2%) deliveries respectively in the years 2012 and 2013. The mean (±SD) maternal age was 28.6±5.8 years. Among the total deliveries 8121 (40.1%) had caesarean section comprising 3868 (19.1%) and 4253 (21.0%) in the years 2012 and 2013

respectively. The distribution of CS rates within the various Robson classifications for the pre-intervention (2012) and post-intervention (2013) years are presented in Tables 2 and 3 respectively. Caesarean section rate was highest and lowest among Robson group 9 and 3 in both the pre-intervention (92.5% and 8.4%) and post-intervention (90.9% and 12.0%) years respectively (Tables 2 and 3). Robson groups 5 and 9 had the highest (32.0%) and lowest (3.2%) relative contributions to the burden of CS in the pre-intervention period. Robson groups 5, 2, 4 and 10 (in decreasing order of frequency) had a composite contribution of 69.5% to the total CS performed in the pre-intervention year (Table 2). The overall CS rate for the pre-intervention year was 39.1% (3868 CS per 9890 deliveries).

In the post-intervention year, Robson groups 5 and 8 had the highest (29.6%) and lowest (2.2%) relative contribution to the burden of CS. Robson groups 5, 10, 1 and 2 (in decreasing order of frequency) had a composite contribution of 66.8% to the total CS performed in the post-intervention year (Table 3). The CS rate for the post-intervention period was 41.0% (4253 CS per 10380 deliveries)

The pattern of relative contribution of the various Robson groups to the burden of CS is shown in Figure 1. There was an increase in the relative contribution to CS in Robson groups 1,3,6,7 and 10 in the post-intervention year. Reduction in relative contribution to CS burden occurred in Robson groups 2,4,5,8 and 9 (Figure 1)

Over the two-year period, the highest and the lowest proportions of caesarean occurring in the Robson groups 9 and 3 respectively. The highest and lowest relative contribution to the burden of CS occurred in groups 5 and 9 respectively (Table 4). Robson groups 5, 2, 10, 4 and 1 (in decreasing order of frequency) had a composite contribution of 73.8% to the total CS performed in the hospital over the two-year period. Robson groups 2, 4 and 5 accounted for over half (54%) to caesarean burden.

There was statistically significant increase in the c-section rate in Robson groups 1 (17.2% to 26.5%; OR=1.735, 95%CI 1.482-2.031), group 2 (8.4 to 12.0%; OR=1.478, 95%CI 1.237-1.768) and Group 10 (33.8 to 38.7%; OR=1.236, 95%CI 1.056-1.449).

Table 1: The Robson Ten Group Classification for caesarean section[10]

Robson Classification
1. Nulliparous, single cephalic, ≥ 37 weeks gestation, spontaneous labour
2. Nulliparous, single cephalic, ≥ 37 weeks gestation, induced labour or caesarean before labour
3. Multiparous, single cephalic, ≥ 37 weeks gestation, no uterine scar, spontaneous labour
4. Multiparous, single cephalic, ≥ 37 weeks gestation, no uterine scar, induced labour or caesarean before labour
5. Multiparous, single cephalic, ≥ 37 weeks gestation, with uterine scar
6. Nulliparous singleton breech
7. Multiparous singleton breech, including previous scar
8. Multiple pregnancies (includes previous uterine scar)
9. Singleton transverse, oblique or unstable lie, (including previous uterine scar)
10. Singleton cephalic, ≤ 36 weeks gestation, including previous uterine scar

Table 2: Robson classification groups and caesarean section rates in the year 2012 (pre-intervention)

Robson classification	**Number in Robson group n (%)**	**CS/Deliveries**	**CS rate (%)**	**Relative contribution to CS**
1	**1823 (18.4)**	314/1823	17.2	8.1
2	**775 (7.8)**	563/775	72.6	14.6
3	**2599 (26.3)**	219/2599	8.4	5.7
4	**817 (8.3)**	462/817	56.5	11.9
5	**1578 (16.0)**	1239/1578	78.5	32.0
6	**220 (2.2)**	146/220	66.4	3.8
7	**302 (3.1)**	194/302	64.4	5.0
8	**384 (3.9)**	183/384	47.7	4.7
9	**133 (1.3)**	123/133	92.5	3.2
10	**1259 (12.7)**	425/1259	33.8	11.0
TOTAL	**9890 (100.0)**	3868/9890	39.1%	100

Table 3: Robson classification groups and caesarean section rates in the year 2013 (post-intervention)

Robson classification	Number in Robson class n (%)	CS/deliveries	CS rate (%)	Relative contribution to CS
1	**1964 (18.9)**	521/1964	26.5	12.3
2	**727 (7.0)**	503/727	69.2	11.8
3	**2856 (27.2)**	342/2856	12.0	8.0
4	**753 (7.3)**	390/753	51.8	9.2
5	**1590 (15.3)**	1261/1590	79.3	29.6
6	**231 (2.2)**	164/231	71.0	3.9
7	**495 (4.8)**	322/495	65.1	7.6
8	**213 (2.1)**	93/213	43.7	2.2
9	**110 (1.1)**	100/110	90.9	2.3
10	**1441 (13.9)**	557/1441	38.7	13.1
TOTAL	**10380 (100)**	4253/10380	41.0	100.0

Table 4: Composite caesarean section rates based on Robson classification in the years 2012 (pre-intervention) and 2013 (post-intervention)

Robson classification	CS/deliveries	CS rate (%)	Relative contribution to CS (%)	Number in Robson class n (%)
1	835/3787	22.1	10.3	3787 (18.7)
2	1066/1502	71.0	13.1	1502 (7.4)
3	561/5455	10.3	6.9	5455 (26.9)
4	852/1570	54.3	10.5	1570 (7.8)
5	2500/3168	78.9	30.8	3168 (15.6)
6	310/451	68.7	3.8	451 (2.2)
7	516/797	64.7	6.4	797 (3.9)
8	276/597	46.2	3.4	597 (3.0)
9	223/243	91.8	2.7	243 (1.2)
10	982/2700	36.4	12.1	2700 (13.3)
TOTAL	8121/20270	40.1	100.0	20270 (100)

Table 4: Comparison of c-section rates between pre-intervention and post-intervention years using Robson classification.

Robson group	Pre-intervention (n=3868)	Post-intervention (n=4253)	P value	OR (95%CI)
1	314 (17.2)	521 (26.5)	0.001	1.735 (1.482-2.031)
2	563 (72.6)	503 (69.2)	0.140	0.846 (0.677-1.057)
3	219 (8.4)	342 (12.0)	0.001	1.478 (1.237-1.768)
4	462 (56.5)	390 (51.8)	0.059	0.826 (0.677-1.007)
5	1239 (78.5)	1261 (79.3)	0.585	1.049 (0.884-1.244)
6	146 (71.0)	164 (71.0)	0.289	1.241 (0.833-1.848)
7	194 (64.4)	322(65.1)	0.816	1.036 (0.768-1.398)
8	183 (47.7)	93 (43.7)	0.348	0.851 (0.608-1.192)
9	133 (92.5)	100 (90.9)	0.657	0.813 (0.325-2.031)
10	425 (33.8)	557 (38.7)	0.008	1.236 (1.056-1.449)

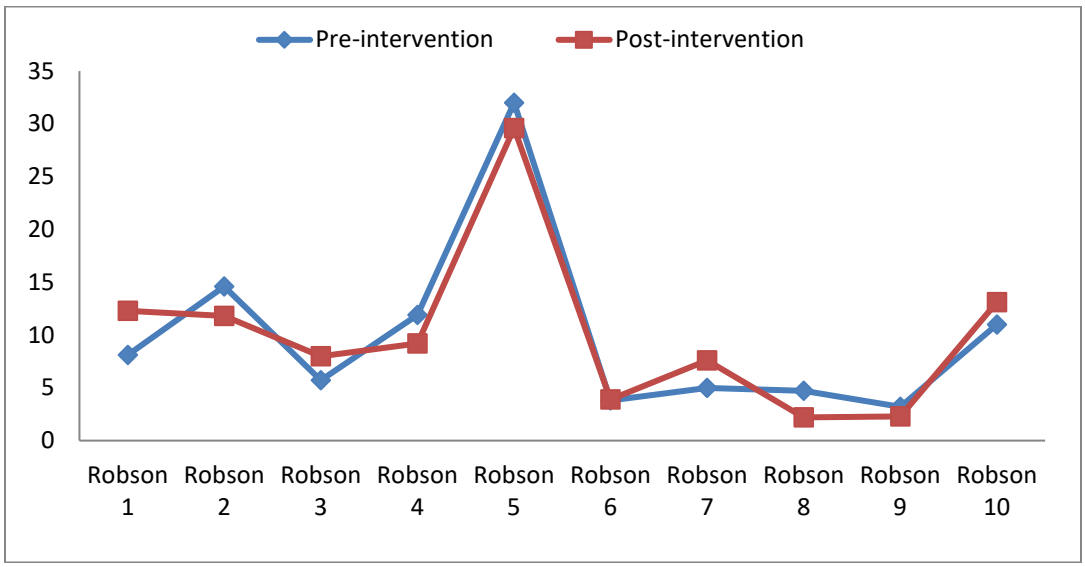

Figure 1: Pattern of relative contribution of Robson groups to the overall CS during the pre-and post-intervention years

Discussion

In this study, significant clinical findings relating to the Robson caesarean classification have been determined. The proportions of CS were highest and lowest among Robson group 9 and 3 in both the pre-intervention (92.5% and 8.4%) and post-intervention (90.9% and 12.0%) phases respectively. Robson groups 5 and 9 had the highest (32.0%) and lowest (3.2%) relative contributions to the burden of c-section in the pre-intervention period. Robson groups 5, 2, 4 and 10 had a composite contribution of 69.5% to the total CS performed in the pre-intervention year. In the post-intervention year, Robson groups 5 and 8 had the highest (29.6%) and lowest (2.2%) relative contribution to the burden of CS. Robson groups 5, 10, 1 and 2 had a composite contribution of 66.8% to the total CS performed in the post-intervention year. Overall, Robson group 5 had the highest relative contribution to the caesarean burden (30.8%) and this is consistent with other reports in both LMICs and high-income countries.[16-18]

Over the two-year period, the CS rate was 40.1% with the highest and lowest proportions occurring in the Robson groups 9 and 1 respectively. Robson groups 1, 2, 4, 5 and 10 had a composite contribution of 73.8% to the total CS performed in the hospital over the two-year period. Similarly, a study from Peru that showed that the high caesarean rate was contributed by Robson groups 1, 3, 4, 5, 7 and 10. In Ghana, the national caesarean rate is about 16%[8] which is higher than the traditional recommendation (10-15%) by the WHO.[6] More recently, WHO stated that caesarean rate higher than 10% at the population level is not associated with reductions in maternal and newborn mortality rates.[4] Although CS is an effective life-saving intervention for the mother and fetus it must only be performed for medically acceptable indications. In retrospective review at the same facility, CS rate of 46.8% was reported with Robson groups 2, 4 and 5 contributing to approximately 48% of caesarean burden[19] compared with the 54% determined in our study.

In this study, there was statistically significant increase in the CS rate in Robson groups 1, 3 and 10 following the intervention. The increased rates in groups 1 and 3 might be partly attributed to suboptimal labour management resulting in prolonged labour or failure to progress. On the other hand, Costa et al reported a significant reduction in the caesarean rate in Robson group 1 from 70.5% to 42.6% in Brazil.[20] In group 10, the rise in CS rate from 33.8% to 38.7% might be due to the combination of prematurity and previous caesarean delivery which preclude induction of labour in such cases. Concerning the pattern of relative contribution of the various Robson groups to the burden of CS, there were mixed findings with an increase in groups 1, 3, 6, 7 and 10, and reduction in 2, 4, 5, 8 and 9 in the post-intervention year.

Intriguingly, the caesarean rate increased from 39.1% in the pre-intervention to 41% in the post-intervention period and this might be explained partly by the significant contribution from Robson groups 1, 3 and 10. It was anticipated that the overall caesarean rate might reduce with the increased awareness of more health workers about the implementation of the Robson ten group caesarean classification system in the hospital. However, the non-reduction in the CS rates in the current study might be caused by the tertiary status of the hospital where most of the clients have complicated cases referred from the primary and secondary health institutions in the southern part of the country. The policy of admitting mainly the complicated cases referred from the smaller facilities may explain the tilt in the denominator characteristics

of the client population with resultant increase in the caesarean rates. Similar finding of progressive increase in overall caesarean rate from 23.5% to 30% was determined in a study conducted in Peru over a period of 10 years with significant contribution from group 1, 3 and 5.[21]

In Robson group 6 (nulliparous with breech) and 7 (multiparous with breech presentation including previous uterine scar), there was an increase in both the caesarean rates and relative contribution to CS. This finding might be partly attributed to the high proportion of women with previous caesarean section in the obstetric population. For instance, breech presentation with a previous caesarean birth (Robson group 7) is a strong clinical indication for repeat caesarean as external version is contraindicated.

To reduce CS rate, there is the need to adequately assess the indications for primary caesarean birth as breech presentation and other abnormal foetal presentation preclude any attempts at achieving natural birth after prior CS. Also, the publication by Hannah et al that indicated significant perinatal morbidity and mortality associated with vaginal breech delivery markedly influenced intrapartum management of breech presentations.[22] Hitherto, most women with breech presentation were mostly slated for vaginal delivery but the practice tilted the balance in favour of CS in attempt to reduce adverse perinatal outcome after the publication in the year 2000. In the study by Costa et al, all the women in groups 6, 7 and 9 were scheduled for caesarean section (100% in each group).[20] In a sharp contrast, CS rate and relative contribution to caesarean delivery in group 9 reduced from 92.5% and 3.2% in the pre-intervention to 90.9% and 2.3% in the post-intervention group respectively. This important finding may be partly explained by the improved advocacy for external cephalic version in the management of abnormal foetal presentation in the hospital.

The strength of this study relies in the prospective data collection and the comparison of the CS rates and the relative contributions of the Robson groups to caesarean burden in the pre-and post-intervention phases. The limitations of the study include the lack of comparison of the obstetric outcomes associated with the various Robson groups which contributed significantly to the caesarean burden. Another limitation is related to the short period between preintervention and post intervention phases.

In conclusion, nulliparous or multiparous women with spontaneous labour and no uterine scar (group 1 and 3) and preterm gestation including previous uterine scar (group 10) constitute the major characteristics associated with increased contribution to the burden of caesarean section in the hospital. There were mixed findings concerning the patterns of relative contribution of the Robson groups to the burden of CS with some groups showing an increase whiles others exhibited a decline in the post-intervention year. Implementation of the Robson classification into maternity care has identified characteristics of women that contribute markedly to the high caesarean birth in the hospital. We recommend further research into the clinical practicability and usefulness of the Robson's caesarean classification for assessing and predicting maternal and perinatal outcomes.

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