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Use of WHO C-Model for Auditing Caesarean Section Rate in a Tertiary Institution

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Abstract: ***Introduction: Recent ecologic data from WHO Department of Reproductive Health and Research including HRP show that when caesarean section rates increases to 10% across a population (e.g. a country), the number of maternal and newborn deaths decrease. When the rate goes above 10%, there is no evidence that mortality rates improve. Due to differences in the cases and obstetric profile of mothers however, it is often difficult to determine an appropriate rate of caesarean section for individual health facilities. A new mathematical model has now been launched to address this issue. Known as the C-Model, and developed by WHO RHR / HRP and partners, the tool is able to estimate the expected caesarean section rate in health facilities according to the characteristics of the population that they serve. Objectives: To study application of WHO C-Model in auditing the caesarean sections at a tertiary centre. Design: Retrospective cohort study. Setting: Father Muller Medical College. Participants: All mothers delivered in Father Muller Medical College Hospital Labour room between August 2016 to August 2017. Method: All women were classified according to the Robson's classification within which caesarean section rate was assessed. Then based on C-Model, probability of caesarean section was calculated for each group and compared with the existing caesarean section rates. Results: The largest group in the study belonged to Robson's group 1(Primi with spontaneous onset of labor)). The largest contributor to caesarean section rates was by Group 5 (previous caesarean section). Highest caesarean section rate was found in groups 5 to 9. When compared to C-Model groups 1, 3 and 5 had 50-60% caesarean section rates higher while the other groups were lower than probability. Conclusions: Using C-Model, the probability for each group can be calculated and the group with significant deviation can be concentrated on for reducing the caesarean section rates. Hence use of C-Model will give probability more specific to local demographics and will help in assessing the caesarean section rate more specific to local population. It will have all benefits of Robson classification with added benefit of demography based comparable standards.***

Keywords: C- model for Caesarean section auditing

1. Introduction

Since its introduction in obstetric practice, caesarean section rates have continuously increased in both developed and developing countries[1]. In 1985, participants of a World Health Organization (WHO) meeting held in Fortaleza, Brazil, stated that "There is no justification for any region to have a rate higher than 10-15%"[2].

Recent ecologic data from WHO Department of Reproductive Health and Research show that when caesarean section rates rise towards 10% across a population, the number of maternal and newborn deaths decreases. When the rate goes above 10%, there is no evidence that mortality rates improve[3].

Some studies showing that higher rates could be linked to negative consequences in maternal and child health, CS rates continue to increase worldwide, particularly in middle- and high-income countries, and have become a major and controversial public health concern[4].

In 2014, WHO conducted a systematic review and proposed the Robson classification system as a global standard for assessing, monitoring and comparing caesarean section rates within healthcare facilities over time, and between facilities[2].

2. Robson's Classification

1) Nulliparous women with a single cephalic pregnancy, at greater than or equal to 37 weeks 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 were delivered by caesarean section before labour (provider-initiated childbirth)
3) Multiparous women, without a previous uterine scar, with a single cephalic pregnancy at greater than or equal 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 before labour (provider-initiated childbirth)
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 37 weeks' gestation, including women with previous scars.

However, at the level of an individual health facility, it is often difficult to determine an appropriate rate of caesarean section. Differences in the case-mix and the obstetric profile complicate the applicability and relevance of a universal reference rate for caesarean section[1]

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A new mathematical model has now been launched to address this issue. Known as the C-Model, and developed by WHO RHR / HRP and partners, the tool is able to estimate the expected caesarean section rate in health facilities according to the characteristics of the population that they serve (obstetric case-mix)[1].

The tool works as a calculator which can help obstetric teams, health system managers, health facilities, researchers and governments to produce a customized reference for the rate of caesarean sections. This data can therefore help people worldwide working across sectors to assess the use and / or overuse of caesarean sections in specific contexts[1].

Although there is a global trend towards increased rates of CS, under-use of this intervention remains an issue in many countries, particularly among underprivileged populations. The C-Model is a tool designed to guide obstetric teams, health managers, and other stakeholders in the complex task of optimising the use of CS. Through a customised estimate of CS rates, the C-Model may provide a locally relevant reference of what would be an optimal CS rate[1].

3. Objectives

To use WHO C-Model to obtain expected caesarean section at a tertiary center and audit the caesarean sections based on C-model.

4. Design

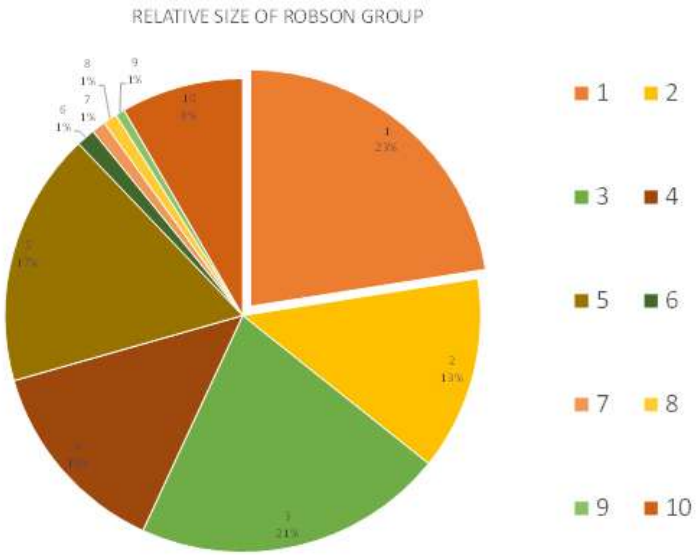
It's a Retrospective cohort study done in Father Muller Medical College between August 2016 and August 2017. All mothers who delivered during above mentioned period in labour room were considered.

5. Method

Study was done based on maternal characteristics and demographics as documented in labour room register. All women were classified according to the Robson's classification based on maternal characteristics. Then based on C-Model, probability of caesarean section was calculated for each group. Then existing caesarean section rate was calculated and compared with those obtained from C-Model.

Relative Size of Robson Group:

Robson Group	Total Cases	Jan-Mar	April-Jun	July-Sept	Oct-Dec
1	856	204	234	204	214
2	504	120	129	129	126
3	804	228	198	177	201
4	520	135	132	123	130
5	660	135	177	183	165
6	48	18	12	6	12
7	36	12	6	12	6
8	36	12	9	6	9
9	24	9	3	6	6
10	316	57	69	111	79



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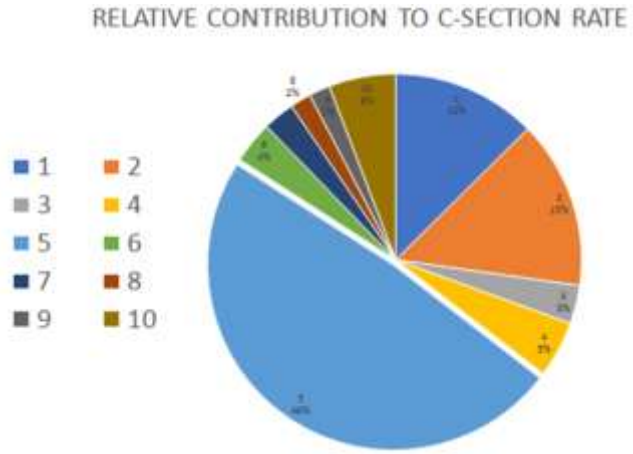
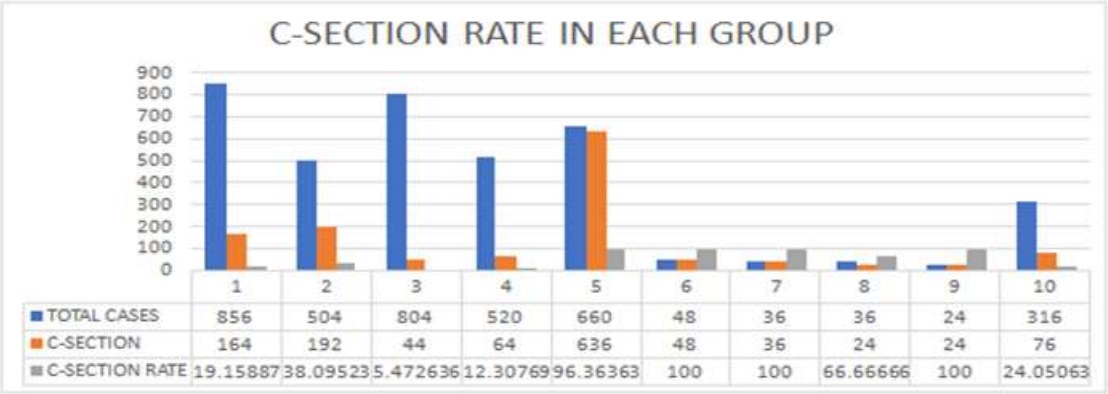
Contribution to C-Section:

Robson Group	Jan-Mar	April-June	July-Sept	Oct-Dec	Total
1	37	27	42	58	164
2	48	39	45	60	192
3	15	9	9	11	44
4	15	15	18	16	64
5	134	175	180	147	636
6	18	12	6	12	48
7	9	6	12	9	36
8	6	6	6	6	24
9	9	3	6	6	24
10	24	12	21	19	76





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Comparison with International Standards

ROBSON'S	RELATIVE SIZE IN STUDY	RELATIVE SIZE IN WHO STUDY	CONTRIBUTION TO C-SECTION RATE IN STUDY	CONTIBUTION TO C SECTION IN WHO STUDY
1	22.5	29.3	12	15.6
2	13.2	8.8	15	18.9
3	21.1	40.1	3	6.4
4	13.7	6.4	5	8.1
5	17.3	7.2	48	28.6
6	1.2	1.2	4	4.8
7	0.94	1.5	3	5.9
8	0.94	0.9	2	2.7
9	0.63	0.4	2	1.6
10	8.3	4.2	6	5.4

Calculations

For each group probability of C-Section calculated using C-Model developed by WHO and results are compared with that of existing C-section rate in each group.

Calculate Logit, using the relevant coefficients for each model, as follows:

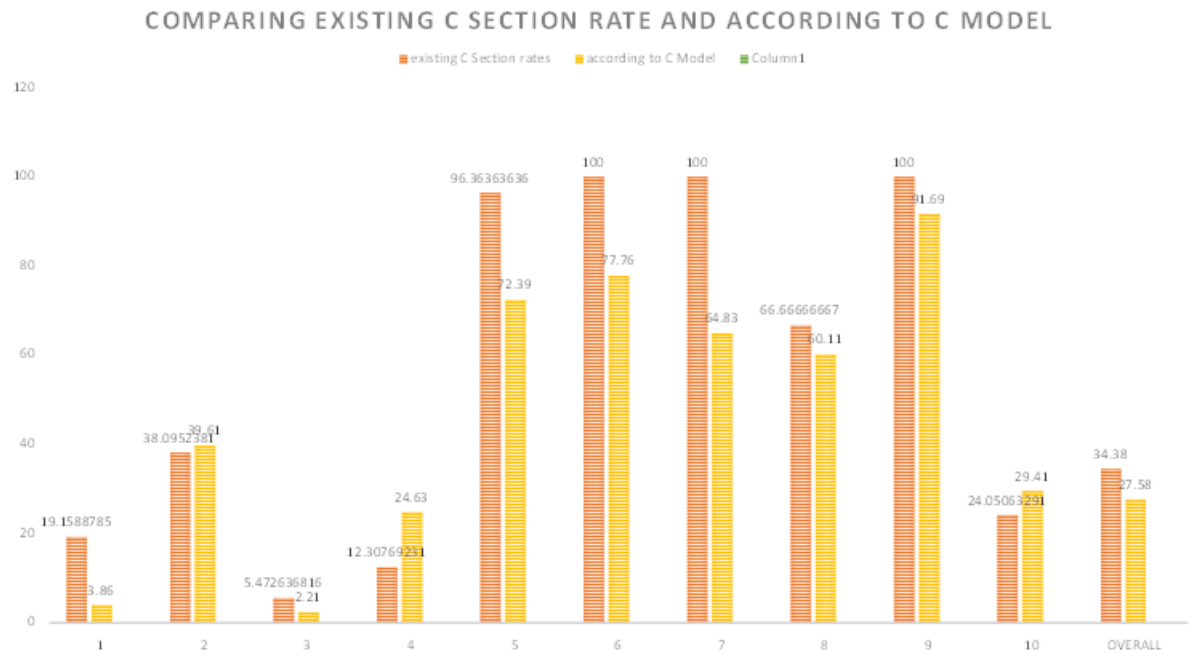
Logit = $\beta + (x_1 \beta_1) + (x_2 \beta_2) + \ldots + (x_i \beta_i)$

Calculate the probability of caesarean section

ProbCS = $e^{Logit}/(1 + e^{Logit})$

e-calculator by WHO was used to calculate the probability.

(link: https://cmodel.fmrp.usp.br or http://www.who.int/reproductivehealth/publications/maternal_perinatal_health/c-model/en/)



6. Results

Robson group 1 was largest cohort in the study. Robson group 5 was largest contributor to c section rate followed by group 2, group 1 and group 10. Within the cohort, c section was high in group 5, followed by group 2, 10 and 1(ignoring group 6-9 since sample size is very small).

Overall c section rate is slightly higher than expected (34% vs 27%). Group 2 has similar c section rate as obtained by c model and group 10 has slightly higher rate. Group 1,3 and 5 has higher c section rates as per c model and requires interventions or further study.

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7. Discussion

As compared to world standards, group 1 is the largest contributor in our study where as its group 3 in WHO study. As we know Multigravida has higher chance of achieving a successful vaginal delivery than primigravida, this demographic variation may contribute to higher caesarean rates. Similarly group 5 which is a major contributor is nearly 3folds larger in our institution. Hence C model is a better tool to assess the caesarean section rates as it considers these demographic factors into consideration and calculates a caesarean section rate which is nearer to the ideal rates in institution especially in referral centers where high risk cases are more. As per the model ideal caesarean rate for our institution was 27%. When compared with existing rate of 34%, caesarean section rate is just 7% higher than existing rate. Even though group 2 is 2nd largest contributor to c-section rate its average caesarean section rate is comparable with that of probable rate. But group 1 has much higher rate than the probable rate and further study should be done to decrease the caesarean rate in this group. This model also helps in assessing the probability of caesarean section rate once patient enters a Robson group i.e. patient in group 2 gas much higher probability of having caesarean than patient in group 1. Hence further study can also be done to reduce the number of patient entering the group 2 (such as scrutinising all inductions and elective sections in the group).

Limitations of the study being C model being improved by WHO and it cannot be used as prospective model.

8. Conclusion

Using c model better analysis of caesarean section rates with respect to local demographic data can be done and the target cohort requiring intervention can be identified specially in a referral center. Among existing methods to audit caesarean section rate, C-model appears to be a good choice.

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