Analysis of caesarean section rate in a referral hospital in Southern Brazil: Associated factors and Robson classification

Análise da taxa de cesariana em hospital de referência no sul do Brasil: fatores associados e classificação de Robson

Maria Luisa Cazula Milleô¹, Marilin Muller Sens¹, Eliane Traebert², Mayara Seemann¹, Jefferson Traebert², Rodrigo Dias Nunes²
Hospital Regional Dr. Homero de Miranda Gomes, São José, Santa Catarina, Brasil.
Programa de Pós-Graduação em Ciências da Saúde, Universidade do Sul de Santa Catarina, Palhoça, Santa Catarina, Brasil.

Abstract
Overview and Aims: Indiscriminate increasing number of caesarean section has raised interest worldwide and has been subject of countless discussion. The aim of this study was to analyze the caesarean section rate according to Robson classification and to identify associated factors in a referral hospital in Southern Brazil.

Study Design: Cross-sectional study.
Population: Data from all births occurred in one-year-period carried out at a referral hospital in the southern Brazilian state of Santa Catarina.
Methods: Gestational characteristics were categorized according to Robson classification criteria. The dependent variable was caesarean section rate and the clinical-obstetric characteristics were the independent variables. Adjusted models were obtained through Poisson Regression analysis.
Results: The caesarean section rate was 35.5%. According to Robson classification, group 3 showed the highest occurrence. Among the groups with greatest impact in caesarean section rates, group 5 showed the highest proportion among all caesareans. Prevalence of statistically higher caesarean section rate was found in women aged 25 and 35 years and who had previously performed caesarean section. Statistically lower prevalence was found in women who had previous vaginal delivery, with spontaneous labor and those with induced labor.
Conclusion: The highest caesarean section rate was observed in group 3 of Robson classification. Age and previous caesarean section were shown to be associated with the higher caesarean section rates.

Keywords: Caesarean section; Prevalence ratio; Robson criteria.

Resumo
Visão Geral e Objetivos: O aumento indiscriminado do número de cesarianas tem despertado interesse em todo o mundo e tem sido objeto de inúmeras discussões. O objetivo deste estudo foi analisar a taxa de cesarianas segundo a classificação de Robson e identificar os fatores associados em um hospital de referência no sul do Brasil.
Desenho do Estudo: Estudo transversal.
População: Dados de todos os partos ocorridos no período de um ano realizados em um hospital de referência no sul do estado brasileiro de Santa Catarina.
 Métodos: As características gestacionais foram categorizadas de acordo com os critérios de classificação de Robson. A variável dependente foi a taxa de cesariana e as características clínico-obstétricas foram as variáveis independentes. Os modelos ajustados foram obtidos por meio da análise de Regressão de Poisson.
INTRODUCTION

Early 20 million caesarean section (CS) are performed yearly, electing it as the most practiced surgical intervention in the world\(^1\,^2\). Nonetheless, the indiscriminate increasing number of CS has raised interest worldwide and has been subject of countless discussion\(^3\,^4\). In 1985, the World Health Organization (WHO) declared that CS rates over 10-15% are not justifiable\(^3\).

Nowadays, considering differences among institutions due to different contexts, populations, local resources and available knowledge, these rates have been rediscussed\(^5\). The use of CS worldwide has increased to unprecedented levels although the gap between higher- and lower-resource settings remains\(^5\). Latin America and the Caribbean region have the highest CS rates (40.5%), followed by Northern America (32.3%), Oceania (31.1%), Europe (25%), Asia (19.2%) and Africa (7.3%)\(^3\).

Brazil experiences an epidemic of CS, bearing roughly 1.6 million surgeries performed every year\(^6\). During the last decades, the national rate has been increasing progressively, becoming the most common birth mode in the country, coming from 15.6% (1970) to 34.6% (1996)\(^7\). Currently, CS rate is at 55.6%, with a significant difference between public (40%) and private service (85%)\(^8\).

The improvement in perinatal and maternal morbimortality due to the increment in CS rates is not well defined. The risk of placenta praevia, placental accretism and uterine rupture in future pregnancies, especially those performed electively and without proper clinical or obstetric indication have been demonstrated. However, the judicious increase of CS could improve perinatal outcome\(^8\).

Furthermore, the performance of unnecessary CS in women at gestational age near 37 weeks is an important factor of respiratory discomfort occurrence and hospitalization in neonatal intensive care unit\(^9\).

Until 2015, there was not a standardized and internationally accepted system to monitor CS rates. Hence, WHO\(^10\) carried out a systematic review about existing protocols to classify CS and concluded that the Robson classification would be a standard tool to assess, monitor and compare CS rates over time. This system classifies pregnant women in ten groups mutually exclusive and totally inclusive (Table I)\(^10\,^11\). It has been shown to be a simple, robust, repeatable, and clinically relevant method, which allows comparison and analysis of CS rates within each group and among themselves\(^12\).

The use of tools, such as the Robson classification, which optimize the indication of CS procedures, is essential for helping to decrease the global rates and improving institutional results upon prioritizing interventions in specific groups which are particularly relevant in each place. Besides, it allows the assessment of assistance quality and practices in clinical cares and outcomes by group. Therefore, the objective of this study is to analyze the rate of CS according to Robson classification and to identify associated factors with its occurrence in a referral hospital in southern Brazil.

1. Hospital Regional Dr. Homero de Miranda Gomes, São José, Santa Catarina, Brasil.
3. Universidade do Sul de Santa Catarina, Palhoça, Santa Catarina, Brasil.

Resultados: A taxa de cesariana foi de 35,5%. De acordo com a classificação de Robson, o grupo 3 apresentou a maior ocorrência. Entre os grupos com maior impacto nas taxas de cesarianas, o grupo 5 apresentou a maior proporção entre todas as cesarianas. A prevalência de taxa de cesariana estatisticamente maior foi encontrada em mulheres com idade entre 25 e 35 anos e que já haviam realizado cesariana anteriormente. Prevalência estatisticamente menor foi encontrada em mulheres que tiveram parto vaginal prévio, com trabalho de parto espontâneo e naquelas com trabalho de parto induzido.

Conclusão: A maior taxa de cesariana foi observada no grupo 3 da classificação de Robson. A idade e cesariana anterior mostraram-se associadas às maiores taxas de cesariana.

Palavras-chave: Cesárea; Taxa de prevalência; Classificação de Robson.
A cross-sectional study was carried out at Hospital Regional de São José, in the metropolitan region of Florianópolis, Santa Catarina, Brazil. This is a tertiary-level hospital and managed by the State Health Department of Santa Catarina, serving exclusively through the Unified Health System (Sistema Único de Saúde – SUS). The Hospital Regional de São José is responsible for a demographic area of approximately 500 thousand inhabitants and performs about 300 births monthly.

Data was obtained from pregnant's records in one-year-period. Births whose records did not allow proper data collection, as previous type of delivery or fetal presentation, were excluded. An ascertainment instrument specially designed by the researchers for this study was used to collect sociodemographic and actual obstetric information. Data regarding obstetric antecedents (nulliparous or multiparous), number of fetuses (one or more), fetal presentation (cephalic, breech or transverse), onset of labor (spontaneous, induced), CS prior to labor and gestational age (term or preterm) were collected. The sociodemographic variables (maternal age and skin color) were also collected and were initially described in absolute numbers and proportions. Gestational characteristics were categorized according to Robson classification criteria12.

Patients' records were classified in one of the ten groups or as unclassified and the reasons to submit them to CS were grouped by similarity. Association studies were carried out using chi-square test or Fisher's exact test. The dependent variable was CS rate and patients' age, skin color and clinical obstetric characteristics were the independent variables. All variables with p < 0.20 values were included in models adjusted through Poisson Regression analysis with robust estimator. In the final model only those with p < 0.05 were maintained. Prevalence ratios and their respective 95% confidence intervals were calculated. The statistical analysis was carried out using the software SPSS 18.0.

This study was based in the ethical principles from resolution 466/12 by the Brazilian National Health Council. The project was approved by the Ethics and Research Committee of the Universidade do Sul de Santa Catarina under CAAE 78646317.8.0000.5369.
(99.3%) were the most frequent occurrences. CS prevalence rate was higher among patients over 30 years old (45.8%), multiparous with just previous CS (73.6%), premature gestations (41.8%), induced labors (44.6%), breech presentations (97.4%) and twinning (82.6%).

According to Robson classification, group 3 (multiparous, without previous uterine scar, singleton fetus, cephalic, full-term pregnancy with spontaneous labor) presented the highest prevalence of births (27.2%), followed by group 1 (nulliparous, singleton fetus, cephalic, full-term, spontaneous labor) with 24.3%, group 5 (multiparous, with previous uterine scar, singleton fetus, cephalic, full-term pregnancy) with 18.8%, group 2 (nulliparous, without previous uterine scar, singleton fetus, cephalic, full-term pregnancy with induced or elective CS) with 11.7% and group 4 (multiparous, without previous uterine scar, singleton fetus, cephalic, full-term pregnancy with induced or elective CS) with 6.5% (Table II).

The highest CS rates occurred in group 9 (singleton fetus, transverse, or oblique lie, including women with previous uterine scar), in which 100% of the pregnant women underwent CS, followed by groups 7 (multiparous, singleton fetus, breech, including women with previous uterine scar), with 98.4% and 6 (nulliparous, singleton fetus, breech), with 96.8%, which represent groups which include non-cephalic presentations. However, groups 6-9 had little impact on the final cesarean rate. Among the groups with greatest impact in CS rates, group 5 was the one that presented the highest prevalence of births (63.9%), followed by group 2 (60.2%), group 4 (32.3%) and group 1 (23.7%). CS rates under the average were shown in group 3, followed by groups 1 and 4 with 23.7% and 32.3%, respectively (Table II).

With respect to the number of CS of each group and the representativeness in the total rate, it was observed that group 5 (multiparous, with previous uterine scar, singleton fetus, cephalic, full-term) presented the highest contribution, with 33.8% of the deliveries via CS (Table II). The most prevalent reason to perform CS was non-reassuring fetal status (24.1%), followed by previous c- (18.5%) and progression failure (15.4%) (Table II).

Using patients under than 25 years old as reference, pregnant women aged 25 to 30 presented 12% higher prevalence [PR 1.12 (1.02-1.24); p=0.019)] and those older than 30 years presented 18% higher prevalence of CS [PR 1.18 (1.07-1.31); p=0.001)]. Patients who had already had vaginal delivery before presented prevalence 18% lower of CS [PR 0.82 (0.72-0.93); p=0.003], whereas those who had already had previously CS presented 24% higher prevalence of CS [PR 1.24 (1.08-1.41); p=0.002] when compared to those who had already had both a vaginal delivery and a CS. Pregnant women with induced labor presented prevalence 20% more CS than those with spontaneous

<table>
<thead>
<tr>
<th>Groups</th>
<th>Total births</th>
<th>Cesarean proportion in each group</th>
<th>Cesarean proportion among all cesareans</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>1</td>
<td>855/3523 (24.3)</td>
<td>203/855 (23.7)</td>
<td>203/1249 (16.2)</td>
</tr>
<tr>
<td>2</td>
<td>412/3523 (11.7)</td>
<td>248/412 (60.2)</td>
<td>248/1249 (19.8)</td>
</tr>
<tr>
<td>3</td>
<td>958/3523 (27.2)</td>
<td>589/958 (6.1)</td>
<td>589/1249 (4.6)</td>
</tr>
<tr>
<td>4</td>
<td>226/3523 (6.5)</td>
<td>73/226 (32.3)</td>
<td>73/1249 (5.8)</td>
</tr>
<tr>
<td>5</td>
<td>660/3523 (18.8)</td>
<td>422/660 (63.9)</td>
<td>422/1249 (33.8)</td>
</tr>
<tr>
<td>6</td>
<td>62/3523 (1.7)</td>
<td>60/62 (96.8)</td>
<td>60/1249 (4.8)</td>
</tr>
<tr>
<td>7</td>
<td>64/3523 (1.8)</td>
<td>63/64 (98.4)</td>
<td>63/1249 (5.0)</td>
</tr>
<tr>
<td>8</td>
<td>23/3523 (0.7)</td>
<td>19/23 (82.6)</td>
<td>22/1249 (1.8)</td>
</tr>
<tr>
<td>9</td>
<td>5/3523 (0.1)</td>
<td>5/5 (100.0)</td>
<td>5/1249 (0.4)</td>
</tr>
<tr>
<td>10</td>
<td>255/3523 (7.2)</td>
<td>95/255 (37.3)</td>
<td>95/1249 (7.6)</td>
</tr>
</tbody>
</table>
in Latin America (33.0%)\textsuperscript{14}. However, much lower than those found in Brazil, when public and private sectors are both considered (55.0%)\textsuperscript{15-18}. Otherwise, this rate is higher than those found internationally (23.2%) in developed countries\textsuperscript{17}.

The increase in the CS rate over the last years may be resulting from a combination of factors. Convenience and protagonism of obstetricians in the assistance to birth and difficulty in obtaining techniques to relieve pain by the public health system, due to the lack of analgesia for this population. Also, the perception of a considerable number of women about a possible superiority onset of labor. All associations were described according to bivariate (Table III) and multivariate analysis (Table IV).

**DISCUSSION**

This research was carried out in a referral health center for expecting women, thus allowing an initial analysis of the Robson classification in the studied region. The general CS rate (35.5%) was in line with data from the region’s public sector (36.5%)\textsuperscript{13}, as well as indices in Latin America (33.0%)\textsuperscript{14}. However, much lower than those found in Brazil, when public and private sectors are both considered (55.0%)\textsuperscript{15-18}. Otherwise, this rate is higher than those found internationally (23.2%) in developed countries\textsuperscript{17}.

The increase in the CS rate over the last years may be resulting from a combination of factors. Convenience and protagonism of obstetricians in the assistance to birth and difficulty in obtaining techniques to relieve pain by the public health system, due to the lack of analgesia for this population. Also, the perception of a considerable number of women about a possible superiority
of the surgical route over the vaginal delivery may be cited. Furthermore, it is possible to mentions the idealization of the CS as a risk-free procedure, a way to be born cleanly and organized\textsuperscript{18}. The lack of information on labor and the imposition of interventions without scientific basis make vaginal delivery a painful and negative experience. The pain has been the main reason for the preference for CS. This has been an issue to be solved in the public and private health sectors\textsuperscript{17}.

Control requirements and monitoring of labor dynamics partially explain the high levels of CS. Currently, the obstetricians’ preference for surgical route of labor may be analyzed by the convenience of a planned intervention, opposite to the vaginal delivery, which occurs at any time and may take a long and unpredictable period\textsuperscript{18}.

In the present study, the highest CS rates occurred in patients aged over 30 years old, multiparous with previous CS, prematurity, induced labor, anomalous and twinning presentations, like the results found by other authors\textsuperscript{12}. The hypothesis that older patients may present more comorbidities or are related to other characteristics, which may lead to more CS, is suggested. The data here presented, as well as those pointed out by other authors, highlight the occurrence of a previous CS as an important factor for the increase in CS rates\textsuperscript{13,14,19-21}. Patients who underwent labor induction, on the other hand, presented higher CS rate (44.6%) than those with spontaneous labor, like the results found in other studies\textsuperscript{19,22}. An analysis of these cesarean section indications and the induction failures criteria should be reviewed for

$$\begin{array}{|c|c|c|c|}
\hline
\text{Clinical-obstetric characteristics} & \text{PR (CI 95\%)} & \text{p-value} & \text{PR (CI 95\%)} & \text{p-value} \\
\hline
\text{Patient’s age} & & & & \\
< 19 years old & 1.00 & & 1.00 & \\
19-24 years old & 1.07 (0.97-1.17) & 0.133 & 1.07 (0.98-1.18) & 0.133 \\
25-30 years old & 1.12 (1.01-1.23) & 0.019 & 1.12 (1.02-1.24) & 0.019 \\
> 30 years old & 1.18 (1.07-1.31) & <0.001 & 1.18 (1.07-1.31) & 0.001 \\
\hline
\text{Parity} & & & & \\
Primipara & 0.98 (0.86-1.12) & 0.840 & 0.99 (0.87-1.12) & 0.840 \\
Multiparous without CS & 0.81 (0.71-0.93) & 0.003 & 0.82 (0.72-0.93) & 0.003 \\
Multiparous with CS & 1.23 (1.07-1.41) & 0.002 & 1.24 (1.08-1.41) & 0.002 \\
Multiparous with CS and VD & 1.00 & 1.00 & & \\
\hline
\text{Gestational age} & & & & \\
< 37 weeks & 1.00 & & 1.00 & \\
37 weeks & 0.95 (0.86-1.04) & 0.312 & 0.95 (0.86-1.04) & 0.312 \\
\hline
\text{Onset of labor} & & & & \\
Spontaneous & 0.60 (0.56-0.64) & <0.001 & 0.60 (0.56-0.65) & <0.001 \\
Induced & 0.72 (0.66-0.79) & <0.001 & 0.72 (0.66-0.79) & <0.001 \\
Elective CS & 1.00 & 1.00 & & \\
\hline
\text{Fetal presentation} & & & & \\
Cephalic & 0.66 (0.35-1.23) & 0.200 & 0.66 (0.35-1.23) & 0.200 \\
Breech & 0.98 (0.52-1.85) & 0.968 & 0.98 (0.52-1.85) & 0.968 \\
Others & 1.00 & & 1.00 & \\
\hline
\text{Twinning} & & & & \\
Yes & 0.74 (0.54-1.00) & 0.052 & 0.74 (0.55-1.00) & 0.052 \\
No & 1.00 & 1.00 & & \\
\hline
\end{array}$$

CS: Cesarean section, VD: Vaginal Delivery, RP.: Crude prevalence ratio, RP.: Adjusted prevalence ratio. #: removed from the model for not fulfilling the inclusion criterion.
better interpretation and adequacy of possible resolutions.

Upon stratifying the sample in Robson classification, groups 3 and 1 presented the highest proportions (51.3%), corroborating the results found by other authors. Nevertheless, another study which evidenced higher birth rates in groups 1 and 5 was identified.

The group with the highest contribution for CS was group 5, corroborating with data from the literature. This clearly demonstrates the consequences of a previous CS and the strong impact on the likelihood of a subsequent surgical delivery. Silva et al suggest the progressive increase of patients belonging to group 5 in the coming years. Therefore, a proper way to reduce global CS rates would be to prevent the first CS to be carried out.

The main reason for CS during labor was failing to progress and non-reassuring fetal status, whereas, out of labor, previous CS was the most prevalent reason. Similar data were found in another study.

A high percentage of previous CS is explained not only by the increase in the number of first CS but also by the decrease of attempt of labor in women with previous CS. There is great concern over the risk of uterine rupture in a vaginal delivery after a CS delivery; however, this risk is considered low, recommending that most women with previous segmental transverse CS be offered a trial of labor.

Even it is possible to observe that there are factors related to relative and non-medical indications being responsible for higher CS rates. Different studies conclude that the raise in CS in Brazil reflect sociocultural factors and the obstetric practice, besides planning intervention to improve institutional results is suggested.

It can be concluded that the total CS rate was 35.5% with higher prevalence among pregnant women over 30 years old, multiparous with just previous CS, premature births, induced labor, breech presentation and twinning. Groups 1 and 3 of the Robson classification were the most prevalent. The highest contributions to the global rates of CS were groups 5, 2 and 1, respectively. The main reasons to perform CS were non-reassuring fetal status, previous CS and progression failure.

The 2.0% rate of unclassified patients shows some errors to be correct during data registration. It demonstrates issues to be solved even if this rate would not probably had influenced the final results. This rate of missing data should not be considered an indicator of low-quality service but must be corrected. A strength point of this study remains in highlighting a very important issue to understand how CS are distributed helping in trying to decrease the unnecessary surgeries for these population. However, the lack of further information is a limitation that could interfere in the results such as clinical and obstetric history. There must be, probably, limitations on the reliability of information. The lack of a professional or a team who reviews cesarean section indications in this service allows bias of registration to be perpetuated. The results found here will constitute the base of information to be compared to future changes in the service itself and as a reference to others.

This study demonstrated the importance of identifying CS rates and associated factors, providing data for planning efficient measures aiming to reduce the high rates and changing obstetric practices. Strategies to decrease the frequency of CS must be included to avoid the first unnecessary surgery, allowing the preparation of clinical protocols to encourage vaginal delivery after a CS. Finally, reviewing existent policies and practices, besides planning intervention to improve institutional results is suggested.

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AUTHOR CONTRIBUTIONS
Maria Luisa Cazula Milléo – concept of the investigation project, analysis and interpretation of data, writing and critical review of the manuscript.
Marilin Muller Sens – concept of the investigation project, analysis and interpretation of data, writing and critical review of the manuscript.
Elaine Traebert – analysis and interpretation of data, writing and critical review of the manuscript.
Mayara Seemann – analysis and data interpretation, writing and critical review of the manuscript.
Jefferson Traebert – analysis and interpretation of data, writing and critical review of the manuscript.
Rodrigo Dias Nunes – concept of the investigation project, analysis and interpretation of data, writing and critical review of the manuscript.

CORRESPONDENCE TO:
Jefferson Traebert
E-mail: jefferson.traebert@gmail.com

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