CHAPTER
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Occurrence of cesarean according to Robson's criteria in two brazilian cohorts

https://doi.org/10.56238/alookdevelopv1-122

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ABSTRACT
Objective: To analyze cesarean delivery according to Robson's criteria in the birth cohorts of São Luís – MA and Ribeirão Preto – SP. Methods: Cross-sectional study conducted with mothers and newborns participating in the BRISA Cohort. Descriptive analyzes were performed using the STATA/SE 14.0 program. Results: In São Luís, 47.52% of births were cesarean sections, and in Ribeirão Preto, 59.82%. When distributing puerperal women within the 10 groups of the Robson Classification, a greater relative contribution to the cesarean section rate is observed in group 4 (multiparous women, without previous cesarean section, with a single fetus, cephalic, ≥ 37 weeks, whose delivery is induced or who undergo a cesarean section before the onset of labor) and 5 (multiparous women with at least one previous cesarean section, with a single fetus, cephalic, ≥ 37 weeks). Conclusions: Groups 4 and 5 showed greater relative contributions to cesarean rates, requiring the implementation of strategies to reduce cesarean sections in these groups.

Keywords: Cesarean section, Childbirth, Birth Cohort, Classification.

1 INTRODUCTION

The World Health Organization (WHO)[1] recommends the ideal rate of cesarean sections between 10% and 15% among all deliveries performed. In Brazil, this rate is approximately 56%, causing additional expenses for the health system. In addition to the high frequency, there is the problem of the lack of accurate and detailed information about the characteristics of patients undergoing this surgical procedure. General cesarean rates become useless if separated from the outcomes and obstetric and epidemiological characteristics of the population served, hence the importance of analysis by standard groups to discuss appropriate rates2.

The WHO affirms the need for a reliable and internationally accepted classification system that can compare and evaluate the possible factors that lead to the steady increase in cesarean section rates. It is believed that this standardization can be achieved with the adoption of the Robson classification, also known as the "Classification of the Ten Groups". A classification system that groups pregnant women into one of ten mutually exclusive and fully inclusive groups, according to obstetric characteristics routinely collected in all maternity hospitals1,3.

The dissemination and implementation of a single cesarean classification system would allow auditing, analysis, and comparison of cesarean rates in different hospitals, cities, countries, and regions, in a systematic and organized way, generating a clear understanding of why, when, where, how and in what situations cesarean sections are being performed. Thus, it would be possible to propose and implement effective strategies and actions directly to the most susceptible groups and, therefore, possibly reduce the rate of cesarean section to improve maternal conditions and perinatal outcomes1.

Since Robson's classification aims to classify cesarean sections, in search of reducing their rate, its importance and relevance are understood, since with the monitoring of the index of each group, it is possible to identify the characteristics that make women more susceptible to cesarean sections. This study aimed to describe cesarean delivery according to Robson's criteria in the birth cohorts of São Luís (SL) and Ribeirão Preto (RP).

2 METHODS

2.1 STUDY DESIGN AND POPULATION

Descriptive study based on data from the study "Etiological factors of preterm birth and consequences of perinatal factors on child health: birth cohorts in two Brazilian cities - BRISA", carried out in the cities of SL - MA and RP - SP4.

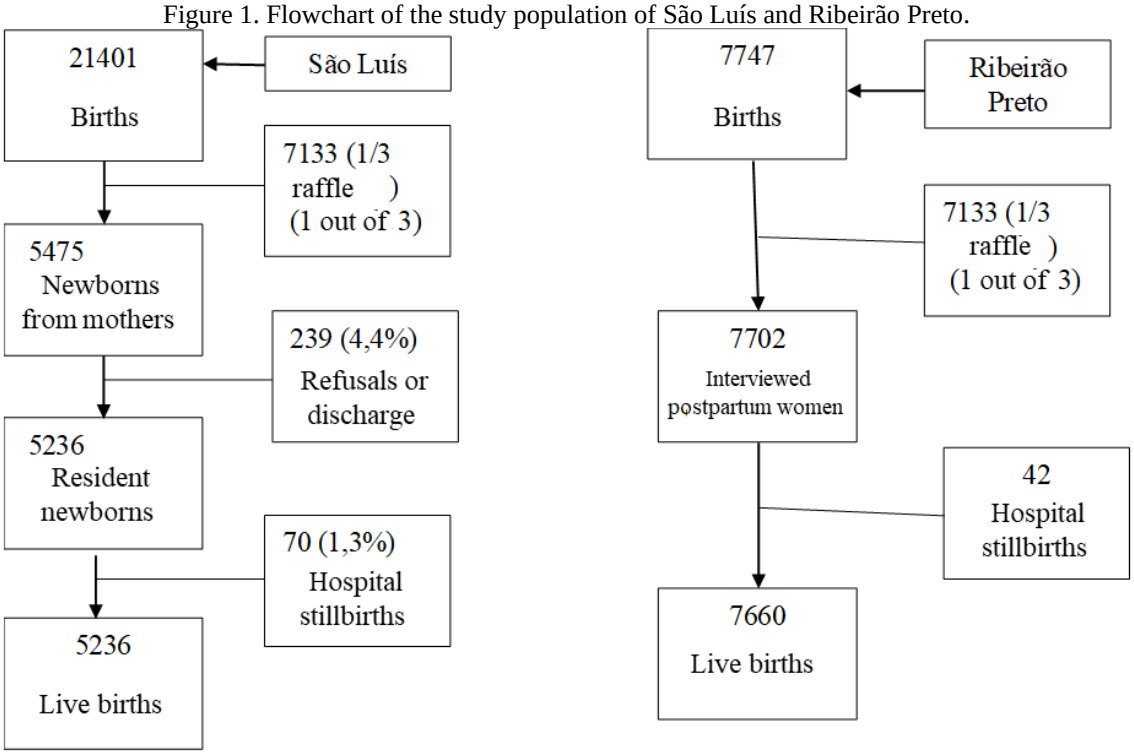
The population of the BRISA birth cohort was composed of women living in SL from 2010 to 2011 and PR in 2010 and who had hospital deliveries (public and private), whose institutions performed at least one hundred deliveries per year4.

In SL, the study sample was stratified by maternity with sharing proportional to the number of deliveries and systematic in the maternity hospitals. In the selected units there were 21,401 births, of which 1/3 (7,133) were drawn. Of these, 5,475 had been residents of the municipality for at least three months and, therefore, eligible4. We excluded 239 births due to refusal or early hospital discharge and 70 for being stillborn, ending in 5,166 births (Figure 1).

In PR, there was no sample size calculation, since all births in maternity hospitals with more than 100 deliveries were considered. In 2010, there were 7,752 hospital births in RP, out of 7,702

postpartum women living in the city that generated the results of this study4. Of the 7,702 postpartum women, 42 stillbirths were excluded, and the final sample was 7,660 births (Figure 1).

Figure 1. Flowchart of the study population of São Luís and Ribeirão Preto.



2.2 DATA COLLECTION

For data collection, a structured instrument was used in the form of interviews. The birth questionnaire applied to the mother contained socioeconomic, demographic, life habits, sexual and reproductive health, characteristics of current pregnancy and prenatal care, and characteristics of delivery and birth, in addition to data from medical records. The questionnaire with data from the newborn included identification data and data from the medical record.

2.3 VARIABLES

The type of delivery was evaluated from the question "What was the type of delivery?", with the answers "normal", "Cesarean section", "forceps", and "vacuum extraction". Being evaluated as cesarean section yes (cesarean section) and no ("normal", "forceps" and "vacuum extraction").

2.4 ROBSON'S CRITERIA

Robson's criterion uses 6 obstetric concepts: parity [nulliparous, multiparous without anterior cesarean section, and multiparous with anterior cesarean section (one or more)], anterior cesarean section (yes, no), the onset of labor (spontaneous, induced or cesarean section before labor), gestational

age (term - ≥ 37 weeks, preterm < 37 weeks), fetal presentation (cephalic, pelvic and transverse or oblique) and several fetuses (single and multiple)[1].

According to the WHO1, the groups were subdivided into:

- Group 1 - nulliparous with a single fetus, cephalic, or equal to 37 weeks, in spontaneous labor.
- Group 2 - nulliparous women with a single, cephalic fetus, greater than or equal to 37 weeks, whose delivery is induced or who are submitted to the cesarean section before the onset of labor.
- Group 3 - multiparous, without previous cesarean section, with a single fetus, cephalic, greater than or equal to 37 weeks, in spontaneous labor.
- Group 4 - multiparous, without previous cesarean section, with a single fetus, cephalic, greater than or equal to 37 weeks, whose delivery is induced or who are submitted to the cesarean section before the beginning of labor.
- Group 5 - multiparous women with at least one previous cesarean section, with a single fetus, cephalic, greater than or equal to 37 weeks.
- Group 6 - nulliparous, with a single fetus, in pelvic presentation.
- Group 7 - multiparous, with a single fetus, in pelvic presentation, including those with anterior cesarean section(s).
- Group 8 - women with multiple pregnancies, including those with previous cesarean section(s).
- Group 9 - pregnant women with a fetus in a transverse or oblique situation, including those with previous cesarean sections.
- Group 10 - pregnant women with a single fetus and cephalic, less than 37 weeks, including those with previous cesarean sections.

The ten groups are mutually exclusive and fully inclusive, meaning all women can be classified, but each woman falls into only one of these groups. These data will be presented in a table5 which is the standard model for the presentation of data from the Robson classification according to the WHO1.

The proportional size of each group was calculated from the number of deliveries of the group divided by the total number of deliveries, the absolute contribution (%) of each group to the cesarean rate will be the number of cesarean sections of each group divided by the total number of deliveries X 100 and the relative contribution (%) of each group to the cesarean rate will be the number of cesarean sections of each group divided by the total number of cesarean sections X 100. Thus, all the puerperal women in the study were grouped according to Robson's criteria and according to the WHO recommendations1.

The sociodemographic variables studied were: maternal age (Less than 20 years, 20 to 34 years, greater than or equal to 35 years), maternal schooling (none to 8 years of schooling, 9 to 11, and greater than or equal to 12 years of study), marital status (married, consensual union or without a partner), skin color (white, brown, black; yellow and indigenous), socioeconomic class by the CEB criterion - Brazil Economic Classification 2016 [A, B, C, D/E, with class A being richer and more educated and classes D/E the poorest and least educated][6].

The variables evaluated, related to the mother, were gestational age (GA - full weeks), parity (1 delivery and more than 1 delivery), cesarean deliveries (none, 1 cesarean delivery and two or more cesarean deliveries - recorded in several deliveries, including the current one), number of fetuses (single or multiple pregnancies), hospitalization in labor (yes or no - obtained from the woman's information if she had been hospitalized before or after beginning to feel the uterine contractions of labor), presentation of the fetal pole (cephalic, pelvic and transverse), induction of labor (yes or no - obtained from the woman's information if she had received serum or medication to stimulate or accelerate the onset of labor), category of childbirth care (public or private).

2.5 DATA ANALYSIS

Descriptive analyses were performed for all variables, estimating absolute and percentage frequencies. Data using the Robson classification were reported in a standardized manner, including:

1) The number of cesarean sections in each group; 2) The number of deliveries in each group; 3) The proportional size of each group (number of deliveries in the group divided by the total number of deliveries); 4) The percentage of cesarean sections in each group; 5) The absolute contribution (%) of each group to the cesarean rate (the number of cesarean sections in each group divided by the total number of deliveries X 100); 6) The relative contribution (%) of each group to the cesarean rate (number of cesarean sections of each group divided by the total number of cesarean sections X 100).

All analyses were performed using the statistical program Stata/SE 14.0 (Stata Corp., College Station, USA).

2.6 ETHICAL ASPECTS

The study met the criteria of Resolution number 466/2012 of the National Health Council and its complements. In SL, the project was approved by the Research Ethics Committee of the University Hospital under the consubstantiated opinion No. 223/2009, protocol: 4771/2008-30. In RP, the project was approved by the Research Ethics Committee of the Hospital das Clínicas da Faculdade de Medicina de Ribeirão Preto under protocol: 4116/2008.

3 FINDINGS

A total of 5,166 women in SL and 7,658 women in PR were evaluated, and 47.52% and 59.82% of PR had cesarean deliveries, respectively.

In SL, 73.65% of the women were between 20 and 34 years old, 67.15% were black, 58.44% had schooling between 9 and 11 years, 59.10% lived in a consensual union, 40.22% belonged to a family with an average monthly income of 1 to 3 minimum wages. Regarding the characteristics of the newborn, 50.93% were male and 84.12% were born in a public maternity hospital (Table 1).

In PR, 74.55% of the women were aged between 20 and 34 years, 58.74% were white, 47.02% were married, and 56.96% belonged to a family with an average monthly income higher than 3 minimum wage. Regarding the characteristics of the newborn, 50.51% were female and 55.60% were born in a public maternity (Table 1).

Table 1. Socioeconomic, maternal, and newborn characteristics belonging to the BRISA birth cohort. São Luís - MA and Ribeirão Preto - SP, 2010.

	St. Louis		Ribeirão Preto	
Variables	**n**	**%**	**n**	**%**
Socioeconomic and maternal				
Maternal Age (years)				
≤19	954	18,47	983	12,84
20-34	3.805	73,65	5709	74,55
≥35	407	7,88	966	12,61
Skin Color*				
White	958	18,54	4332	58,74
Pardon	661	12,80	2284	30,94
Black	3,469	67,15	701	9,51
Education (years)				
0-8	1390	26,91	1993	26,40
9-11	2997	58,44	3803	50,37
≥12	779	15,08	1764	23,23
Marital Status				
Married woman	1125	21,78	3596	47,02
Consensual union	3053	59,10	3011	39,37
No companion	988	19,3	1041	13,61
Household income*				
≤1	767	14,85	202	3,18
1-3	2078	40,22	2536	39,87
>3	1396	27,02	3623	56,96
Characteristics of the newborn (NB)				
Sex of the NB				
Female	2535	49,07	3868	50,51
Male	2631	50,93	3789	49,48
Motherhood*				
Public	4.345	84,12	4251	55,60
Private	820	15,88	3394	44,40
Type of Delivery				
Normal	2711	52,48	3020	40,18
Cesarean section	2455	47,52	4497	59,82

*Excluded individuals with ignored data.

Regarding the characteristics of the women according to the Robson classification, 52.71% were multiparous, 46.00% the onset of delivery was spontaneous, 12.89% were preterm, 94.87% had a cephalic presentation, 98.08% had a single fetus, and 34.33% had a previous cesarean section in SL. In PR, 50.12% were nulliparous, 40.38% had an elective cesarean section, 14.76% were preterm, 95.82% had a cephalic presentation, 98.79% had a single fetus and 23.64% had a previous cesarean section (Table 2).

Table 2. Characteristics of women according to Robson's classification. São Luís - MA and Ribeirão Preto - SP, 2010.

	St. Louis		Black Brook	
Variables	**n**	**%**	**n**	**%**
Parity				
Nulípara	2443	47,29	3826	50,12
Multípara	2723	52,71	3807	49,88
Onset of labor*				
Induced	1578	30,86	2072	27,39
Spontaneous	2352	46,00	2438	32,23
Elective Cesarean Section	1183	23,14	3055	40,38
Gestational Age				
Term	4500	87,11	6527	85,24
Preterm	666	12,89	1130	14,76
Presentation*				
Cephalic	4676	94,87	7147	95,82
Pelvic	181	3,67	292	3,91
Transverse	72	1,46	20	0,27
Number of Fetuses				
Unique	5067	98,08	7565	98,79
Multiple	99	1,92	93	1,21
Previous Caesarean section				
Yes	1013	34,33	1805	23,64
No	1938	65,67	5829	76,36
Total	5166	100	7660	100

*The ignored ones were not considered.

Regarding the classification of Robson in PR, group 1 has 763 deliveries, 420 were cesarean sections and the cesarean section rate of the group was equal to 55.04%. In SL, group 1 has that of 766 deliveries, 257 were cesarean sections and the cesarean section rate of the group was equal to 33.55%. Group 4 in RP was composed of 2369 births and 1578 cesarean sections, with 66.61% of the cesarean section rate in this group. Group 4 in SL was composed of 1139 births and 709 cesarean sections, with 62.25% of the cesarean section rate in this group. In PR, the cesarean section rate was 85.66%, and in SL 86.49% (Table 3).

Table 3 shows the overall Robson Classification in PR and SL. The analysis of the cesarean section rate by the group showed that the cesarean section rate was higher in group 9 (100.00%), followed by group 6 (95.56%), group 7 (93.85%), group 5 (85.66) and group 8 (79.54%), with cesarean rates above 75% in PR. While in SL, the highest rate of cesarean section was in group 6 (97.26%),

followed by group 9 (95.24%), group 5 (86.49%), group 8 (83.91%) and group 7 (80.52%), with rates above 80%.

The group that most contributed to the overall rate of cesarean sections in both cities was group 4, with a relative contribution in PR of 35.86% and in SL of 31.06%. It is noteworthy that the fourth group that most contributed to the relative rate of cesarean sections in both cities was group 10 (preterm delivery: <37 weeks), with 12.63% and 9.59%, in PR and SL.

Table 3. Overall Robson classification - Ribeirão Preto and São Luís.

Groups	Number of cesarean sections in the group		Number of deliveries in the group		Group size (%)		Group cesarean section rate (%)		Absolute contribution to cesarean section rate (%)		Relative contribution to the cesarean section rate (%)	
	RP	SL	RP	SL	RP	SL	RP	SL	RP	SL	RP	SL
1	420	257	763	766	10,2	15,62	55,04	33,55	5,65	5,24	9,54	11,26
2	224	184	902	618	12,12	12,60	24,83	29,77	3,01	3,75	5,09	8,06
3	81	72	718	856	9,60	17,46	11,28	8,41	1,09	1,47	1,84	3,15
4	1578	709	2369	1139	31,8	23,23	66,61	62,25	21,21	14,46	35,86	31,06
5	1195	576	1395	666	18,75	13,58	85,66	86,49	16,06	11,75	27,15	25,23
6	151	71	158	73	2,12	1,49	95,56	97,26	2,03	1,45	3,43	3,11
7	107	62	114	77	1,53	1,57	93,85	80,52	1,44	1,26	2,43	2,72
8	70	73	88	87	1,18	1,77	79,54	83,91	0,94	1,49	1,59	3,20
9	19	60	19	63	0,25	1,28	100,00	95,24	0,26	1,22	0,43	2,63
10	556	219	914	559	12,28	11,40	60,83	39,18	7,47	4,47	12,63	9,59
Total	4401	2283	7440	4904	100,00	100,00	59,15	46,55	59,15	46,55	100,00	100,00

4 DISCUSSION

In the present study, 47.52% of deliveries in SL and 59.82% in RP were cesarean sections. When distributing women within the 10 groups of the Robson Classification, there is a higher occurrence of deliveries in the two cities in group 4 (multiparous, without previous cesarean section, with a single fetus, cephalic, ≥37 weeks, whose delivery is induced or who are submitted to the cesarean section before the beginning of labor) and in the type of cesarean delivery, also with higher occurrence in group 4 followed by group 5 (all multiparous with at least one previous cesarean section, single fetus, cephalic, ≥37 weeks).

Regarding age, it was observed that the highest prevalence of pregnant women in SL and RP is found in the age between 20 and 34 years, corroborating data from the Birth in Brazil survey7. Most pregnant women did not belong to the favorable group for high-risk pregnancies, which could contribute to the indication of cesarean sections since advanced maternal age is considered a risk factor for pregnancy. According to the Technical Manual of High-Risk Pregnancy, the unfavorable individual characteristics would be an age less than 15 and greater than 40 years8.

Most women in SL had a family income of 1 to 3 minimum wages, while in RP, most had a monthly income higher than 3 minimum wages, and the contrasting socioeconomic conditions between

the cities were clear. It is known that women belonging to the most favored economic classes are the ones who most undergo cesarean section surgery9, which can be evidenced in the PR participants. This choice may be related to the fact that this profile of women believes that cesarean section is safer, more convenient, and less painful than vaginal delivery and that better quality of delivery care would be associated with greater use of technologies. In addition, women with better socioeconomic conditions would have, in general, greater knowledge and power to request an operative delivery, when compared to women with less education10.

Regarding the characteristics of the newborns, most were born in the public health service in both cities, and SL had a prevalence of 47.52% of cesarean deliveries and in PR 59.82%. It is also noteworthy the percentage of scheduled cesarean sections, which suggests excessive use of cesarean sections without clinical indication, especially in the city of RP (40.38%).

Such findings may be associated with greater purchasing power, which often facilitates payment for this service. Over time, cesarean section has ceased to be a method to improve perinatal outcomes and has become a consumer product, in such a way that the rates are lower in the poorest cities and increase in proportion to the population's purchasing power11.

It can be inferred that women's socioeconomic conditions interfere with the type of delivery to which they are submitted, with a close relationship between greater socioeconomic power and the possibility of choosing the type of delivery12.

Regarding the performance of previous cesarean section, in SL 34.33% of the women had already performed it, and in PR only 23.64%. The first cesarean section contributes a large number of procedures to the overall rate. High delivery indicated by interactiveness, that is, by the presence of a previous uterine scar helps in increasing the overall rates of cesarean sections. In the United States, one-third of all cesarean sections are performed in patients with previous cesarean sections13.

In a study conducted with women who had a previous vaginal delivery, it was observed that they have a lower chance (around 25 times) of opting for a cesarean section. Vaginal delivery after cesarean section, when compared to the routine cesarean section indicated by interactiveness, presents favorable results. A systematic review with meta-analysis showed that maternal mortality increased significantly with repeat cesarean sections, comparing these data with the results of vaginal deliveries after cesarean section[14].

The rate of cesarean sections in group 1 was 33.55% in SL, and PR was 55.04% in both, higher than that expected, up to 10% according to the WHO1. These data show the significant rates of cesarean delivery in the country even in groups considered low risk since this group is composed of nulliparous women with pregnancy with a single fetus, at term, fetus in cephalic presentation, and spontaneous labor.

It is also observed a higher rate of cesarean section in RP, a city with better socioeconomic conditions. This can be explained by the relationship between the number of women in Group 1 and the number of women in Group 2. According to a study by Ferrari et al.[15], this ratio when lower than 2.00 (2:1), represents an important number of hospitalizations for labor inductions and cesarean sections before labor. This ratio was 0.83 in PR and 1.24 in SL. A lower value is observed in PR and it can be inferred that in this city there are more interruptions of pregnancy before labor than in SL and, consequently, this characteristic impacts the rate of cesarean sections probably because it is a city with better socioeconomic conditions and authors point out that the higher the socioeconomic conditions the greater the chances of cesarean section16.

For group 3, the rate of cesarean sections should not exceed 3%, according to the literature1. In this study, the rate in group 3 was 11.28% in PR and 8.41% in SL. Thus, higher rates are observed in the city located in the southeast region of the country. This result could be a reflection of a more interventionist model of childbirth care, with obstetric care centered on the physician, in which there is, among other practices, the excessive use of oxytocin as well as the woman's desire for surgery. Cesarean sections on request can impact this group, and the approach to these cases is complex because it involves cultural issues17.

SL and PR presented cesarean section rates in group 4 higher than indicated. According to Robson3 the ideal rate for this group would be less than 15%, however in SL the cesarean section rate was 62.25% and in PR it was 66.61%, observing the significant number of induced cesarean sections or surgeries before the beginning of labor, making the audit extremely important for a careful evaluation of the indications for such procedures.

According to Robson3, the high rates of cesarean section in group 4 may reflect a high maternal desire, either due to traumatic previous delivery or due to a desire for tubal ligation due to low access to contraception. This fact deserves attention and could be better evaluated in later studies since there are relatively few absolute medical indications for cesarean section in this group.

According to the evaluation proposed by Robson et al.[3], the number of pregnant women classified in group 5 should not be above 10.0%. In the case of the women in this study, 85.66% of them were classified in this group in PR and 86.49% in São Luís. Group 5 is composed of multiparous women with at least one previous cesarean section, which reinforces that the previous cesarean section increases the indication of operative delivery in future pregnancies.

The data found in the study may reflect a direct consequence of the high rates of cesarean sections in nulliparous women (groups 1 and 2) in previous years. In addition, with the increasing number of cesarean sections in Brazil18–20 and worldwide, the population of women classified in this group tends to increase in the coming years19.

Group 5 was a major contributor to the rate of cesarean sections in the present study, corroborating the study conducted in the city of Caxias-MA, in which most of the women studied were part of this group. This finding was similar to previous studies conducted in Brazil and also in other countries19,21.

Recently, the WHO found that cesarean section rates and the absolute contribution of group 5 have increased in recent years. These data show the domino effect of the use of cesarean section: increased cesarean rates, especially in nulliparous women, increase in the number of women with previous cesarean section, who are more susceptible to a repeat cesarean section22.

Nulliparous women in groups 1 and 2 are key to decreasing the trend of increasing cesarean sections. Preventing a first uterine scar is also preventing an increase in the proportion of women in group 5, which consequently optimizes cesarean section rates22.

Group 10 presented different cesarean rates between the two cities. This data may mean the highest number of hospitalizations for cesarean section before labor, probably due to medical indication of anticipation of delivery, in the city located in the southeast region of Brazil where the percentage of premature deliveries was higher than in São Luís.

The evidence from Robson's Group 10 analysis3 reinforced the assumption that the high rates of premature births are related to unnecessary cesarean sections, probably due to the decision of the route of birth before starting labor and before completing the 39th week of gestation22.

Because of the findings, the perception that the first cesarean section, the lack of family planning, and, consequently, the difficulty in accessing contraception are determinants for the future obstetric of women is reinforced since the groups with the highest occurrence of cesarean sections are composed exclusively of multiparous women. It is inferred that making an analysis of cesarean sections in a differentiated way, with standardized systems, focused on maternal and child safety and based on the analysis of Robson's groups may be more effective in achieving goals and improving obstetric care

AUTHORS' CONTRIBUTIONS

Botentuit TNA; Batista RFL, Rodrigues LS, Abreu LP, Costa LC, Aristizabal LYG, Confortin SC contributed to the conception and design of the study, writing and critical review of the manuscript, responsibility for all aspects of the work, including the guarantee of its accuracy and integrity. All authors approved the final version of the manuscript.

FINANCING

This research was funded by the Support Program for Centers of Excellence (Pronex); National Council for Scientific and Technological Development (CNPq); Foundation for Research Support of Maranhão (FAPEMA); São Paulo Research Foundation (FAPESP); Department of Science and Technology (DECIT)/ Ministry of Health.

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