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PREVALENCE OF SPONTANEOUS, INDUCED LABOUR OR PLANNED CAESAREAN SECTION AND FACTORS ASSOCIATED WITH CAESAREAN SECTION IN LOW-RISK WOMEN IN SOUTHERN BRAZIL

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ABSTRACT: Objectives: This study aimed to examine the prevalence of spontaneous labour, induced labour and planned caesarean section in low-risk women; to identify the contribution of each group to the overall caesarean section rate; and to estimate factors associated with caesarean section in low-risk women according to spontaneous labour, induced labour and planned caesarean section. **Design:** Cross-sectional hospital-based study of postpartum women and newborns, using data from the survey Birth in Brazil, Southern region. In the sample of 2,668 low-risk women, a descriptive analysis was undertaken and a Multinomial Logistic Regression model was applied to verify associations among caesarean section and spontaneous labour, induced labour and planned caesarean section in comparison with vaginal birth. **Measurements and Findings:** The results showed the prevalence of spontaneous labour (48.0%), induced labour (14.0%) and planned caesarean sections (38.0%); these frequencies contributed to an overall caesarean section rate of 50.5%. Obstetric characteristics like previous vaginal birth or previous caesarean section were differentially associated with caesarean section, independently of the labour. Caesarean section without labour was significantly associated with age ≥ 35 years (ORadj 5.45 95%CI 3.16-9.39), economic class A and B (ORadj 3.10 95%CI 1.92-4.99), pregnancy between 37 and 38 weeks (ORadj 1.65 95%CI 1.22-2.24), same obstetrician in prenatal and childbirth (ORadj 13.83 95%CI 8.85-21.61) and private payment source at birth (ORadj 11.50 95%CI 6.64-19.93). **Key conclusion:** For low-risk women in Southern Brazil, the results identify high planned caesarean section rates, not associated with socioeconomic, obstetric, institutional or prenatal factors that justify these rates.

HIGHLIGHTS

- Only half (48.0%) of the low-risk women experienced spontaneous labour

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- One in seven pregnant women of usual risk were subject to induced labour (14.0%)
- More than one third of the women were subject to planned caesarean section (38.0%)
- The overall caesarean section rate was 50.5% of low-risk women
- Socioeconomic, obstetric and professional factors associated with planned caesarean section do not justify these patterns of use

KEYWORDS

Parturition; Labour, Obstetric; Labour; Induction; Caesarean Section; Prevalence.

INTRODUCTION

A global epidemic of caesarean section has been observed in the last decades, characterized by the high growth of rates internationally (Boerma et al., 2018). When analyzing the Brazilian situation, the evolution of caesarean rates shows an upward growth, in addition to presenting one of the highest caesarean rates found in the world (Betrán et al., 2016). In the 1970s, the first records in Brazil showed a rate of 15.0%, which rose to 40.2% in the 90s and reached the apex in 2014, with 57.0% of births by caesarean (Brasil, 2014a; Victora et al., 2011).

A consensus widely accepted in the literature, proclaimed in 1985 by the World Health Organization (WHO), is that there are no benefits in reducing maternal and neonatal morbidity and mortality for caesarean rates greater than 15% (World Health Organization, 2015; Sandall et al., 2018). An ecological study confirmed that caesarean rates for inflection point in the maternal mortality curve are close to 15% while, for perinatal mortality, they are close to 10% (Ye et al., 2014). Recent analyses have highlighted the risks associated with caesarean birth (Hu et al. 2018; Sandall et al. 2018) and confirmed that a range of institutional factors may account for excess rates (Boerma et al. 2018).

A range of factors have contributed to the increase observed. Advances in surgical techniques, anesthesia, hemotherapy and antibiotic therapy have made this procedure relatively safe, as compared with the past. However, the argument that variable and high rates of caesarean delivery is attributable to caring for women with demographic and obstetric characteristics of increased risk, was refuted in a study which analyzed clinical, demographic, socioeconomic, and health-related factors across European countries (Macfarlane et al., 2015). Evidence is increasing that non-medical factors are key drivers (Dweik et al., 2014). The popular assumption that high rates could be attributed to request for caesarean delivery by women, did not find support in previous studies (McCourt et al., 2007). Nonetheless, a range of social

influences including rapid modernization, risk discourse and responsabilisation of women as reproductive bodies and as mothers (Bryant et al., 2007), impact of media discourse and experience or fears of traumatic birth (Gamble et al., 2007) may also play a role in influencing some women's preferences. A later systematic review of observational studies identified a global caesarean preference of only 15.6% of women (Mazzoni et al., 2012). Although in that review, the multivariate analysis identified a greater impact on caesarean preference in middle-income countries when compared to high-income countries, it was observed in Latin America that one in five women declared themselves in favor of caesarean section; higher than typical preferences but considerably lower than CS rates in this region (Mazzoni et al., 2012). In addition, studies have identified an association between prevalence of private healthcare and CS rates (Murray, 2000; Boerma et al., 2018).

In the Brazilian context, studies have shown an association with maternal age, high education and economic class, larger number of prenatal consultations, gestational age of 41 weeks or higher and under 37 weeks, cervical dilation under three centimeters when admitted for labour, first-time mothers, history of caesarean section, attended on workdays, birth in day shift, weight at birth $\geq 3,500\text{g}$, non-cephalic presentation, with lower gestational risk, attended by the same professional during prenatal care and birth and in privately-funded hospitals (Barros et al., 2011; Béhague, Victora; Barros, 2002; d'Orsi et al., 2006; Freitas et al., 2008; Freitas et al., 2005; Gama et al., 2014; Gomes et al., 1999; Ribeiro et al., 2007; Sakae, Freitas, d'Orsi, 2009). The social science literature indicates the significance of socioeconomic, cultural and health system factors in Brazil including role of private healthcare sector, 'obstetric pilgrimage' (where women are unable to book for care and risk having to transfer between hospitals in labour seeking admission), lack of humanized care and support for coping with labour pain, and the normalization of caesarean section (Gamble et al., 2007; Hopkins, 2000; Behague et al., 2002; Potter et al. 2001). A recent study showed a higher preference for vaginal birth or no preference in primiparous women in both public care (84.6%) and private care (63.9%); multiparous women preferred vaginal or no preference (70.8%) in public care, while in private care, the majority preferred caesarean section (58.8%) (Domingues et al., 2014). In Brazil, the participation of nurses and midwives in vaginal birth care is limited (16.2%) and their assistance is less interventionist than that by obstetricians, such as more mobility during labour and use of non-pharmacological pain relief and lower use of amniotomy, uterine fundal pressure, episiotomy and caesarean section (Gama et al., 2016).

In this context, public policies and programmes make efforts to encourage normal childbirth in an attempt to control the indiscriminate rise in the use of surgical technology. The

strategies have been broad and involve women, professionals and health institutions, as well as public and private administrative entities. Some of them were instituted in the public financing of care: the inclusion of the payment of labour analgesia and the care provided by nurse midwives to normal delivery without dystocia (Brasil, 1998a); the determination of a maximum remuneration in the percentage of caesareans, in relation to the total number of deliveries per hospital (Brasil, 1998b); the implementation of the Professor Galba de Araújo Award, aimed at recognizing the humanization of obstetric and neonatal care (Brasil, 1998c); the institution of the Prenatal and Birth Humanization Programme, with guarantees for dignified and quality care during pregnancy, childbirth and postpartum (Brasil, 2001); and the World Health Organization led initiative for certification of hospitals with the title of Baby-Friendly Hospital (Brasil, 2014b), which include support actions and good practices during normal childbirth. In the Supplementary Health Sector, strategies were developed for the development and implementation of alternative delivery models to current models (Brasil, 2008), considering that private health institutions have the highest prevalence of caesarean section (80.8%) in the Brazilian reality (Lago, Lima, 2009). Clinical guidelines recognize pregnancy as a physiological process and, as such, any intervention offered should have proven benefits and be accepted by the pregnant women (National Institute for Health and Care Excellence, 2016).

However, it cannot be assumed that policies designed to implement more evidence-based and humanized practice will be implemented easily, especially given the prevalence of structural factors on CS rates noted in the literature cited here (Dias et al., 2016) and de-implementation of established practices may be even more challenging (Merritt-Johns et al., 2016). Thus, this study aimed to analyze a comprehensive and high-quality dataset to describe the prevalence of spontaneous labour, induction of labour and planned caesarean section in low-risk women; to identify the contribution of each group to the overall rate of caesarean section and to estimate factors associated with caesarean section in low-risk women.

METHOD

‘Birth in Brazil’ was a national postpartum survey of women and their newborns. The study population was all pregnant women hospitalized on the occasion of the birth of their children, alive or dead (birth weight ≥ 500 g and / or gestational age ≥ 22 weeks). Women were excluded if they delivered at home, or have severe mental health disorder, were homeless, women with mental health problems sectioned by court order, or could not communicate in the Portuguese language. The first stage to determine the sample size considered all hospitals with

500 or more births per year in 2007 as eligible, according to the Live Birth Information System. Hospitals were stratified by the five macro-regions of the country (North, Northeast, Southeast, South, Central), location (capital or non-capital) and type of hospital (public, mixed and private). In the second stage to determine the sample size, a reverse sampling method was used to reach at least seven days of data collection at each hospital (Vasconcellos et al., 2014).

The caesarean section frequency of 46.6% (data for 2007) was used to calculate the sample in each stratum. Significance was set at 5% to detect differences of 14% among types of service, power of 95% and design effect of 1.3, resulting in a minimum sample of 450 women per stratum. The final national sample consisted of 23,894 women distributed in 266 hospitals, with 90 interviews per hospital. The sample calculation of the national study permits the analysis of outcomes higher than 3% in each geographic region. Further information about the sample design is detailed in Vasconcellos et al. (2014).

Face-to-face interviews were carried out with the mothers starting six hours after birth; data were extracted from the records of the postpartum woman and the newborn; prenatal cards were photographed. In addition, information about the hospital was collected through an interview with the hospital manager (Leal et al., 2012).

In this study, the data of women classified as low-risk women from the South of Brazil were analyzed, with data collection between March and August of 2011. Obstetric and neonatal factors were considered to determine a low-risk woman; pregnant women with other previous and/or gestational disorders were not included. The identification of the inclusion and exclusion criteria for this analysis was based on the studies of Dahlen et al. (2012) and an already published analysis of the national data from the survey Birth in Brazil (Leal et al., 2014). The inclusion criteria were: women with gestational age between 37 and 41 weeks, single pregnancy, fetus with cephalic presentation, birth weight between 2,500 g and 4,499 g. Exclusion criteria were: women with a history of diabetes or gestational or pre-gestational hypertension and positive human immunodeficiency virus. The biometric information presented a high number of losses and, for this reason, body mass indices were not considered in the determination of low-risk women.

The South Region of Brazil sample was composed of 2,668 low-risk women. In the analysis, the prevalence of spontaneous labour and women submitted to labour induction was verified, as well as the proportion of caesarean sections in each group of women plus planned caesarean section, and their respective contributions to the overall caesarean section rate. A descriptive analysis of the type of delivery outcome (vaginal delivery, caesarean section with spontaneous labour, caesarean section with induction of labour and planned caesarean section)

was performed according to the distribution of socioeconomic, demographic, obstetric, institutional characteristics and attending of health professionals. Subsequently, a multivariate analysis was performed of the caesarean outcome with spontaneous labour, caesarean section with induced labour or planned caesarean section, in comparison with the outcome of vaginal delivery. The crude and adjusted Odds Ratio was estimated, as well as their respective 95% confidence intervals; product of a multinomial logistic regression. In the adjusted analysis, maternal age, education, economic class according to the Brazilian Association of Market Research Institutes, parity, gestational age at birth, and previous caesarean history were considered as confounding factors. The confounding factors were determined from the conceptual definition and based on previous studies on the outcome (Béhague, Victora; Barros, 2002; Barros et al., 2011; d'Orsi et al., 2006; Gomes et al., 1999; Freitas et al., 2005; Ribeiro et al., 2007; Freitas et al., 2008; Sakae, Freitas, d'Orsi, 2009) and included in the model.

Different sources were used to construct the variables. The following variables were taken from the prenatal card, the mother's chart or newborn's chart and by interview with the postpartum mother: caesarean section, spontaneous labour, labour induction, age, education, economic class, parity, gestational age, number of prenatal consultations, obstetric history and source of payment at birth. A few variables which were not available in routine records were obtained only from the interview with the postpartum woman in the maternity ward: 'place of prenatal care' and 'care by the same health professional in prenatal care and birth'. Other variables were obtained from the structured questionnaire: hospital status (Baby-Friendly Hospital, Galba de Araújo Hospital, reference hospital for the delivery of high-risk pregnant women) and presence of a nurse-midwife in the coordination of the institution nursing service. The final variable was based on geopolitical location (capital or interior).

Labour was considered spontaneous when there was a record of spontaneous labour and cervical dilation was ≥ 4 cm at admission for labour; as well as pregnant women without the type of labour recorded, but who presented dilation ≥ 4 cm. Labour was considered to be induced when medicines such as misoprostol and/or oxytocin were used in women without the diagnosis of spontaneous labour. Planned caesarean section denotes women who did not present with diagnosis of spontaneous labour and who were not submitted to induction of labour.

Data analysis was performed in Stata/SE version 13 statistical software (Stata Corp., College Station, USA) (Stata, 2013) and the sample weights based on the inverse probability of inclusion in the sample were considered. The calibration process was used in each stratum, selected to ensure that estimated totals were equivalent to the number of births in hospitals with

500 or more deliveries per year in 2011. The results presented are estimates of the study population, based on the sample.

The survey Birth in Brazil was approved by the Research Ethics Committee of *Escola Nacional de Saúde Pública Sérgio Arouca*, Oswaldo Cruz Foundation, under Opinion 92/2010. All participants signed a written informed consent form.

RESULTS

Approximately half (48.0%) of the women at low-risk had a spontaneous labour, while one in seven women were subject to labour induction (14.0%). The overall caesarean section rate was one in two women (50.5%), and of those who had a caesarean section, labour onset was spontaneous in 6.9% of cases, induced in 5.6%, while 38.0% had planned caesarean section (Table 1).

Table 1 – Spontaneous labour, induced labour and planned caesarean section in low-risk women. Southern Brazil. 2011 (n= 2,668)

	Overall caesarean section rate 50.5% (95%CI 44.0-56.9)		
	Prevalence % (95%CI)	Proportion by caesarean section % (95%CI)	Contribution to overall caesarean section rate % (95%CI)
Spontaneous labour	48.0 (42.2-53.8)	14.3 (11.2-18.1)	6.9 (5.3-8.9)
Induction of labour	14.0 (11.3-17.3)	40.0 (31.8-48.9)	5.6 (4.1-7.6)
Planned caesarean section	38.0 (31.3-45.1)	100.0	38.0 (31.3-45.1)

Descriptive analysis of delivery mode according to socioeconomic, demographic and obstetric characteristics identified significant differences in rates of caesarean section birth. Prevalence of planned caesarean section reached more than half of the women aged ≥ 35 years (55.4%); with complete higher education (72.1%); who belonged to a more favored social class, class A/B (56.8%), or had a prior caesarean history (69.2%). The prevalence of planned caesarean section in primiparous women (38.9%) as well as gestational age between 37 and 38 weeks (47.4%) was also high. All these investigated characteristics presented a statistically significant difference, with the lowest prevalences of caesarean section being found in women with spontaneous or induced labour (Table 2).

The chance of caesarean delivery compared to vaginal delivery according to labour onset (spontaneous or induced) was associated with obstetric variables. Women with previous vaginal delivery had a lower chance of caesarean delivery in both spontaneous labour and induced labour, and women with previous caesarean delivery had a higher chance of caesarean

delivery during spontaneous labour. When associations of planned caesarean sections were investigated in comparison to vaginal delivery, however, not only the obstetric characteristics, but also the demographic and socioeconomic characteristics were associated (Table 3).

Table 2 – Prevalence of outcome vaginal birth and caesarean section with spontaneous labour, induced labour or planned caesarean section according to socioeconomic, demographic and obstetric characteristics in low-risk women. Southern Brazil. 2011 (n= 2,668)

	Total % (95%CI)	Vaginal birth % (95%CI)	Caesarean section with spontaneous labour % (95%CI)	Caesarean section with induced labour % (95%CI)	Planned caesarean section % (95%CI)
Age					
12 to 19 years	17.8 (15.4-20.6)	66.6 (58.3-73.9)	9.9 (5.8-16.4)	7.0 (4.2-11.5)	16.5 (11.9-22.4)
20 to 34 years	71.6 (69.2-74.0)	48.1 (41.6-54.6)	5.9 (4.6-7.5)	5.3 (3.9-7.2)	40.7 (34.0-47.9)
35 or older	10.6 (9.0-12.3)	30.9 (23.1-39.9)	8.4 (4.3-15.8)	5.3 (1.5-17.2)	55.4 (45.4-64.9)
Education					
Incomplete Primary School	23.3 (19.8-27.2)	67.5 (61.5-72.9)	7.8 (4.7-12.8)	4.6 (3.2-6.5)	20.1 (15.8-25.4)
Complete Primary School	27.5 (24.8-30.4)	60.2 (53.7-66.4)	6.0 (3.7-9.7)	8.0 (4.8-13.2)	25.8 (20.2-32.2)
Complete Secondary School	37.7 (34.4-41.0)	40.2 (33.2-47.7)	7.3 (5.3-10.0)	5.1 (3.5-7.5)	47.3 (39.1-55.7)
University and further	11.5 (8.4-15.5)	18.6 (13.4-25.3)	5.6 (3.6-8.4)	3.7 (1.9-7.3)	72.1 (64.3-78.8)
Economic class					
D/E	9.0 (7.2-11.2)	68.9 (62.1-75.1)	9.1 (4.4-17.6)	5.9 (3.3-10.5)	16.1 (11.5-22.1)
C	52.7 (48.7-56.7)	58.2 (51.5-64.6)	6.6 (5.0-8.8)	7.2 (4.9-10.4)	28.0 (22.5-34.2)
A/B	38.3 (33.4-43.5)	33.0 (26.4-40.3)	6.7 (4.6-9.7)	3.5 (2.1-5.7)	56.8 (48.4-64.8)
Gestational age					
37 to 38 weeks	37.7 (34.2-41.4)	42.7 (35.2-50.5)	6.7 (4.5-9.6)	3.2 (2.1-5.1)	47.4 (39.1-55.9)
39 to 40 weeks	52.7 (50.0-55.3)	53.7 (47.1-60.2)	7.0 (5.1-9.5)	5.4 (3.9-7.5)	33.9 (27.5-41.0)
41 weeks	9.6 (9.6-11.6)	53.7 (44.3-62.9)	7.1 (3.5-14.0)	16.1 (9.7-25.6)	23.0 (16.8-30.8)
Parity					
Nulliparous	46.2 (43.3-49.2)	45.1 (37.8-52.5)	7.5 (5.4-10.2)	8.6 (6.1-11.9)	38.9 (31.3-47.1)
Previous vaginal birth	30.0 (26.9-33.4)	80.9 (75.6-85.2)	3.2 (2.1-5.0)	4.0 (2.6-6.2)	11.9 (7.9-17.5)
Previous caesarean section	23.7 (21.4-26.3)	18.7 (13.9-24.6)	10.3 (7.3-14.3)	1.9 (0.9-3.9)	69.2 (61.0-76.3)

Table 3 – Relation between caesarean section (caesarean with spontaneous labour, induced labour and planned caesarean section) and vaginal birth according to socioeconomic, demographic and obstetric characteristics in low-risk women. Southern Brazil. 2011 (n= 2,668)

	Caesarean section with spontaneous labour			Caesarean section with induced labour			Planned caesarean section		
	Crude OR (95%CI)	Adjusted OR* (95%CI)	p- value*	Crude OR (95%CI)	Adjusted OR* (95%CI)	p- value*	Crude OR (95%CI)	Adjusted OR* (95%CI)	p- value*
Age									
12 to 19 years	Reference			Reference			Reference		
20 to 34 years	0.82 (0.45-1.51)	0.68 (0.35-1.33)	0.252	1.04 (0.58-1.88)	1.75 (0.83-3.69)	0.135	3.42 (2.60-4.51)	2.06 (1.46-2.89)	<0.001
35 or older	1.83 (0.72-4.63)	1.94 (0.59-6.34)	0.268	1.63 (0.37-7.10)	3.73 (0.82-16.95)	0.087	7.23 (4.55-11.49)	5.45 (3.16-9.39)	<0.001
Education									
Incomplete Primary School	Reference			Reference			Reference		
Complete Primary School	0.86 (0.41-1.81)	0.82 (0.41-1.67)	0.581	1.97 (1.13-3.45)	1.51 (0.95-2.42)	0.080	1.43 (1.10-1.87)	1.23 (0.89-1.70)	0.197
Complete Secondary School	1.56 (0.88-2.77)	1.56 (0.87-2.79)	0.132	1.89 (1.30-2.74)	1.28 (0.84-1.95)	0.249	3.94 (2.73-5.68)	2.50 (1.65-3.79)	<0.001
University and further	2.57 (1.19-5.58)	1.80 (0.70-4.66)	0.219	2.96 (1.40-6.24)	2.13 (0.94-4.82)	0.069	12.96 (8.08-20.78)	4.44 (2.55-7.74)	<0.001
Economic class									
D/E	Reference			Reference			Reference		
C	0.87 (0.45-1.68)	0.91 (0.45-1.82)	0.783	1.43 (0.76-2.70)	1.18 (0.59-2.36)	0.642	2.06 (1.43-2.98)	1.63 (1.03-2.58)	0.037
A/B	1.55 (0.75-3.21)	1.28 (0.61-2.67)	0.506	1.23 (0.53-2.86)	0.81 (0.30-2.17)	0.675	7.38 (4.72-11.55)	3.10 (1.92-4.99)	<0.001
Gestational age									
37 to 38 weeks	1.20 (0.72-2.00)	1.23 (0.70-2.16)	0.466	0.75 (0.49-1.13)	0.79 (0.51-1.21)	0.266	1.76 (1.40-2.21)	1.65 (1.22-2.24)	0.002
39 to 40 weeks	Reference			Reference			Reference		
41 weeks	1.02 (0.49-2.12)	1.16 (0.54-2.48)	0.705	2.97 (1.67-5.29)	2.69 (1.64-4.40)	<0.001	0.68 (0.44-1.06)	0.85 (0.52-1.39)	0.517
Parity									
Nulliparous	Reference			Reference			Reference		
Previous vaginal birth	0.24 (0.14-0.40)	0.25 (0.13-0.48)	<0.001	0.26 (0.17-0.40)	0.22 (0.12-0.40)	<0.001	0.17 (0.12-0.24)	0.16 (0.11-0.25)	<0.001
Previous caesarean section	3.30 (2.26-4.84)	3.76 (2.29-6.16)	<0.001	0.53 (0.26-1.09)	0.47 (0.23-0.98)	0.043	4.29 (3.10-5.95)	4.17 (2.75-6.32)	<0.001

* Adjusted OR for age, education, economic class ABIPEME, parity, gestational age at birth and background history of caesarean section.

Significance level according to Wald Test.

Obs.: p-value <0.05 highlighted in bold.

Planned caesarean section was more common in women with a previous caesarean section (Adjusted OR 4.17 95% CI 2.75-6.32) in comparison with nulliparous women; in women aged ≥ 35 years (Adjusted OR 5.45 CI 95% 3.16-9.39) and between 20 and 34 years (Adjusted OR 2.06 CI 95% 1.46-2.89) when compared to women between 12 and 19 years; in women with university or further education (Adjusted OR 4.44 CI 95% 2.55-7.74) or complete secondary school (Adjusted OR 2.50 IC95% 1.65-3.79) in relation to incomplete primary school; in women belonging to social class A/B (Adjusted OR 3.10 95% CI 1.92-4.99) and C (Adjusted OR 1.63 CI 95% 1.03-2.58) when compared to social class D/E; and in pregnancies between 37 and 38 weeks (Adjusted OR 1.65 CI 95% 1.22-2.24) compared to pregnancies between 39 and 40 weeks (Table 3).

Among the characteristics of prenatal care, institutions and attending health professionals, the descriptive analysis also showed a significant difference in the type of delivery outcome. The prevalence of planned caesarean section exceeded 70% when women received prenatal care at the private health service or with a health insurance (71.1%); with a source of private payment at birth (81.0%) and attended by the same health professional in prenatal care and at birth (76.4%). Likewise, all these characteristics were less frequent when caesarean sections were evaluated in spontaneous or induced labour. In the evaluation of planned caesarean section, the institutional characteristics that presented the lowest prevalence rates were hospitals associated to the Baby-Friendly Hospital Initiative (22.2%) and institutions recognized with the Professor Galba de Araújo Award (14.7%) (Table 4).

Table 4 – Prevalence of outcome vaginal birth; caesarean section with spontaneous labour, induced labour and planned caesarean section according to characteristics of prenatal care, institutions and activities of health professionals in low-risk women. Southern Brazil. 2011 (n= 2,668)

	Total % (95%CI)	Vaginal birth % (95%CI)	Caesarean section with spontaneous labour % (95%CI)	Caesarean section with induced labour % (95%CI)	Planned caesarean section % (95%CI)
Place prenatal care					
Public	62.3 (54.1-69.8)	65.3 (60.0-70.3)	7.7 (5.6-10.5)	6.8 (4.7-9.7)	20.2 (16.3-24.7)
Private/health insurance	33.6 (26.2-41.9)	20.6 (15.8-26.4)	4.8 (3.3-7.0)	3.5 (2.2-5.5)	71.1 (64.0-77.4)
Public and private	4.2 (3.2-5.4)	44.0 (31.3-57.6)	10.3 (5.5-18.3)	4.1 (1.5-10.5)	41.7 (31.4-52.81)
Number of prenatal consultations					
< 6 consultations	20.8 (17.5-24.5)	63.3 (58.0-68.4)	8.4 (4.8-14.2)	3.8 (2.3-6.2)	24.5 (19.2-30.5)
6 or more consultations	79.2 (75.5-82.5)	45.8 (38.7-53.1)	6.5 (5.1-8.2)	6.2 (4.4-8.5)	41.6 (34.2-49.4)
Payment source of birth					
Public	74.4 (64.0-82.6)	61.9 (56.4-67.2)	7.9 (5.9-10.6)	7.0 (5.1-9.5)	23.2 (18.9-28.1)
Private	25.6 (17.4-36.0)	13.5 (9.8-18.3)	3.8 (2.4-5.8)	1.7 (0.8-3.5)	81.0 (75.9-85.3)
Same professional in prenatal and childbirth					
No	66.7 (58.3-74.2)	66.3 (61.1-71.1)	7.8 (5.9-10.4)	7.0 (5.1-9.7)	18.8 (15.1-23.2)
Yes	33.3 (25.8-41.7)	15.9 (11.9-20.9)	4.9 (2.9-8.1)	2.8 (1.5-5.2)	76.4 (70.2-81.6)
Baby-Friendly Hospital Initiative					
No	53.2 (37.4-68.3)	36.0 (28.4-44.4)	7.9 (5.4-11.4)	4.3 (2.5-7.3)	51.8 (42.2-61.3)
Yes	46.8 (31.7-62.6)	64.9 (57.9-71.4)	5.7 (4.3-7.6)	7.2 (5.1-10.0)	22.2 (16.7-29.0)
Galba de Araújo Award					
No	95.6 (82.7-99.0)	48.4 (41.9-54.9)	7.0 (5.3-9.1)	5.6 (4.0-7.7)	39.0 (32.3-46.3)
Yes	4.4 (1.0-17.4)	75.0 (63.1-84.0)	3.8 (3.2-4.6)	6.5 (2.9-14.0)	14.7 (4.5-39.0)
Location					
Interior	75.4 (61.0-85.7)	48.9 (41.9-55.8)	7.2 (5.2-9.8)	5.9 (4.0-8.5)	38.1 (31.1-45.7)
Capital	24.6 (14.3-39.0)	51.7 (37.0-66.2)	6.0 (4.1-8.6)	4.9 (3.2-7.4)	37.5 (22.5-55.2)
Reference high-risk pregnant women					
No	52.3 (36.6-67.6)	44.4 (34.5-54.7)	6.2 (4.1-9.3)	3.6 (2.2-5.8)	45.9 (35.0-57.2)
Yes	47.7 (32.4-63.4)	55.2 (47.3-62.9)	7.6 (5.4-10.6)	7.9 (5.5-11.1)	29.3 (22.4-37.3)
Nurse midwife at the institution					
No	56.0 (40.1-70.8)	44.1 (36.3-52.2)	5.7 (4.3-7.5)	6.3 (4.1-9.5)	43.9 (35.3-52.9)
Yes	44.0 (29.2-60.0)	56.5 (46.5-66.0)	8.3 (5.5-12.6)	4.8 (3.2-7.1)	30.4 (21.1-41.6)

In the multivariate analysis, associations with prenatal characteristics were not found in caesarean sections performed during spontaneous or induced labour in comparison to vaginal delivery. The chance of a caesarean section with spontaneous labour was 2.46 times higher (95% CI 1.33-4.55) when performed by the same health professional in prenatal and childbirth. In planned caesarean section, positive associations in the multivariable analysis were found in prenatal care in private services/health insurances (Adjusted OR 7.39 95% 4.81-11.36), or in private and public services simultaneously (Adjusted OR 2.20 CI 95% 1.16-4.16), in comparison with prenatal care in the public service; in the performance of six or more prenatal visits (Adjusted OR 1.49 95% CI 1.07-2.08) compared to less than six visits. The women had an 11.50 times greater chance of a planned caesarean section with a private payment source (95% CI 6.64-19.93), compared with a public source; and a 13.83 times greater chance when attended by the same health professional in prenatal and birth care (95% CI 8.85-21.61) (Table 5).

The institutional characteristics, such as having the title of Baby-Friendly Hospital or the Professor Galba de Araújo Award, revealed an association in the adjusted analysis as a protection factor for caesarean delivery in spontaneous labour and planned caesarean section. The presence of a nurse midwife in the coordination of the nursing service at the institution reduced the chance of caesarean section with induced labour by 54% (95% CI 0.30-0.97) and the chance of planned caesarean section by 50% (95% CI 0.28-0.90) (Table 5). The location of the hospital (interior or capital) and being a reference for delivery care to pregnant women with obstetric risk were characteristics that were not associated with caesarean section, regardless of when they were performed (data not shown in the tables).

Table 5 – Relation between caesarean section (caesarean section with spontaneous labour, induced labour and planned caesarean section) and vaginal birth according to characteristics of prenatal care, institutions and health professionals' activities in low-risk women. Southern Brazil. 2011 (n= 2,668)

	Caesarean section with spontaneous labour			Caesarean section with induced labour			Planned caesarean section		
	Crude OR (95%CI)	Adjusted OR* (95%CI)	p-value*	Crude OR (95%CI)	Adjusted OR* (95%CI)	p-value*	Crude OR (95%CI)	Adjusted OR* (95%CI)	p-value#
Place prenatal care									
Public	Reference			Reference			Reference		
Private/health insurance	1.97 (1.17-3.31)	1.53 (0.83-2.81)	0.170	1.63 (0.96-2.77)	1.63 (0.86-3.08)	0.127	11.20 (7.83-16.03)	7.39 (4.81-11.36)	< 0.001
Public and private	1.98 (0.86-4.53)	1.58 (0.64-3.93)	0.315	0.89 (0.27-2.92)	0.79 (0.23-2.70)	0.697	3.07 (1.76-5.38)	2.20 (1.16-4.16)	0.017
Number of prenatal consultations									
< 6 consultations	Reference			Reference			Reference		
6 or more consultations	1.06 (0.61-1.85)	0.90 (0.50-1.60)	0.711	2.24 (1.30-3.84)	1.44 (0.82-2.52)	0.196	2.35 (1.69-3.27)	1.49 (1.07-2.08)	0.021
Payment source of birth									
Public	Reference			Reference			Reference		
Private	2.17 (1.11-4.24)	1.66 (0.71-3.92)	0.238	1.11 (0.50-2.48)	1.01 (0.34-3.00)	0.987	16.02 (10.09-25.44)	11.50 (6.64-19.93)	< 0.001
Same professional in prenatal and childbirth									
No	Reference			Reference			Reference		
Yes	2.61 (1.39-4.90)	2.46 (1.33-4.55)	0.005	1.64 (0.83-3.25)	1.82 (0.80-4.13)	0.147	16.93 (11.43-25.07)	13.83 (8.85-21.61)	< 0.001
Baby-Friendly Hospital Initiative									
No	Reference			Reference			Reference		
Yes	0.40 (0.24-0.65)	0.39 (0.24-0.65)	< 0.001	0.93 (0.46-1.87)	0.85 (0.42-1.73)	0.648	0.24 (0.14-0.41)	0.27 (0.16-0.48)	< 0.001
Galba de Araújo Award									
No	Reference			Reference			Reference		
Yes	0.35 (0.26-0.471)	0.29 (0.18-0.47)	< 0.001	0.75 (0.36-1.57)	0.74 (0.36-1.54)	0.417	0.24 (0.07-0.89)	0.23 (0.10-0.55)	0.001
Nurse midwife at the institution									
No	Reference			Reference			Reference		
Yes	1.14 (0.65-2.02)	1.04 (0.58-1.86)	0.896	0.59 (0.32-1.09)	0.54 (0.30-0.97)	0.040	0.54 (0.29-1.02)	0.50 (0.28-0.90)	0.022

* Adjusted OR for age, education, economic class ABIPEME, parity, gestational age at birth and background history of caesarean section.

Significance level according to Wald Test.

Obs.: p-value <0.05 highlighted in bold.

DISCUSSION

The results showed a low prevalence of spontaneous labour, a reasonable prevalence of labour induction, and a high prevalence of caesarean delivery, even in pregnant women with a low level of obstetric risk. These data provide an overview of childbirth care in Southern Brazil and, together with the high prevalence of planned caesarean section and other associations found, provide a picture of interventional delivery care influenced largely by socioeconomic and organizational factors, rather than clinical factors, especially due to the absence of preterm or gestational risk factors to justify the approach to childbirth care.

Admission of women in labour was a complicated analysis process, given the difficulty in characterizing spontaneous labour and/or the lack of national/regional data for the sake of comparison. The prevalence of spontaneous labour in the South of Brazil was lower than found in most European Union countries, regardless of the obstetric risk classification (European Perinatal Health Report, 2010). Induction of labour is an increasingly frequent obstetric practice in childbirth care and has an impact on the experience of women, which may be less efficient and more painful than spontaneous labour, and more prone to epidural analgesia or instrumental delivery (Coates et al. 2018; National Institute for Health and Care Excellence, 2016). Women should be advised during prenatal care about labour induction, its risks, benefits and alternatives (McCarthy and Kenny, 2011). In uncomplicated pregnancies, UK National Clinical Guidelines recommend it should be offered between 41 and 42 weeks of gestational age to avoid the risk of a prolonged pregnancy, but should take into account and respect women's preferences and local circumstances (National Institute For Health And Care Excellence, 2016).

National data from several countries show a wide variation in labour induction rates (McCarthy and Kenny, 2013). In Europe, frequencies below 10% were identified in the Baltic countries and the Czech Republic, while frequencies in Belgium, Malta and Northern Ireland were above 27% (European Perinatal Health Report, 2010). An observational study conducted in Latin America, which included Brazil in the sampling method, identified a prevalence of 4.9% of elective induction of labour in women of habitual risk (Guerra et al, 2011). Thus, the results of this study on the prevalence of labour induction, when compared with other realities, were not expressively low or high.

The rate of induction of labour is likely to be related to the high prevalence of planned caesarean section, although such associations were not evaluated in this study. Rates of caesarean sections planned or performed before the onset of labour in the European Union ranged from 3.8% in Romania to 17.9% in Luxembourg; except for the two highest prevalence rates found - Italy (24.9%) and Republic of Cyprus (38.8%) - countries known for their high intervention rates in childbirth care (European Perinatal Health Report, 2010). In Brazil nationally, a similar association of women's socioeconomic characteristics with prevalence of elective caesarean section (23.0%) was identified, the most frequent associations being found in older women and those with higher purchasing power (Barros et al., 2011).

The obstetric practice of interrupting pregnancy through a planned caesarean section, on a scheduled date and time, performed early and as a way of controlling the birth route, could be revealed in the greater chance of caesarean section performed with gestational age between 37 and 38 weeks. International organizations recognize the increased risk newborns are exposed to due to the increased chance of elective caesarean section in early-term pregnancies (American College of Obstetricians and Gynecologists, 2013). In an attempt to reduce the number of caesareans in early-term pregnancies in Brazil, the Federal Council of Medicine issued Resolution 2.144 in 2016, in which it affirms that it is the right of the pregnant woman, in elective situations, to choose to perform the caesarean section, guaranteed by her autonomy, provided she has received all the information on vaginal delivery and caesarean delivery, their benefits and risks; and that it can only be performed as from the 39th week of pregnancy (Conselho Federal de Medicina, 2016).

Among the characteristics that were associated with caesarean section, regardless of the moment of occurrence in relation to labour, having a previous vaginal delivery was a protection factor, whereas having a previous caesarean section was a risk factor. These data are in line with previous studies conducted in Brazil, which evaluated the previous caesarean section (d'Orsi et al., 2006; Freitas et al., 2005; Sakae, Freitas, d'Orsi, 2009) and which require special care, representing a cascade of subsequent events in the reproductive history of women (Freitas et al., 2005). A similar situation was identified in the European Union, in which countries with high caesarean rates in primiparous women showed a higher trend towards high rates of caesarean section in women with a previous caesarean history (Macfarlane et al., 2015).

The predictive factors found for caesarean section without labour reflect socioeconomic characteristics and obstetric care funded by supplementary health or by individuals' own resources; i.e. private sector healthcare. The analysis, independently of the risk factors of the women investigated, showed that the higher maternal education and social class was associated with elevated caesarean rates and with care in private institutions compared to public institutions, in line with previous studies (Barros et al., 2011; Freitas et al., 2005). The associations found ratify the influence of non-clinical factors for the performance of caesarean section identified in the earlier literature.

The analysis also identified a negative association of spontaneous vaginal birth with prenatal and birth care being delivered by the same health professional, and when six or more consultations were performed in prenatal care. In the case of Brazil this is with an obstetrician, contrasting with international studies which demonstrate that continuity of midwife-led care is associated with lower overall intervention rates (Sandall et al. 2016). In the context of Brazil's maternity care system, continuity of carer is only experienced with obstetricians and is more commonly experienced in private hospitals. Continuity of care with a midwife is rare except in a very small number of freestanding midwifery units.

Among the characteristics of health institutions, planned caesarean section presented the lowest prevalence in public hospitals, those with the title of Baby-Friendly Hospital and in institutions recognized with the Professor Galba de Araújo Award. Despite the potential effect of reverse causality in the last two associations described, it is reiterated that the data were collected after the titles had been obtained and that these hospitals presented data on less interventionist care; in addition the association remained in the multivariate analysis. These strategies suggest a positive impact on the reduction of planned caesarean section but, when we consider the prevalence of the overall caesarean rate found, these rates are still above the WHO recommendations (World Health Organization, 2015).

The associations identified in non-labour caesarean delivery suggest a standardized routine for a profile of women who are unaware of the risks they and their newborns are being exposed to. A multicenter study conducted in Latin America shows a higher prevalence of complications (blood transfusion, hysterectomy, admission to the Intensive Care Unit and hospital stay of more than seven days), with at least one of the events included in the maternal morbidity and mortality index, the chance of occurrence in both elective and intrapartum caesarean sections being twice as high when compared

to vaginal delivery. The performance of caesarean section without labour also exerts negative influence on the neonatal outcomes, with chances twice as high of being hospitalized for seven days or more at the Neonatal Intensive Care Unit when compared to vaginal delivery with spontaneous labour; the same effect was observed in comparison with caesarean section with spontaneous labour, but to a lesser extent. Fetal death as a neonatal outcome until the discharge was practically twice as high in case of elective caesarean section, but did not reveal an association with caesarean section during spontaneous labour (Villar et al., 2007; Boerma et al., 2018).

No associations were found with caesarean section, regardless of the time of occurrence according to the type of labour, the location of the hospitals (capital and interior) or the institution being a reference for birth care in pregnant women with some risk. These data suggest a change in the pattern of caesarean delivery, with a higher prevalence of rates in the urban environment in Brazil (Lago, Lima, 2009) with a possibility that the caesarean epidemic is spreading within cities located in the interior of the states.

The presence of the obstetric nurse in the coordination of the nursing service at the institution implied a lower chance of caesarean section in induced labour and planned caesarean section in comparison to vaginal delivery. National data from the Birth in Brazil survey identified the greater chance in the use of good practices such as feeding, walking and use of non-pharmacological methods for pain relief; as well as a lower chance of using interventional practices such as the use of anesthesia, lithotomy position, fundal pressure and episiotomy in the delivery of vaginal delivery by nurses and nurse-midwives (Gama et al., 2016). Brazilian public policies promote a greater insertion of these professionals in public hospitals, due to their acknowledged performance in the context of the humanization of childbirth care (Brasil, 2001) but at the point of this study, the proportion remained low.

Simultaneously with the collection of the data analyzed here, in 2011, the Brazilian Ministry of Health established the Stork Network, a strategy that aims at the implementation of a network of care that guarantees women the right to humanized care in pregnancy, childbirth and postpartum (Brasil, 2011). In order to structure and organize maternal and child health care, the strategy foresees resources for the construction, expansion and reform of Birth Centers (midwifery units), as well as the adaptation of the environment to services that deliver infants (Brasil, 2015). Strategies that strengthen the performance of the obstetrician and obstetric nurse or midwife in low-risk birth care,

based on previous international models, which managed to maintain caesarean rates at acceptable levels.

The National Supplementary Health Agency in Brazil also launched new strategies, similarly aimed at stimulating normal delivery and reducing unnecessary caesarean sections. Normative Resolution 368, launched at the beginning of 2015, provided for the right of access to information for beneficiaries to the percentages of caesarean sections and vaginal deliveries per operator, health facility and physician; and also determined the use of the partogram, the card of the pregnant woman and the letter of information to the pregnant woman. The National Supplementary Health Agency considers that providing evidence-based information to the woman about the risks that can be generated as a result of an unnecessary surgical procedure makes her more confident about her decision regarding delivery and the discernment of what is best for her health and that of her baby (Agência Nacional de Saúde Suplementar, 2015). However, as highlighted in the wider literature, multifaceted approaches are needed and there is evidence that even well-developed policies for evidence-based and person-centered care may not be implemented owing to the range of structural and power factors influencing care provision, particularly where the change involved requires de-implementation of established authoritative and routinized practices (Altaweli et al. 2018).

Most recently, in 2017, the Brazilian Ministry of Health launched the Apice On programme - Improvement and Innovation in Care and Education in Obstetrics and Neonatology - which aims to contribute with the implementation and expansion of evidence-based obstetric and neonatal practices, strengthening the partnership between the Ministry of Health, teaching hospitals and training institutions for the qualification of teaching and practice of obstetrics and neonatology based on scientific evidence, observing the rights and principles of humanization. Over time, an evaluation of the impact of the implementation of the Stork Network, Apice On and the ANS strategies on obstetric practices performed in Brazilian maternity hospitals is needed.

The finding that stands out in this study is the major contribution of planned caesarean section to the high rate of caesarean sections in low-risk women in the South of Brazil. Caesarean sections are performed in women with the highest education level, the highest social class and an early full-term gestational age, who took part in a larger number of prenatal consultations, with continuity in care by the same prenatal and birth care professional (usually an obstetrician) in a private healthcare setting. The high

educational level should imply women have a good understanding of the risk they are exposed to along with their newborns but a health system with private financing to perform a surgical procedure that is characterized as an object of consumption accessible according to an income standard and which appoints the convenience in its accomplishment in women with the best social conditions, precisely being the least susceptible to benefit from a caesarean section (Belizán et al., 1999; Freitas et al., 2005; Gomes et al., 1999; Yazlle et al., 2001). Further work is needed to address the challenges of social norms and structural factors which shape the ways in which information about risks and benefits of birth interventions is provided to women, to address the human resources for health in Brazil, the attitudes and skills as well as knowledge of health professionals, in initial and continuing education, and the organization and provision of maternity care.

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