Influence of hospital characteristics on the performance of elective cesareans in Southeast Brazil

Influência das características hospitalares na realização de cesárea eletiva na Região Sudeste do Brasil

Influencia de las características hospitalarias en la realización de cesáreas electivas en la Región Sudeste de Brasil

Laura Zaiden [1,2]
Marcos Nakamura-Pereira [1]
Maria Auxiliadora Mendes Gomes [1]
Ana Paula Esteves-Pereira [3]
Maria do Carmo Leal [3]

Abstract

This article aims to assess the influence of hospital characteristics on the odds of performing an elective cesarean in the Southeast region of Brazil. Data were obtained from the Birth in Brazil study, conducted from February 2011 to October 2012. The current analysis includes the sample from Southeast Brazil, with 10,155 women. The group of women that underwent elective cesareans was compared to the women who went into labor or underwent labor induction, regardless they had intrapartum cesarean or vaginal delivery. Except for gestational age, all the obstetric characteristics analyzed were associated with elective cesarean. In this group, 60.5% had no prior cesarean and 64.7% had low-risk gestations. Among the births with public financing, there were higher odds of elective cesareans in women treated at hospitals with < 1,500 births/year (OR = 2.11; 95%CI: 1.37-3.26) and 1,500-2,999 births/ year (OR = 1.45; 95%CI: 1.04-2.02) and in mixed hospitals (OR = 1.81; 95%CI: 1.37-2.39). In the mixed hospitals, the association was stronger when located in non-capital cities with > 3,000 births/year (OR = 3.45; 95%CI: 1.68-7.08), reaching the highest level in hospitals in non-capital cities with < 3,000 births/year (OR = 4.08; 95%CI: 2.61-6.37). Meanwhile, no association was seen between elective cesarean and public hospitals located in non-capital cities of the Southeast region. Prevalence rates of elective cesareans in public hospitals in Southeast Brazil are high when compared to other countries, and they are heavily influenced by hospital characteristics.

Cesarean Section; Natural Childbirth; Unified Health System; Public Hospitals; Induced Labor

Correspondence
M. Nakamura-Pereira
Instituto Nacional de Saúde da Mulher, da Criança e do Adolescente Fernandes Figueira, Fundação Oswaldo Cruz.
Av. Rui Barbosa 716, 3º andar, Rio de Janeiro, RJ 22250-020, Brasil.
marcosnakamura@globo.com

[1] *Instituto Nacional de Saúde da Mulher, da Criança e do Adolescente Fernandes Figueira, Fundação Oswaldo Cruz, Rio de Janeiro, Brasil.*
[2] *Faculdade de Medicina de Petrópolis, Petrópolis, Brasil.*
[3] *Escola Nacional de Saúde Pública Sergio Arouca, Fundação Oswaldo Cruz, Rio de Janeiro, Brasil.*

Introduction

Brazil is known worldwide for the prevalence of cesarean sections. In the last two decades, there was a relevant increase in the number of these surgeries, reaching 57% of all births in 2014 (Brazilian Information System on Live Births.http://tabnet.datasus.gov.br/cgi/tabcgi.exe?sinasc/cnv/nvuf.def, accessed on 16/May/2019). Recent analysis have not identified any benefits in terms of population level when cesarean prevalence was above 15% [1,2]. Cesareans, when clinically recommended, can save mothers and babies, however its indiscriminate use can increase the risk of complications for both [3,4,5,6], hence the importance of understanding the reasons behind such a high cesarean rate.

The prevalence of cesarean sections is heterogeneous throughout the country, being higher in the richest regions (Southeast, South and Central), among women with higher purchasing power, who are older and of higher level of schooling [7]. In terms of funding for childbirth, there is a great difference in the prevalence of cesareans, reaching 89% of private funded births and 43% of public funded births [8]. On top of that, there are three types of hospital institutions in Brazil in terms of funding: strictly government-funded hospitals, strictly private hospitals and mixed hospitals, which are private institutions that can receive both public and private funding. These latter facilities may eventually serve only publicly funded patients, but commonly serve patients from the private and public systems. In 2009, according to the Brazilian National Registry of Healthcare Establishment (CNES) of the 7,161 registered hospitals, 40.6% were public, 9.8% private and 46.6% mixed, and the highest concentration of the latter was found in the Southeast region [9].

It is a widely known fact that the number of cesarean sections within the private sector is high throughout the country. However, when it comes to assistance with funding from the Brazilian Unified National Health System (SUS), these numbers can significantly range according to the size of the hospital, the type of hospital (public or mixed) and, probably according to the location, i.e., located in state capitals or in non-capital cities [10]. Some researches have already evidenced the association between the characteristics of hospitals and the prevalence of cesareans [10,11,12,13].

The analysis of such characteristics is relevant to understand its participation in the increase of cesarean sections in order to formulate proposals for its reduction.

Thus, the present study aims to evaluate the influence of hospital characteristics upon the risk of elective cesareans in the Southeast region of the country.

Methodology

The study *Birth in Brazil* is a national survey on labor and birth, hospital based and carried out from February 2011 to October 2012. The sample comprised postpartum women and their neonates, aiming at assessing the conditions of assistance provided towards labor and birth in the country. Samples of 266 hospitals were collected, in which 90 postpartum women from each hospital were interviewed. The eligibility criteria were hospitals that carried out more than 500 deliveries in 2007 and where 78.6% of all births in Brazil took place on that same year [14].

The sample was selected in three stages. On the first one, the hospitals were stratified by the five macro regions of the country, location (state capital or not) and type of hospital (private, public or mixed). In the second stage, a reverse sampling method was performed to select the number of days (minimum of seven) required to interview 90 postpartum women in each hospital. In the third stage, all women who had live births in a hospital (regardless of weight and gestational age), or stillbirths weighing over 500g and/or with gestational age greater than 22 weeks, were invited to participate. The sample weights were set by the inverse probability of the inclusion of each postpartum woman in the sample. A calibration process ensured that the total estimates were equivalent to the number of births in hospitals with 500 or more births/year in 2011. Such calibration was necessary because the selection of hospitals was based on information from the 2007 Brazilian Information System on Live Births (SINASC). Detailed information on the data collection and the design of the sample can be obtained elsewhere [14,15].

This study included all postpartum women sampled in the Southeast region, totalling 10,155 among the 23,894 women interviewed within *Birth in Brazil*. The sample was divided into two groups for comparison: women subject to elective cesarean sections and women subject to intrapartum cesarean or vaginal delivery. These variables were based on information about the beginning of labor (spontaneous, induced or cesarean before labor). Intrapartum cesarean sections were those performed during labor or after induction. Elective cesarean was the surgery performed before the beginning of labor with no induced labor. Those who reached 4cm or more of dilation (active phase of labor) were considered to have been in labor. Women with 4cm or less of dilation including those who were possibly in the latent phase of labor and those who underwent cesarean before labor were included in the elective cesarean section group.

The hospital characteristics which were subject to our analysis were: type of hospital (public, mixed, private); source of payment for the birth (public or private); location of the hospital (state capital or non-capital); number of births/year (< 1,500, 1,500-2,999, ≥ 3,000); level of complexity (absence of neonatal intermediate units [NIU] and intensive care units [NICU], presence of NIU beds; presence of NIU and NICU beds). Public funding were those related to women who gave birth in public hospitals or in mixed funded hospitals with payments funded by SUS, and privately funded were those of women whose births were funded by private health insurance plans or via direct disbursement, either in private or mixed funded hospitals.

Several socioeconomic and obstetric variables concerning characteristics were also applied: age (< 20, 20-34, > 35 years); marital status (living with partner or not); schooling (≤ 7, 8-10, ≥ 11 years); previous cesarean (yes, no), type of pregnancy (single, multiple); fetal presentation (cephalic, non-cephalic); high risk pregnancy (yes, no); obesity (BMI ≥ 30kg/m² or not); macrosomia (birth weight ≥ 4,000g or not) and gestational age (< 37 or ≥ 37 weeks).

For this study, high risk pregnancy were those of women with the following conditions: gestational hypertension/pre-eclampsia, chronic hypertension, eclampsia, pre-gestational diabetes, gestational diabetes, severe chronic diseases, infection during hospitalization for delivery (including urinary tract infections and other severe infections such as chorioamnionitis and pneumonia), premature placenta detachment, placenta previa, restricted intrauterine growth and fetal malformation. These variables were used in the study for confounding control.

All data was collected from the medical history of the women and the newborn infants, except from socioeconomic data, which was collected via face-to-face interview. The hospital characteristics were collected via interviews with their directors.

The analysis comprised the distribution of relative frequency of studied variables according to the type of delivery: elective cesarean and intrapartum cesarean/vaginal delivery and, in a second analysis, stratification according to public and private paying sources. Subsequently, using only data regarding public funding, analysis was performed using the chi-squared test and via multiple logistic regression models to analyse the variables associated with the outcome. The first model was adjusted by all socioeconomic and obstetric variables related to elective cesareans (p < 0.05) simultaneously, in order to assess the link between the hospital characteristics and the outcome, regardless of each other. In the second model, also simultaneously, the odds ratio was also adjusted by hospital variables to assess the difference in the odds ratios for elective cesareans of these variables since the other hospital characteristics entered the model.

The hospitals were categorized as per their location (state capital or non-capital), number of deliveries/year (< 3,000, > 3,000) and type of hospital (SUS, mixed, private), with posterior analysis via logistic regression, adjusting for obstetric and socioeconomic characteristics. Private hospitals were not categorized according to the other characteristics due to the high prevalence of cesarean sections in all scenarios.

The variables which showed p-value < 0.05 were identified as factors independently associated to elective cesareans, being calculated as adjusted odds ratios (OR) and their respective 95% confidence intervals (95%CI).

The present study has followed all of the guidelines issued by the Brazilian National Health Council, which provides guidelines and standards to researches in human beings, and it was approved by the research ethics committee of the Sergio Arouca National School of Public Health, Oswaldo Cruz Foundation (CEP/ENSP n. 92/2010). All required measures were adopted in order to ensure privacy

and confidentiality of information. Approval was obtained from all institutional review boards of each of the 266 participating hospitals. All hospital directors and all puerperal women have duly signed the informed consent.

Results

With the exception of gestational age, all obstetric characteristics were associated to elective cesareans. Among the patients who underwent elective cesareans, 14.8% were over 34 years old, and 65% had educational level of ≥ 11 years. Vis-à-vis obstetric characteristics, 60.5% of the women had no prior cesarean, 64.7% had low obstetric risk, 93.4% of fetuses were cephalic, 14.1% were obese women, and 4.9% of the fetuses were macrosomic (Table 1). In relation to hospital characteristics, women treated in private hospitals, in non-capital cities and in hospitals with < 1,500 births/year have shown a higher prevalence of elective cesarean (Table 1). Regarding the level of complexity of the hospital, there was no statistically significant difference between the type of delivery and the presence or absence of beds in neonatal intermediate unit and/or neonatal intensive care unit.

Table 1

Hospital, socioeconomic and obstetric characteristics of women according to type of delivery (elective cesarean section and intrapartum cesarean section/vaginal delivery).

Characteristics	Total	Type of delivery		Prevalence of elective cesarean	p-value
		Elective cesarean	Intrapartum cesarean/Vaginal delivery		
	n (%)	n (%)	n (%)	%	
Type of hospital					
Public	3,453 (34.0)	978 (21.1)	2,475 (44.9)	28.3	< 0.001
Mixed	5,127 (50.5)	2,350 (50.7)	2,777 (50.3)	45.8	
Private	1,575 (15.5)	1,311 (28.3)	264 (4.8)	83.2	
Location of the hospital					
Capital	3,429 (33.8)	1,321 (28.5)	2,108 (38.2)	38.5	0.04
Non-capital	6,726 (66.2)	3,318 (71.5)	3,408 (61.8)	49.3	
Number of births/year					
< 1,500	3,045 (30.0)	1,739 (37.5)	1,306 (23.7)	57.1	< 0.001
1,500-2,999	2,649 (26.1)	1,307 (28.2)	1,342 (24.3)	49.3	
≥ 3,000	4,461 (43.9)	1,593 (34.3)	2,868 (52.0)	35.7	
Complexity of the hospital					
No NIU and NICU beds	1,604 (15.8)	755 (16.3)	849 (15.4)	47.0	0.95
NIU beds, no NICU beds	1,279 (12.6)	578 (12.4)	701 (12.7)	45.1	
NICU beds	7,272 (71.6)	3,306 (71.3)	3,966 (71.9)	45.4	
Age (years)					
≤ 19	1,686 (16.6)	449 (9.7)	1,237 (22.4)	26.6	< 0.001
20-34	7,342 (72.3)	3,500 (75.5)	3,842 (69.7)	47.6	
≥ 35	1,127 (11.1)	690 (14.8)	437 (7.9)	61.2	
Years of schooling					
≤ 7	2,023 (20.0)	686 (14.8)	1,337 (24.3)	33.9	< 0.001
8-10	2,637 (26.1)	930 (20.1)	1,707 (31.1)	35.2	
≥ 11	5,456 (53.9)	3,006 (65.0)	2,450 (44.6)	55.0	

(continue)

Table 1 (continues)

Characteristics	Total	Type of delivery		Prevalence of elective cesarean	p-value
		Elective cesarean	Intrapartum cesarean/Vaginal delivery		
	n (%)	n (%)	n (%)	%	
Marital status					
Does not live with partner	2,185 (21.5)	806 (17.4)	1,379 (25.0)	36.8	< 0.001
Lives with partner	7,964 (78.5)	3,831 (82.6)	4,133 (75.0)	48.1	
Previous cesarean					
No	7,825 (77.1)	2,805 (60.5)	5,020 (91.0)	35.8	< 0.001
Yes	2,330 (22.9)	1,834 (39.5)	496 (9.0)	78.7	
Type of pregnancy					
Single	10,055 (99.0)	4,571 (98.5)	5,484 (99.4)	45.4	0.03
Multiple	100 (1.0)	68 (1.5)	32 (0.6)	68.0	
Fetal presentation					
Cephalic	9,758 (96.1)	4,331 (93.4)	5,427 (98.4)	44.3	< 0.001
Non-cephalic	397 (3.9)	308 (6.6)	89 (1.6)	77.5	
High-risk pregnancy					
No	7,578 (74.6)	3,001 (64.7)	4,577 (83.0)	39.6	< 0.001
Yes	2,577 (25.4)	1,638 (35.3)	939 (17.0)	63.5	
Obesity					
No	9,096 (89.6)	3,987 (85.9)	5,109 (92.6)	43.8	< 0.001
Yes	1,059 (10.4)	652 (14.1)	407 (7.4)	61.5	
Macrosomia					
No	9,741 (95.9)	4,410 (95.1)	5,331 (96.6)	45.2	0.04
Yes	414 (4.1)	229 (4.9)	185 (3.4)	55.3	
Gestacional age					
Preterm	1,050 (10.3)	504 (10.9)	546 (9.9)	48.0	0.22
Term/Postterm	9,105 (89.7)	4,135 (89.1)	4,970 (90.1)	45.4	

NICU: neonatal intensive care unit; NIU: neonatal intermediate unit.

In Table 2 we stratify the variables according to funding for childbirth. Among women with publicly funded childbirths, all hospital characteristics we tested were associated with elective cesareans, which were more frequent in mixed hospitals, located in non-capitals, of less complexity and with less than 1,500 births/year. On the other hand, among women with privately funded childbirths, hospital complexity was not associated with elective cesarean section, which is more frequently used in private hospitals than in mixed hospitals, in hospitals outside the states capitals and with lower annual volume of deliveries.

As for socioeconomic and obstetric characteristics, all variables were associated with elective cesarean in women with publicly funded childbirths, and among women with private funding births, living with a partner, multiple pregnancy and macrosomia were not linked to elective cesareans.

According to the multivariate analysis of publicly funded births (Table 3), it was noted that in the model adjusted only for socioeconomic and obstetric characteristics, all hospital characteristics displayed a significantly higher odds of elective cesareans. However, when statistical adjustment was performed also including hospital characteristics, only mixed hospitals and lower annual volume of births maintained a significant association with elective cesareans. In the final model, the odds of elective cesareans was higher among women who were assisted in mixed hospitals (OR = 1.81; 95%CI: 1.37-2.39), in those with less than 1,500 (OR = 2.11; 95%CI: 1.37-3.26) and between 1,500-2,999 (OR = 1.45; 95%CI: 1.04-261 2.02) births/year, among those with a previous cesarean (OR = 8.91; 95%CI: 6.76-11.74), non-cephalic babies (OR = 7.17; 95%CI: 5.18-9.93), high-risk pregnancies

Table 2

Hospital, socioeconomic and obstetric characteristics of women who underwent elective cesarean section and who had intrapartum cesarean section/vaginal delivery, stratified by source of childbirth funding.

Characteristics	Public funding				Privare funidng			
	Elective cesarean	Intrapartum cesarean/ Vaginal delivery	Prevalence of elective cesarean	p-value	Elective cesarean	Intrapartum cesarean/ Vaginal delivery	Prevalence of elective cesarean	p-value
	n (%)	n (%)	%		n (%)	n (%)	%	
Type of hospital								
Public	978 (35.0)	2,475 (49.0)	28.3	< 0.001	-	-		< 0.001
Mixed	1,816 (65.0)	2,573 (51.0)	41.3		534 (29.0)	204 (43.6)	72.3	
Private	-	-			1,311 (71.0)	264 (56.4)	83.2	
Location of the hospital								
Capital	736 (26.3)	1,914 (37.9)	27.7	0.002	585 (31.7)	194 (41.4)	75.1	0.003
Non-capital	2,058 (73.7)	3,135 (62.1)	39.6		1,260 (68.3)	274 (58.6)	82.1	
Number of births/year								
< 1,500	994 (35.6)	1,169 (23.1)	45.9	< 0.001	745 (40.4)	137 (29.3)	84.4	0.04
1,500-2,999	827 (29.6)	1,229 (24.3)	40.2		480 (26.0)	113 (24.2)	80.9	
≥ 3,000	973 (34.8)	2,651 (52.5)	26.8		620 (33.6)	217 (46.5)	74.0	
Complexity of the hospital								
No NIU and NICU beds	528 (18.9)	818 (16.2)	39.2	< 0.001	226 (12.3)	30 (6.5)	88.2	0.14
NIU beds, no NICU beds	496 (17.8)	651 (12.9)	43.2		81 (4.4)	50 (10.7)	61.8	
NICU beds	1,769(63.3)	3,579 (70.9)	33.0		1,537 (83.3)	387 (82.8)	79.8	
Age (years)								
≤ 19	380 (13.6)	1,174 (23.3)	24.4	< 0.001	69 (3.7)	63 (13.5)	52.2	0.001
20-34	2,087 (74.7)	3,500 (69.3)	37.3		1,413 (76.6)	341 (73.1)	80.5	
≥ 35	326 (11.7)	374 (7.4)	46.5		364 (19.7)	63 (13.4)	85.2	
Years of schooling								
≤ 7	625 (22.5)	1,305 (25.9)	32.3	0.03	60 (3.3)	32 (6.9)	65.2	0.002
8-10	765 (27.5)	1,622 (32.2)	32.0		165 (9.0)	84 (18.2)	66.2	
≥ 11	1,395 (50.0)	2,104 (41.8)	39.8		1,611 (87.7)	346 (74.9)	82.3	
Marital status								
Does not live with partner	590 (21.1)	1,324 (26.2)	30.8	0.01	215 (11.7)	55 (11.9)	79.6	0.90
Lives with partner	2,203 (78.9)	3,721 (73.8)	37.2		1,628 (88.3)	412 (88.1)	79.8	
Previous cesarean								
No	1,594 (57.1)	4,577 (90.7)	25.8	< 0.001	1,211 (65.6)	443 (94.8)	73.2	< 0.001
Yes	1,199 (42.9)	471 (9.3)	71.8		635 (34.4)	24 (5.2)	96.3	
Type of pregnancy								
Single	2,752 (98.5)	5,022 (99.5)	35.4	0.03	1,818 (98.5)	462 (98.9)	79.7	0.52
Multiple	42 (1.5)	27 (0.5)	60.8		27 (1.5)	5 (1.1)	84.3	
Fetal presentation								
Cephalic	2,571 (92.0)	4,969 (98.4)	34.1	< 0.001	1,760 (95.4)	458 (97.9)	79.3	0.02
Non-cephalic	222 (8.0)	80 (1.6)	73.5		86 (4.6)	10 (2.1)	89.5	
High-risk pregnancy								
No	1,667 (59.7)	4,196 (83.1)	28.4	0.04	1,334 (72.3)	380 (81.4)	77.8	0.03
Yes	1,127 (40.3)	852 (16.9)	56.9		511 (27.7)	87 (18.6)	85.4	
Obesity								
No	2,394 (85.7)	4,681 (92.7)	33.8	< 0.001	1,593 (86.3)	428 (91.6)	78.8	0.005
Yes	400 (14.3)	368 (7.3)	52.0		252 (13.7)	39 (8.4)	86.5	

(continue)

Table 2 (continues)

Characteristics	Public funding				Privare funidng			
	Elective cesarean	Intrapartum cesarean/ Vaginal delivery	Prevalence of elective cesarean	p-value	Elective cesarean	Intrapartum cesarean/ Vaginal delivery	Prevalence of elective cesarean	p-value
	n (%)	n (%)	%		n (%)	n (%)	%	
Macrosomia								
No	2,631 (94.2)	4,879 (96.6)	35.0	0.02	1,779 (96.4)	452 (96.7)	79.7	0.58
Yes	163 (5.8)	169 (3.4)	49.1		66 (3.6)	15 (3.3)	81.4	
Gestacional age								
Preterm	324 (11.6)	489 (9.7)	39.8	0.04	180 (9.8)	57 (12.1)	75.9	0.03
Term/Postterm	2,470 (88.4)	4,560 (90.3)	35.1		1,665 (90.2)	410 (87.9)	80.2	

NICU: neonatal intensive care unit; NIU: neonatal intermediate unit.

Table 3

Crude and adjusted odds ratio of elective cesarean section according to hospital, socioeconomic and obstetric characteristics of women with public-funded childbirth.

Characteristics	Prevalence of elective cesarean (%)	Crude OR (95%CI)	Adjusted OR 1 * (95%CI)	Adjusted OR 2 ** (95%CI)
Type of hospital				
Public	28.3	1.00	1.00	1.00
Mixed	41.3	1.78 (1.32-2.42)	2.20 (1.65-2.96)	1.81 (1.37-2.39)
Location of the hospital				
Capital	27.7	1.00	1.00	1.00
Non-capital	39.6	1.70 (1.23-2.38)	2.04 (1.53-2.75)	1.35 (0.98-1.84)
Number of births/year				
< 1,500	45.9	2.31 (1.67-3.21)	2.62 (1.84-3.75)	2.11 (1.37-3.26)
1,500-2,999	40.2	1.83 (1.34-2.51)	1.92 (1.32-2.81)	1.45 (1.04-2.02)
≥ 3,000	26.8	1.00	1.00	1.00
Complexity of the hospital				
No NIU and NICU beds	39.2	1.30 (0.88-1.94)	1.71 (1.10-2.64)	0.81 (0.49-1.34)
NIU beds, no NICU beds	43.2	1.54 (1.01-2.37)	1.73 (1.11-2.73)	0.94 (0.58-1.51)
NICU beds	33.0	1.00	1.00	1.00
Age (years)				
≤ 19	24.4	0.54 (0.46-0.63)	1.06 (0.89-1.27)	1.05 (0.87-1.28)
20-34	37.3	1.00	1.00	1.00
≥ 35	46.5	1.46 (1.20-1.78)	1.02 (0.82-1.28)	1.08 (0.87-1.34)
Years of schooling				
≤ 7	32.3	0.72 (0.59-0.88)	0.54 (0.45-0.67)	0.53 (0.44-0.65)
8-10	32.0	0.71 (0.62-0.82)	0.65 (0.56-0.77)	0.65 (0.55-0.76)
≥ 11	39.8	1.00	1.00	1.00
Marital status				
Does not live with partner	30.8	0.75 (0.64-0.88)	0.93 (0.77-1.13)	0.98 (0.82-1.19)
Lives with partner	37.2	1.00	1.00	1.00
Previous cesarean				
No	25.8	1.00	1.00	1.00
Yes	71.8	7.30 (5.66-9.43)	8.48 (6.40-11.24)	8.91 (6.76-11.74)

(continue)

Table 3 (continues)

Characteristics	Prevalence of elective cesarean (%)	Crude OR (95%CI)	Adjusted OR 1 * (95%CI)	Adjusted OR 2 ** (95%CI)
Type of pregnancy				
Single	35.4	1.00	1.00	1.00
Multiple	60.8	2.79 (1.36-5.76)	1.52 (0.64-3.62)	1.47 (0.60-3.58)
Fetal presentation				
Cephalic	34.1	1.00	1.00	1.00
Non-cephalic	73.5	5.38 (3.99-7.26)	6.89 (4.83-9.86)	7.17 (5.18-9.93)
High-risk pregnancy				
No	28.4	1.00	1.00	1.00
Yes	56.9	3.32 (2.82-3.93)	3.40 (2.87-4.03)	3.69 (3.11-4.38)
Obesity				
No	33.8	1.00	1.00	1.00
Yes	52.0	2.12 (1.79-2.52)	1.38 (1.13-1.68)	1.33 (1.09-1.63)
Macrosomia				
No	35.0	1.00	1.00	1.00
Yes	49.1	1.77 (1.33-2.38)	1.83 (1.28-2.62)	1.97 (1.36-2.86)
Gestacional age				
Preterm	39.8	1.22 (1.01-1.47)	0.97 (0.79-1.21)	1.10 (0.86-1.42)
Term/Postterm	35.1	1.00	1.00	1.00

95%CI: 95% confidence interval; NICU: neonatal intensive care unit; NIU: intermediate neonatal unit; OR: odds ratio.

* Adjusted by age, schooling, marital status, previous cesarean, type of pregnancy, fetal presentation, high-risk pregnancy, obesity, macrosomia, hospital complexity;

** Adjusted by variables from the first adjustment and type of hospital, hospital location, number of births/year, and hospital complexity.

(OR = 3.69; 95%CI: 3.11-4.38), obese women (OR = 1.33; IC95%: 1.09-1.63) and babies with macrosomia (OR = 1.97; 95%CI: 1.36-2.86). On the other hand, the odds of an elective cesarean were lower among women with lower levels of schooling (OR = 0.53; 95%CI: 0.44-0.65, when level of schooling was ≤ 7 years; OR = 0.65; 95%CI: 0.55-0.76, when level of schooling was 8-10 years).

The analysis of Table 4 indicated higher chances of performing elective cesareans in mixed hospitals in general. The magnitude of the association increases in non-capital hospitals with over 3,000 deliveries (OR = 3.45; 95%CI: 1.68-7.08) and reaches its highest value in non-capital mixed hospitals with less than 3,000 deliveries, displaying odds 4 times higher for an elective cesarean section (OR = 4.08; 95%CI: 2.61-6.37). On the other hand, there was no association between elective cesarean sections and public hospitals located in non-capital cities of the Southeast.

Discussion

Obstetric care in Brazil is marked by its high prevalence of cesarean sections. Although the large number of elective cesareans performed in private health is an important contributor to this scenario [8], we still see a high prevalence of this type of surgery even among SUS users. In the present analysis, we observed that the prevalence of elective cesareans in the Southeast region was 45.7%, reaching 83.2% in private hospitals.

According to information available on SINASC (http://tabnet.datasus.gov.br/cgi/tabcgi.exe?sinasc/cnv/nvuf.def, accessed on 16/May/2019), in 2017 the percentage of antepartum cesareans in the Southeast region was 35.5%, lower than the findings of our study, which can be due to a change in labor care in the country, as well as to differences in the definition of antepartum cesarean. However, this percentage is twice the percentage found in the North (15.2%) and the Northeast (17.7%), and slightly lower than in the South (38.8%). When we analyzed only publicly funded births, we noticed

that 26.4% of women underwent elective cesarean section in the Southeast, a figure that is also lower than the one we found in the present analysis (35.6% – data not shown). Once again, this percentage is higher than those found in the North (11.9%) and the Northeast (12.9%), and lower than in the South region (32.6%). Such data may indicate a greater difficulty in access to healthcare in the North and Northeast regions, but the numbers found in the South and Southeast regions show an excessive use of elective cesarean section even in the public system. In the present study, the prevalence of elective cesareans was of 28.3% in strictly public hospitals, nearly three times higher than in France (10.9%) [16] and four times higher than in Holland (6.9%) [17].

The results of our research highlight the importance of hospital characteristics for the occurrence of elective cesareans in the Southeast. As observed in several other studies [8,12,18,19], private funding greatly increases the odds of elective cesareans. On the other hand, we could also observe that, in addition to financing, some hospital characteristics in the public sector were associated with a higher chance of elective cesareans, particularly the volume of births per year and if the hospital was located in non-capital cities.

Hospital characteristics such as geographical location, infrastructure, amount of births, and human resources, among others, have become the subject of studies [10,18,20,21,22,23] aiming to evaluate the adequacy of resources and to assess the influence of these characteristics upon outcomes of interest, such as neonatal mortality and cesareans. Some investigations carried out to elucidate the factors related to the high prevalence of cesareans showed that, after the adjustment for clinical and sociodemographic variables, the prevalence remained high and varied between hospitals [13,18,24], i.e., the prevalence of cesareans was not always linked to the risk profile of the population under care. This indicates that the facility where the woman receives care is also an important influencer in the mode of delivery, as it is believed that factors such as the variation of protocols between maternity wards, the adherence to the protocols by healthcare professionals, different care routines, infrastructure of the maternity wards, as well as the presence or not of a multidisciplinary team can be directly linked to the means of delivery [12,19,25,26].

In the general analysis, mixed hospitals had a prevalence of elective cesarean of 45.8%, whereas in public hospitals this prevalence was of 28.3%. At first, this finding could be attributed to the share of privately funded deliveries. However, after the stratified analysis per public funding source, we can still notice a prevalence of 41.3%, and an 80% higher chance of elective cesarean in these hospitals, even in care funded by SUS. A study that analysed the prevalence of cesareans in Brazilian hospitals, selecting public and mixed hospitals, also found a higher proportion of cesareans in mixed-funded hospitals [27].

The reasons for such findings have not yet been clarified, and require specific studies. However, it is possible to raise the hypothesis that the type of care provided at these hospitals is similar for all births, regardless of the source of funding. This would imply some sort of "contamination" of the indexes that are usually observed in hospitals with exclusive public funding, due to the coexistence with private funding. This "contamination" would happen by the replication of the methods applied by private hospitals, such as scheduling cesareans in advance both due to maternal desire and medical convenience.

The complexity of hospitals was not associated with elective cesareans in the final model, contrasting with the findings in some studies carried out in other countries [19,21]. Padua et al. [27] also found no relation between hospital complexity and cesarean sections in Brazil. However, it is relevant to note that when adjusted only for socioeconomic and hospital characteristics, the odds of cesareans were higher in lower level hospitals, when in fact it was expected to see more elective cesareans in hospitals with NICUs, usually able to cater for more complicated pregnancies.

In the adjusted analysis for all variables, hospitals located outside state capitals did not display a statistically significant association with elective cesareans. However, after adjusting only for clinical and socioeconomic characteristics, the odds for elective cesareans were twice as high, showing that for hospitals in non-capital cities other hospital characteristics may increase the prevalence of elective cesarean. This could be noticed in the analysis presented in Table 4, showing that among hospitals located in non-capitals, the mixed ones had a higher odd of elective cesareans, regardless of the amount of deliveries/year when compared with SUS hospitals. Therefore, we can state that the

Table 4

Prevalence of elective cesarean sections and crude and adjusted odds ratios according to combinations of hospital characteristics.

Combinations	Elective cesarean n (%)	Crude OR (95%CI)	Adjusted OR * (95%CI)
Capital, Public, ≥ 3,000 (n = 1,203)	317 (26.4)	Reference	Reference
Capital, Public, < 3,000 (n = 370)	154 (41.6)	1.99 (0.74-5.33)	2.26 (1.08-4.73)
Capital, Mixed, ≥ 3,000 (n = 1,227)	327 (26.7)	1.01 (0.66-1.55)	1.68 (1.07-7.08)
Non-capital, Mixed ≥ 3,000 (n = 521)	228 (43.8)	2.17 (1.62-2.93)	3.45 (1.68-7.08)
Non-capital, Mixed, < 3,000 (n = 3,379)	1,795 (53.1)	3.16 (2.36-4.24)	4.08 (2.61-6.37)
Non-capital, Public, ≥ 3,000 (n = 913)	233 (25.5)	0.95 (0.72-1.27)	1.10 (0.63-1.91)
Non-capital, Public, < 3,000 (n = 966)	273 (28.3)	1.10 (0.73-1.64)	1.25 (0.71-2.19)
Private (n = 1,575)	1,311 (83.2)	13.87 (8.68-22.14)	14.72 (8.32-26.05)

95%CI: 95% confidence interval; OR: odds ratio.

* Adjusted by age, schooling, marital status, previous cesarean, type of pregnancy, fetal presentation, high-risk pregnancy, obesity, macrosomia, hospital complexity.

fact that a hospital is mixed already increases the chances of elective cesareans, regardless of other hospital characteristics.

It shall be pointed out that hospitals with over 3,000 births/year have the lowest prevalence of cesarean sections (35.7%) when compared with hospitals with 1,500 to 2,999 births/year (49.3%) and with those with < 1,500 births/year (57.1%). This association remains in the stratification regarding the type of childbirth financing, but it is noticed that the difference is greater when it comes to births funded by SUS, in which the chances are twice higher for elective cesareans in hospitals with < 1,500 births/year. The volume of hospital deliveries is especially relevant in public hospitals in the capitals, more than doubling the chance of elective cesarean. The association of the annual volume of deliveries with cesareans [18,24] or repeated cesareans [19] was not identified in previous studies carried out in developed countries. However, a study conducted in South Korea demonstrated that the occurrence of cesarean sections was higher in hospitals with below average volume [28]. The authors attributed this association to the need for hospitals with a lower volume to keep their beds occupied with patients demanding longer recoveries and a higher financial reimbursement to the hospital [28]. It is likely that in hospitals with a low number of births/year, the mode of delivery is influenced by organizational issues such as fewer physicians per team, decision-making focused solely on one professional, scheduling cesarean sections for a better workflow, among others.

The data displayed and the propositions raised herein bring the discussion to the field of organization, management and financing of the health system. The Brazilian Ministry of Health itself recognizes the existing deficiency in such areas, and on December 30, 2010 published *Ordinance n. 4,279* [29], establishing guidelines for the organization of the healthcare network (Rede de Atenção à Saúde) within SUS. The Ordinance acknowledges the fragmentation of the system and the pulverization of the same services in municipal levels as a problem to be solved. In this context, the organization of healthcare via regionalized networks would allow a better allocation of resources, prioritizing larger hospitals with a better infrastructure to serve the population, aiming at reducing the number of small hospitals, which financially drain and fragment the system. Hospitals with the largest volume of births, on top of lower percentages of cesarean sections, as demonstrated in the present study, also may influence other relevant outcomes, such as lower neonatal mortality [22] and lower maternal morbidity [30].

Based on the abovementioned facts, it is clear that the country needs to restructure its hospital network of obstetric care. Such restructuring inescapably entails the reorganization of care in a regionalized network, centred on larger hospitals, with higher volume of births and, preferably, strictly public [31]. This network shall have sufficient beds for high-risk gestations, NICU and NIU, as well as

obstetric ICU. The maternity wards qualified as reference for high maternal risk shall preferably have an obstetric ICU and, when not possible, they must have an agreement with a hospital equipped with ICU beds to avoid delays in service [31]. On top of that, they shall have adequate coordination, specialized human resources and sufficient funding. A second point is the organization of an efficient flow of information within the system to disseminate consensus on good practices regarding childbirth.

One of the strengths of this article is the fact that we did not identify previous studies in Brazil investigating the association of hospital characteristics with the odds of cesarean births, nor analysing the annual volume of deliveries and the geographical location of hospitals in state capitals or inland. Another strenght is that the sample from *Birth in Brazil* was designed to have representation for all regions of the country. However, it excluded facilities with less than 500 births/year, which account for 20% of births in Brazil. Nevertheless, as we found out that the smaller the hospital, the higher the prevalence of elective cesareans, excluding these hospitals would possibly underestimate the odds ratios for elective cesareans in hospitals with less than 1,500 births/year. Another limitation is the definition of elective cesarean adopted in the study, which considered as women that went into labor only those who dilated 4cm or more, possibly encompassing in the elective cesarean variable parturient women in the latent phase of labor. In addition, we did not assess the indication for cesarean and whether it was performed due to a request by the mother herself.

Even though the study was not designed for the purpose of this article, it was possible to raise some important questions about the type of care provided in hospitals in the Southeast. As it is the most industrialized region and the one with the highest economic power in the country, it is also the region that displays the best assistance indicators. However, we understand that there are still many challenges to be overcome.

Contributors

L. Zaiden and M. Nakamura-Pereira contributed to the design, data analysis, writing the article and approving the final version. M. A. M. Gomes has contributed to the design, critical review of the article and approval of the final version. A. P. Esteves-Pereira e M. C. Leal have contributed to the data collection, critical review and approval of the final version.

Additional informations

ORCID: Laura Zaiden (0000-0001-5074-708X); Marcos Nakamura-Pereira (0000-0002-4231-0205); Maria Auxiliadora Mendes Gomes (0000-0001-5908-1763); Ana Paula Esteves-Pereira (0000-0002-0236-2043); Maria do Carmo Leal (0000-0002-3047-515X).

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Resumo

Este artigo tem como objetivo avaliar a influência das características hospitalares sobre a chance de realização de cesariana eletiva na Região Sudeste do Brasil. Foram utilizados dados da pesquisa Nascer no Brasil, realizada entre fevereiro de 2011 e outubro de 2012. A presente análise inclui a amostra da Região Sudeste, compreendendo 10.155 mulheres. O grupo de mulheres submetidas à cesariana eletiva foi comparado ao de mulheres que entraram em trabalho de parto ou foram submetidas à indução do parto, independentemente se fizeram cesariana intraparto ou parto vaginal. Com exceção da idade gestacional, todas as características obstétricas analisadas mostraram-se associadas à cesariana eletiva. Nesse grupo, 60,5% não possuíam cesariana prévia à gestação atual e 64,7% eram de baixo risco. Dentre os partos com financiamento público, observou-se maior chance de cesárea eletiva nas mulheres que foram atendidas nos hospitais com < 1.500 (OR = 2,11; IC95%: 1,37-3,26) e entre 1.500-2.999 partos/ano (OR = 1,45; IC95%: 1,04-2,02) e nos hospitais mistos (OR = 1,81; IC95%: 1,37-2,39). Nos hospitais mistos, a magnitude da associação é maior quando localizados em não capitais com volume > 3.000 partos/ano (OR = 3,45; IC95%: 1,68-7,08) e atinge seu maior valor nos hospitais localizados em não capitais com volume < 3.000 partos/ano (OR = 4,08; IC95%: 2,61-6,37). Em contrapartida, não observou-se associação entre cesariana eletiva e os hospitais públicos localizados em não capitais do Sudeste. As prevalências de cesariana eletiva nos hospitais públicos da Região Sudeste são altas quando comparadas a outros países, e sofrem importante influência das características hospitalares.

Cesárea; Parto Normal; Sistema Único de Saúde; Hospitais Públicos; Trabalho de Parto Induzido

Resumen

El objetivo de este artículo es evaluar la influencia de las características hospitalarias sobre la oportunidad de realización de cesáreas electivas en la región sudeste de Brasil. Se utilizan datos de la investigación Nacer en Brasil, realizada entre febrero de 2011 y octubre de 2012. El presente análisis incluye la muestra de la región sudeste, comprendiendo a 10.155 mujeres. El grupo de mujeres sometidas a una cesárea electiva se comparó con el de mujeres que entraron en trabajo de parto o fueron sometidas a la inducción del parto, independientemente si tuvieron cesárea intraparto o parto vaginal. Con excepción de la edad gestacional, todas las características obstétricas analizadas se mostraron asociadas con la cesárea electiva. En ese grupo un 60,5% no tuvieron una cesárea previa y un 64,7% tenían gestaciones de riesgo bajo. Entre los partos con financiación pública se observó una mayor oportunidad de cesárea electiva en las mujeres que fueron atendidas en los hospitales con < 1.500 (OR = 2,11; IC95%: 1,37-3,26) y entre 1.500-2.999 partos/año (OR = 1,45; IC95%: 1,04-2,02) y en los hospitales mixtos (OR = 1,81; IC95%: 1,37-2,39). En los hospitales mixtos, la magnitud de la asociación es mayor cuando están localizados fuera de la capital (OR = 3,45; IC95%: 1,68-7,08), en los con volumen > 3.000 partos/año, y alcanza su mayor valor en los hospitales fuera de las capitales con volumen < 3.000 partos/año (OR = 4,08; IC95%: 2,61-6,37). Como contrapartida, no se observó asociación entre cesárea electiva y los hospitales públicos localizados fuera de las capitales del sudeste. Las prevalencias de cesárea electiva en los hospitales públicos de la región sudeste son altas, cuando se comparan con las de otros países, y sufren una importante influencia de las características hospitalarias.

Cesárea; Parto Normal; Sistema Único de Salud; Hospitales Públicos; Trabajo de Parto Inducido