

Caesarean section and neonatal outcomes in private hospitals in Brazil: comparative study of two different perinatal models of care

Cesariana e resultados neonatais em hospitais privados no Brasil: estudo comparativo de dois diferentes modelos de atenção perinatal

Cesárea y resultados neonatales de hospitales privados en Brasil: un estudio comparativo de dos diferentes modelos de prestación de servicios perinatales

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Abstract

This study aims at comparing caesarean section rates and neonatal outcomes of two perinatal models of care provided in private hospitals in Brazil. Birth in Brazil data, a national hospital-based cohort conducted in the years 2011/2012 was used. We analysed 1,664 postpartum women and their offspring attended at 13 hospitals located in the South-east region of Brazil, divided into a "typical" – standard care model and "atypical" – Baby-Friendly hospital with collaborative practices between nurse-midwives and obstetricians on duty to attend deliveries in an alternative labour ward. The Robson's classification system was used to compare caesarean sections, which was lower in the atypical hospital (47.8% vs. 90.8%, $p < 0.001$). Full term birth, early skin-to-skin contact, breastfeeding in the first hour, rooming-in care, and discharge in exclusive breastfeeding were more frequent in the atypical hospital. Neonatal adverse outcome did not differ significantly between hospitals. The atypical hospital's intervention should be further evaluated since it might reduce caesarean section prevalence and increase good practices in neonatal care.

Cesarean Section; Parturition; Maternal and Child Health; Breast Feeding

Resumo

Objetiva-se comparar a prevalência de cesariana e desfechos neonatais de dois modelos de atenção ao parto em hospitais privados brasileiros, utilizando-se dados do estudo Nascer no Brasil, coorte de base hospitalar realizada nos anos 2011/2012. Foram analisadas 1.664 puérperas e seus conceitos, atendidos em 13 hospitais localizados na Região Sudeste, divididos em "típico" – modelo de atenção padrão, e "atípico" – Hospital Amigo da Criança com equipes de plantão e trabalho colaborativo entre enfermeiras obstétricas e médicos na atenção ao parto. A classificação de Robson foi adotada para a comparação das prevalências de cesariana, que foram menores no hospital atípico (47,8% vs. 90,8%; $p < 0,001$). Desfechos positivos relativos ao aleitamento materno foram mais frequentes no hospital atípico. Eventos neonatais adversos não apresentaram diferença significativa entre os hospitais. A intervenção adotada no hospital atípico deve ser avaliada em profundidade, uma vez que parecer reduzido a prevalência de cesariana e aumentado as boas práticas de cuidado neonatal.

Cesárea; Parto; Saúde Materno-Infantil; Aleitamento Materno

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Introduction

Caesarean sections are almost universal among women who give birth financed by private funds in Brazil; the proportion of this procedure in this group is nearly 90%¹. The association between caesarean sections and private health care is well documented and occurs in developed and developing countries^{2,3,4,5,6}. However, none of these countries has as high a caesarean section prevalence as that reported for the private sector in Brazil. The World Health Organization (WHO) sets an upper limit of 15% as appropriate for caesarean section prevalence on medical grounds^{7,8}. Based on this, there are no clinical reasons that can justify a caesarean section prevalence of 90%. This prevalence suggests that critical, non-clinical factors play a role in the process of clinical decision-making surrounding the type of birth. Probably there are local contextual determinants, especially those related to the health system⁹, in the causal chain of this problem.

The health system in Brazil mixes public and private financing¹⁰. The access to the public sector is universal¹⁰. Part of the public care is carried out in certain private hospitals, known as mixed hospitals, which can have both beds contracted by the government and those paid through private funds¹⁰. In addition, there are some private hospitals which assist only private patients, in this case there are two options: patients can pay providers directly (out of pocket payment), which is less common, or pay for private health insurance¹⁰. This paper focuses on women who had maternity care paid through private funds in private hospitals, excluding mixed hospitals.

According to official data¹¹ from December 2012, 24.7% of the Brazilian population had at least one private health insurance plan, with this coverage varying by region throughout the country. The Southeast is the richest region of Brazil and the states that make up this region have the highest coverage of private health insurance, ranging from 25.9% to 43.6%¹¹. There are around 20 million women at fertile age (10 to 45 years old) in this region, which represents 31% of the overall number of women at fertile age in Brazil (Departamento de Informática do SUS. Informações de saúde (Tabnet): estatísticas vitais. Mortalidade e nascidos vivos. <http://www2.datasus.gov.br/DATASUS/index.php?area=0206>, accessed on 25/Jun/2013).

Studies^{12,13,14,15} conducted in cities located in the Southeast region of Brazil of women who use private health insurance have found a prevalence of caesarean section ranging from 80% to 90%.

The standard perinatal model of care for people who use private health insurance in Brazil has the following characteristics: antenatal care and delivery are provided by the same doctor, who is paid by private health insurers in a fee-for-service reimbursement system and who is responsible for covering antenatal care appointments during weekday office hours and for attending labour and birth¹². There are very few births attended independent nurse-midwives in this sector.

Since 2004, the National Regulatory Agency for Private Health Insurance and Plans (ANS) has been studying strategies to reduce caesarean section prevalence in the private sector in Brazil. In line with this, technicians from the ANS have identified one private hospital whose managers reported an innovative perinatal model of care, which was the reason why it was chosen for comparison and that will be referred to as an "atypical hospital" in this paper. The main features of this model were: the antenatal care team is different from the delivery care team; there is collaborative labour and birth assistance between nurse-midwives, and physicians, who are paid by monthly salary regardless of the number of deliveries. The atypical hospital is located in a non-capital city in the Southeast region of Brazil and is a referral to maternity services in this region for women insured by the health plan that owns the hospital.

Evidence suggests that there is an association between higher proportions of caesarean sections and non-clinical factors, such as: the fee-for-service as payment type¹⁶ and deliveries in obstetric unit instead of midwifery-led units¹⁷ or instead of other kinds of alternative hospitals or freestanding settings of birth¹⁸. In addition, previous studies^{12,13,14,15} have found that private care is strongly associated with the high prevalence of caesarean sections in Brazil.

According to the WHO report⁹, aspects related to health systems, such as human resources and financing profiles, have the largest impact on caesarean section prevalence and should receive more attention in research on this topic. From this perspective, the hypothesis of this paper is that the atypical hospital's perinatal model of care might have a significant effect on caesarean section prevalence and neonatal outcomes. Considering this hypothesis, this study aims at comparing the caesarean section prevalence and neonatal outcomes of women who gave birth at the atypical hospital with those of women who gave birth in private hospitals that adopt the standard perinatal model of care (typical hospitals), taking into account women's characteristics.

Methods

This study was a sub-project of a national hospital-based cohort study of postnatal women and their offspring called *Birth in Brazil*¹⁹. Clinical criteria for participants' eligibility were: postnatal women who gave birth to a live newborn of any weight or gestational age or to a stillbirth with birth weight ≥ 500 g and/or gestational age ≥ 22 weeks of pregnancy.

For this analysis, the group exposed to the innovative perinatal model of care was formed by women who gave birth in the atypical hospital. The unexposed group was formed of women who gave birth in private hospitals located in non-capital cities in the Southeast Region of Brazil sampled in the *Birth in Brazil* study.

Setting and participants

A probabilistic sample in three stages was designed for the *Birth in Brazil* study. Firstly, hospitals with 500 or more births in 2007 were selected randomly with the probability proportional to the number of live births per hospital in 2007 in each of the 30 strata defined for the study. Then, the number of days that would be necessary (a minimum of 7 days) to reach a fixed number of 90 postpartum women in each hospital was defined. Finally, the women and their offspring were selected randomly, with equal probability, in each one of the 266 hospitals selected in the first stage, totalling 23,940 postnatal women and their offspring²⁰.

There were 86 private hospitals eligible for the *Birth in Brazil* study in non-capital cities of the Southeast of Brazil. In this stratum, 13 private hospitals, at least one in each of the four states that form the region, were randomly selected. The atypical hospital was among these 13 private hospitals. In order to estimate the atypical hospital caesarean section prevalence and neonatal outcomes, a random sample of this hospital was calculated based on a late preterm births (from 34 to 36 weeks of gestational age) prevalence of 8%, with 5% of significance to detect differences of at least 5% and with testing power of 80%. A finite population correction was used based on the number of births in the atypical hospital in 2007 (2,507 births). The minimum sample size calculated for the atypical hospital was 503 postnatal women and their offspring. Following the 90 interviews performed in the atypical hospital during the *Birth in Brazil* field work, 512 further interviews were completed in this hospital, compounding the exposed group. The unexposed group was made up of women who gave birth in one of the other 12 private hospitals, totalling

1,080 women; the atypical hospital was excluded from this group. The sample weights were based on the inverse of the inclusion probabilities in the sample.

Data collection

Fieldwork was carried out between February 2011 and October 2012 and the measurement instruments were the same as those used during the *Birth in Brazil* study (see the instruments in the additional files and more information about the fieldwork in the study protocol)¹⁹. A woman's face-to-face electronic questionnaire, collected in the hospital between 6 to 24 hours after birth, was the first one used; information on patients' and newborns' medical records was assessed using a second electronic questionnaire, completed after death or discharge from hospital, or at maximum on the 42nd hospitalization day for the woman and the 28th hospitalization day for the newborn. A folder with a summary of the antenatal appointments and obstetric ultrasonography was photographed, when available. This was used to access relevant data, such as gestational age in the early pregnancy. A specific electronic form was used for the data extraction from these photos. In addition, the managers of hospitals were interviewed by the supervisor to assess hospital facilities, using a face-to-face paper-format questionnaire.

Statistical analysis

The occurrence of caesarean sections was the primary outcome; secondary outcomes comprised: (1) gestational age in weeks, which was determined using an algorithm²¹ that reduced the chance of miscalculating the gestational age, acknowledging the Brazilian context; (2) early skin-to-skin contact (holding the baby or breastfeeding just after birth *vs.* visual contact or no contact at all); (3) breastfeeding in the first hour after birth; (4) rooming-in care during all hospitalization; (5) discharge in exclusive breastfeeding and (6) adverse neonatal outcome, a composite dichotomy variable including neonatal mortality – death of a live-born infant in the first 28 days of life – or neonatal near miss²², which comprises the presence of any of the following: birth weight $< 1,500$ g, Apgar score at the 5th minute of life < 7 , mechanical ventilation, gestational age < 32 weeks and congenital malformations.

Independent variables were: maternal age in years (< 20 ; 20 to 34; 35 or more); skin colour (white; black; brown/mixed; Asian; indigenous); years of schooling (7 or less; 8 to 10; 11 to 14; 15 or more); economic status (measured using the

ABEP index, which is a score based on family level of consumption and level of education of the head of the family) (Associação Brasileira de Empresas de Pesquisa. Critério de classificação econômica Brasil 2010. <http://www.abep.org>, accessed on 30/Jun/2013); marital status (living with partner or not); women classification based on obstetrically relevant concepts (Robson's 10-group classification); and high risk pregnancy (yes or no).

The Robson's 10-group classification system was developed in 2001²³ based on the following obstetric concepts at the time of delivery: the category of pregnancy (single or multiple and cephalic or non-cephalic); the previous obstetric record of the woman (nulliparous or multiparous, with or without uterine scar); the course of labour and delivery (spontaneous, induced or caesarean sections before labour) and the gestational age at the time of delivery. The 10 groups formed from these concepts (Table 1 and 2) are mutually exclusive but totally inclusive and clinically relevant. Robson's 10-group classification is the best method for institutional comparison of the mode of delivery²⁴. It was used to assess differences between the atypical and typical hospitals regarding: the relative size of the groups (total number of women in each group divided by total number of women who give birth); the overall proportion of caesarean sections and the proportion of caesarean sections in each group (number of caesarean sections in each group divided by number of women who give birth in each group); contribution of each group to the overall proportion of caesarean sections (number of caesarean sections in each group divided by total number of women who gave birth) and proportion of vaginal births (number of vaginal births in each group divided by total number of women who gave birth).

The composite variable named "high risk pregnancy" was created considering the registration in the medical records of at least one of the following maternal morbidities and/or obstetric or medical complications in the current pregnancy (before hospital admission): heart disease; hypertensive disorders; anaemia or other hemoglobinopathy; asthma; lupus or scleroderma; hyperthyroidism; diabetes (gestational or non-gestational); chronic kidney disease; seizures/epilepsy; cerebral vascular accident (stroke); chronic liver disease; psychiatric illness; cervical incompetence; intra uterine growth restriction (IUGR); oligohydramnios; polyhydramnios; RH isoimmunization; placenta praevia; placenta abruption; premature rupture of membranes; eclampsia; fetal distress; HIV infection; positive culture for streptococcus in

the vagina. Furthermore, conditions diagnosed on hospital admission were also considered in order to form the high risk pregnancy variable: breech or other non-cephalic presentation; multiple pregnancy (two fetuses or more); any alteration in cardiotocography; any alteration in Doppler flowmetry; preterm labour/ threat of premature labour; fetal distress (acute/chronic); macrosomia; failed induction; malformation; prematurity and post-maturity.

Variables related to social and demographic maternal characteristics, early skin-to-skin contact and all others related to breastfeeding were extracted from the woman's face-to-face electronic questionnaire; occurrence of caesarean sections, adverse neonatal outcome, high risk pregnancy and Robson's 10-group classification were taken from medical records; data related to hospital organization and the perinatal model of care, such as availability of neonatal intensive care unit, type of providers, schedules of labour and delivery care team, accreditation as a Baby-Friendly Hospital and availability of non-pharmacological features for pain relief during labour, were extracted from the face-to-face questionnaire with the manager of the hospital.

To analyse whether proportional distributions of the independent variables differed significantly (p-value at least 0.05) between the atypical hospital and typical hospitals, the Wald test for homogeneity was used. Independence between outcomes and type of hospital was explored using a second-order Rao-Scott adjusted chi-square test (p-value at least 0.05 to be considered significant). Statistical analyses were performed using the package complex survey samples in the R 2.15.2 software (The R Foundation for Statistical Computing, Vienna, Austria; <http://www.r-project.org>).

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Results

In total, 1,788 women were invited to participate; 629 in the atypical hospital and 1,159 in the typical hospitals; 6% of those eligible women were not interviewed (108 women) – 4.6%

Table 1

Characteristics of women by type of private hospital. Southeast Region of Brazil, 2011-2012.

Variable	Atypical hospital	Typical hospitals	p-value *
	(n = 584) %	(n = 1,080) %	
Maternal age (years)			
< 20	8.0	5.1	0.184
20-34	78.1	76.7	
35 or more	13.8	18.2	
Skin colour			
White	51.3	56.8	0.386
Black	6.1	4.2	
Brown/Mixed	41.0	37.2	
Asian	0.6	1.5	
Indigenous	1.0	0.3	
Years of study			
7 or less	6.5	4.2	0.121
8-10	13.5	9.3	
11-14	68.5	58.4	
15 or more	11.6	28.1	
Income status			
Classes D + E	2.8	1.8	0.229
Class C	46.3	35.5	
Classes B + A	50.8	62.8	
Marital status			
Living with partner	88.4	87.4	0.669
High risk pregnancy			
Yes	48.9	46.4	0.546
Robson's 10-group classification			
1. Nulliparous, single cephalic, > 37 weeks in spontaneous labour	16.2	10.1	0.045
2. Nulliparous, single cephalic, > 37 weeks, induced or caesarean section before labour	25.1	38.1	
3. Multiparous (excluding previous caesarean section), single cephalic, > 37 weeks in spontaneous labour	9.6	5.5	
4. Multiparous (excluding previous caesarean section), single cephalic > 37 weeks, induced or caesarean section before labour	14.9	6.4	
5. Previous caesarean section, single cephalic, > 37 weeks	19.4	26.2	
6. All nulliparous breeches	2.5	1.2	
7. All multiparous breeches (including previous caesarean section)	2.1	1.3	
8. All multiple pregnancies (including previous caesarean section)	1.7	1.7	
9. All abnormal lies (including previous caesarean section)	0.4	0.2	
10. All single cephalic, < 36 weeks (including previous caesarean section)	7.5	8.6	

* Wald test for homogeneity.

in the atypical hospital (29 women) and 6.8% in the typical hospitals (79 women) because of early discharge or because they did not want to participate. In addition, 16 women in the atypical hospital (2.5%) were excluded because the medical record questionnaires were not completed. These women did not differ to those included in analysis in relation to the variables

“age” and “mode of delivery”. This analysis included 584 women who gave birth in the atypical hospital and 1,080 women who gave birth in typical hospitals.

The atypical and typical hospitals were akin in relation to geographic location and type of hospital financing – all hospitals assisted only private patients and are based in non-capital

Table 2

Proportion of caesarean section according to Robson's 10-group classification by type of private hospital. Southeast Region of Brazil, 2011-2012.

Robson's 10-group classification	Caesarean section rate in each group * (%)		Contribution of each group to the overall caesarean section rate * (%)		Contribution of each group to the overall vaginal birth rate * (%)	
	Atypical	Typical	Atypical	Typical	Atypical	Typical
1. Nulliparous, single cephalic, > 37 weeks in spontaneous labour	34.9	82.8	5.7	8.3	10.5	1.7
2. Nulliparous, single cephalic, > 37 weeks, induced or caesarean section before labour	53.0	97.4	13.3	37.1	11.8	1.0
3. Multiparous (excluding previous caesarean section), single cephalic, > 37 weeks in spontaneous labour	8.1	29.6	0.8	1.6	8.8	3.9
4. Multiparous (excluding previous caesarean section), single cephalic > 37 weeks, induced or caesarean section before labour	19.4	82.5	2.9	5.3	12.0	1.1
5. Previous caesarean section, single cephalic, > 37 weeks	77.6	99.5	15.0	26.1	4.3	0.1
6. All nulliparous breeches	100.0	100.0	2.5	1.2	0.0	0.0
7. All multiparous breeches (including previous caesarean section)	89.3	100.0	1.9	1.3	0.2	0.0
8. All multiple pregnancies (including previous caesarean section)	100.0	91.8	1.7	1.6	0.0	0.1
9. All abnormal lies (including previous caesarean section)	100.0	100.0	0.4	0.2	0.0	0.0
10. All single cephalic, < 36 weeks (including previous caesarean section)	45.0	86.3	3.4	7.4	4.1	1.2
Total	47.8	90.8	47.8	90.8	52.2	9.2

* p-value < 0.001 in all comparison between atypical and typical hospitals using the second-order Rao-Scott adjusted chi-square test.

cities of the South-east region of Brazil. According to the manager of these hospitals, the atypical hospital had a neonatal intensive care unit (neonatal ICU) and was referral for high-risk pregnancies; among typical hospitals seven in twelve (58.3%) had neonatal ICU and four in twelve (33.3%) were referral to high-risk pregnancies. The atypical hospital was the only one that held the Baby-Friendly Hospital accreditation, offered non-pharmacological features for pain relief during labour (bath; birthing ball; rocking/birth chair) and had nurse-midwives attending vaginal births – 75.9% of overall vaginal birth was attended by nurse-midwives in the atypical hospital (data not shown in table). Other features of the atypical hospital perinatal model of care were adopted by very few typical hospitals: in two out of twelve (16.7%) typical hospitals there were periodical meetings to discuss caesarean sections rate and its indications and in one out of twelve (8.3%) typical hospitals there was a bath in the labour ward.

Women attended in the atypical and typical hospitals were similar (Table 1); differences in age, skin colour, years of schooling, income status, marital status and high risk pregnancy between these two types of hospitals were not statistically significant. Women differed significantly ($p = 0.045$) in relation to Robson's 10-group classification; group 2 (nulliparous, single cephalic, > 37 weeks, induced or caesarean sections before labour) and group 5 (previous caesarean sections, single cephalic, > 37 weeks) comprised the highest proportion of women in both type of hospitals. There were more nulliparous (groups 1 and 2) and more multiparous with previous caesarean sections (group 5) in typical hospitals than in the atypical one.

The overall caesarean section prevalence was 1.9 times higher ($p < 0.001$) in typical hospitals than in the atypical one, the proportion of caesarean sections was also higher in typical hospitals compared to the atypical hospitals in most of the groups of the Robson's classification (Table

2). The contribution of each group to the overall proportion of caesarean sections, taking into account the relative size of the groups, varied according to the type of hospital – group 5, which comprised women with previous caesarean sections, contributed more to the overall prevalence of caesarean sections in the atypical hospital (15% of the overall caesarean sections was in this group), while in typical hospitals group 2, which included nulliparous, induced or caesarean sections before labour, comprised the majority of caesarean sections (37.1%). The groups that contributed more to the overall proportion of vaginal birth in the atypical hospital were groups 4 (12%) and 2 (11.8%), which included multiparous and nulliparous induced labour; in typical hospitals, group 3 (3.9%) which included multiparous with spontaneous labour, contributed more to the overall proportion of vaginal birth.

Caesarean sections before labour (Figure 1) were 2.3 times higher among women who gave birth in typical hospitals than those in the atypical one (73% *vs.* 31%, $p < 0.001$). In typical hospitals, the prevalence of caesarean sections among women who were classified as low risk pregnancy was nearly the same as those who were classified as high risk pregnancy (88.6%, *vs.* 93.4%, $p = 0.129$). In the atypical hospital, the prevalence of caesarean sections among women who were classified as high risk pregnancy was more than three times higher than the prevalence of caesarean sections among low risk pregnancies (76.1%, *vs.* 20.7%, $p < 0.001$).

The atypical hospital presented better neonatal outcomes (Table 3). Interventions that facilitate initiation of breastfeeding like early skin-to-skin contact between mother and baby, breastfeeding in the first hour after birth and rooming-in care during all hospitalization were more frequent in the atypical hospital than in the typical ones. Although the adverse neonatal outcome rate was higher in the atypical hospital (32 per 1,000 live births in the atypical hospital and 25 per 1,000 live births in typical hospitals), this difference was not statistically significant ($p = 0.250$).

Distribution of gestational age among babies born by caesarean sections was different according to the type of hospital (Table 4). Most of the babies who were born by caesarean section in the atypical hospital were full term (born between 39 and 41 weeks of gestational age); while in typical hospitals the majority of babies born by caesarean sections were early term (born within 37 or 38 weeks of gestational age). The prevalence of early terms born by caesarean section was 1.5 times higher in typical hospitals than in the atypical hospital (51.2%, *vs.* 33.8%,

$p < 0.001$). For those babies born by vaginal birth, differences in gestational age by type of hospital were not statistically significant ($p = 0.103$).

Discussion

Typical hospitals are similar among them and differ from the atypical hospital regarding characteristics of maternity care management. Features such as Baby-Friendly Hospital accreditation, availability of non-pharmacological features for pain relief during labour and nurse-midwives as primarily responsible for attending vaginal births were observed only in the atypical hospital, suggesting that the perinatal model of care in the atypical hospital is innovative when compared with the standard model of care in private hospitals in the Southeast region of Brazil.

The case-mix of the population included in this study had similar demographic and obstetric characteristics in both types of hospitals and might not explain the differences in caesarean section prevalence and neonatal outcomes between the atypical and typical hospitals. It is therefore most likely improbable that other women's characteristics, not included in this study, would be able to explain the differences observed. These results strongly suggest that differences in the perinatal model of care explain the considerable variation in caesarean section prevalence and neonatal outcomes among the atypical and typical hospitals.

The overall caesarean section prevalence, the proportion of caesarean sections before labour and the proportions of caesarean sections in most groups of the Robson's 10-group classification were remarkably lower among women who gave birth in the atypical hospital than those who gave birth in typical hospitals. The difference in the overall caesarean section prevalence between the two types of hospitals was even higher for women classified as low risk pregnancy. The reduced overall prevalence of caesarean sections in the atypical hospital could be due to access restrictions for this type of birth, however the caesarean section prevalence of 76% among women classified as high risk pregnancy in the atypical hospital suggest that there was no caesarean section access restrictions for women who needed this type of birth.

The overall caesarean section prevalence in both types of hospitals was much higher than the maximum of 15% recommended by the WHO to prevent or treat life-threatening perinatal complications^{7,8}. However, the overall caesarean section prevalence in the atypical hospital was similar to the median caesarean

Figure 1

Caesarean section by type of private hospital. Southeast Region of Brazil, 2011-2012.

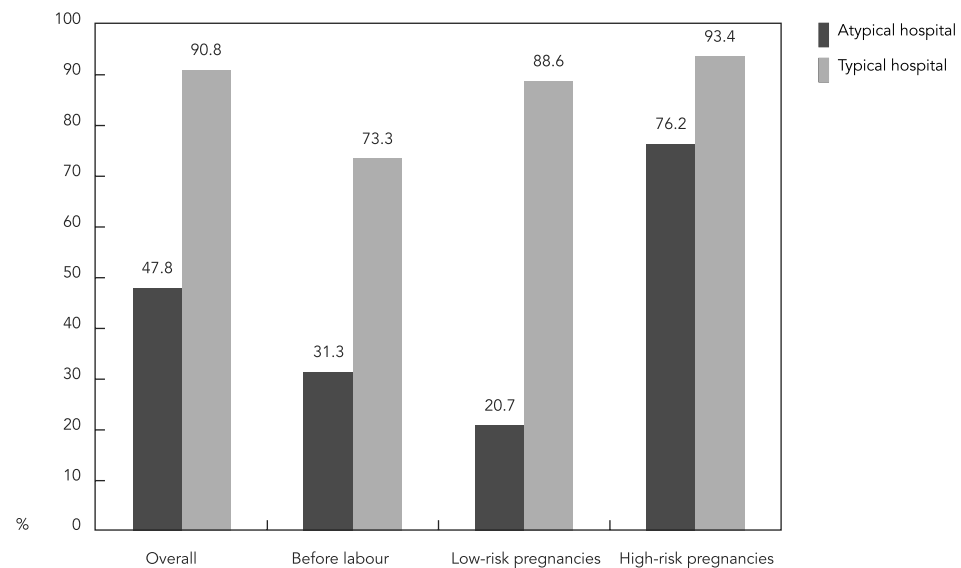


Table 3

Neonatal outcomes by type of private hospital. Southeast Region of Brazil, 2011-2012.

Variable	Atypical hospital (n = 584)	Typical hospitals (n = 1,080)	p-value *
	%	%	
Early skin-to-skin contact			
Yes	37.7	12.8	0.000
Breastfeeding in the first hour after birth			
Yes	65.8	11.9	0.000
Rooming-in care during all hospitalization			
Yes	92.2	34.7	0.000
Discharge in exclusive breastfeeding			
Yes	90.3	56.5	0.000
Adverse neonatal outcome			
Yes	3.2	2.4	0.250

* Second-order Rao-Scott adjusted chi-square test.

section prevalence (51%) in private hospitals in Latin America ² and lower than those reported for low risk women in private hospitals in Australia ³ (27.1% compared to 20.7%), a country in which the health system ²⁵ shares similarities with the Brazilian health system ¹⁰ – both

formed by a public-private mix, offering public universal health coverage and private insurance as an option.

In both types of hospitals, group 2 (nulliparous, single cephalic, > 37 weeks, induced or caesarean sections before labour) followed by group

Table 4

Distribution of gestational age by type of birth and type of private hospital. Southeast Region of Brazil, 2011-2012.

Gestational age (weeks)	Caesarean section		p-value *	Vaginal birth		p-value *	Total		p-value *
	Atypical (n = 282)	Typical (n = 971)		Atypical (n = 302)	Typical (n = 109)		Atypical (n = 584)	Typical (n = 1,080)	
	%	%		%	%		%	%	
≤ 33	4.5	2.4	0.001	0.7	3.2	0.103	2.5	2.5	0.001
34-36	7.8	7.6		7.3	11.1		7.5	7.9	
37-38	33.8	51.2		37.7	32.3		35.8	49.5	
39-41	53.6	38.5		53.8	53.4		53.7	39.8	
≥ 42	0.4	0.3		0.6	0.0		0.5	0.3	
Total	100.0	100.0		100.0	100.0		100.0	100.0	

* Second-order Rao-Scott adjusted chi-square test.

5 (previous caesarean sections, single cephalic, > 37 weeks) of the Robson's 10-groups classification were the largest. This result was different than expected because groups 1 and 3, which include all women with single cephalic pregnancy, at > 37 weeks gestation, in spontaneous labour and without uterine scar, are the biggest groups in the majority of obstetric populations²³. In addition, group 2 in typical hospitals and group 5 in the atypical hospital were the ones that contributed more to the overall proportion of caesarean sections. These results suggest that strategies aiming at reducing caesarean sections in private hospitals in Brazil should give more emphasis and consider specific actions to groups 2 and 5. In the atypical hospital, groups 2 and 4 had a high contribution to the overall proportion of vaginal birth, suggesting that the perinatal model of care in this hospital focused successfully on these groups, perhaps because of labour induction. However, reducing caesarean section prevalence among women with previous caesarean sections (group 5) remains a challenge in both the atypical and typical hospitals.

The majority of caesarean sections performed in the atypical hospital was after 39 weeks of gestational age as recommended by international guidelines^{26,27}. On the other hand, in the typical hospitals, the majority of caesarean sections was performed before 39 weeks. The high prevalence of caesarean sections before labour and the high frequency of early terms born by caesarean sections in typical hospitals suggest that a great number of elective caesarean sections were performed before 39 weeks of gestational age in typical hospitals. This is a worrying situation since elective caesarean sections before 39 weeks increases the risk of neonatal

morbidity^{28,29} and of negative long term outcomes, such as lower reading and mathematics results when compared to full term children³⁰.

Although the atypical hospital is a referral service for high risk pregnancy and neonatal requiring neonatal ICU, there was no difference between the atypical and typical hospitals regarding adverse neonatal outcomes. In addition, good practices related to neonatal care – early skin to skin contact, breastfeeding at first hour after birth, rooming-in care, and discharge in exclusive breastfeeding – were more frequent in the atypical hospital.

Evidence supports the theory that teams on duty³¹ made up of nurse-midwives and obstetricians working collaboratively to attend women in labour³², with midwives as the primary person responsible for attending vaginal births^{33,34}; audit review of caesarean section prevalence and its indication^{36,36}; availability of non-pharmacological features to support normal labour¹⁸ and the Baby-Friendly Hospital accreditation^{37,38} are strategies adopted by the atypical hospital that might explain its results. However, it is not clear how all these strategies interacted and what in particular contributed to the reduced caesarean section prevalence found in the atypical hospital. The perinatal model of care of this hospital is likely to be a multifaceted complex intervention³⁹, with components regarding maternity management and organization and behavioural change in health professionals and patients. For a better understanding of how this intervention worked an in depth examination was necessary⁴⁰. To perform such a qualitative research was carried out in the atypical hospital and will be presented in a future publication.

The strengths of this study include, firstly, its originality because this is the first study in Brazil with a sample size and statistical power to compare private hospitals with pronounced variation on caesarean section prevalence and its effect on neonatal outcomes. Secondly, this study used the same instruments and quality control measures of a national survey into labour and birth¹⁹ which contributed to the minimisation of bias and increased the possibility of comparisons with results on a national level. The weakness of the study comprises the observational design which limited the possibility of identifying reliable estimates of effect; also the possibility that the study did not have the power to detect differences that may exist regarding adverse neonatal outcomes because of the low rate of this composite variable.

Resumen

El objetivo de este estudio es comparar la tasa de cesárea y los resultados neonatales de dos modelos de atención del parto en hospitales privados en Brasil. Fueron utilizados datos de la encuesta Nacer en Brasil, cohorte de base hospitalaria en los años 2011/2012. Se analizaron 1.664 madres y sus recién nacidos en 13 hospitales de la región sureste, dividido en "típico" – modelo de atención estándar y "atípico" – Hospital Amigo del Niño con la atención al parto por equipos de turno integrados por médicos y parteras. Se adoptó la clasificación de Robson para comparar las tasas de cesárea, lo cual fue inferior en el hospital atípico (47,8% vs. 90,8%, $p < 0,001$). Los resultados positivos relacionados con la lactancia materna fueron más frecuentes en el hospital atípico. Eventos adversos neonatales no difirieron significativamente entre los hospitales. La intervención utilizada en el hospital atípico se debe evaluar en profundidad ya que parece haber reducido la prevalencia de la cesárea y aumentado las mejores prácticas de atención neonatal.

Cesárea; Parto; Salud Materno-Infantil; Lactancia Materna

Conclusion

Our results suggest that evidence-based changes in maternity care might markedly reduce caesarean section prevalence and increase good practices related to neonatal care, without an increase in adverse neonatal outcomes in private hospitals in Brazil. The high proportion of early term births and caesarean sections before labour may be a matter of ethical concern. The Brazilian Medical Council should develop recommendation in order to reduce elective caesarean sections, especially those before 39 weeks of gestational age and before labor, following what has been done in other countries. Further research exploring features of the innovative perinatal model of care of the atypical hospital would better explain which key aspects policy makers should focus on in order to develop interventions to reduce caesarean sections and improve neonatal outcomes in private sector in Brazil.

Contributors

J. A. Torres proposed the design and objectives, conducted statistical analyses, interpretation of results and wrote the first and final versions of the article. R. M. S. M. Domingues, J. Sandall, Z. Hartz, S. G. N. Gama, M. M. Theme Filha, A. O. C. Schilithz and M. C. Leal contributed to the interpretation of results, and read, revised and approved the final version of the manuscript.

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