



Cesarean sections in Brazil: will they ever stop increasing?

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ABSTRACT

Objective. To describe trends, geographic distribution, and risk factors for cesarean deliveries in Brazil in 2000–2011, and to determine if efforts to curtail rates have had a measurable impact.

Methods. This was an observational study using nationwide information from the Department of Informatics of the Unified Health System (DATASUS). Individual level analyses were based on data regarding maternal education, age, parity, and skin color. Ecological analyses at the level of 431 health districts investigated the relationships with health facility density and poverty level.

Results. Cesarean rates increased markedly, from 37.9% in 2000 to 53.9% in 2011. Preliminary results from 2012 showed a rate of 55.8%, with the richest geographic areas showing the highest rates. Rates at the municipal level varied from 9%–96%. Cesareans were more common in women with higher education, white skin color, older age, and in primiparas. In the ecological analyses, the number of health facilities per 1 000 population was strongly and positively correlated with cesarean rates, with an increase of 16.1 percentage points (95% Confidence Interval [95%CI] = 4.3–17.8) for each facility. An increase of 1 percentage point in the poverty rate was associated with a decline of 0.5 percentage point in cesarean rates (95%CI = 0.5–0.6).

Conclusions. The strong associations with maternal education and health facility density suggest that the vast majority of cesareans are not medically indicated. A number of policies and programs have been launched to counteract this trend, but have had virtually no impact.

Key words:

Cesarean section; delivery, obstetric; trial of labor; socioeconomic factors; maternal and child health; Brazil.

In 1991, the rate of cesarean sections in Brazil was forecasted to rise markedly

over the following decades (1). In the 1970s, cesarean sections had accounted

for 15% of all births in Brazil; during the 1990s, this figure reached 35% (2). Currently, more than 50% of all births in Brazil are by cesarean (45% of public-sector births and 90% of private) (3). Brazil presents, together with China, the highest prevalence of cesareans in the world (4–6). Both countries are jointly responsible for half of all cesareans worldwide (4).

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Furthermore, numerous studies have shown clear social inequalities, with cesarean rates being positively associated with maternal education and family income (7–10).

The imposing increase in cesarean rates in Brazil has had repercussions throughout the health system. For one, health care services have had to adapt to provide the structure, equipment, and staff required by the escalating number of surgeries. Secondly, the cost of health care has been impacted given that cesarean deliveries are 40% more expensive than vaginal births (Ministry of Health of Brazil, 2013; unpublished data). Moreover, health outcomes are affected by the increased risk of maternal death posed by cesareans, even when the procedure has no medical indication (11); this increased risk extends to both mother and fetus in subsequent pregnancies (12).

Increased cesarean-related morbidity and mortality have been confirmed by both a multicenter study of 100 000 births in Latin America (13); and an international multicenter study showing that women who were submitted to a cesarean without a clear medical need, presented increased risk of immediate complications, including admission to an intensive care unit, blood transfusion, hysterectomy, and death (14). A study of elective cesareans in the United States also showed that more than one-third were performed prior to 39 weeks of gestation and these infants had a higher risk of morbidity/mortality than those born at 39–41 weeks (15).

In Brazil, preterm births are increasing steadily (16). The role of cesareans in this increase is still unclear. Some studies show an association (17, 18), while others show that preterm rates have increased for both vaginal and cesarean deliveries (19, 20). Additionally, although a number of government policies have been adopted since 1980 to reduce cesarean deliveries (2), the steady increases make clear that they have been ineffective.

The objective of this study was to describe time trends and differences in cesarean sections among Brazil's geographic areas using data available from the Department of Informatics of the Unified Health System (DATASUS). This information can be helpful for the programming of new initiatives to reduce the cesarean section epidemic.

MATERIALS AND METHODS

Data source

This was an observational study of cesarean sections in Brazil from 2000–2011. Data was derived from DATASUS, which tracks all live births (Live Births Information System, SINASC), plus health information, such as morbidity and mortality. A SINASC Live Birth Form is completed each time a child is born in Brazil. In 2000, the database registered approximately 3.2 million live births, but due to a subsequent fertility drop in the country, the figure for 2011 was 2.9 million. In total, the database contains information on nearly 36 million births, with a coverage estimated at more than 90% (21).

Variables and data analysis

Initially, data were analyzed to check consistency at the national level and by geographic area (North, Northeast, Center-West, Southeast, and South). The main variable of interest was the proportion of deliveries by cesarean section. Both individual and ecological level analyses were carried out (22).

On the individual level, the following variables were extracted from the database: maternal age, parity, schooling (years), and skin color/ethnicity. The latter was categorized according to Brazil's official classifications: white (Euro-descendants), black (Afrodescendants), brown (mixed Euro-Afrodescendants), yellow (Asian-descendants), and Indigenous (native Brazilian).

In the ecologic model, the units of analysis were all 431 of the country's health districts, each one encompassing a number of municipalities. For each municipality, the following information was obtained from the Ministry of Health: rate of cesareans; number of health facilities (hospitals, health centers, health posts, private clinics, pharmacies, etc.) per 1 000 residents; and four socioeconomic variables—one for illiteracy rate (proportion of illiterate persons in the adult population) and three for poverty rate (household income per-capita, per-capita gross product, and proportion of the adult population with low income [defined as < 50% of the national minimum wage]). These variables were obtained for the more than 5 500 municipalities in the country, and then aggregated

by health districts, weighing each municipality according to its population.

Cesarean rates were calculated for different groups of maternal schooling, skin color/ethnicity, parity, and age. Pearson's coefficients were calculated to analyze correlations between explanatory variables and the outcome. Multiple linear regression analysis was used to adjust for possible confounding effects of explanatory variables, i.e., number of health facilities per 1 000 inhabitants and percent of the adult population with low income.

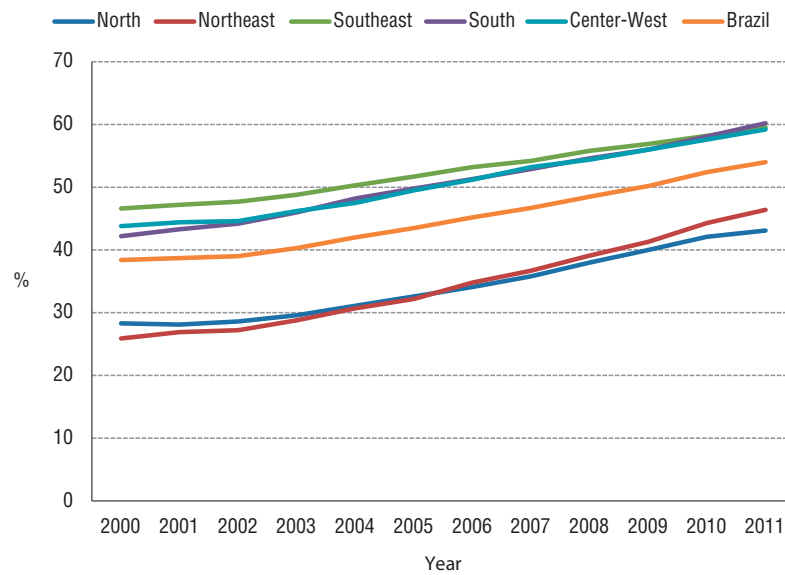
RESULTS

Trends in cesarean sections

For the country as a whole, cesarean rates increased dramatically during the study period, from 37.9% in 2000 to 53.9% in 2011. Figure 1 shows different patterns of trends by geographic area. There are two primary groups: the poorer North and Northeast areas, which in 2000 presented cesarean rates under 30%; and the richer South, Southeast, and Center-West areas where rates were already over 40%. Increases from 2000–2011 ranged from 12.9 percentage points in the Southeast to 20.5 percentage points in the Northeast. In the North, the increase was 14.8 percentage points; in the Center-West, 15.4; and in the South, 18.0. Relative increases, using the rates in 2000 as baseline, varied markedly. In the Northeast, which had the lowest rate in 2000, the increase was approximately 79%, whereas in the Southeast, which had the highest initial rate, the increase was 28%.

Figure 2A shows national prevalence of cesareans sections according to maternal education, for 2000, 2005, and 2010. The rates increased markedly with maternal education in the 3 years studied. Moreover, rates for 2010 were higher than in previous years, for all groups of education. In 2010, nearly 15% of the children whose mothers had never been to school were born by cesarean, compared to more than 75% for mothers with 12 years or more of education.

Figure 2B shows cesarean sections relative to skin color/ethnicity. The increase in cesarean sections affected all ethnicities, with the exception of indigenous women for whom the rate declined from 20% in 2000 to 15% in 2010.

FIGURE 1. Cesarean section trends for the country as a whole and by geographic area, Brazil, 2000–2011

Source: Data from the study analyses.

Relative to maternal age, Figure 2C shows that the prevalence of cesareans increased in the last decade for all groups, but the pattern of lower rates among adolescents persisted.

Figure 2D shows that cesareans are more common among primiparas, but decrease as parity augments. Again, since rates increased over time in all groups, the descending trend in relation to parity was unaltered.

Cesarean rates in municipalities and health districts

Figure 3 shows a map of Brazil with cesarean rates by municipality. The highest rates (65%+) are concentrated in the South, Southeast, and Center-West. Table 1 shows the 10 municipalities with the highest and 10 with the lowest rates of cesareans. To reduce random fluctuations, these analyses were based on large municipalities with at least 1 000 births in 2011. It is remarkable that several municipalities had rates from 84%–91%, most of which are found in the Southeast area. Large municipalities with the lowest rates (9%–20%) pertain to the North and Northeast areas.

Ecological analyses by health care and socioeconomic variables

The individual level results were complemented by a series of ecological analyses with health districts as the units.

All five explanatory variables (the aforementioned health care and four socioeconomic indices) were strongly and significantly associated with cesarean rates. The proportion of the adult population with low income was especially associated, with a negative correlation coefficient (r) of -0.719 ($P < 0.001$). A similar negative correlation was found for the proportion of illiteracy among the adult population ($r = -0.592$; $P < 0.001$). The average per-capita household income presented a positive correlation with the outcome ($r = 0.491$; $P < 0.001$). The socioeconomic index that showed the weakest correlation with the outcome was per-capita gross product ($r = 0.375$; $P < 0.001$). The number of health facilities per 1 000 inhabitants was positively associated with cesareans ($r = 0.548$; $P < 0.001$).

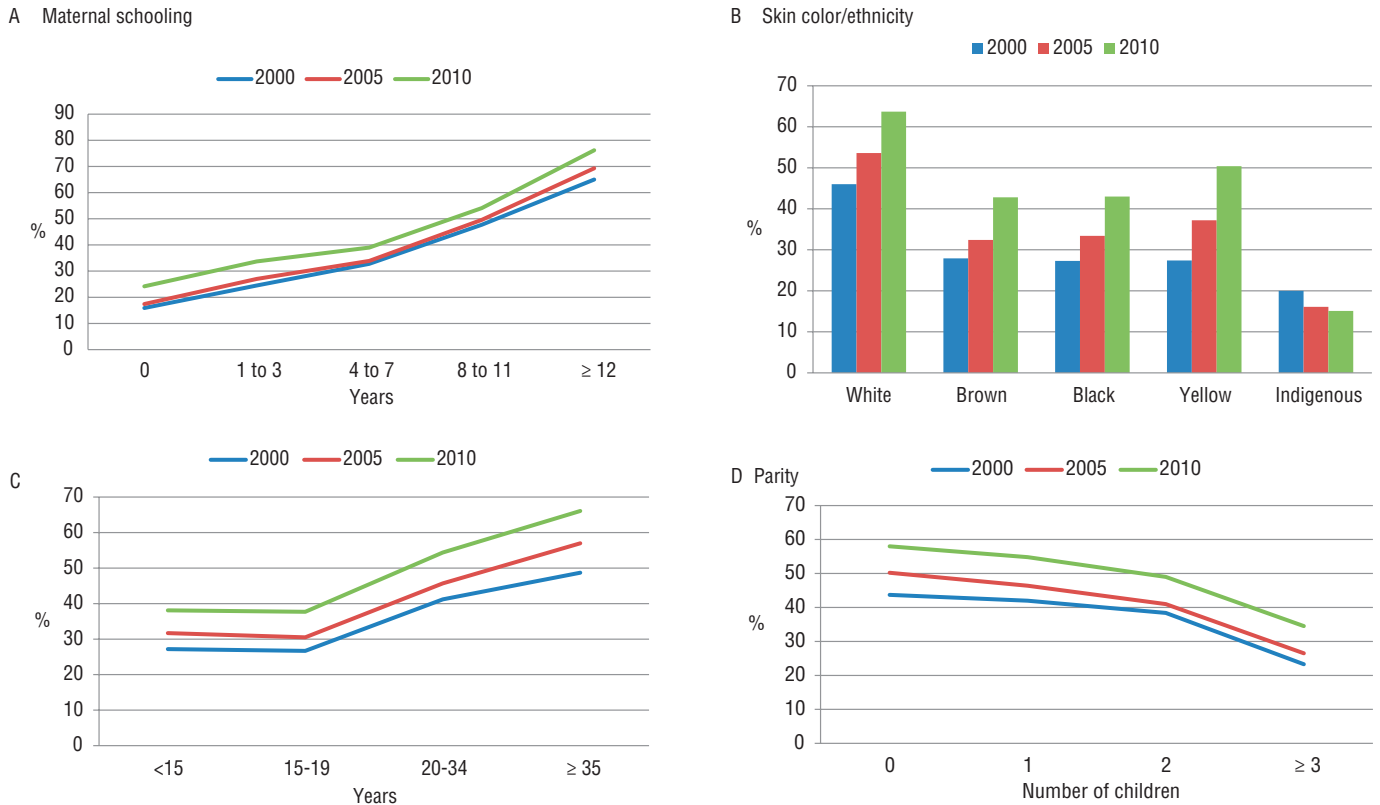
Socioeconomic variables were also associated with health facility density, with the strongest correlation for the proportion of adult population with low income ($r = -0.603$), followed by proportion of illiterate persons in the adult population ($r = -0.423$), and the average per-capita household income ($r = 0.420$). Again, the weakest correlation was for per-capita gross product ($r = 0.318$). All P levels were < 0.001 . Finally, as expected, all four socioeconomic variables presented strong internal correlation with coefficients above 0.80 or below -0.80 , depending on how the variable was coded.

The next step consisted of multiple linear regression analyses with the

health care and socioeconomic indices. Because of the strong collinearity among socioeconomic indicators, only the percentage of the adult population with low income was included since it showed the strongest correlation with the other variables. Both the density of health facilities and the low income indicator presented linear associations with cesarean rates (results not shown). Because of the differences among the geographic areas described above, separate regression analyses for each area were performed.

Table 2 shows the results of the multivariable analyses. These analyses were not weighted by health district population, although weighted analyses were also carried out and results were very similar in terms of the regression coefficients, but confidence intervals were narrower. In the crude analysis, health facility density presented strong associations with cesareans, but this varied by geographic area. In the North, each additional health facility per 1 000 residents was associated with an increase of nearly 30 percentage points in the prevalence of cesareans, whereas in the South the increase was 6 percentage points. The other three areas showed regression coefficients from 11–17 percentage points.

In relation to the poverty index, an increase of one percentage point in the proportion of the population with low income was associated with a reduction in the cesarean rate ranging from 0.63–0.90

FIGURE 2. Cesarean section rates by maternal schooling, skin color, age, and parity, Brazil, 2000, 2005, and 2010

Source: Data from the study analyses.

percentage points among the various geographic areas, except for in the South where the reduction was 0.39.

When both explanatory variables were adjusted for one another (Table 2), the effects of facility density were greatly attenuated, while those of the poverty indicator showed very slight changes.

Finally, tests were conducted for interaction between geographic area and facility density ($P = 0.0028$), and between geographic area and low income ($P = 0.0229$). The first interaction is graphically presented in Figure 4. Increases in facility density had more marked effects on the cesarean rates in the North than on any other geographic area; the other areas were relatively homogenous. On the other hand, the interaction between geographic area and low income suggested that the inverse association between poverty and cesareans was less marked in the South (with the highest facility density) than in the other four areas.

DISCUSSION

Cesarean section rates in Brazil continue to increase year after year. Preliminary

results from 2012 indicate a rate of 55.8%, that is, almost 2 percentage points above the 2011 value. Cesarean rates are higher in the more developed areas of the country. In all areas, the prevalence of cesareans is positively associated with maternal schooling. These results are counter-intuitive, as one would expect that women with higher levels of education would have more information on the risks of operative deliveries. Also, clinical and obstetric risks should be the main indications for a cesarean delivery, and such risks should be less prevalent in women with higher educational and income levels (23–25). Non-medical reasons, therefore, must account for the rising trends and the social patterning of cesareans.

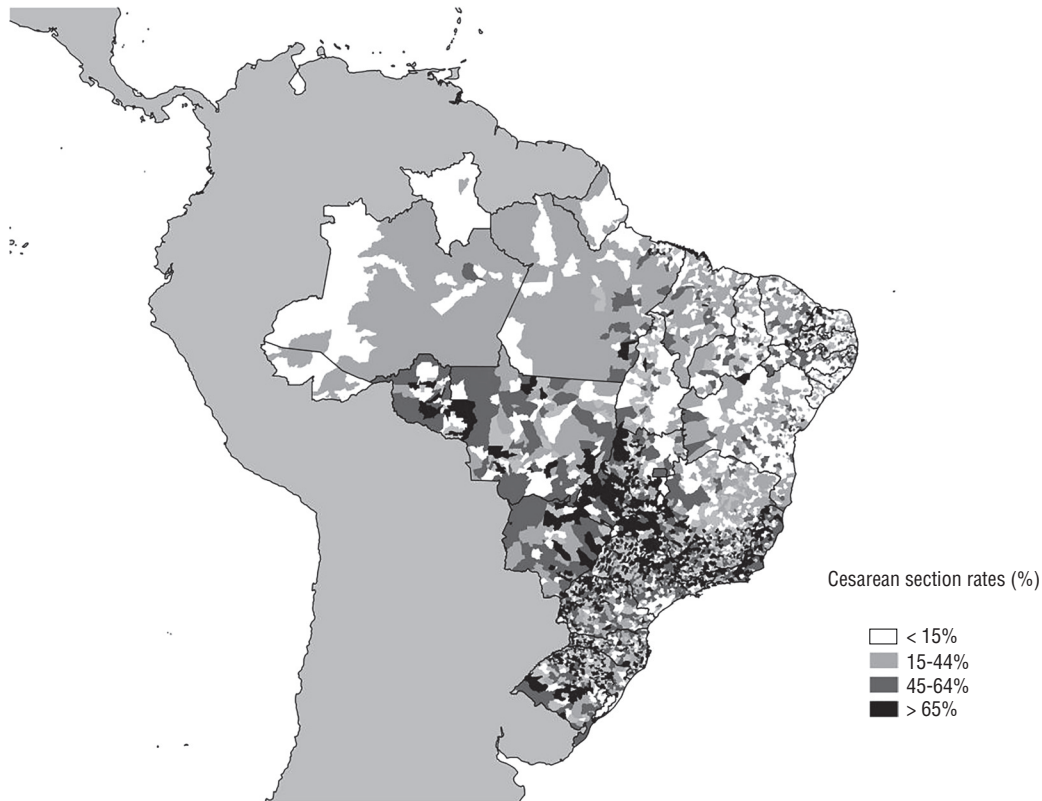
About two-thirds of all deliveries are covered by the SUS, even though many of these take place in private hospitals. The remaining one-third are mostly covered by private insurance. In the case of the latter, cesarean rates are close to 90%, compared to about 45% in the public sector (3).

We relied on ecological analyses using health districts as units to investigate how contextual factors affect cesarean rates.

The ecological analyses at national level showed that cesarean rates are inversely related to the level of poverty. After adjustment for poverty, cesarean sections increase proportionally with the availability of health facilities: for each additional health facility per 1 000 inhabitants, cesarean rates increased by 3.8 percentage points. Likewise, the inverse association between poverty and cesarean rates persists after adjustment for facility density.

The interaction analyses show that facility density is more strongly associated with cesarean sections in the North (Amazon) than in the rest of the country. This is likely explained by the fact that the average number of facilities per 1 000 inhabitants is much lower in the North (0.76) than in other areas, e.g., 1.68 in the Southeast and 1.95 in the South. Given the national-level expectations and demand for cesareans, even a smaller increase in facility availability in the North would possibly allow more cesareans to be performed there. On the other hand, the inverse association between poverty and cesareans is less marked in the South where most of the health facilities are.

FIGURE 3. Cesarean section rates by municipality, Brazil, 2011



Source: Data from the study analyses.

TABLE 1. Ten municipalities in Brazil with > 1 000 live births and the lowest cesarean rates, and 10 municipalities with the highest rates, Brazil, 2011

Municipalities	State	Geographic area	Number of live-births	Proportion of cesareans (%)
Lowest rates				
Óbidos	Pará	North	1 037	9.5
Tabatinga	Amazonas	North	1 607	10.6
Alenquer	Pará	North	1 227	14.3
Portel	Pará	North	1 151	17.0
Maués	Amazonas	North	1 338	17.0
Oriximiná	Pará	North	1 301	17.7
Breves	Pará	North	2 098	17.8
Barreirinhas	Maranhão	Northeast	1 168	18.8
Viana	Maranhão	Northeast	1 078	19.7
Viseu	Pará	Northeast	1 387	20.9
Highest rates				
Guaratinguetá	São Paulo	Southeast	1 431	84.1
Varginha	Minas Gerais	Southeast	1 628	84.8
Ituiutaba	Minas Gerais	Southeast	1 185	84.8
Uberlândia	Minas Gerais	Southeast	8 594	85.1
Ubá	Minas Gerais	Southeast	1 421	85.5
São José do Rio Preto	São Paulo	Southeast	5 215	85.7
Barretos	São Paulo	Southeast	1 483	88.9
Lorena	São Paulo	Southeast	1 188	89.7
Matão	São Paulo	Southeast	1 001	90.1
Votuporanga	São Paulo	Southeast	1 040	91.2

Source: Data from the study analyses.

The rising trend in cesareans persists in spite of a number of governmental policies and programs instituted to reduce rates during the last 30 years. The first attempt, in the 1980s, established

equal pay for vaginal and cesarean deliveries—until then physicians received higher remuneration for cesareans (26). This measure had only a temporary effect, and soon cesarean deliveries began

to rise again. In 1998, SUS decided to cap reimbursement to hospitals for cesareans at 40% of all deliveries; this was then reduced to 30%. Again, the effects of these measures were short lived. In 2000, a

TABLE 2. Ecological linear regression analyses of cesarean section rates according to number of health facilities and poverty level, stratified by geographic area, Brazil, 2011

Geographic area	Number of health districts	Variable	Crude analyses				Adjusted analyses ^a			
			B ^b	95%CI ^c	P ^d	r ^{2e}	B	95%CI	P	r ²
North	50	Health facilities	29.5	16.8 – 42.2	< 0.001	0.299	-5.4	-20.0 – 9.1	0.456	0.613
		Poverty	-0.9	-1.1 – -0.7	< 0.001	0.616	-0.9	-1.3 – -0.6	< 0.001	
Northeast	131	Health facilities	17.4	11.5 – 23.4	< 0.001	0.204	9.6	2.8 – 16.3	0.005	0.291
		Poverty	-0.6	-0.8 – -0.4	< 0.001	0.253	-0.4	-0.6 – -0.2	< 0.001	
Center-West	40	Health facilities	11.4	4.4 – 18.4	0.002	0.206	-0.1	-7.3 – 7.1	0.976	0.506
		Poverty	-0.6	-0.8 – -0.4	< 0.001	0.519	-0.6	-0.9 – -0.4	< 0.001	
Southeast	153	Health facilities	11.9	8.7 – 15.2	< 0.001	0.256	3.8	1.0 – 6.7	0.008	0.576
		Poverty	-0.7	-0.8 – -0.6	< 0.001	0.559	-0.6	-0.7 – -0.5	< 0.001	
South	57	Health facilities	6.3	1.9 – 10.8	0.006	0.113	3.0	-1.6 – 7.7	0.195	0.233
		Poverty	-0.3	-0.5 – -0.2	< 0.001	0.223	-0.3	-0.5 – -0.1	0.003	
BRAZIL	431	Health facilities	16.1	14.3 – 17.8	< 0.001	0.432	3.8	1.5 – 6.0	0.001	0.647
		Poverty	-0.5	-0.6 – -0.5	< 0.001	0.612	-0.6	-0.7 – -0.5	< 0.001	

Source: Data from the study analyses. The unit of analysis was each of the 431 health districts in Brazil.

^a Health facilities were adjusted for poverty and vice-versa.

^b Beta coefficient.

^c Confidence intervals.

^d P values refer to crude and adjusted regression analyses.

^e r² = Coefficient of determination.

Pact for the Reduction of Cesarean Sections was signed between the Ministry of Health and the States with the aim of reducing the cesarean rate to 25% by 2007; however, this goal was never achieved, undermined mostly by the high rates that persisted in the private sector. Still in 2000, the National Program for the Humanization of Antenatal, Delivery, and Post-Partum Care was launched with strong support by women's organizations (27). One of its aims was to reduce cesarean sections. Finally, in 2011, the Ministry of Health launched the Stork Network initiative, focused on providing optimal care within SUS, from pregnancy confirmation through the child's first 24 months. The initiative promotes prenatal visits and humanized care during labor and delivery (18). Despite all of these past and current initiatives, cesarean rates have not ceased to rise.

Ethnographic research reveals an apparent paradox between what doctors and many mothers say, and what they do (28). The official discourse is that vaginal deliveries are best. For example, in a study in Rio de Janeiro, 70% of the women stated at the beginning of gestation that they preferred vaginal delivery; at the time of labor, only 30% retained their original opinion, and only 10% delivered vaginally (29). A national survey in 2011–2012 confirmed this trend: 72% of the

women expressed their preference for vaginal delivery at pregnancy onset, but only 45% delivered vaginally (3).

It appears that cesareans are viewed as safer, more practical, less painful, and more convenient (since physicians and families can set a predetermined delivery date). The idea that cesarean deliveries are less painful may come from analgesia being provided to only about one-third of women in labor (30). If labor lasts for more than 8 hours, families often will press the attending physician to perform a cesarean section—the birthing process is perceived as too painful (28). The idea that a vaginal delivery is more painful is difficult to sustain, since in reality the number of days of post-partum pain is much greater for women who undergo a cesarean section.

Cesareans sections in Brazil constitute an unusual presentation of inequalities in health. A potentially hazardous procedure is much more common among the rich than among the poor. This is partly because unnecessary cesareans are not associated with obvious increases in negative outcomes—even though there are definite hazards that are only apparent when large samples are analyzed (22). Also contributing to the popularity of cesareans among mothers is that it constitutes “painless” delivery in a country where birth analgesia for vaginal delivery, together

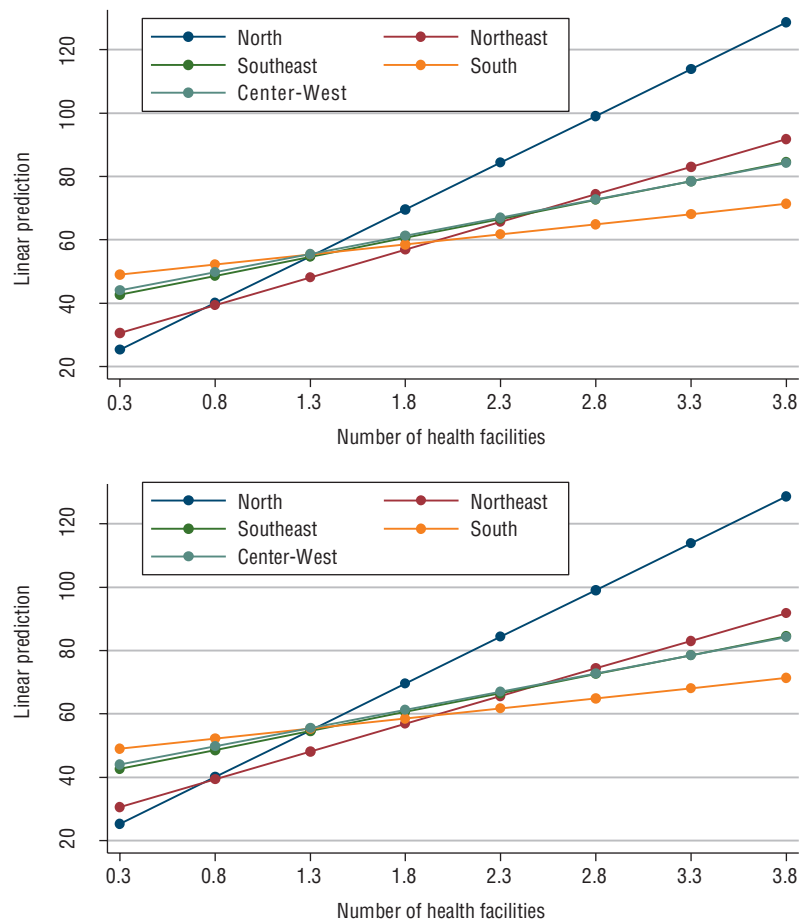
with other appropriate technological interventions, is underutilized. And, cesareans are certainly more convenient for physicians, particularly private practitioners who can perform a cesarean in about an hour, rather than staying at the hospital for several hours awaiting a vaginal delivery. Obstetricians in Brazil appear much more at ease performing cesareans, and families also feel safer. For these reasons, cesarean sections, mostly with epidural anesthesia, are almost universal among rich women, and as a consequence are also being perceived by poor women as the method of choice (31).

Limitations

One limitation of this paper was the lack of data on the need/reason for a cesarean section. This information was not available from the database. Also, the ecological analyses could have been improved if more socioeconomic and health care variables were available.

Conclusions

It is difficult to predict what will happen to cesarean rates in Brazil in the future. If one simply follows the line of prevalence for the last 10 years, it appears that the public sector will eventually reach the current rates of the private

FIGURE 4. Interaction between the number of health facilities and cesarean section rates,^a by geographic area, Brazil, 2011

Source: Data from the study analyses.
^a Values above 100 should be disregarded.

sector, i.e., close to 90% (3). Rates above 80% are already observed for all births—in the private and public sectors—in a number of large municipalities, particularly in the Southeast (Table 2).

Nevertheless, several public health campaigns in Brazil, such as smoking cessation (32) and exclusive breastfeeding (2), have turned out to be huge successes against the initial odds. In an attempt to reduce the number of cesarean section in the country, the Ministry of Health released two new health policies in January 2015. The first one defines, reorganizes, and funds different levels of obstetric and neonatal care, promoting the creation of Centers for Normal Delivery in the National Health System (33). The second policy was issued by the National Agency for Supplementary Health (ANS) and addresses the excessive number of cesareans in the private

sector. This normative resolution allows all beneficiaries of private health plans to be informed about the track record in cesarean section rates for individual maternity hospitals and obstetricians (34). In addition, in order to be reimbursed for delivery costs, a maternity hospital must present the woman's pregnancy card and partogram showing the evolution of labor and the health conditions of mother and baby. This resolution began to be implemented in July 2015. Medical associations reacted strongly against such policies, arguing for example that some obstetricians and establishments may have high proportions of cesarean sections because they concentrate on high-risk pregnancies. The proportions of cesareans conducted by medical doctors working in private health plans are already publicly available, having been published in national newspapers.

Women's groups promoting natural childbirth are disseminating these lists through social media and blogs. It remains to be seen if these new policies will reverse the near universal rates of cesarean sections in the Brazilian private sector.

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Conflicts of interest. None.

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Cesáreas en el Brasil: ¿dejarán de aumentar alguna vez?

RESUMEN

Objetivo. Describir las tendencias, la distribución geográfica, y los factores de riesgo de parto por cesárea en el Brasil durante el período del 2000 al 2011, y determinar si las iniciativas dirigidas a reducir las tasas de cesáreas han tenido una repercusión cuantificable.

Métodos. Se trata de un estudio de observación que utilizó información a escala nacional del Departamento de Informática del Sistema Unificado de Salud (DATASUS). Los análisis a nivel individual se basaron en datos sobre el nivel de formación materna, la edad, la paridad y el color de la piel. Se investigaron las relaciones con la densidad de establecimientos de salud y el nivel de pobreza mediante análisis ecológicos a nivel de 431 distritos de salud.

Resultados. Las tasas de cesáreas aumentaron notablemente, de 37,9% en el 2000 a 53,9% en el 2011. Los resultados preliminares del 2012 mostraron una tasa de 55,8%, con tasas más elevadas en las zonas geográficas más ricas. Las tasas a escala municipal variaron de 9 a 96%. Los partos por cesárea fueron más frecuentes en las mujeres blancas, en las que tenían un mayor nivel de formación, en las de mayor edad y en las primíparas. En los análisis ecológicos, el número de establecimientos de salud por 1 000 habitantes se correlacionó intensa y positivamente con la tasa de cesáreas, con un incremento de 16,1 puntos porcentuales (intervalo de confianza (IC) de 95% = 4,3–17,8) para cada establecimiento. Un aumento de un punto porcentual en la tasa de pobreza se asociaba con una disminución de medio punto porcentual en la tasa de cesáreas (IC de 95% = 0,5–0,6).

Conclusiones. Las intensas asociaciones con el nivel de formación materna y la densidad de establecimientos de salud indican que la mayor parte de las cesáreas no están indicadas médicamente. Se han puesto en marcha diversos programas y políticas dirigidos a contrarrestar esta tendencia, pero prácticamente no han tenido ninguna repercusión.

Palabras clave

Cesárea; parto obstétrico; esfuerzo de parto; factores socioeconómicos; salud materno-infantil; Brasil.

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Se ha cambiado el nombre del autor indicado debajo:

Donde dice:

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Debe decir:

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