

# Inadequate utilization of prenatal care in two Brazilian birth cohorts

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## Abstract

Data for two birth cohorts from two Brazilian municipalities, Ribeirão Preto in 1994 and São Luís in 1997/1998, were used to identify and compare factors associated with inadequate utilization of prenatal care and to identify factors capable of explaining the differences observed between the two cities. Prenatal care was defined as adequate or inadequate according to the recommendations of the Brazilian Ministry of Health. The chi-square test and Poisson regression were used to compare differences in the inadequacy of prenatal care utilization. The percentage of inadequacy was higher in São Luís (34.6%) than in Ribeirão Preto (16.9%). Practically the same variables were associated with inadequacy in both cities. Puerperae with lower educational level, without a companion or cohabiting, who delivered in public health units, younger than 20 years, multiparae and smokers, with low family income presented higher percentages of inadequate prenatal care utilization. However, the effects of some variables differed between the two cities. The risk for inadequate use of prenatal care was higher for women attended in the public health sector in São Luís and for cohabiting women in Ribeirão Preto. The effect of the remaining factors studied did not differ between cities. The category of admission accounted for 57.0% of the difference in the inadequate use of prenatal care between cities and marital status accounted for 45.3% of the difference. Even after adjustment for all variables, part of the difference in the inadequacy of prenatal care utilization remained unexplained.

## Key words

- Prenatal care
- Maternal health
- Quality of health services

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## Introduction

Much has been done in Brazil to expand the offer of health care to mothers and their newborn infants, but situations of insufficient facilities, low quality of the services

and of social inequality of access still persist (1). The objective of prenatal care is to promote the health of mother and fetus by identifying risk situations for both and permitting opportune interventions. Thus, pregnant women with access to better prenatal care

services have fewer diseases and their babies have better intrauterine growth, lower rates of low birth weight or preterm births, and lower perinatal and infant mortality (1-5).

Several studies evaluating the use of prenatal care facilities since the 1970's have suggested indices to be used to classify this care. Particularly important among them are the Kessner index (6), proposed in 1973, and the index proposed by Kotelchuck (7) in 1994, known as Adequacy of Prenatal Care Utilization. The latter index was adapted according to the recommendations of the Brazilian Ministry of Health in 1988 (8). All of these indices use as reference the number of visits made during pregnancy and the month when they were started, both adjusted according to the duration of pregnancy.

No studies have been conducted in Brazil to determine whether the factors associated with the utilization of prenatal care are the same in different places and whether the effect of these factors differs between Brazilian cities. Thus, the objective of the present study was to identify and compare factors associated with inadequate utilization of prenatal care in two Brazilian birth cohorts from cities with different levels of socioeconomic development, and to identify variables capable of explaining the differences in the inadequacy of prenatal care utilization between them (8-10).

## Material and Methods

Two studies were conducted on samples of hospital births in two Brazilian municipalities: Ribeirão Preto, located in Southeast Brazil, a more developed region, in 1994, and São Luís, located in the Northeast, a less developed region, in 1997/1998. Socioeconomic and demographic factors, reproductive health, morbidity during pregnancy, and the utilization of prenatal health services were evaluated. The Ribeirão Preto study sample consisted of 2846 puerperae and comprised all births that occurred over 4 con-

secutive months. In São Luís 2443 puerperae selected by systematic sampling of births stratified by the 10 hospitals of the city were interviewed over a period of one year. A standardized questionnaire was applied to the puerperae before hospital discharge in both locations. Regarding the utilization of prenatal care services, questions about attending visits, number of visits and month when they were started were asked. The samples were representative of the births that occurred during the study periods in the two cities and comprised only hospital births, which represented 98% of all births in Ribeirão Preto and 94% of all births in São Luís. Details regarding the methodology of the two studies are available in previous publications (10-12).

In the present study, the utilization of prenatal care was classified as adequate or inadequate. The use of care was considered to be adequate when the prenatal visits started up to the 4th month and the pregnant woman performed a minimum of seven visits for a term pregnancy or a smaller number of visits according to gestational age (at least five visits for a pregnancy concluded within 33-36 weeks, four visits for a pregnancy concluded between 29 and 32 weeks, and two visits for a pregnancy concluded within less than 24 weeks). All other situations were considered to be inadequate. Women who did not receive any prenatal care were assigned to the inadequate category. Details about the construction of these criteria have been described in a previous study (9).

For data analysis, the chi-square test was used to compare the adequacy of prenatal care utilization between the two cities and to determine eventual differences. Next, the association between the different independent variables and the inadequate utilization of prenatal care was determined using the Poisson regression model with robust adjustment of the standard errors in order to perform the analyses with and without adjustment for confounding factors (13,14). In

the regression analysis, the crude and adjusted prevalence rate ratios and their respective 95% confidence intervals were calculated for both studies. All variables with a P value  $\leq 0.20$  in at least one of the two cities in univariate analysis were entered into the multivariable analysis. The following demographic, reproductive and socioeconomic variables were included in the regression model: maternal age (<20, 20-34, and  $\geq 35$  years), maternal schooling as number of years of study ( $\leq 4$ , 5 to 11 and  $\geq 12$  years), marital status (married, cohabiting, and without a companion), maternal smoking habit (yes, when the mother smoked at least one cigarette per day during pregnancy, and no otherwise), parity (1, 2 to 4, and 5 children or more), previous abortion and/or stillbirth, category of admission (public when attended by the Unified Health System, and private when attended by private health insurance plans or when paying directly the provider of services), and family income (classified as low, middle and high based on tertile divisions).

Factors associated with inadequate utilization of prenatal care in at least one city after adjustment for confounding factors were then evaluated to determine whether they explained the differences in the inadequacy of prenatal care utilization between Ribeirão Preto and São Luís. For this purpose, the authors tested interactions in the multivariable model between a binary variable incorporating the “city” and the risk factors identified as candidates to explain these differences. The binary variable had a value of 1 for São Luís and of 0 for Ribeirão Preto (15).

Sequential multivariable analysis in a joint model including the two cities was also performed. Adjustment only for the “city” variable was first performed. The prevalence rate ratio of this model identifies the increase in the risk of inadequate utilization of prenatal care in São Luís compared to Ribeirão Preto. Adjustment for “city” and for each variable was then performed and

this prevalence rate ratio was then compared to the prevalence rate ratio adjusted only for “city”. If the variable reduced the prevalence rate ratio by at least 10%, this meant that the variable explained some of the difference in the inadequate utilization of prenatal care between cities. At the end, adjustment was performed for all variables studied.

All calculations were made using the Stata 8.0 statistical package (16).

## Results

Ribeirão Preto showed a higher percentage of adequate use of prenatal care (57.1%) compared to São Luís (47.3%). The inadequacy in São Luís was approximately double that in Ribeirão Preto, with values of 34.6 and 16.9%, respectively. In addition, 8.2% of the puerperae did not utilize prenatal care services in São Luís, as opposed to only 2.6% in Ribeirão Preto. However, Ribeirão Preto had the higher percentage of unknown gestational age, 14.7%, and of unknown number of prenatal visits, 8.7%, compared to values of 8.7 and 1.2% in São Luís (Table 1).

A search for factors independently associated with inadequate utilization of prenatal care revealed a significant relation ( $P < 0.05$ ) for most of the variables studied, and practi-

Table 1. Adequacy of prenatal care utilization in the two cities under study (Ribeirão Preto, SP, and São Luís, MA).

Classification	Ribeirão Preto (1994)	São Luís (1997/1998)
Adequate	1624 (57.1%)	1155 (47.3%)
Inadequate	481 (16.9%)	845 (34.6%)
No prenatal care	75 (2.6%)	201 (8.2%)
Missing information on gestational age	417 (14.7%)	214 (8.7%)
Missing information on prenatal care use	249 (8.7%)	28 (1.2%)
Total	2846 (100.0%)	2443 (100.0%)

Data are reported as number with percent in parentheses. Adequacy was defined according to the recommendations of the Brazilian Health Ministry. The use of prenatal care was considered to be adequate when the prenatal visits started up to the 4th month and the pregnant woman performed a minimum of seven visits for a term pregnancy or a smaller number of visits according to gestational age.

cally the same variables were associated with inadequacy in both cities. Women younger than 20 years, multiparae, women with low schooling, cohabiting or without a companion, smokers, with a low family income, and receiving public care for delivery were at higher risk for inadequate utilization of prenatal care in non-adjusted analysis. In contrast, primiparae were at lower risk for inadequacy in both cities. A lower risk of inadequate utilization of prenatal care was

found only in São Luís in the group with previous abortion or stillbirth (Table 2). The results of multivariable analysis were practically the same as those obtained by non-adjusted analysis (Table 3).

Analysis of adjusted risk factors in a joint model for the two cities (Table 4) revealed that marital status and category of admission showed significant differences regarding the risk of inadequate utilization of prenatal care between cities, with a significant interaction

Table 2. Univariable analysis of risk factors for inadequate utilization of prenatal care in Ribeirão Preto, SP, and São Luís, MA.

	Ribeirão Preto (1994)				São Luís (1997/1998)			
	Total number	Inadequacy (%)	Prevalence rate ratio (95%CI)	P	Total number	Inadequacy (%)	Prevalence rate ratio (95%CI)	P
Maternal age				<0.001				<0.001
<20	378	39.4%	1.74 (1.49-2.03)		631	55.1%	1.22 (1.12-1.34)	
20-34	1592	22.7%	1.00		1477	45.1%	1.00	
≥35	208	22.1%	0.97 (0.74-1.28)		92	34.8%	0.77 (0.58-1.03)	
Parity				<0.001				<0.001
1 child	936	21.6%	0.81 (0.69-0.95)		1098	43.1%	0.85 (0.78-0.94)	
2 to 4 children	1131	26.6%	1.00		1011	50.4%	1.00	
5 children or more	110	47.3%	1.78 (1.43-2.21)		92	68.5%	1.36 (1.17-1.58)	
Maternal schooling				<0.001				<0.001
≥12 years	305	6.2%	1.00		115	7.8%	1.00	
5 to 11 years	1478	24.6%	3.06 (1.96-4.80)		1861	46.5%	5.94 (3.16-11.14)	
≤4 years	263	48.7%	7.81 (4.97-12.29)		220	77.3%	9.87 (5.25-18.57)	
Marital status				<0.001				<0.001
Married	1381	16.4%	1.00		650	32.6%	1.00	
Cohabiting	517	45.3%	2.75 (2.37-3.21)		1021	51.5%	1.58 (1.39-1.79)	
No companion	251	36.2%	2.21 (1.80-2.70)		529	58.2%	1.79 (1.56-2.04)	
Maternal smoking				<0.001				<0.001
No	1731	21.8%	1.00		2070	46.5%	1.00	
Yes	447	39.6%	1.81 (1.57-2.10)		131	63.4%	1.36 (1.19-1.56)	
Family income				<0.001				<0.001
High	678	12.7%	1.00		413	21.5%	1.00	
Middle	507	23.7%	1.87 (1.45-2.40)		534	41.6%	1.93 (1.56-2.38)	
Low	450	38.2%	3.01 (2.39-3.79)		1110	58.1%	2.70 (2.23-3.26)	
Previous abortion/stillbirth				<0.561				0.034
No	1766	25.2%	1.00		1682	48.8%	1.00	
Yes	413	26.6%	1.05 (0.88-1.26)		519	43.3%	0.89 (0.80-0.99)	
Category of admission				<0.001				<0.001
Private	870	8.5%	1.00		256	6.2%	1.00	
Public	1270	37.5%	4.41 (3.50-5.54)		1945	53.0%	8.47 (5.26-13.64)	

The total number differs because of missing values. Prevalence rate ratio estimated by simple Poisson regression model with robust adjustment of the standard errors. P values for the log-likelihood ratio test.

of these variables with the city variable. Women admitted to public hospitals in São Luís had a higher inadequacy of prenatal care utilization compared to Ribeirão Preto women (P value for the interaction = 0.013). On the other hand, cohabiting women had a lower risk of inadequate utilization of prenatal care (0.74) in São Luís than in Ribeirão Preto (P value for the interaction = 0.022).

In a joint sequential model, category of admission explained 57.0% and marital status explained 45.3% of the difference in the inadequacy of prenatal care utilization between the two cities. Even when the data were adjusted for all variables, part of the difference in the rate of inadequate utilization of prenatal care between cities remained unexplained (Table 5).

## Discussion

As expected, the inadequacy of prenatal care utilization was higher in the less developed city, São Luís (34.6%), than in Ribeirão Preto (16.9%). Practically the same variables were associated with inadequacy in the two cities, although the effect of some of them differed between the two locations. Women attended by the public health network were at higher risk for inadequacy in São Luís than in Ribeirão Preto. On the other hand, cohabiting women were at higher risk for inadequacy in Ribeirão Preto than in São Luís. The effect of the remaining variables studied did not vary according to city.

The index of adequacy of prenatal care used in the present study was based on the guidelines of the Health Ministry, which recommends at least six prenatal visits for a term pregnancy with no risk factors, starting early during pregnancy (8,9). This index has been used because the World Health Organization and some studies consider the Kessner index (6) and the index of Adequate Prenatal Care Utilization proposed by Kotelchuck (7) to possibly require an excessive number of visits for utilization of prenatal care to be

considered adequate.

Comparison of the percentages of inadequate utilization of prenatal care among different studies is impaired by the different forms of classification employed. In Pelotas, Rio Grande do Sul, Halpern et al. (2) in 1993, classifying the prenatal visits according to the Kessner score modified by Takeda, detected a 17.3% inadequate utilization of prenatal care when summing the care classi-

Table 3. Multivariable analysis of risk factors for inadequate utilization of prenatal care in Ribeirão Preto, SP, and São Luís, MA.

	Ribeirão Preto (1994)		São Luís (1997/1998)	
	Prevalence rate ratio (95%CI)	P	Prevalence rate ratio (95%CI)	P
Maternal age		<0.059		<0.100
<20	1.32 (1.05-1.66)		1.10 (1.00-1.22)	
20-34	1.00		1.00	
≥35	1.00 (0.72-1.38)		0.88 (0.68-1.14)	
Parity		<0.113		<0.001
1 child	0.87 (0.70-1.07)		0.84 (0.77-0.93)	
2 to 4 children	1.00		1.00	
5 children or more	1.28 (0.92-1.77)		1.12 (0.95-1.32)	
Maternal schooling		0.019		<0.001
≥12 years	1.00		1.00	
5 to 11 years	1.70 (1.07-2.71)		2.00 (1.09-3.67)	
≤4 years	2.14 (1.32-3.49)		2.68 (1.45-4.94)	
Marital status		<0.001		<0.001
Married	1.00		1.00	
Cohabiting	1.57 (1.27-1.93)		1.18 (1.04-1.33)	
No companion	1.39 (1.04-1.85)		1.35 (1.18-1.53)	
Maternal smoking		<0.001		0.064
No	1.00		1.00	
Yes	1.42 (1.18-1.70)		1.14 (0.99-1.32)	
Family income		0.194		<0.001
High	1.00		1.00	
Middle	1.09 (0.84-1.42)		1.22 (1.00-1.50)	
Low	1.25 (0.96-1.61)		1.50 (1.24-1.80)	
Previous abortion/stillbirth		0.444		0.182
No	1.00		1.00	
Yes	0.91 (0.72-1.15)		0.93 (0.83-1.04)	
Category of admission		<0.001		<0.001
Private	1.00		1.00	
Public	2.31 (1.66-3.21)		4.39 (2.65-7.26)	

Prevalence rate ratio estimated by multiple Poisson regression model with robust adjustment of the standard errors. P values for the log-likelihood ratio test.

Table 4. Multivariable analysis of risk factors for inadequate utilization of prenatal care in a joint model including the two cities of Ribeirão Preto, SP, 1994 and São Luís, MA, 1997/1998.

	Prevalence rate ratio (95%CI)	P
<b>Main effects</b>		
Maternal age		0.004
20-34	1.00	
<20	1.15 (1.06- 1.27)	
≥35	0.91 (0.74- 1.12)	
Parity		<0.001
2 to 4 children	1.00	
1 child	0.85 (0.78-0.94)	
5 children or more	1.15 (0.99-1.34)	
Maternal smoking		<0.001
No	1.00	
Yes	1.25 (1.11-1.39)	
Family income		<0.001
High	1.00	
Middle	1.16 (0.99-1.36)	
Low	1.40 (1.21-1.63)	
Maternal schooling		<0.001
≥12 years	1.00	
5 to 11 years	1.87 (1.25-2.80)	
≤4 years	2.41 (1.59-3.65)	
<b>Interactions</b>		
Marital status and city		0.022
Married	1.00	
Cohabiting	0.74 (0.58-0.93)	
No companion	0.95 (0.70-1.29)	
Category of admission and city		0.013
Private	1.00	
Public	2.04 (1.16-3.56)	

Prevalence rate ratio estimated by multiple Poisson regression model with robust adjustment of the standard errors. P values for the log-likelihood ratio test.

Table 5. Sequential multivariable analysis of risk factors for inadequate utilization of prenatal care in a joint model (Ribeirão Preto, SP, 1994 and São Luís, MA, 1997/1998).

Adjustment	Prevalence rate ratio (95%CI)	%Risk reduction
City	1.86 (1.71-2.03)	
City and maternal age	1.78 (1.64-1.94)	-9.3%
City and parity	1.89 (1.74-2.06)	3.5%
City and maternal age	1.81 (1.66-1.97)	-5.8%
City and marital status	1.47 (1.34-1.60)	-45.3%
City and maternal smoking	2.03 (1.86-2.21)	19.8%
City and family income	1.62 (1.47-1.79)	-27.9%
City and previous abortion/stillbirth	1.87 (1.72-2.03)	1.2%
City and category of admission	1.37 (1.27-1.48)	-57.0%
City, maternal age, marital status, family income, and category of admission	1.27 (1.15-1.40)	-68.6%
All variables studied	1.42 (1.27-1.57)	-51.2%

Prevalence rate ratio estimated by multiple Poisson regression model with robust adjustment of the standard errors comparing the inadequacy of prenatal care utilization in São Luís vs Ribeirão Preto. %Risk reduction comparing the sequentially adjusted prevalence rate ratios with the prevalence rate ratio adjusted for city (1.86).

fied as intermediate with the care considered to be inadequate. Puccini et al. (17) observed that utilization of prenatal care was adequate in the municipality of Embu, in 1996, in 35.5% of cases. These investigators considered prenatal care to be adequate when a pregnant woman attended six or more visits, started them during the first trimester, was submitted to laboratory tests and to at least one breast examination and one ultrasound, and had her blood pressure determined at least once (17). The low percentage of adequacy observed by Puccini et al. (17) was due to the fact that the inclusion of tests was required for prenatal care to be considered adequate. In contrast, Almeida and Barros (1) observed a 72.2% inadequate utilization of prenatal care in Campinas in 2001/2002, using as a criterion for adequacy an index proposed by them based on the recommendations of the Brazilian Health Ministry (beginning of prenatal care before 14 weeks of pregnancy, six or more visits for a term pregnancy or a smaller number of visits according to gestational age, execution of all routine tests and clinical-obstetrical procedures proposed, and of at least one echography, and guidelines about breast-feeding). If the Kessner (6) or Kotelchuck (7) indices of adequate utilization of prenatal care appear to be inadequate for Brazilian reality, it is necessary to strive for the standardization of the measurement of adequate utilization of prenatal care that will facilitate comparison of different studies. Until the same criteria are used, data from within Brazil and between Brazil and the rest of the world cannot be adequately compared.

Since a direct comparison of the adequacy of prenatal care utilization was not possible, we compared the percentages of lack of prenatal care. Of the puerperae from São Luís, 8.2% had no prenatal visits, a higher percentage than that observed in Ribeirão Preto (2.6%) in the present study, in Pelotas (4.9%) (2), in the municipality of Rio de Janeiro, in 1999/2001 (3.9%) (18), and in

Embu in 1996 (3.7%) (17). In 2002, prenatal care coverage was 86% in poor areas of the Brazilian North and Northeast (19), a lower value than observed in the present study.

In a European study on the barriers existing for the utilization of prenatal care, Delvaux et al. (20) observed higher inadequate utilization of prenatal care among women with irregular income, aged less than 20 years, with high parity, without health insurance, of low educational level, and single, results that agree with those obtained in the present study. Other studies have also shown a relation between high parity and a greater risk of inadequate utilization of prenatal care (9,18,21). Coimbra et al. (9) attribute this higher risk to a possible sense of safety provided by the greater experience of multiparous mothers.

A maternal age of less than 20 years was an independent risk factor for inadequate utilization of prenatal care in multivariable analysis, confirming data obtained in previous studies (1,18,20,21).

As was the case for São Luís and Ribeirão Preto, studies conducted in Campinas (SP) and in Pelotas (RS) also demonstrated more inadequate utilization of prenatal care for women with a lower *per capita* income (1,2). Other studies have also shown association between maternal smoking habit and inadequate utilization of prenatal care, as also observed in the present study (3,22-24).

Women cohabiting with their companions were at higher risk for inadequate utilization of prenatal care in Ribeirão Preto than in São Luís. This fact may be related to differences in the social acceptance of this category of marital status between the two cities. Perhaps "living together" is less socially accepted in Ribeirão Preto than in São Luís, a fact that may interfere with the social network of support for pregnant women. This means that married women are at higher risk for inadequate utilization of prenatal care in São Luís, this being a factor contributing to the explanation for the difference in

the inadequacy of prenatal care utilization between the two cities.

When we tried to identify which of the variables under study would explain the more inadequate utilization of prenatal care in São Luís compared to Ribeirão Preto, the category of admission was found to be the variable more strongly related to this difference (lowest P value = 0.013). The fact that women attended by the public health service in São Luís were at higher risk for inadequate utilization of prenatal care than in Ribeirão Preto may reflect the lower quality of public health care in São Luís.

One of the advantages of the present study was the use of the same criteria for the classification of adequacy of prenatal care, which allowed us to compare the percentage of adequate utilization of prenatal care in cities in two Brazilian regions. Another advantage was the use of an index that seems to be more appropriate for Brazilian reality by considering six prenatal visits to be adequate, as recommended by the Brazilian Health Ministry. This index also took into account gestational age in order to consider a given number of visits as adequate, a fact that minimizes the bias of erroneously attributing lower adequacy of prenatal care utilization to pregnancies that are concluded prematurely. In addition, the two studies are representative of at least 94% of the births that occurred in the two cities, a fact that reinforces the results.

The main limitation of the present study was that the number of missing cases regarding gestational age was elevated in both cities. Furthermore, studies that use time of initiation and number of prenatal visits to evaluate adequacy of prenatal care use have important limitations. The number of visits conveys information regarding the extension of care but does not inform about its continuity or quality. The indices of adequacy of prenatal care use are based on the mean number of visits recommended for a low-risk pregnancy. They do not establish

any recommendation of a standard number of visits for high-risk women or women with certain medical conditions. Interval between visits is not part of any of these indices. Adequate prenatal care, for example, may include a trimester of intensive and excessive care followed by a period of irregular and suboptimal visits. In addition, the recommended standard of visits varies among the indices and the impact of each schedule of visits on pregnancy outcomes still needs careful assessment. However, even with these limitations in mind, the indices of evaluation

of the adequacy of prenatal care use available offer some useful information.

Thus, although several factors were associated with inadequate utilization of prenatal care in both cities, the present study demonstrated that the differences in the inadequacy of prenatal care utilization were mainly due to differences in marital status and in the category of health care. However, part of the difference in the inadequate utilization of prenatal care between the two cities was not explained by the variables analyzed.

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