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Trends in preterm birth: results from five population-based surveys in the extreme south of Brazil

Tendências do nascimento prematuro: resultados de cinco inquéritos populacionais no extremo sul do Brasil

Tendencias del nacimiento prematuro: resultados de cinco encuestas de población en el extremo sur de Brasil

Luana Patrícia Marmitt (https://orcid.org/0000-0003-0526-7954) [1]
Adriana Kramer Fiala Machado (https://orcid.org/0000-0002-6800-1064) [2]
Juraci Almeida Cesar (https://orcid.org/0000-0003-0864-0486) [3]

Resumo *Objetivou-se analisar tendências na ocorrência de prematuridade e identificar características maternas associadas. Em cinco estudos transversais, incluímos todas as 10.582 puérperas de Rio Grande, RS, que tiveram parto nos anos de 2007, 2010, 2013, 2016 e 2019. Um questionário foi aplicado em até 48 horas após o parto. A prevalência de prematuridade (< 37 semanas de gestação) foi apresentada de acordo com as características maternas e o ano do estudo. Observamos redução nos nascimentos prematuros, de 17,3% em 2007 para 15,5% em 2019 (-1,8 pontos percentuais (p.p.)). A redução mais expressiva foi observada entre as mulheres com parto no setor privado (-12,3 p.p.) e aquelas com diabetes gestacional (-10,3 p.p.). O risco de ter um nascimento prematuro foi significativamente maior para mulheres mais velhas, de cor da pele preta, com menor escolaridade, multíparas e com hipertensão, diabetes e depressão durante a gravidez. Entre 2007 e 2019, houve redução nos nascimentos prematuros na maioria dos grupos de risco identificados, exceto para mulheres com baixa escolaridade, depressão e diabetes. Apesar da ligeira redução da prematuridade ao longo do tempo, esse desfecho continua a aumentar em alguns grupos de risco.*
Palavras-chave *Nascimento prematuro, Trabalho de parto prematuro, Estudos transversais, Tendências*

Abstract *This study aimed to analyze trends in preterm birth in Southern Brazil, and to identify associated maternal characteristics with this outcome. In five cross-sectional surveys, we included all 10,582 puerperal women residing in Rio Grande who had a single birth at years 2007, 2010, 2013, 2016 and 2019. A questionnaire was applied up to 48 hours after delivery. The prevalence of preterm birth (< 37 weeks of gestation) was presented according to maternal characteristics and year of study. We observed a reduction in preterm births, from 17.3% in 2007 to 15.5% in 2019 (-1.8 percentage points (p.p.)). The most expressive reduction was observed among women who gave birth in the private sector (-12.3 p.p.) and those with gestational diabetes (-10.3 p.p.). The risk of having a preterm birth was significantly higher for older women, with black skin color, lower education, multiparous, and those with hypertension, diabetes, and depression during pregnancy. Between 2007 and 2019, there was a reduction in preterm births for most identified risk groups, except for women with low education, depression, and diabetes. Despite the slight reduction in the preterm birth rate over time, this outcome continues to grow in some risk groups.*
Key words *Premature birth, Preterm labor, Cross-sectional studies, Trends*

Resumen *El estudio tuvo como objetivo analizar tendencias en la ocurrencia de prematuridad e identificar características maternas asociadas. En cinco estudios transversales, incluimos a las 10.582 mujeres posparto de Rio Grande, RS, que dieron a luz en 2007, 2010, 2013, 2016 y 2019. Se administró un cuestionario dentro de las 48 horas posteriores al nacimiento. La prevalencia de prematuridad (< 37 semanas de gestación) se presentó según las características maternas y el año del estudio. Observamos una reducción de los nacimientos prematuros del 17,3% en 2007 al 15,5% en 2019 (-1,8 puntos porcentuales (p.p.)). La reducción más significativa se observó entre las mujeres que dieron a luz en el sector privado (-12,3 p.p.) y aquellas con diabetes gestacional (-10,3 p.p.). El riesgo de tener un parto prematuro fue significativamente mayor para las mujeres mayores, las de color de piel negra, las de menor nivel educativo, las multíparas y las que padecían hipertensión, diabetes y depresión durante el embarazo. Entre 2007 y 2019, hubo una reducción de los nacimientos prematuros en la mayoría de los grupos de riesgo identificados, excepto en mujeres con bajo nivel educativo, depresión y diabetes. A pesar de la ligera reducción de la prematuridad con el tiempo, este resultado continúa aumentando en algunos grupos de riesgo.*
Palabras clave *Nacimiento prematuro, Trabajo de parto prematuro, Estudios transversales, Tendencias*

[1] Programa de Pós-Graduação em Biociências e Saúde, Universidade do Oeste de Santa Catarina. R. Getulio Vargas 2125, Flor da Serra. 89600-000 Joaçaba SC Brasil. luanamarmitt@gmail.com
[2] Programa de Pós-Graduação em Epidemiologia, Universidade Federal de Pelotas. Pelotas RS Brasil.
[3] Programa de Pós-Graduação em Saúde Pública, Universidade Federal do Rio Grande. Rio Grande RS Brasil.

Introduction

Brazil has reached remarkable achievements in maternal and child health in recent decades. Universal prenatal coverage is a reality, and the number of prenatal care visits has increased[1], but gestational outcomes have not developed in the same proportion. Maternal mortality stagnated, and although infant mortality rates have decreased considering the post-neonatal period, neonatal deaths (death in the first 28 days of life) have shown a slight reduction. However, these deaths have increased among vulnerable populations[2-4].

Preterm birth complications were the leading cause of death in children worldwide, contributing to 18% of all deaths among children under the age of 5, and up to 35% of all deaths among neonates[5]. In addition, prematurity is associated with a wide range of short and long-term health consequences. Short-term complications include increased risks of neonatal respiratory conditions, necrotizing enterocolitis, sepsis, neurological conditions, feeding difficulties, and visual and hearing problems[6]. Long-term consequences include neurodevelopmental deficits, higher blood pressure, reduced insulin sensitivity, chronic airway obstruction, and learning disabilities[7]. Preterm birth is also associated with significant costs to health systems and families of children, beyond psychological hardship[8].

Data from 38 countries estimated that the global prevalence of preterm birth in 2014 was 10.6%, ranging from 8.7% in some European countries to 13.4% in some African countries[9]. Most of the world's preterm births occurr in low- and middle-income countries. Brazil is among the top ten countries with the highest prematurity rates[9]. According to data from the National Live Births System (SINASC), the prevalence of preterm birth was 11.1% in 2019[10]. Data from four birth cohorts in Southern Brazil have shown that preterm births increased from 5.8% (1982) to 13.8% (2015)[11].

Women from urban areas with a history of hypertension or heart disease, twin gestations, non-elective c-sections, health insurance for delivery, low number of antenatal visits, and severe morbidity were at higher risk of having a child born preterm in Brazil[12,13]. Prenatal care quality seems to play a crucial role in preterm occurrence[14].

Although several cross-sectional studies have analyzed the rate of preterm birth in Brazil, the rates reported in these studies varied greatly due to differences in sampling, data collection, and measurement of gestational age[15-18]. These methodological differences make it challenging to study the temporal trend of prematurity countrywide. Monitoring the prevalence of preterm birth and being aware of which women are at greater risk are fundamental to planning more effective public policies. This study aimed to analyze the evolution of preterm birth in five surveys over 13 years (2007-19) and to identify characteristics associated with this occurrence among all puerperal women who had a child in a medium-sized municipality in southern Brazil.

Methods

Five cross-sectional surveys were conducted every three years in Rio Grande, a municipality with approximately 210,000 inhabitants located in the extreme South of the state of Rio Grande do Sul, Brazil. These studies, known as "*Estudos perinatais*" (Perinatal Studies), were conducted between January 1 and December 31 of 2007, 2010, 2013, 2016, and 2019 at the only two local maternities. All puerperal women living in urban or rural areas of this municipality whose newborns weighed at least 500 g or reached 20 weeks of gestational age were included in the studies. For the present analysis, we excluded multiple births and women with missing information for gestational age.

Parturients were approached at the hospital within 48 hours after delivery. A single, standardized, and pre-coded questionnaire was applied. In each year of the study, the questionnaire was applied by at least three trained interviewers. This instrument investigated demographic, occupational, and socioeconomic information, reproductive history, lifestyle and behavior, morbidity pattern, use of health services during pregnancy, and delivery information, among others. All information in the pregnant women's cards used in prenatal consultations was also collected.

Searches were carried out daily in medical records, and maternity hospitals were visited to identify puerperal women. After confirming whether the place of residence was in Rio Grande urban or rural area, the informed consent record (TCLE) was read to the puerperal woman. Further details about this methodology are provided in a previous publication[19].

The outcome evaluated in the present study was preterm birth (< 37 weeks of gestation), estimated mainly based on ultrasound performed

between the 6th and 20th gestational weeks recorded in the mother's antenatal cards. If the ultrasound period-based gestational age was unknown, we used the last menstrual period (LMP) present in the pregnant woman's card. As a third option, we referred to the LMP reported in the interview.

The independent variables analyzed were: i) sociodemographic: maternal age (< 20, 20-24, ≥ 35 years), self-reported skin color (white, mixed, black), living with a partner (yes or no), completed years of schooling (0-8 years, 9-11 years, 12 years or more), monthly family income in minimum wages (in quartiles); ii) past obstetric history: parity (primiparous, multiparous); iii) pregnancy characteristics: prenatal care (public or private), prenatal care adequacy (considering adequate when the pregnant women attended to six or more appointments starting in the first trimester of pregnancy, performed two or more qualitative tests of urine and two or more diagnostic tests of HIV and syphilis[19]; smoking during pregnancy (yes or no), morbidities (anemia, depression, diabetes and hypertension) (yes or no); iv) delivery: hospital type (public or private), type of delivery (vaginal, c-section).

After analysis for consistency errors, data was analyzed using Stata 16.1 software. The prevalence of preterm birth was presented for the total sample and according to maternal characteristics and study year. Changes in the occurrence of premature births in the period were presented in percentage points for each analyzed variable. Percentage points (p.p.) were calculated considering the difference between the premature birth rate at the end and the beginning of the studied period (2019-2007).

Crude and adjusted prevalence ratios of preterm birth classification and their respective 95% confidence interval (95%CI) were presented according to the independent variables. We performed a multivariate analysis using Poisson regression with robust confidence intervals. The analysis considered four hierarchical levels according to a conceptual framework[20]. At the first level, family income and maternal sociodemographic variables (age, skin color, schooling, family income, and living with a partner) were included. Parity was included at the second level. At the third level of prenatal care, smoking during pregnancy and morbidities were included. Finally, at the fourth level, assistance at delivery and type of delivery were included in the model. All variables were inserted into the model using backward selection, each level at a time, excluding those variables with $p > 0.20$.

Each research protocol was submitted and approved by the Health Research Ethics Committee of the Federal University of Rio Grande in the respective years 2007 (process 05369/2006), 2010 (process 06258/2009), 2013 (process 02623/2012), 2016 (process 0030-2015), and 2019 (process 23116.010992/2018-19). Written consent was obtained from the mothers.

Results

A total of 12,894 women gave birth between 2007 and 2019. Of them, 12,645 were successfully interviewed, with a response rate reaching 98.0% considering all years. After excluding women with multiple births (n = 230) and without information regarding gestational age (n = 1,833), 10,582 women were included in the analysis. The main method used to estimate gestational age at birth was ultrasonography (US) (50.3%) (Figure 1).

The overall prevalence of preterm birth was 16.0% (CI95%: 15.3%; 16.7%). Over the years, there was a reduction in the proportion of preterm births from 17.3% in 2007 to 15.5% in 2019 (-1.8 p.p.). This reduction in preterm births occurred mainly among women aged 35 years or older (-2.6 p.p.); with black skin color (-2.4 p.p.); in the second and fourth highest quartiles of family income (-4.7 p.p. and -4.6 p.p., respectively); primiparous women (-2.9 p.p.); who received prenatal care in the private sector (-4.6 p.p.); and had a c-section (-3.3 p.p.). The most notable reductions were observed among women who delivered in the private sector (-12.3 p.p.) and those with diabetes during pregnancy (-10.3 p.p.). Among women with less education and lower family income, the occurrence of preterm births increased +1.5 p.p. and +1.1 p.p., respectively. Similar results were found among those with adequate prenatal care (+2.4 p.p.), smokers (+2.5 p.p.), and who had depression during pregnancy (+3.3 p.p.) (Table 1).

Table 2 presents crude and adjusted associations between maternal characteristics and preterm birth. After adjustments, age 35 years or older, black skin color, lower maternal education, and multiparity were significantly associated with a higher risk of prematurity. Similarly, women with depression, hypertension, and diabetes during pregnancy presented a higher prevalence of having a preterm birth, while those from the private sector showed a lower probability of preterm birth.

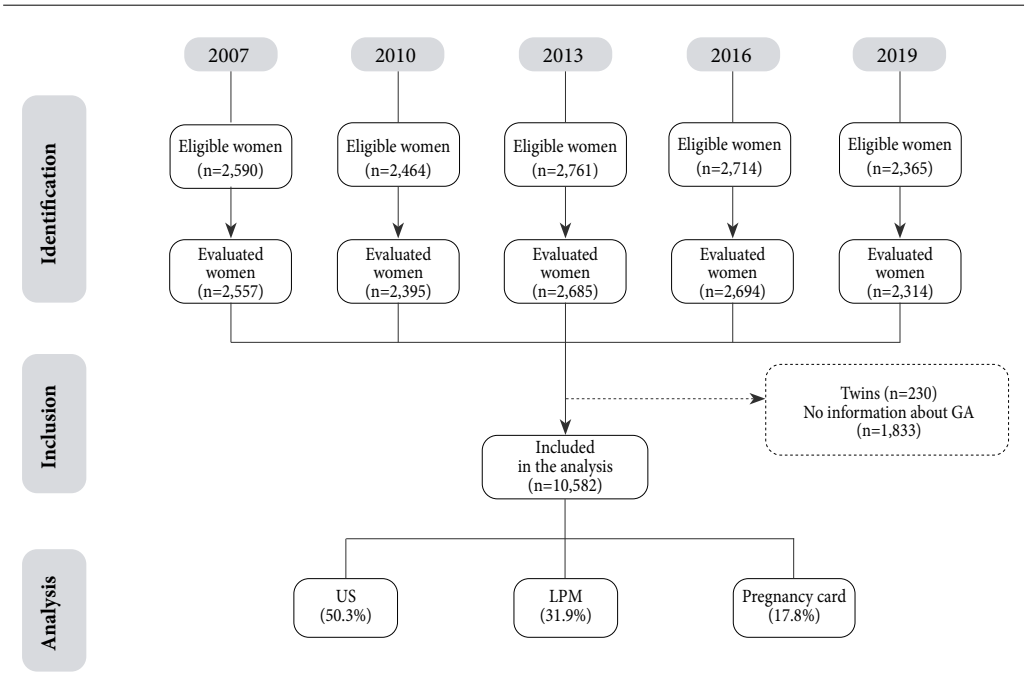

Figure 1. Sample selection and method used to calculate gestational age. Rio Grande, RS.

Source: Authors.

Table 1. Sample description and preterm birth occurrence according to maternal characteristics and study year. Rio Grande, RS, 2007-2019 (n = 10,582).

Maternal characteristics	All births % (n)	Preterm birth %					Difference in p.p (2007-2019)
		2007	2010	2013	2016	2019	
		n = 2.217	n = 2.007	n = 2.430	n = 2.061	n = 1.867	
Maternal age							
< 20	16.9 (1,793)	19.0	14.4	16.0	14.8	16.7	-2.3
20-34	70.4 (7,449)	16.0	14.0	17.3	14.1	14.6	-1.4
≥ 35	12.7 (1,340)	21.4	18.6	17.6	19.3	18.8	-2.6
Skin color							
White	70.7 (7,480)	16.7	13.2	16.0	14.6	14.9	-1.8
Brown	19.5 (2,060)	18.1	16.4	19.3	14.3	17.7	-0.4
Black	9.9 (1,042)	20.0	20.9	19.6	18.3	17.6	-2.4
Living with a partner							
No	14.9 (1,578)	18.9	14.7	18.9	18.2	19.3	0.4
Yes	85.1 (9,004)	17.0	14.5	16.8	14.3	15.0	-2.0
Schooling (complete years)							
0-8	38.8 (4,109)	19.7	17.1	17.0	16.3	21.2	1.5
9-11	44.4 (4,702)	15.3	14.0	17.8	14.7	13.1	-2.2
≥ 12	16.7 (1,771)	14.2	6.6	15.6	13.2	13.6	-0.6

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Maternal characteristics	All births % (n)	Preterm birth %					Difference in p.p (2007-2019)
		2007	2010	2013	2016	2019	
		n = 2.217	n = 2.007	n = 2.430	n = 2.061	n = 1.867	
Family income (quartiles)[a]							
1 (the poorest)	24.3 (2,487)	17.6	17.7	16.5	16.2	18.7	1.1
2	25.4 (2,598)	18.5	16.1	16.0	15.9	13.8	-4.7
3	24.9 (2,554)	16.9	12.0	17.1	14.2	16.0	-0.9
4 (the richest)	25.4 (2,605)	16.0	12.4	18.4	12.8	11.4	-4.6
Parity							
Primiparous	43.9 (4,641)	15.9	11.4	17.0	12.9	13.0	-2.9
Multiparous	56.1 (5,941)	18.2	17.1	17.2	16.6	17.2	-1.0
Prenatal care							
Public sector	58.0 (6,032)	18.1	15.6	15.0	15.8	17.7	-0.4
Private sector	42.0 (4,362)	15.3	12.5	18.5	13.8	10.7	-4.6
Prenatal care adequacy[b]							
Adequate	43.3 (4,581)	18.5	18.2	19.9	17.6	20.9	2.4
Inadequate	56.7 (6,001)	11.1	9.4	14.6	10.9	13.0	1.9
Hospital type							
Public	75.2 (7,956)	17.1	15.0	17.5	17.4	17.7	0.6
Private	25.8 (2,626)	17.8	13.3	16.5	6.6	5.5	-12.3
Type of birth							
Vaginal	44.8 (4,735)	16.8	17.0	17.5	16.6	16.6	-0.2
Cesarean section	55.2 (5,847)	17.7	12.7	16.9	13.4	14.4	-3.3
Smoking during pregnancy							
No	83.2 (8,802)	17.4	13.4	16.9	14.3	15.1	-2.3
Yes	16.8 (1,780)	16.8	19.3	18.0	19.0	19.3	2.5
Anemia							
No	59.5 (6,299)	18.4	14.1	16.9	15.2	16.5	-1.9
Yes	40.5 (4,283)	16.2	15.1	17.5	14.3	14.0	-2.2
Depression							
No	91.4 (9,674)	16.3	14.2	16.4	14.8	15.3	-1.0
Yes	8.6 (908)	22.2	17.9	23.6	17.3	25.6	3.4
Hypertension							
No	82.4 (8,725)	15.8	13.6	16.3	13.3	14.2	-1.6
Yes	17.6 (1,857)	24.3	18.6	20.3	21.7	24.8	0.5
Diabetes							
No	95.0 (10,055)	16.7	14.2	16.9	14.9	14.5	-2.2
Yes	5.0 (527)	35.4	24.6	20.8	14.8	25.1	-10.3
Total	100.0 (10,582)	17.3	14.6	17.1	14.9	15.5	-1.8

[a] Family income in minimum wages; [b] it was considered adequate when the pregnant woman had six or more appointments starting in the first trimester of pregnancy, performed two or more qualitative urine tests and two or more HIV and syphilis tests.

Source: Authors.

Table 2. Crude and adjusted association between preterm birth and maternal characteristics. Rio Grande, RS, 2007-2019 (n = 10,582).

Level	Variables	Preterm birth		
		%	CPR (95%CI)	APR (95%CI)
1º	Maternal age (Years)		p = 0.001	p < 0.001
	< 20	16.3	1.06 (0.95-1.20)	0.95 (0.84-1.08)
	20-34	15.3	1.00	1.00
	≥ 35	19.1	1.25 (1.10-1.41)	1.26 (1.12-1.43)
	Skin color		p < 0.001	p = 0.009
	White	15.1	1.00	1.00
	Brown	17.2	1.14 (1.02-1.27)	1.10 (0.98-1.22)
	Black	19.4	1.28 (1.12-1.47)	1.22 (1.06-1.39)
	Living with a partner		p = 0.015	p = 0.056
	Yes	15.6	1.00	1.00
	No	18.0	1.15 (1.03-1.30)	1.12 (1.00-1.26)
	Schooling (complete years)		p < 0.001*	p < 0.001*
	0-8	13.2	1.15 (1.00-1.32)	1.38 (1.18-1.61)
	9-11	15.1	1.38 (1.20-1.58)	1.19 (1.02-1.37)
	12 ou mais	18.8	1.00	1.00
	Family income[a]		p = 0.069	p = 0.882
	1 (the poorest)	17.5	1.17 (1.03-1.33)	1.03 (0.89-1.18)
	2	16.1	1.08 (0.95-1.23)	0.98 (0.85-1.13)
	3	15.4	1.04 (0.91-1.18)	0.98 (0.86-1.12)
	4 (the richest)	14.9	1.00	1.00
2º	Parity		p < 0.001	p = 0.006
	Primiparous	14.2	1.00	1.00
	Multiparous	17.3	1.21 (1.11-1.33)	1.15 (1.04-1.28)

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Discussion

Our results showed a slight reduction in the occurrence of preterm birth over the years. The most expressive reduction was observed among women who gave birth in the private sector and among those with diabetes during pregnancy. The risk of having a preterm birth was higher for older, black-skinned, less educated, and multiparous women. Morbidities such as hypertension, diabetes, and depression during pregnancy were also identified as risk factors. Between 2007 and 2019, there was a reduction in the proportion of preterm births for most of these risk groups, except for women with low education, depression, and diabetes, who had an increase in preterm births.

In Brazil, the occurrence of preterm births showed rising trends from 1990 onwards, mainly in the Southeastern and Southern regions[15], and an increase in cesarean sections has been pointed out as the main cause. In Ribeirão Preto, the prevalence of preterm birth increased from 6.0% (1978-79) to 13.3% (1994)[15]. In Pelotas, this prevalence increased considerably between 1982 and 1993 (from 5.8% to 11.2%, respectively), while between 2004 and 2015, it remained stable (from 13.7% to 13.8%, respectively)[11]. Similarly, our findings showed a slight variation in preterm rates during the 2000s. However, our results showed a higher prevalence than the study conducted in Pelotas, and this difference could be due to the different methods used to measure gestational age, as we primarily used ultrasound performed between the 6th and 20th gestational weeks, while the study conducted in Pelotas used LMP.

Delivery in the private sector had the greatest reduction in preterm births, while in the public sector, where most deliveries were performed (around 75,0%), had an increase of 0.6 p.p. in the period. Furthermore, in the adjusted analysis, it was the only variable analyzed that had a protective effect on the outcome. In the same way, prenatal care performed in the private sector also presented a greater reduction in the

Table 2. Crude and adjusted association between preterm birth and maternal characteristics. Rio Grande, RS, 2007-2019 (n = 10,582).

Level	Variables	Preterm birth		
		%	CPR (95%CI)	APR (95%CI)
3º	Prenatal care		p = 0.010	p = 0.906
	Public sector	16.5	1.00	1.00
	Private sector	14.6	0.89 (0.81-0.97)	1.01 (0.91-1.12)
	Prenatal care adequacy[b]		p < 0.001	p = 0,115
	Inadequate	12.3	1.00	1,00
	Adequate	18.7	1.53 (1.40-1.68)	1,11 (0,98-1,26)
	Smoking during pregnancy		p = 0.003	p = 0.738
	No	15.5	1.00	1.00
	Yes	18.3	1.18 (1.06-1.32)	1.02 (0.91-1.14)
	Anemia		p = 0.411	p = 0.136
	No	16.2	1.00	1.00
	Yes	15.6	0.96 (0.88-1.05)	0.93 (0.85-1.02)
	Depression		p < 0.001	p = 0.011
	No	15.4	1.00	1.00
	Yes	21.4	1.38 (1.21-1.58)	1.19 (1.04-1.36)
	Hypertension		p < 0.001	p < 0.001
	No	14.7	1.00	1.00
	Yes	21.7	1.47 (1.33-1.62)	1.39 (1.26-1.54)
	Diabetes		p < 0.001	p < 0.001
	No	15.6	1.00	1.00
	Yes	23.5	1.51 (1.29-1.78)	1.46 (1.25-1.71)
4º	Hospital type		p < 0.001	p = 0.008
	Public	17.0	1.00	1.00
	Private	12.9	0.76 (0.68-0.85)	0.85 (0.75-0.96)
	Type of birth		p = 0.017	p = 0.350
	Vaginal	16.9	1.00	1.00
	Cesarean section	15.2	0.90 (0.82-0.98)	0.96 (0.87-1.05)

[a] Family income in minimum wages; [b] it was considered adequate when the pregnant woman had six or more appointments starting in the first trimester of pregnancy, performed two or more qualitative urine tests and two or more HIV and syphilis tests; CPR: crude prevalence ratio; APR: adjusted prevalence ratio; * linear trend test.

Source: Authors.

outcome than in the public sector. This association may be explained by the priority in the care of high-risk pregnant women and complicated pregnancies in the public maternity hospital of the Unified Health System (SUS), which has a neonatal intensive care unit (NICU). In this way, the severe cases of pregnancy went to the public system of the municipality, consequently increasing the indicators of negative outcomes in this sector.

The second largest reduction in preterm birth rates in the period was observed among women with diabetes during pregnancy (-10.3 p.p.). However, only 5.0% of women in the sample had diabetes, and there was an important trend of reduction in preterm births among diabetic women between 2007 and 2016. In 2019, this trend was broken, and a new increase was observed. However, it remains lower than at the beginning of the period (2007).

Comorbidities, such as diabetes and hypertension during pregnancy, increased the risk of preterm birth regardless of the quality of the prenatal care. The relationship between these conditions and prematurity is well documented[21,22]. Some authors observed that the combination of diabetes and hypertension significantly raises the risk of preterm birth[23]. A meta-analysis showed that the use of antihypertensive treatment reduces the incidence of severe hypertension by half. However, it has not been shown to affect any other outcome, such as preterm birth[24]. In any case, women should receive pre-pregnancy counseling to optimize

their health before pregnancy and be informed about the increased maternal and fetal risks associated with hypertension and diabetes. Accessibility to health professionals and facilitating early referral can optimize treatment. Other beneficial management strategies that need to be implemented before or early in pregnancy include weight loss and smoking cessation[21].

Depression causes dysregulation of the hypothalamic-pituitary-adrenocortical axis, thus stimulating the release of various stress hormones such as cortisol. Cortisol may disrupt the flow of oxygen and nutrients, predisposing the fetus to preterm birth[25,26]. In our study, depression was associated with a higher risk of preterm birth. It is also important to note a high increase in premature births among women with depression between 2016 and 2019 (about 8.0 p.p.). This result emphasizes the need for a screening mechanism to detect gestational depression early in prenatal services and to refer pregnant women to adequate follow-up to minimize the negative repercussions of depression to the mother and, consequently, the negative repercussions on fetal health.

Black skin color, lower education, older age, and multiparity are socioeconomic and demographic characteristics that increase the risk of premature birth. These associations were previously described in the literature[16,27,28]. Of all these factors, the proportion of preterm births has increased over time only in the group with lower maternal education, making it the main factor for targeting intervention policies in the municipality. Mothers with higher levels of education can live in better neighborhood conditions for favorable neonatal health, and have greater knowledge and attitudes of self-care during pregnancy[29].

In interpreting the results, some limitations must be taken into consideration. Most of the information comes from the parturient's report obtained through a single approach and may have been affected by the recall bias. However, we sought to minimize this bias by performing the interviews in the first 48 hours after delivery. Women excluded from the analysis due to missing information on gestational age were less educated, poorer, and with a lower prevalence of adequate prenatal care. Thus, the prevalence of preterm births was likely underestimated. As strengths, it is noteworthy that this study represents a census with a large sample size, a low percentage of losses, and carried out periodically since 2007, enabling the temporal evaluation of delivery indicators. Furthermore, the classification of preterm births did not depend on a single criterion, as most information was obtained from the Pregnancy Card, with 52,5% referring to ultrasound examinations between the 6th and 20th week of gestation, which is the most adequate parameter for determining gestational age[30,31], and only around 16% depending on the LMP obtained from the card used at consultations.

Our results showed that during the 13-year period covered by this study (from 2007 to 2019), the prevalence of preterm birth slightly decreased, but with rates greater than 16% in all years. Although virtually stable, rates differed across maternal characteristics. Special attention must be paid to women with unfavorable socioeconomic status, especially with less education, in which the proportion of preterm births increased in the period. Likewise, morbidities such as diabetes, hypertension, and depression represent potentially important conditions for the occurrence of this outcome and must be investigated and treated during prenatal care. Otherwise, the prevalence of preterm births may increase again.

Collaborations

Investigation, writing original draft preparation and formal analysis: LP Marmitt and AKF Machado. Conceptualization, writing review and editing and funding acquisition, JA Cesar. All authors have read and agreed to the published version of the manuscript.

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