Original article

Evolution of socioeconomic inequalities in conducting prenatal consultations among Brazilian parturient women: analysis of the period 2000-2015*

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Abstract

Objective: to analyze evolution as to conducting seven or more prenatal consultations with pregnant women in Brazil, in the period 2000-2015 according to maternal education level and race/skin color of the newborn baby. **Methods:** this was a time series study based on Live Births Information System (SINASC) data; relative and absolute inequalities were investigated, adjusted for maternal age and gestational week in which childbirth occurred. **Results:** we analyzed approximately 48 million births; the proportion of seven or more prenatal consultations increased nationally (from 46.0% to 66.9%) in all groups analyzed; the relative difference between the extremes of education level ranged from 3.0 to 2.0, while the absolute difference ranged from 53.1 to 47.7 percentage points; the adjusted ratio between White/Black race/skin color was 1.4 in 2000 and 1.2 in 2015. **Conclusion:** the proportion of pregnant women having seven or more prenatal consultations has increased in Brazil, although inequalities are still found.

Keywords: Prenatal Care; Socioeconomic Factors; Educational Status; Ethnicity and Health; Health Status Disparities; Time Series Studies.

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Introduction

The existence of extensive literature supporting the provision of prenatal consultations as an important Public Health action has motivated countries all over the world to include them among their priorities in care for pregnant women and children.[1] In 2000, the Brazilian Ministry of Health incorporated into its Humanization of Prenatal and Birth Program the recommendation for pregnant women to have at least six prenatal consultations during the gestation period.[2] In 2011, the guarantee of prenatal consultations being conducted was included in the Cegonha Network and thus reaffirmed as a duty of the Brazilian National Health System (SUS).[3]

> *Despite the existence of a legal framework guaranteeing access to health services, despite the Brazilian National Health System (SUS) being a universal and egalitarian system and despite scientific evidence showing the benefits, having prenatal consultations occurs unevenly among the population.*

Studies have demonstrated that increasing the number of prenatal consultations is associated with the reduction of maternal and infant morbidity and mortality[4,5], ferrous sulphate supplementation,[6] having laboratory tests,[7] tetanus vaccination,[7] and greater likelihood of starting breastfeeding in the first hour after birth.[8]

Despite the existence of a legal framework guaranteeing access to health services, despite the Brazilian National Health System (SUS) being a universal and egalitarian system and despite scientific evidence showing the benefits, having prenatal consultations occurs unevenly among the population.[9,10] Fonseca et al.[9] analyzed the data on 62,449 births in Niteroi, in the state of Rio de Janeiro, between 2000 and 2009, and found that women with less schooling, aged under 19 years old and having Black ethnicity/skin had less probability of having the appropriate number of prenatal consultations for gestational age. A higher level of maternal education positively influences a better understanding of information provided by health professionals, greater autonomy of pregnant women and greater care in relation to complications during pregnancy.

When analyzing population surveys conducted in Brazil in 1986, 1996, 2006 and 2013, France et al.[11] described an increase in access to prenatal consultations and, based on the scale of ownership of domestic goods and access to services, found a reduction in inequality between having one and four consultations. Throughout the decades of 2000 and 2010, Brazil implemented various national and local strategies to promote access of pregnant women to prenatal consultations. Even so, we found no studies that have analyzed the evolution of socioeconomic disparities in this period regarding having seven prenatal consultations - as provided for in the Cegonha Network diagnosis matrix – nor according to maternal education level and race/skin color of the newborn baby.

Brazil has a Live Births Information System (SINASC), officially deployed by the Brazilian Ministry of Health in 1990, with the objective of gathering information on the characteristics of pregnant women and prenatal care, as well as providing the epidemiological profile of all live births in Brazilian territory. The system has expanded its coverage and quality, especially with effect from the end of the 1990s, and is capable of contributing to the planning of maternal and child health care. Despite the continuing need for its records to be improved, and the existence of regional disparities in data quality, SINASC is of extreme relevance for surveillance and the information it holds should be used in the monitoring of the health situation in Brazil.[12]

The objective of this study was to analyze evolution as to conducting seven or more prenatal consultations in Brazil in the period 2000-2015, according to maternal education level and race/skin color of the newborn baby.

Methods

This was a time series study based on analysis of Live Births Information System (SINASC) data. The base document of the system is the Certificate of Live Birth (CLB), the filling in of which is compulsory in relation to all children born in Brazil.

Maternal characteristics were obtained for all women who had children born alive in the period 2000-2015 in Brazil and who were registered on SINASC. The outcome analyzed was having had seven or more prenatal consultations, and the exploratory variables were maternal education level (illiterate, 1-3 years, 4-7 years, 8-11 years and 12 years or more

of schooling) and race/skin color of the newborn baby (Indigenous, White, Asian, Brown and Black). Adjustment variables incorporated in the study were maternal age (in years) and gestational week in which childbirth occurred (analyzed as a discrete variable).

The information for each Federative Unit in the years investigated was expanded from the DBC format (database container) to the DBF (database file) format on the TabWin32 program. The data were then converted into DTA and processed using Stata 14 (Stata Corp., College Station, USA), whereby the completeness of the analyzed variables and their consistency were assessed, considering the variables available in the population counts carried out in the period analyzed.

We initially described total births per year and per category of exploratory variables, in addition to the proportion of pregnant women having had seven or more prenatal consultations in Brazil in the period 2000-2015. We then checked the proportion of the outcome according to maternal education level and race/skin color of the newborn baby. We also estimated the tendency of the outcome using the Prais-Winsten linear regression model, correcting for the effect of first-order autocorrelation. Based on the calculation of the regression coefficients and standard error values we estimated average annual percentage variations in the outcome and respective 95% confidence intervals (95%CI). In the case of the indigenous population, we estimated coefficients between the years 2000 and 2008 and 2009 and 2015, because these periods were found to present distinct movements in the trend. For all other categories, the period analyzed was 2000-2015.

As a measure of relative inequality, we used Poisson regression to estimate the proportion ratios for having had seven or more consultations, according to the categories of the exploratory variables, taking as a reference illiterate mothers, in the case of education level, and new-born Black babies, in the case of race/skin color. All values were obtained in models containing all the explanatory variables and were adjusted for maternal age, gestational week, and race/skin color (when analyzing education level) and education level (when analyzing ethnicity/skin color). Adopting the same reference categories, we calculated the absolute differences in each year analyzed. In both cases, the respective 95%CI were described.

This study analyzed aggregated public data. The people to whom the data related were not identified and as such the study did not need to be approved by a Research Ethics Committee. The ethical principles used in the study were fully compliant with the standards defined by National Health Council Resolution CNS No. 510, dated 7 April 2016.

Results

We analyzed 47,715,968 births that occurred in Brazil between 2000 and 2015. Mean maternal age was 24.7 years (standard deviation of 6.3 years) in 2000 and 26.3 years (standard deviation of 6.7 years) in 2015, and the proportion of mothers with 12 or more years of schooling increased from 10.9% to 18.3%. At the end of the period analyzed, 54.0% of newborn babies had brown skin color whilst 35.5% were White (Table 1).

We observed an increase in the proportion of seven or more prenatal consultations in all levels of maternal education (Figure 1A). Illiterate pregnant women having seven or more consultations rose from 21.3% in the year 2000 to 35.1% in 2015; among women with 12 or more years of schooling, the proportion increased from 74.4% to 82.9%. The highest average annual increases were observed in the groups with less schooling, with 3.2% in illiterate pregnant women compared to 0.7% among those with 12 or more years of schooling (Table 2).

We found that, among those classified as having White, Black and brown ethnicity/skin color, there was an increase of around 25 percentage points in having seven or more consultations in the period analyzed (+2.4%, +4.0% and +4.2% per year on average, respectively) (Table 2). Among those of Asian ethnicity/skin color, there was an increase of approximately 37 percentage points (+5.4% per year on average). The exception was the indigenous ethnicity/skin color, where the proportion of seven or more prenatal consultations over the period analyzed fluctuated substantially, decreasing between 2005 and 2008 (-5.5% per year on average) and increasing between 2009 and 2015 (+10.9%) (Figure 1B; Table 2).

When illiterate pregnant women were compared with those with 12 or more years of schooling, the difference in the proportion of seven or more consultations, which was 53.1 percentage points in the year 2000, changed to 47.7 percentage points in 2015. We also observed reduction in the differences in relative terms, with the proportional ratio changing

Table 1 – Average maternal age, proportion having seven or more prenatal consultations and sample distribution, according to maternal education level and newborn baby race/skin color, Brazil, 2000-2015

Sample characteristics				Newborn baby ethnicity/skin color (%)						Maternal education level (in years of schooling) (%)					
Year	N	Maternal average age (SD [a])	Seven or more consultations (%)	White	Black	Asian	Brown	Indigenous	NI[b]	0	1-3	4-7	8-11	≥12	NI[b]
2000	3,206,761	24.7 (6.3)	46.0	48.6	2.8	0.6	34.6	0.6	12.8	4.4	15.4	38.0	25.7	10.9	5.5
2001	3,115,474	24.7 (6.3)	47.3	47.6	2.6	0.6	36.7	0.6	11.9	4.2	14.9	37.6	27.5	11.2	4.6
2002	3,059,402	24.8 (6.4)	49.1	47.2	2.4	0.5	37.6	0.5	11.8	3.8	15.0	36.3	29.6	11.7	3.7
2003	3,038,251	24.9 (6.3)	51.1	46.1	2.2	0.4	39.6	0.5	11.2	3.3	13.0	36.0	32.2	12.1	3.3
2004	3,026,548	25.0 (6.4)	52.9	46.2	2.1	0.4	40.5	0.5	10.3	2.8	11.7	34.9	34.9	12.9	2.7
2005	3,035,096	25.0 (6.4)	53.6	45.2	2.1	0.3	42.7	0.5	9.2	2.5	10.8	34.0	36.9	13.3	2.5
2006	2,944,928	25.1 (6.4)	55.4	45.3	1.8	0.2	44.8	0.5	7.4	2.1	9.5	32.3	39.4	14.1	2.6
2007	2,891,328	25.2 (6.5)	56.6	44.9	1.7	0.2	46.6	0.5	6.1	1.9	8.4	30.9	41.2	14.7	2.9
2008	2,934,828	25.4 (6.5)	57.7	44.7	1.6	0.2	47.3	0.6	5.5	1.6	7.6	29.6	43.4	15.8	2.1
2009	2,881,581	25.5 (6.5)	58.5	44.6	1.6	0.2	48.1	0.6	5.0	1.4	6.7	28.1	45.2	16.6	2.0
2010	2,861,868	25.7 (6.5)	61.1	44.8	1.5	0.2	48.5	0.6	4.4	1.2	5.9	26.6	47.2	17.7	1.4
2011	2,913,160	25.8 (6.5)	61.8	41.9	3.9	0.3	49.5	0.7	3.8	1.0	5.4	24.7	51.2	15.9	1.8
2012	2,905,789	25.9 (6.6)	62.4	37.5	5.3	0.4	52.1	0.7	4.0	0.8	4.5	22.8	54.4	15.1	2.3
2013	2,904,027	26.0 (6.6)	63.1	36.5	5.4	0.4	52.9	0.8	4.1	0.7	3.8	21.5	55.8	16.2	2.0
2014	2,979,259	26.1 (6.7)	64.7	35.9	5.1	0.4	53.8	0.8	4.0	0.7	3.4	20.6	57.9	17.3	0.1
2015	3,017,668	26.3 (6.7)	66.9	35.5	5.0	0.4	54.0	0.8	4.3	0.6	2.8	18.9	58.7	18.3	0.5

a) SD: standard deviation.
b) NI: not informed.

from 3.0 (95%CI 3.0;3.0) to 2.0 (95%CI 1.9;2.0) at the beginning and the end of the period analyzed (Table 3).

As to ethnicity/skin color, we observed a slight reduction of relative and absolute differences between Black and White newborn babies, with the former always having the worst profile, falling from an absolute difference of 20.4 percentage points in 2000 to 15.8 percentage points in 2015 (Table 4). When analyzing the differences of all categories of ethnicity/skin color with the indigenous, we found an increase in inequalities in both absolute and relative terms.

Discussion

The results obtained in our study indicated that having seven or more prenatal consultations increased significantly in Brazil between 2000 and 2015. In all groups of schooling and ethnicity/skin color, there was an increase in the proportion of pregnant women who had seven or more consultations. There was also a decrease in absolute and relative inequalities, although their levels are still signficant. Notwithstanding the expansion in the use of services, in the period of a decade and a half that was analyzed, inequality in the number of prenatal consultations conducted remained quite pronounced.

Using a cross-sectional approach, studies carried out in Brazil with regional[13] or national samples[10] have identified higher levels of schooling associated with greater likelihood of having the appropriate number of prenatal consultations. Studies have also found and described that increased uptake of prenatal care is more common among people with better living conditions and better jobs.[14] The same phenomenon has been reported in other countries and in different socioeconomic contexts. Poorer prenatal care, whether related to fewer consultations with health professionals, late uptake or less access to examinations and care has been associated with women in poorer socioeconomic conditions in the United States,[15] Belgium[16] and France[17] as well as among African countries.[18]

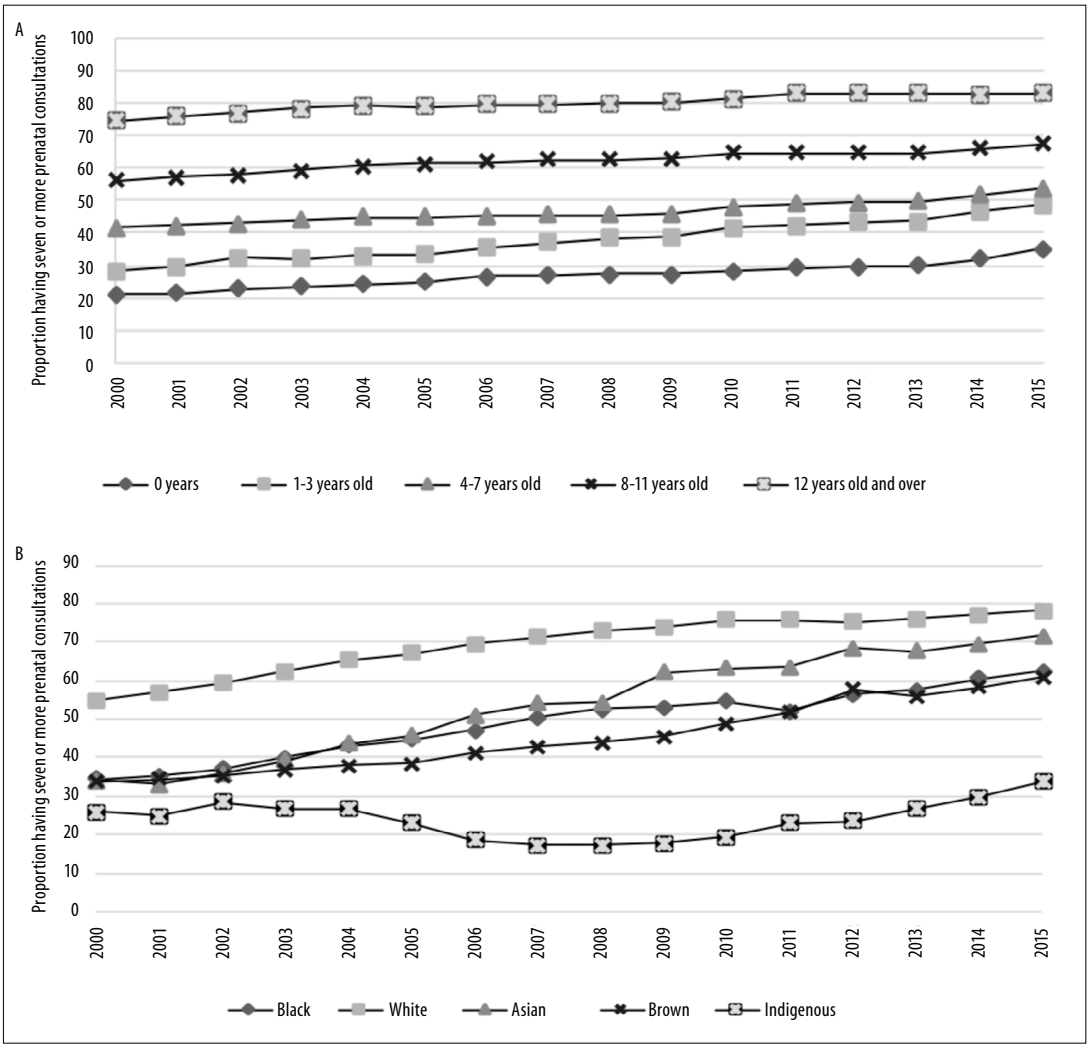

Figure 1 – Evolution of the proportion of pregnant women having seven or more prenatal consultations according to (A) years of schooling and (B) newborn baby ethnicity/skin color, Brazil, 2000-2015

Over the period examined, we found that the proportion of seven or more prenatal consultations being conducted varied according to maternal education level: the higher the maternal educational level, the greater the proportion of consultations. This result is consistent with subnational studies previously conducted in Brazil.[9] Level of education appears to bear influence both on the use of health care services in general[19] and also on having prenatal care. Women with more schooling are potentially more exposed to knowledge about their reproductive rights and are in a better financial situation to perform self-care and have healthier practices, and therefore have the recommended number of prenatal consultations and demand quality services.[20]

The lowest proportions of pregnant women having had seven or more prenatal consultations were those whose newborn babies were of indigenous, brown and Black ethnicity/skin color, in comparison with those whose children were of White ethnicity/skin color. This result corroborates previous reports in the literature of more adequate prenatal care among the White population.[21,22] This finding was demonstrated in a study conducted in the municipality of Niterói, in the state of Rio de Janeiro, where 68.8% of women of Black race/skin color and 74.8% of women with brown ethnicity/skin color had the appropriate number of consultations for gestational age, while 90.8% of women considered to be White achieved this

Table 2 – Trend analysis of the proportion of pregnant women who had seven or more prenatal consultations, Brazil, 2000-2015

Characteristics	AAPV[a]	AAPV[a] - 95%CI[b]	Interpretation
Maternal education level (in years of schooling)			
0	3.2	2.6;3.7	Increase
1-3	3.5	3.2;3.7	Increase
4-7	1.6	1.2;2.0	Increase
8-11	1.2	0.9;1.4	Increase
≥12	0.7	0.5;0.9	Increase
Newborn baby ethnicity/skin color			
Black	4.0	3.1;4.9	Increase
Brown	4.2	3.7;4.7	Increase
White	2.4	1.6;3.2	Increase
Asian	5.4	4.1;6.7	Increase
Indigenous (2000-2008)	-5.5	-1.6;-9.2	Reduction
Indigenous (2009-2015)	10.9	10.0;11.7	Increase

a) AAPV: annual average percentage variation.
b) 95%CI: 95% confidence interval.

level.[9] The inequalities we found reduced only slightly between 2000 and 2015, in particular the differences between women of White ethnicity/skin color and those of brown/Black ethnicity/skin color. In the case of indigenous people, differences increased.

The race/skin color variable has been considered a marker of inequities in health care service access and use, in this case prenatal care. A study conducted in Colombia found that women who were indigenous and descendants of Africans were those who least used prenatal care services and had the lowest number of consultations.[23] This discrepancy, both in the case of indigenous people and African descendants, may be due above all to geographical and economic barriers and, at times, to lack of trust in health care professionals.

A systematic review of the literature showed that working with indigenous community leaders and taking into account their beliefs, values, knowledge and skills is essential for obtaining a higher level of success with health actions that aim to positively impact prenatal care.[24] This was confirmed by a Brazilian study the objective of which was to identify the difficulties faced by indigenous people during their stay in an Indigenous Health House:[25] in addition to the factors mentioned above, having difficulty in being able to afford to buy medication, food different from traditional indigenous food, the language barrier and the lack of specific training to deal with this population were also important factors for difficulties in care provision.[25] In relation to the Afro-Brazilian population, a study aimed at analyzing the relationship between inadequate uptake of prenatal care and associated factors suggested that, apart from socioeconomic factors, racial discrimination may be negatively influencing access to and use of prenatal care.[26] Our study did not investigate the interaction between maternal schooling and ethnicity/skin color; however, it is possible that a multiplying effect may occur, indicating poorer access by indigenous and Black women with low schooling in comparison to highly educated White pregnant women.

Although the 2012/2013 National Primary Health Care Access and Quality Improvement Program (PMAQ-AB) data indicate high coverage of prenatal consultations, the data also showed inequalities in care provision between the major regions of the country and between the characteristics of the women cared for.[27] A higher proportion of white women, women living in the Southern region and older women had at least six prenatal consultations. Also regarding the adequacy of prenatal care in the Brazilian National Health System, a study conducted in the municipality of Juiz de Fora, in the state of Minas Gerais, found low adequacy of prenatal care provided to service

Table 3 – Relative and absolute differences in having seven or more prenatal consultations according to maternal education level, Brazil, 2000-2015

Period	Seven or more prenatal consultations, per years of schooling[a]			
	1-3 years	5-7 years	8-11 years	≥12 years
Relative Difference (95%CI [c]) [b]				
2000	1.3 (1.3;1.3)	1.9 (1.9;1.9)	2.5 (2.4;2.5)	3.0 (3.0;3.0)
2001	1.4 (1.3;1.4)	1.9 (1.9;1.9)	2.5 (2.4;2.5)	3.0 (3.0;3.1)
2002	1.4 (1.4;1.4)	1.8 (1.8;1.9)	2.3 (2.3;2.4)	2.9 (2.8;2.9)
2003	1.4 (1.3;1.4)	1.8 (1.8;1.8)	2.3 (2.3;2.4)	2.8 (2.8;2.9)
2004	1.3 (1.3;1.4)	1.8 (1.8;1.8)	2.3 (2.2;2.3)	2.7 (2.7;2.7)
2005	1.4 (1.3;1.4)	1.8 (1.8;1.8)	2.3 (2.3;2.4)	2.7 (2.6;2.7)
2006	1.3 (1.3;1.3)	1.6 (1.6;1.7)	2.1 (2.1;2.2)	2.4 (2.4;2.5)
2007	1.3 (1.3;1.4)	1.6 (1.6;1.6)	2.1 (2.0;2.1)	2.4 (2.3;2.4)
2008	1.4 (1.4;1.4)	1.6 (1.6;1.6)	2.1 (2.0;2.1)	2.4 (2.3;2.4)
2009	1.4 (1.4;1.4)	1.6 (1.6;1.7)	2.1 (2.0;2.1)	2.4 (2.3;2.4)
2010	1.4 (1.4;1.5)	1.6 (1.6;1.7)	2.1 (2.0;2.1)	2.3 (2.3;2.4)
2011	1.4 (1.3;1.4)	1.6 (1.5;1.6)	1.9 (1.9;2.0)	2.2 (2.1;2.2)
2012	1.4 (1.3;1.4)	1.6 (1.5;1.6)	1.9 (1.9;2.0)	2.2 (2.1;2.2)
2013	1.4 (1.3;1.4)	1.6 (1.5;1.6)	1.9 (1.9;2.0)	2.2 (2.1;2.2)
2014	1.4 (1.3;1.4)	1.5 (1.5;1.6)	1.8 (1.8;1.9)	2.1 (2.0;2.1)
2015	1.3 (1.3;1.3)	1.5 (1.4;1.5)	1.8 (1.7;1.8)	2.0 (1.9;2.0)
Absolute Difference (95%CI[c])				
2000	7.0 (6.5;7.5)	20.4 (19.9;20.9)	34.9 (34.4;35.4)	53.1 (52.6;53.6)
2001	8.0 (7.5;8.6)	20.8 (20.3;21.3)	35.6 (35.1;36.1)	54.5 (54.0;55.0)
2002	9.5 (8.9;10.0)	20.2 (19.6;20.7)	35.0 (34.5;35.5)	54.1 (53.5;54.6)
2003	8.7 (8.1;9.3)	20.6 (20.1;21.2)	35.9 (35.3;36.5)	54.9 (54.3;55.5)
2004	8.6 (8.0;9.3)	20.6 (20.0;21.2)	36.2 (35.6;36.8)	54.6 (54.0;55.2)
2005	8.2 (7.5;8.8)	19.5 (18.8;20.1)	36.1 (35.4;36.7)	53.5 (52.9;54.2)
2006	9.0 (8.2;9.7)	18.4 (17.7;19.1)	35.1 (34.5;35.8)	52.7 (52.0;53.4)
2007	9.7 (8.9;10.4)	18.0 (17.3;18.8)	35.0 (34.3;35.7)	52.1 (51.3;52.8)
2008	11.1 (10.3;11.9)	18.3 (17.5;19.1)	35.2 (34.4;36.0)	52.5 (51.7;53.3)
2009	11.4 (10.5;12.3)	18.5 (17.7;19.4)	35.3 (34.4;36.1)	52.7 (51.8;53.5)
2010	13.5 (12.6;14.5)	19.6 (18.6;20.5)	36.3 (35.4;37.2)	53.0 (52.1;53.9)
2011	13.1 (12.0;14.1)	19.9 (18.9;20.9)	35.6 (34.6;36.5)	53.9 (52.9;54.8)
2012	13.5 (12.4;14.6)	19.7 (18.6;20.8)	34.8 (33.7;35.8)	53.1 (52.0;54.1)
2013	13.6 (12.3;14.8)	19.7 (18.6;20.9)	34.5 (33.4;35.6)	52.7 (51.6;53.8)
2014	14.3 (13.0; 15.5)	19.5 (18.3; 20.6)	33.6 (32.5;34.8)	50.3 (49.1;51.4)
2015	13.3 (11.9; 14.6)	18.6 (17.3; 19.8)	32.4 (31.1;33.6)	47.7 (46.4;49.0)

a) Reference category: 0 years of study.
b) Adjusted for maternal age, gestational week when birth occurred and newborn baby ethnicity/skin color.
c) 95%CI: 95% confidence interval.

users, both with regard to procedures performed and also in relation to the carrying out of laboratory tests normally required during prenatal care.[28] This can also be seen in the findings of a study on prenatal care in Brazil's primary health care network: 69.2% of the women interviewed reported having had all the examinations recommended during pregnancy, 60.3% had received full guidance and only 23.6% underwent all the recommended procedures.[27] Similarly, according to a survey conducted in SUS health centers in Rio de Janeiro city, approximately 25% of the 2,353 pregnant women studied had started prenatal care late.[7] In other words, in addition to the number of consultations, consideration must also be

Table 4 – Relative and absolute differences in having seven or more prenatal consultations according to newborn baby race/skin color, Brazil, 2000-2015

Period	Seven or more prenatal consultations, by ethnicity/skin color[a]			
	White	Asian	Brown	Indigenous
Relative difference (95%CI[c])[b]				
2000	1.4 (1.3;1.4)	1.0 (0.9;1.0)	1.0 (0.9;1.0)	0.8 (0.8;0.8)
2001	1.4 (1.4;1.4)	0.9 (0.9;0.9)	0.9 (0.9;1.0)	0.8 (0.7;0.8)
2002	1.4 (1.4;1.4)	1.0 (0.9;1.0)	0.9 (0.9;0.9)	0.8 (0.8;0.8)
2003	1.4 (1.3;1.4)	1.0 (0.9;1.0)	0.9 (0.9;0.9)	0.8 (0.7;0.8)
2004	1.3 (1.3;1.4)	1.0 (0.9;1.0)	0.9 (0.9;0.9)	0.7 (0.7;0.8)
2005	1.3 (1.3;1.3)	1.0 (0.9;1.0)	0.9 (0.8;0.9)	0.6 (0.6;0.6)
2006	1.3 (1.3;1.3)	1.0 (1.0;1.1)	0.9 (0.9;0.9)	0.5 (0.5;0.5)
2007	1.3 (1.3; 1.3)	1.0 (1.0; 1.0)	0.8 (0.8; 0.9)	0.4 (0.4;0.4)
2008	1.3 (1.2;1.3)	1.0 (1.0;1.0)	0.8 (0.8;0.8)	0.4 (0.4;0.4)
2009	1.3 (1.2;1.3)	1.1 (1.1;1.1)	0.9 (0.8;0.9)	0.4 (0.4;0.4)
2010	1.3 (1.2;1.3)	1.1 (1.0;1.1)	0.9 (0.9;0.9)	0.4 (0.4;0.5)
2011	1.3 (1.3;1.3)	1.1 (1.1;1.1)	1.0 (1.0;1.0)	0.6 (0.5;0.6)
2012	1.2 (1.2;1.2)	1.1 (1.1;1.1)	1.0 (1.0;1.0)	0.6 (0.6;0.6)
2013	1.2 (1.2;1.2)	1.1 (1.1;1.1)	1.0 (1.0;1.0)	0.6 (0.6;0.6)
2014	1.2 (1.2;1.2)	1.1 (1.0; 1.1)	1.0 (1.0; 1.0)	0.6 (0.6;0.6)
2015	1.2 (1.2;1.2)	1.1 (1.0;1.1)	1.0 (1.0;1.0)	0.7 (0.6;0.7)
Absolute Difference (95%CI[c])				
2000	20.4 (19.8;21.0)	-0.4 (-1.7;0.8)	-0.6 (-1.1;0.0)	-8.4 (-9.8;-7.0)
2001	21.6 (20.8;22.5)	-2.2 (-3.5;-0.9)	-0.8 (-1.4;-0.2)	-10.4 (-11.8;-8.9)
2002	22.2 (21.6;22.8)	-1.4 (-2.8;0.0)	-1.9 (-2.5; -1.3)	-8.7 (-10.1;-7.2)
2003	22.3 (21.7;22.9)	-1.0 (-2.5;0.5)	-3.2 (-3.8;-2.6)	-13.5 (-14.9;-12.0)
2004	22.3 (21.7;22.9)	0.5 (-1.0;2.0)	-5.3 (-5.9;-4.7)	-16.4 (-17.9;-14.9)
2005	22.3 (21.7;22.9)	1.0 (-0.6;2.6)	-6.2 (-6.8;-5.6)	-21.7 (-23.2;-20.2)
2006	22.2 (21.6;22.9)	3.7 (18.4;55.2)	-6.2 (-6.8;-5.5)	-28.6 (-30.2;-26.9)
2007	21.1 (20.5;21.7)	3.6 (1.7;5.6)	-7.6 (-8.3;-7.0)	-33.1 (-34.7;-31.4)
2008	20.4 (19.8;21.0)	2.6 (0.7;4.5)	-8.5 (-9.2;-7.9)	-35.2 (-36.8;-33.6)
2009	20.9 (20.2;21.5)	9.1 (7.4;10.8)	-7.4 (-8.0;-6.8)	-35.1 (-36.7;-33.6)
2010	21.1 (20.5;21.8)	8.6 (6.9;10.4)	-5.7 (-6.4;-5.1)	-35.0 (-36.6;-33.5)
2011	23.6 (23.2;24.0)	11.2 (9.9;12.6)	-0.4 (-0.8;0.0)	-29.1 (-30.4;-27.8)
2012	18.7 (18.4;19.1)	11.9 (10.8;13.0)	-1.6 (-2.0;-1.3)	-32.0 (-33.2;-30.8)
2013	18.4 (18.0;18.7)	10.1 (9.0;11.2)	-1.8 (-2.1;-1.4)	-30.8 (-32.0;-29.6)
2014	16.5 (16.1;16.8)	8.9 (0.77;0.99)	-2.3 (-1.9;-2.6)	-30.6 (-29.4;-31.7)
2015	15.8 (15.5;16.1)	9.4 (0.8;10.5)	-1.5 (-1.4;-1.8)	-28.5 (-27.3;-29.5)

a) Reference category: Black race/skin color.
b) Adjusted for maternal age, gestational week when birth occurred and mother's education level.
c) 95%CI: 95% confidence interval.

given to the potential inequalities in the quality of care provided to pregnant women.

As this study was based on SINASC data, there may have been bias arising from problems with the quality of the information, given that the system's coverage, underreporting of information and the reliability thereof vary according to the region of the country and the period analyzed. For example: unknown data for the race/skin color variable fluctuated between 12.8% in 2000 and 4.4% in 2015. In the case of maternal education level, unknown data fell from 5.5% to 1.5% in the same period. It is possible that the unknown data are precisely those relating to people who are more disadvantaged and distant from public services. It must also be highlighted that there

was a substantial decrease in pregnant women with low schooling and an increase in those with high school and higher education qualifications over the period analyzed.

Another limitation of this study is the impossibility of making a comparison with the minimum number of six prenatal consultations established by the Ministry of Health, due to the number of consultations being grouped together on the Certificate of Live Birth (CLB) forms. It was only with effect of the implantation of the new CLB form in 2011, that the field for the number of prenatal consultations has allowed a cut-off point of six consultations to be established. As such, the proportion of pregnant women who achieved the Ministry of Health goal of at least six prenatal consultations is higher than that reported in our study, which was based on a minimum of seven visits. Even so, it is unlikely that the direction taken by the inequalities reported in our study is different to those of the six consultations cut-off point. In addition, the cut-off point of seven or more consultations is indicated in the Cegonha Network diagnosis matrix.

Our study also investigated inequalities using two different forms of analysis: we calculated absolute and relative differences. Each one has a different and complementary type of information and both of them are of great relevance for researchers and planners.[29] Relative inequality is quite sensitive to the frequency of the occurrence of the outcome and, with the substantial increase in coverage, there may, for example, be a reduction in relative inequality and an increase in absolute inequality. Therefore, it is always advisable to use both measures when analyzing health inequalities.

Furthermore, we emphasize that since the beginning of the 1990s, Brazil has experienced major changes that have influenced the social determinants of diseases and health service organization. The experience of SUS, a public and universal health system, has enabled the expansion of healthcare coverage in the country and this has been reflected in the improvement of health indicators for women and children.[30] In recent years, Brazil has also seen the expansion of social programs and their clear impact on the health sector. Although the proportion of pregnant women having seven or more prenatal consultations has increased nationwide, inequalities were still found to be considerable at the end of the period studied. Actions that promote equity should be planned and implemented by public policy makers and health care service managers.

Authors' contributions

Boing AF and Boing AC contributed to the conception of the study, defining its objectives and theoretical approach. Mallmann MB and Boing AF contributed to the study design. Mallmann MB and Tomasi YT performed the data analysis and interpretation, in addition to helping to write the article. Dos Anjos JC contributed to reviewing the literature on the topic, participated in drafting the text and data interpretation. Boing AF, Dos Anjos JC and Boing AC contributed to writing the text and critically reviewing it. The final version of the manuscript was approved by all the authors, who take on responsibility for all its aspects and assure its integrity.

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