

Prenatal care in Southern Brazil: coverage, trend and disparities

Janaina S Saavedra^I , Juraci A Cesar^{II} , Angélica O Linhares^{III} 

^I Universidade Federal do Rio Grande. Faculdade de Medicina. Programa de Pós-Graduação em Ciências da Saúde. Rio Grande, RS, Brasil

^{II} Universidade Federal do Rio Grande. Faculdade de Medicina. Programa de Pós-Graduação em Saúde Pública. Rio Grande, RS, Brasil

^{III} Universidade Federal de Pelotas. Faculdade de Nutrição. Programa de Pós-Graduação em Nutrição e Alimentos. Pelotas, RS, Brasil

ABSTRACT

OBJECTIVE: To estimate coverage, examine trend and assess the disparity reduction regarding household income during prenatal care between mothers living in Rio Grande, state of Rio Grande do Sul, in 2007, 2010, 2013 and 2016.

METHODS: This study included all recent mothers living in this municipality, between 1/1 and 12/31 of those years, who had a child weighing more than 500 grams or 20 weeks of gestational age in one of the only two local maternity hospitals. Trained interviewers applied, still in the hospital and up to 48 hours after delivery, a unique and standardized questionnaire, seeking to investigate maternal demographic and reproductive characteristics, the socioeconomic conditions of the family and the assistance received during pregnancy and childbirth. To assess the adequacy of prenatal care, the criteria proposed by Takeda were used, which considers only the number of prenatal appointments and gestational age at initiation, and by Silveira et al., who in addition to these two variables, considers the achievement of some laboratory tests. Chi-square tests were used to compare proportions and assess the linear trend.

RESULTS: The total of 10,669 recent mothers were included in this survey (96.8% of the total). Prenatal coverage substantially increased between 2007 and 2016. According to Takeda, it rose from 69% to 80%, while for Silveira et al., it increased from 21% to 55%. This improvement occurred for all income groups ($p < 0.01$). The disparity between the extreme categories of income reduced, according to Takeda, and increased according to Silveira et al.

CONCLUSIONS: The provision of prenatal care, considering only the number of appointments and the early start, occurred in greater proportion among the poorest. However, only the richest recent mothers were contemplated with more elaborate care, such as laboratory tests, which increased the disparities in the provision of prenatal care.

DESCRIPTORS: Prenatal Care, utilization. Health Services Coverage. Coverage Equity. Health Status Disparities. Health Evaluation.

Correspondence:

Janaína Salomão Saavedra
Faculdade de Medicina – FURG
Campus Saúde – Área Acadêmica
Prof. Newton Azevedo
Rua Visconde de Paranaguá, 102
Sala 411
96203-900 Rio Grande, RS, Brasil
E-mail: salomaosaavedra@gmail.com

Received: Jun 4, 2018

Approved: Aug 15, 2018

How to cite: Saavedra JS, Cesar JA, Linhares AO. Prenatal care in Southern Brazil: coverage, trend and disparities. Rev Saude Publica. 2019;53:40.

Copyright: This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided that the original author and source are credited.



INTRODUCTION

Prenatal care reduces the occurrence of intrauterine growth restriction, low birth weight, prematurity, neonatal mortality and malnutrition in children^{1,2}. The better the quality of the services offered, the greater the impact on maternal and child health and the lower the morbidity and mortality rate in this population^{1,3}.

This quality has been measured by the combination of care offered to pregnant women, including, in general, number of appointments, gestational age at initiation of the prenatal care and, more recently, laboratory tests. As a rule, three categories were originated: adequate, intermediate and inadequate⁴⁻⁶.

Several studies have reported the existence of inequality in prenatal care⁷⁻¹¹. Most of them have done this after the identification of associated factors and found that pregnant women with the worst socioeconomic status are more likely to receive inadequate care⁵⁻¹⁰. Other studies have made more sophisticated analyses and shown that the inequality is decreasing because the proportion of pregnant women beginning prenatal care is increasing, and the number of appointments made by them approaches, more and more, those with a better socioeconomic level. The reduction in the difference between the rich and the poor suggests that the inequality in prenatal care has been decreasing^{11,12}.

Perinatal studies conducted every three years in the municipality of Rio Grande, state of Rio Grande do Sul, since 2007, have been collecting information about the care received by pregnant women since the beginning of prenatal until the immediate postpartum. These data allow the completion of this assessment in a period of 10 years (2007–2016).

This study has three objectives: 1) estimate the adequate prenatal coverage according to the criteria proposed by Takeda and Silveira et al. between 2007 and 2016 in this municipality, 2) meet the trend of this adequacy and 3) verify how this coverage behaved during this period according to the household income.

METHODS

The municipality of Rio Grande is located in the coastal stretch of the south of Rio Grande do Sul state, 300 km from Porto Alegre. Between 2007 and 2016, the data collection period, its population increased from 197 thousand to about 213 thousand inhabitants. Throughout this period, the gross domestic product (GDP) increased from R\$19.6 to R\$41.3 thousand¹³, while the employment relationship doubled, going from 52,875 to 107.338¹⁴. The infant mortality coefficient remained around 11.5/1,000¹⁵, while little changed in the public health system, except for the Family Health Strategy (FHS), which went from 10 to 36 teams over the period. The same services remained in the others: 32 basic health units, three outpatient clinics and two hospitals, the University Hospital of the Universidade Federal do Rio Grande being destined entirely to the Unified Health System.

This research is part of the Perinatal Studies of Rio Grande, conducted in the municipality every three years since 2007 to assess the care received by mothers from the beginning of pregnancy until immediate postpartum. Data presented here have a time series that included all births that occurred between 1/1 and 12/31 2007, 2010, 2013 and 2016 in only two local maternity hospitals. To be included in the study, mothers should reside in the rural or urban area of the municipality of Rio Grande, and their children should have at least 500 grams or 20 weeks of gestational age at birth.

The sample size was estimated a posteriori based on the prevalence of 81.3 for Takeda⁴ in 2016 and 43.8 for Silveira et al.⁵ in 2010. Thus, from the “n” available (10,331), for a 95% confidence level, it would be possible to work with a margin of error of 2.0 and 1.0 percentage point, respectively¹⁶.

Data collection was performed using a single and standardized questionnaire, divided into blocks, which sought information about demographic, occupational, behavioral, and reproductive characteristics, as well as complications in this last pregnancy. We also collected information on housing conditions, possession of durable products, family crowding and socioeconomic level of the family.

The outcome, completion of adequate prenatal, was constituted from the criteria proposed by Takeda⁴ and Silveira et al.⁵ Takeda considered adequate when pregnant women began attending the appointments before the fifth month of pregnancy and attended six or more prenatal care appointments, while Silveira et al. classified as appropriate when pregnant women who attended six or more appointments began prenatal care before the fifth month of pregnancy and did two or more qualitative tests of urine, complete blood count and exams for the diagnosis of syphilis by the rapid test or the Venereal Disease Research Laboratory (VDRL).

Recent mothers were approached only once, in the maternity hospital, up to 48 hours after delivery. In the surveys of 2007, 2010 and 2013, printed and coded questionnaires were used by the interviewers and delivered at the headquarters of the project for further review, double typing, comparison and correction in EpiData 3.1¹⁷ and EpiInfo 6.04¹⁶ software. In 2016, the data were entered using tablets by the interviewers themselves via online Platform Web REDCap (Research Electronic Data Capture)¹⁸ with the server of the Universidade Federal do Rio Grande (FURG) at the address www.redcap.furg.br. The data entered were verified on the next day, when any inconsistencies were corrected.

The consistency and categorization of variables were analyzed in Stata 11¹⁹. Then the variables were assembled to assess the prenatal adequacy according to the criteria proposed by Takeda⁴ and Silveira et al.⁵ The proportions and the linear trend between 2007 and 2016 were assessed using chi-square test and trend tests, respectively. The confidence level employed was 95%. For quality control, 7% of the interviews were redone, i.e. every 15 questionnaires, one was chosen at random to be partially repeated. This mini questionnaire contained questions from all blocks of questions of the questionnaire. The answers were then compared. The agreement was assessed using the Kappa coefficient. In 2007, this coefficient ranged from 0.76 to 0.91; in 2010, from 0.63 to 0.78; in 2013, from 0.63 to 0.89; and in 2016, from 0.60 to 0.99. This shows satisfactory agreement²⁰.

The research project was approved by the Research Ethics Committee in the Health Area of the Universidade Federal do Rio Grande (CEPAS/FURG) under numbers 23116.5369/6.58-12/2007, 23116.6258/9.64-117/2009, 23116.2623/67-007-2012 and 030/2015. Thus, all participants signed the informed consent form and received a copy of this document.

RESULTS

In 2007, 2010, 2013 and 2016, the number of births was 10,669, and the mothers lived in the municipality of Rio Grande. Of this total, 10,331 (96.8%) mothers were interviewed.

Table 1 shows the main socioeconomic characteristics of recent mothers included in these surveys. Between 2007 and 2016, the rate of teenage mothers decreased 16% and labors among those of brown skin color increased 23%. The proportion of those who lived with a partner remained stable at around 84%. The schooling rate increased, especially among mothers who have graduated high school (≥ 12 years). The household income has improved, especially in categories of lower (up to 0.99 minimum wage) and higher (four minimum wages or more) income. The proportion of mothers who worked during pregnancy increased 23% over the period. The absence

Table 1. Main characteristics of recent mothers living in the municipality of Rio Grande, state of Rio Grande do Sul, who had children in 2007, 2010, 2013 or 2016.

Characteristic	Year of the perinatal study				p	Change (%) in the study period
	2007	2010	2013	2016		
Mother's age (in years)					p < 0.001	
11 to 19	20.2	18.6	17.3	16.9		-16.3
20 to 24	28.1	26.8	26.3	26.1		-7.1
25 to 29	24.6	25.8	24.1	23.6		-4.1
30 or more	27.2	28.8	32.2	33.3		+22.4
Mean: (standard deviation)	25.6 (6.6)	25.9 (6.4)	26.3 (6.5)	26.5 (6.6)		+0.9 (year)
Skin color					p < 0.001	
White	69.5	66.4	66.1	67.0		-3.6
Brown	18.3	20.6	22.3	22.6		+23.5
Black	12.2	9.9	11.7	10.3		-15.6
Mothers living with a partner	82.8	83.2	85.8	83.6	p = 0.02	+1.0
Schooling (years of study)					p < 0.001	
0 to 4	12.6	8.0	6.0	3.3		-73.8
5 to 8	36.1	37.2	33.6	33.4		-7.5
9 to 11	41.9	44.5	44.7	39.8		-5.0
12 or more	9.4	10.3	15.6	23.5		+150.0
Mean (standard deviation)	8.6 (3.5)	9.0 (3.2)	9.5 (3.3)	10.1 (3.6)		+1.5 (year)
Monthly household income in minimum wages (MW)					p < 0.001	
Up to 0.99	14.7	17.6	5.4	8.0		-45.6
1 to 1.99	32.5	33.5	28.5	29.1		-10.5
2 to 3.99	33.7	31.3	39.5	36.7		+8.9
4 or more	19.1	17.6	26.7	26.1		+36.6
Mean (standard deviation)	2.9 (3.2)	3.4 (10.5)	3.4 (3.5)	3.1 (3.1)		+0.3 (MW)
Mothers who work	37.4	42.8	43.6	45.9	p < 0.001	+22.7
Mothers who did not attend a single prenatal appointment	4.2	4.5	2.6	1.5	p < 0.001	-64.3
Mothers who began attending appointments in the first trimester of pregnancy	73.6	78.3	78.6	79.4	p < 0.001	+7.9
Mothers who attended six or more prenatal appointments	72.5	76.7	83.5	84.3	p < 0.001	+16.3
Mean (standard deviation)	7.4 (3.7)	7.7 (3.6)	8.3 (3.3)	8.2 (3.1)		+0.8 (appointment)
Total (n = 10,331)	2,557	2,395	2,685	2,694		

of prenatal appointments decreased and there was a gain, on average, of one prenatal appointment in the period.

Table 2 shows the coverage of adequate prenatal care according to the household income between 2007 and 2016. According to Takeda, a significant increase occurred in the provision of adequate prenatal care, going from 69% to 81%, while for Silveira et al., this change was even higher, from 21% to 55% ($p_{\text{trend}} < 0.001$). This increase occurred in all income categories in both criteria used. After assessing the disparity between extreme categories of the same survey, a drastic reduction occurred, according to Takeda, falling from 37.7 p.p. (or 74.5%) in 2007 to 28.3 p.p. (or 44.8%) in 2016, i.e. the disparity was reduced by one third over the period. Regarding the criterion proposed by Silveira et al., we observed the opposite: the disparity, which was 5.6 p.p. in 2007, increased to 14.8 p.p. in 2016, that is, an increase of 164% (14.8/5.6).

Table 2. Adequacy of prenatal care according to different criteria relating to the household income between recent mothers living in the municipality of Rio Grande, state of Rio Grande do Sul, 2007–2016.

Criterion/Monthly household income in minimum wages	Year of the perinatal survey				Change 2007–2016.		p for trend
	2007	2010	2013	2016	p.p.*	%	
	% (95%CI)	% (95%CI)	% (95%CI)	% (95%CI)			
Takeda	p < 0.001	p < 0.001	p < 0.001	p < 0.001			
Total	69.0 (67.2–70.8)	73.2 (71.5–75.0)	78.9 (77.4–80.5)	80.5 (79.1–82.1)	11.5	+16.7	p < 0.001
≤ 0.9	50.6 (45.9–56.0)	63.0 (58.4–67.7)	63.2 (55.2–71.2)	67.9 (61.6–74.2)	17.3	+34.2	p < 0.001
1 to 1.9	61.1 (57.8–64.4)	64.7 (61.4–68.0)	71.0 (67.8–74.2)	74.1 (71.0–77.2)	13.0	+21.3	p < 0.001
2 to 3.9	73.7 (70.7–76.6)	79.2 (76.2–82.1)	78.3 (75.8–80.8)	83.8 (81.6–86.1)	10.1	+13.7	p < 0.001
≥ 4	88.3 (85.4–91.2)	89.1 (86.1–92.1)	91.5 (89.4–93.5)	91.3 (90.0–93.7)	3.0	+3.4	p < 0.001
Difference between extreme income groups in the same survey							
p.p.*	37.7	26.1	28.3	23.4	-14.3	-61.1	
%	74.5	41.4	44.8	34.4	-40.1	-116.6	
Silveira et al.	p = 0.04	p < 0.001	p < 0.001	p < 0.001	33.4		
Total	21.3 (19.7–22.9)	44.0 (42.1–46.0)	57.0 (55.1–58.9)	54.7 (52.8–56.5)	28.0	+156.8	p < 0.001
≤ 0.9	19.4 (15.3–23.40)	34.8 (30.3–39.4)	36.8 (28.8–44.7)	47.4 (40.7–54.2)	28.9	+144.3	p = 0.036
1 to 1.9	20.2 (17.5–23.0)	37.2 (33.8–40.5)	50.3 (46.8–53.90)	49.1 (45.5–52.6)	36.1	+143.1	p < 0.001
2 to 3.9	21.1 (18.4–23.8)	49.9 (46.3–53.5)	57.2 (54.2–60.1)	57.2 (54.1–60.2)	37.2	+171.1	p < 0.001
≥ 4	25.0 (21.1–23.8)	55.9 (51.2–60.7)	68.0 (64.6–71.4)	62.2 (58.1–66.2)	37.2	+148.8	p < 0.001
Difference between extreme income groups in the same survey							
p.p.*	5.6	21.1	31.2	14.8	+9.2	+164.3	
%	28.9	60.6	84.8	31.2	+2.3	+7.9	
Total (n = 10,005)	2,449	2,288	2,614	2,654			

* percentage point.

DISCUSSION

This study showed an increase in the coverage of adequate prenatal care in all income categories of both criteria used. It also showed the disparity reduction according to Takeda and increase regarding the criterion proposed by Silveira et al.

As to the assessment of the adequacy of prenatal care using the criterion by Takeda⁴, we verified the coverage of 81% in Caracol and Anísio de Abreu²¹, PI, in 2008; 59% in Santa Maria²², RS, in 2009; and 42% in João Pessoa²³, PB, and 56% in Vitória²⁴, ES, both in 2010. For the criteria proposed by Silveira et al.⁵, the adequacy rate found in Pelotas²⁵, RS, was 37% in 2002, while in Palmas²⁶, TO, it reached 69% in 2009. This study, however, analyzed only pregnant women treated in the FHS. In Rio Grande, the coverage rates for adequate prenatal care were 81% for Takeda and 55% for Silveira et al. The differences observed can be attributed to sample characteristics, the year of the study, socioeconomic level and the availability of health services in each of these locations.

Regarding the trend, for both criteria, we found that the provision of adequate prenatal care has increased consistently in the municipality, which is in agreement with the results

observed in the cohorts of Pelotas²⁵, São Luís and Ribeirão Preto.⁹ However, even for Takeda, undemanding criterion to achieve adequacy, there is room for improvement, while for Silveira et al., more robust criterion that requires two laboratory tests, the challenge is much bigger because almost half of them (45%) have not reached adequacy yet.

Despite the increase in the provision of adequate prenatal in all income categories in Rio Grande, we verified reduction and increase in disparity according to Takeda and Silveira et al., respectively. In the case of Takeda, the reduction was basically due to the expansion of the Family Health Strategy in the municipality, which went from 10 teams in 2007 to 36 teams in 2016, increasing the coverage of FHS from 38% to 57% over the period²⁷. These teams were primarily installed in neglected areas or with insufficient capacity to meet the demand for prenatal care in these locals.

The fact that only the poor have a low number of appointments or do not receive prenatal care decreased the difference between extreme categories, reducing significantly the inequality in prenatal care, finding already evidenced in other studies^{11,12}.

According to Silveira et al., despite the increase in prenatal coverage in all categories of income, the difference between extreme categories was higher in 2016 than in 2007, going from 5.6 p.p. in 2007 to 14.8 p.p. in 2016 (increase of 164%). This occurred because pregnant women with a better household income underwent tests of urine, VDRL and CBC in greater proportion than poor women, which explains the increase in both coverage and disparity. As to the fact that poor women get worse coverage, the care received by them is not satisfactory, either in quantity or in quality; at the same time, among the richest, the opposite occurs. This scenario was termed Inverse Care Law, qualification coined by JT. Hart in the 1970s²⁸. More recently, other authors²⁹ established a corollary to that law, stating that new technologies, such as more complex exams mentioned here, reach the rich first and only then the poor. Between 2007 and 2016 in Rio Grande, the coverage for these three tests among poor women increased from 91% to 94%, while it increased from 93% to 99% among the rich. These data may explain the increased disparity between these groups, since those with higher income achieved practically the universalization, while the poor had less evident improvement.

Finally, the increase in disparity regarding prenatal care found in Rio Grande is not in accordance with other studies on the subject^{12,30}. A possible explanation is that other studies assessed only the number of appointments, but not the complementary exams as our study. If this analysis included only the criterion proposed by Takeda, restricted to the number of appointments and gestational age at initiation of prenatal care, the result would be similar.

When interpreting these results, one should consider the limitations inherent to the design used and the fact that they include questions since the planning of pregnancy until the immediate postpartum, that the questionnaire was applied a few hours after delivery, and that it took between 60 and 80 minutes. In addition, we included a technical question related to the kind of disparity assessed: our aim was to assess the difference between extremes, so we did not considerate the intermediate groups³¹. The assessment of intermediate groups requires more complex analysis of difficult interpretation, which would differ from our goal to denounce the increasing disparity between income extremes.

The provision of adequate prenatal care has been increasing consistently, but we must prioritize the provision of care for pregnant women with the worst household income. We suggest that other variables are included besides the number of appointments when assessing the adequacy of prenatal care, in order to provide a more in-depth analysis about the prenatal care, extremely relevant to the health care of mother and child.

REFERENCES

1. Dowswell T, Carroli G, Duley L, Gates S, Gülmezoglu AM, Khan-Neelofur D, et al. Alternative versus standard packages of antenatal care for low-risk pregnancy. *Cochrane Database Sys Rev.* 2015;(7):CD000934. <https://doi.org/10.1002/14651858.CD000934.pub3>

2. Kuhnt J, Vollmer S. Antenatal care services and its implications for vital and health outcomes of children: evidence from 193 surveys in 69 low-income and middle-income countries. *BMJ Open*. 2017;7(11):e017122. <https://doi.org/10.1136/bmjopen-2017-017122>
3. Doku DT, Neupane S. Survival analysis of the association between antenatal care attendance and neonatal mortality in 57 low- and middle-income countries. *Int J Epidemiol*. 2017;46(5):1668-77. <https://doi.org/10.1093/ije/dyx125>
4. Takeda SMP. Avaliação de unidade de atenção primária: modificação dos indicadores de saúde e qualidade da atenção [dissertação]. Pelotas: Centro de Pesquisas Epidemiológicas da Universidade Federal de Pelotas; 1993.
5. Silveira DS, Santos IS, Costa JSD. Atenção pré-natal na rede básica: uma avaliação da estrutura e do processo. *Cad Saude Publica*. 2001;17(1):131-9. <https://doi.org/10.1590/S0102-311X2001000100013>
6. Coimbra LC, Silva AAM, Mochel EG, Alves MTSSB, Ribeiro VS, Aragão VM, et al. Fatores associados à inadequação do uso da assistência pré-natal. *Rev Saude Publica*. 2003;37(4):456-62. <https://doi.org/10.1590/S0034-89102003000400010>
7. Leal MC, Gama SGN, Cunha CB. Desigualdades raciais, sociodemográficas e na assistência ao pré-natal e ao parto, 1999-2001. *Rev Saude Publica*. 2005;39(1):100-7. <https://doi.org/10.1590/S0034-89102005000100013>
8. Bernardes AC, Silva RA, Coimbra LC, Alves MT, Queiroz RC, Batista RF, et al. Inadequate prenatal care utilization and associated factors in São Luís, Brazil. *BMC Pregnancy Childbirth*. 2014;10:14:266. <https://doi.org/10.1186/1471-2393-14-266>
9. Goudard MJF, Simões VMF, Batista RFL, Queiroz RCS, Alves MTSSB, Coimbra LC, et al. Inadequação do conteúdo da assistência pré-natal e fatores associados em uma coorte no nordeste brasileiro *Cienc Saude Coletiva*. 2016;21(4):1227-38. <https://doi.org/10.1590/1413-81232015214.12512015>
10. Fonseca SC, Monteiro DSA, Pereira CMSC, Scoralick ACD, Jorge MG, Rozario S. Desigualdades no pré-natal em cidade do Sudeste do Brasil. *Cienc Saude Coletiva*. 2014;19(7):1991-8. <https://doi.org/10.1590/1413-81232014197.04212013>
11. Victora CG, Matijasevich A, Silveira MF, Santos IS, Barros AJD, Barros FC. Socio-economic and ethnic group inequities in antenatal care quality in the public and private sector in Brazil. *Health Policy Plan*. 2010;25(4):253-61. <https://doi.org/10.1093/heapol/czp065>
12. França GVA, Restrepo-Méndez MC, Maia MFS, Victora CG, Barros AJD. Coverage and equity in reproductive and maternal health interventions in Brazil: impressive progress following the implementation of the Unified Health System. *Int J Equity Health*. 2016;15(1):149. <https://doi.org/10.1186/s12939-016-0445-2>
13. Fundação de Economia e Estatística. PIB Municipal: série histórica. Porto Alegre: FEE; 2017 [cited 2018 Feb 16]. Available from: <https://www.fee.rs.gov.br/indicadores/pib-rs/municipal/serie-historica>.
14. Fundação de Economia e Estatística. FEEDADOS. Porto Alegre: FEE; 2016 [cited 2018 Feb 5]. Available from: <http://www.feedados.fee.tche.br/feedados/#!pesquisa=1/Emprego\NúmerodeVínculosEmpregatícios\Total>
15. Instituto Brasileiro de Geografia e Estatística; Programa das Nações Unidas para o Desenvolvimento. Atlas Brasil 2013. Rio de Janeiro: IBGE; 2014. [cited 2017 Sep 5]. Available from: <https://cidades.ibge.gov.br/brasil/rs/rio-grande/panorama>
16. Dean AG, Dean JA, Coulombier D, Brendel KA, Smith DC, Burton AH, et al. Epi-Info, version 6: a word processing, database, and statistics program for epidemiology on microcomputers. Atlanta: Centers of Disease Control and Prevention; 2002.
17. Lauritsen JM, editor. EpiData Classic, Data Management and basic Statistical Analysis System. Odense (DK): EpiData Association; 2000-2008 [cited 2017 Sep 5]. Available from: <http://www.epidata.dk>
18. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap): a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform*. 2009;42(2):377-81. <https://doi.org/10.1016/j.jbi.2008.08.010>
19. StataCorp. Stata Statistical Software: release 11.2. College Station: StataCorp LP; 2011.
20. Gordis L. *Epidemiology*. 4.ed. Philadelphia, PA: Saunders; 2009.

21. Dias-da-Costa JS, Cesar JA, Haag CB, Watte G, Vicenzi K, Schaefer R. Inadequação do pré-natal em áreas pobres no Nordeste do Brasil: prevalência e alguns fatores associados. *Rev Bras Saude Mater Infant*. 2013;13(2):101-9. <https://doi.org/10.1590/S1519-38292013000200003>
22. Anversa ETR, Bastos GAN, Nunes LN, Dal Pizzol TS. Qualidade do processo da assistência pré-natal: unidades básicas de saúde e unidades de Estratégia Saúde da Família em município no Sul do Brasil. *Cad Saude Publica*. 2012;28(4):789-800. <https://doi.org/10.1590/S0102-311X2012000400018>
23. Silva EP, Lima RT, Costa MJC, Batista Filho M. Desenvolvimento e aplicação de um novo índice para avaliação do pré-natal. *Rev Panam Salud Publica*. 2013;33(5):356-62.
24. Santos Neto ET, Oliveira AE, Zandonade E, Leal MC. Acesso à assistência pré-natal: avaliação da adequação por diferentes índices. *Cad Saude Publica*. 2013;29(8):1664-74. <https://doi.org/10.1590/0102-311X00125612>
25. Cesar JA, Matijasevich A, Santos IS, Barros AJD, Dias-da-Costa JS, Barros FC, et al. The use of maternal and child health services in three population-based cohorts in Southern Brazil, 1982-2004. *Cad Saude Publica*. 2008;24 Suppl 3:S427-36. <https://doi.org/10.1590/S0102-311X2008001500008>
26. Silva MB, Monteiro PS. Adequação do pré-natal em gestantes atendidas na Estratégia de Saúde da Família em Palmas-TO, 2009. *Comun Cienc Saude*. 2010;21(1):21-30.
27. Ministério da Saúde, Secretaria de Atenção à Saúde, Departamento de Atenção Básica. Cobertura de Atenção Básica: unidades geográficas: Brasil. Brasília, DF; 2017 [cited 2018 Aug 7]. Available from: <https://egestorab.saude.gov.br/paginas/acesoPublico/relatorios/relHistoricoCoberturaAB.xhtml>
28. Hart JT. The inverse care law. *Lancet*. 1971;297(7696):405-12. [https://doi.org/10.1016/S0140-6736\(71\)92410-X](https://doi.org/10.1016/S0140-6736(71)92410-X)
29. Victora CG, Vaughan JP, Barros FC, Silva AC, Tomasi E. Explaining trends in inequities: evidence from Brazilian child health studies. *Lancet*. 2000;356(9235):1093-8. [https://doi.org/10.1016/S0140-6736\(00\)02741-0](https://doi.org/10.1016/S0140-6736(00)02741-0)
30. Victora CG, Aquino E, do Carmo Leal M, Monteiro CA, Barros FC, Szwarcwald CL. Maternal and child health in Brazil: progress and challenges. *Lancet*. 2011;377:1863-76. [https://doi.org/10.1016/S0140-6736\(11\)60138-4](https://doi.org/10.1016/S0140-6736(11)60138-4)
31. Barros AJD, Victora CG. Measuring coverage in MNCH: Determining and interpreting inequalities in coverage of maternal, newborn, and child health interventions. *PLoS Med*. 2013;10(5):e1001390. <https://doi.org/10.1371/journal.pmed.1001390>

Funding: Secretaria de Município da Saúde de Rio Grande (SSPMRG); Fundação de Amparo à Pesquisa do Rio Grande do Sul (FAPERGS); Programa Pesquisa Para o SUS (PPSUS); Pastoral da Criança; Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES); Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq).

Authors' Contribution: Substantial contribution in the design and planning of the study: JSS, JAC. Data analysis and interpretation: JSS, JAC, AOL. Writing of the manuscript: JSS, JAC, AOL. Approval of the final version to be published: JAC. Public responsibility for the content of the article: JSS, JAC.

Conflict of Interest: The authors declare no conflict of interest.