










Prenatal care and association with low-birth-weight, small-for-gestational-age or preterm newborns

Assistência pré-natal e associação com recém-nascidos com baixo peso ao nascimento, pequenos para a idade gestacional ou prematuros

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ABSTRACT

Introduction: Prenatal care is one of the pillars of maternal and child healthcare and has long established its relevance during the pregnancy and post-natal period. **Objective:** To describe the prenatal care of mothers of preterm and/or low-birth-weight and/or small-for-gestational-age newborns with no defined cause and compare with full-term newborns to identify risk factors. **Methods:** Cross-sectional study, carried out in Belo Horizonte, between 2016 and 2020. The study group included premature, and/or low-birth-weight and/or small-for-gestational-age newborns. The control group included full-term newborns, with adequate gestational age and without intrauterine growth restrictions. **Results:** 213 newborns were selected, 118 in the study group and 95 in the control group. During prenatal care, the mothers of patients in the control group had a greater number of visits ($p<0.001$), tests for HIV ($p<0.001$) and syphilis ($p<0.001$), while the mothers of patients in the study group had a higher mean of ultrasound exams ($p<0.001$) and testing for Hepatitis C ($p<0.001$). Vaginal delivery and transfontanelar ultrasound were more frequent in the study group ($p<0.001$). **Conclusion:** This study does not establish an association between the quality of prenatal care and the outcomes of prematurity, low-birth-weight or small-for-gestational-age newborns. It was observed, however, that monitoring during pregnancy did not occur as recommended by the Brazilian Health Ministry. Thus, understanding the causes of care limitations can help in the development of public measures to improve follow-up during prenatal care.

Keywords: Prenatal care; Low birth weight; Infant, Premature.

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RESUMO

Introdução: Pré-natal é um dos pilares do cuidado materno e infantil e está bem estabelecida sua relevância durante a gestação e período pós-natal. **Objetivo:** Descrever a assistência pré-natal de mães de recém-nascidos prematuros e/ou com baixo peso ao nascimento e/ou pequenos para idade gestacional sem causa definida e comparar com recém-nascidos a termo para identificar fatores de risco. **Método:** Estudo transversal, realizado em Belo Horizonte, entre 2016 e 2020. Grupo-caso incluiu recém-nascidos prematuros, e/ou baixo peso ao nascimento e/ou pequenos para idade gestacional. No grupo-controle foram incluídos recém-nascidos a termo, com idade gestacional adequada e sem crescimento intrauterino restrito. **Resultados:** Foram selecionados 213 recém-nascidos, 118 no grupo-caso e 95 no grupo-controle. Durante o pré-natal as mães dos pacientes do grupo-controle realizaram maior número de consultas ($p < 0,001$) e de testagens para HIV ($p < 0,001$) e sífilis ($p < 0,001$) e as mães dos pacientes do grupo-caso realizaram maior média de exames de ultrassonografia ($p < 0,001$) e testagem para Hepatite C ($p < 0,001$). O parto vaginal e a realização de ultrassom transfontanela foram mais frequentes no grupo-caso ($p < 0,001$). **Conclusão:** Este estudo não estabelece associação entre a qualidade da assistência pré-natal e os desfechos de prematuridade, baixo peso ao nascimento ou pequenos para idade gestacional. Observa-se que o acompanhamento durante a gravidez ainda não ocorre como preconizado pelo Ministério da Saúde. Entender as causas das limitações da assistência pode auxiliar na elaboração de medidas públicas para melhorar o seguimento durante o pré-natal.

Palavras-chave: Cuidado pré-natal; Recém-nascido de baixo peso; Pré-termo.

Científica (Voluntários, UFMG/PROBIC/FAPEMIG e UFMG/PIBIC/CNPq), e pelo Minas Agência Estadual de Pesquisa e Desenvolvimento de Gerais (FAPEMIG).

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INTRODUCTION

Prenatal care seeks to provide care for pregnant women so as to ensure the best health conditions for the newborn and mother¹. In Brazil, the Prenatal and Birth Humanization Program was implemented in 2000 and was the first national prenatal care guideline to establish a minimum number of consultations and examinations during pregnancy². The Ministry of Health of Brazil recommends starting prenatal care in the first trimester and that there be access to at least six consultations for all pregnant women³. However, studies indicate that not all pregnant Brazilian women have access to adequate prenatal care⁴⁻⁶.

Epidemiological studies indicate that prenatal care allows one to identify risk factors and prevent and treat pregnancy-related diseases, resulting in better maternal and fetal outcomes¹. Inadequate monitoring during prenatal care is associated with outcomes such as maternal and neonatal death, prematurity, and low birth weight^{7,8}. In this context,

understanding the association between adequate prenatal care and health outcomes can help provide subsidies for the implementation of health services.

This study aimed to describe the prenatal care of mothers of preterm, low-birth-weight, small-for-gestational-age, and/or preterm infants without a defined cause and compare it with full-term newborns without risk factors.

METHODS

This cross-sectional study was conducted from 2016 to 2020. Newborns from four principal public reference maternity hospitals (Hospital das Clínicas da Universidade Federal de Minas Gerais, Hospital Risoleta Tolentino Neves, Hospital Sofia Feldman e Maternidade Odete Valadares) were eligible.

In each hospital, the researcher responsible was assigned to identify the patients who met the inclusion criteria in the study group: premature newborns with no defined

cause, and/or small-for-gestational-age newborns without a defined cause, and/or newborns born with a low birth weight with no definite cause.

Newborns with asphyxia, neonatal sepsis, or any other comorbidities, and patients whose mother had an obstetric or peripartum complication or used any medication (except multivitamins, folic acid and iron supplements) during pregnancy were excluded.

Patients were identified using a daily list of newborns. The inclusion and exclusion criteria were verified using information from medical records and a standardized questionnaire that was filled out. Parents or legal guardians signed an informed consent form.

Full-term newborns that were born during the same study period with no underlying disease associated or attributed to a known possible (congenital) infection, were adequate for the gestational age, and whose mother did not present prenatal or peripartum comorbidities (obstetric or placental) were included in the control group (Figure 1).

The definitions of the World Health Organization (WHO) were as follows: a) preterm newborn: babies born alive before completing 37 weeks of gestation⁹; b) small for gestational age newborns: those born weighing below the 10th percentile for their sex and gestational age¹⁰; c) low birth weight newborns: those born weighing less than 2,500 g¹¹.

Data were analyzed using the Statistical Package for Social Sciences version 19.0 (IBM, Armonk, NY, USA). Clinical, obstetric, and neonatal data were also included in the analysis. Descriptive analysis was performed with

frequencies and percentages for categorical variables and means and standard deviations for quantitative variables. A comparative analysis of variables between the study and control groups was conducted using the Chi-square or Fisher's test for categorical variables and Student's t-test or Mann Whitney test for quantitative variables. Statistical significance was set at $p < 0.05$.

The Research Ethics Committee of all institutions involved approved these procedures.

RESULTS

This study included 213 newborns, of which 118 were included in the study group and 95 in the control group. Table 1 compares the perinatal and clinical characteristics of all newborns included in the study, in general, and by group. During prenatal care, 205 (96.2%) pregnant women were followed up, and 140 (65.7%) started prenatal care in the first trimester. Sixty-six (69.4%) pregnant women in the control group and 74 (62.7%) in the study group started prenatal care in the first trimester. Among the 213 pregnant women, only two (0.9%) reported a previous history of prematurity. In total, 161 (75.6%) pregnant women underwent ultrasound monitoring, of whom 54 (25.4%) underwent two or more examinations. Seven newborns were diagnosed as small for gestational age.

Regarding testing for congenital infections, the HIV test was performed in all pregnant women; 47 (22.1%) underwent three or more tests. Screening for syphilis was also performed

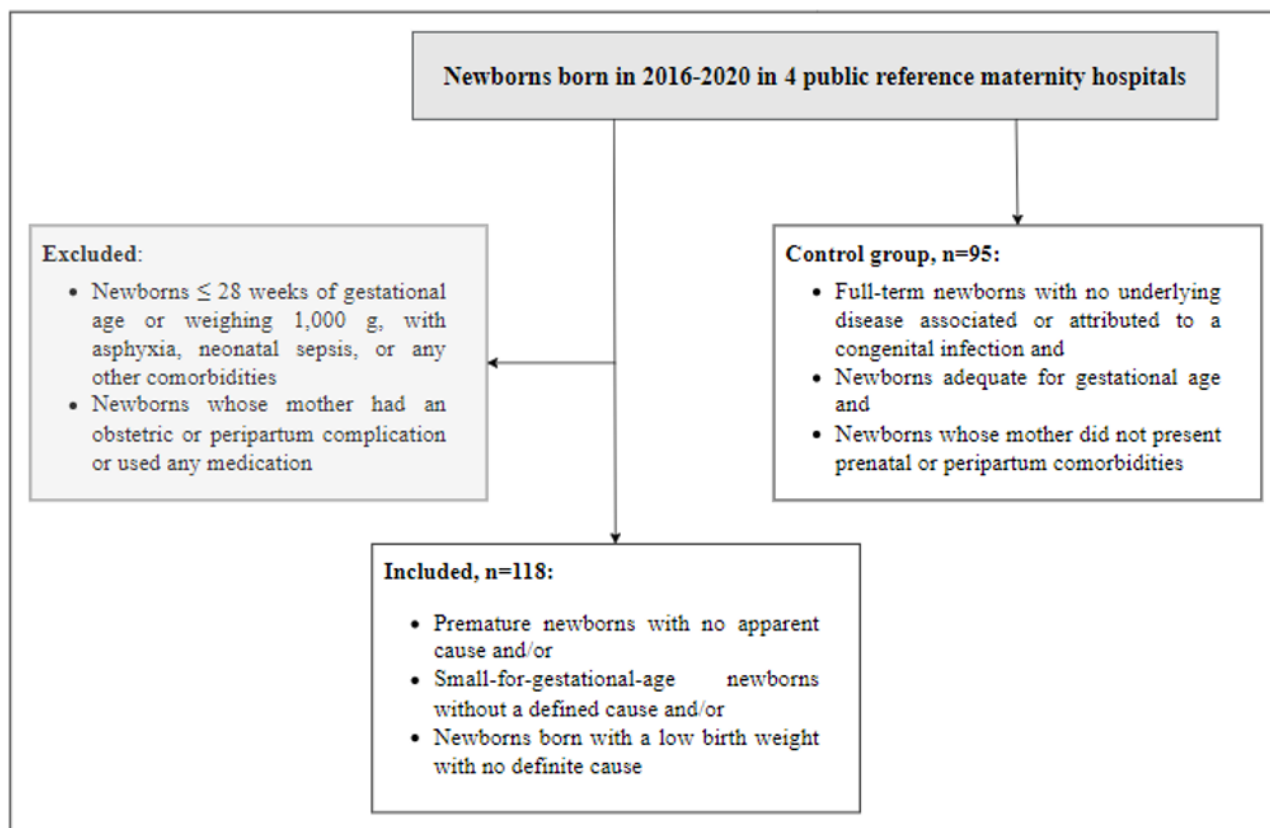


Figure 1. Flowchart of the participants in maternity hospitals.

in all pregnant women; 57 (26.8%) underwent three or more tests. Hepatitis B was investigated in 205 (96.2%) pregnant women; 44 (20.7%) underwent two or more tests, and two underwent anti-Hbs serology. Hepatitis C was tested in 13 (6.1%) pregnant women. Thirteen (6.1%) women were investigated for rubella, three of which were susceptible, and ten were immune. Cytomegalovirus was investigated in ten (4.7%) women, all of whom were considered immune to the disease. Toxoplasmosis was investigated in 197 (92.5%) women; 125 (58.7%) were susceptible, and 72 (33.8%) were considered immune. None of the patients reported a previous history of infection or was investigated for herpes simplex infection. The average number of tests performed during prenatal care is shown in Table 1.

Table 2 presents clinical and perinatal characteristics of the newborns in the study. Among 213 newborns, 100

(46.9%) were female. Vaginal delivery was chosen in 178 (83.6%) pregnant women and a mean gestational age of 37.62 (\pm 2.77) weeks. The mean weight of newborns was 2,737.07 (\pm 618.01) g.

In the case group (118), there were 68 (57.6%) newborns classified as preterm, with 48 newborns between 34 and 36 weeks of GA and 20 \leq 33 weeks of GA. In addition, 49 (41,5%) newborns were considered small for their gestational age, and 82 (69,5%) were born low weight.

After birth, workups were performed on some newborns (Table 2). The main blood test findings were anemia, polycythemia, thrombocytopenia, thrombocytosis, leukopenia, and leukocytosis. Only one newborn presented altered transfontanellar ultrasound (TFUS) findings, with a diagnosis of periventricular hemorrhage. One patient underwent a lumbar puncture, which showed no alterations.

Table 1. Maternal and prenatal characteristics, 2016 - 2020.

Variable	Group			p	Odds ratio 95% CI
	Total n=213	Case n=118	Control n=95		
Maternal age mean (\pm sd)	26.59 (\pm 9.01)	25.80 (\pm 7.38)	26.67(\pm 7.30)	0,41 ^b	--
Prenatal care					
Yes	205 (96.2%)	114 (53.5%)	91 (42.7%)	0.75 ^c	OR 1.25
No	8 (3.8%)	4 (1.9%)	4 (1.9%)		IC95% 0.30–0.14
Prenatal visits mean (\pm sd)	6.75 (\pm 2.58)	6.20 (\pm 2.51)	7.41 (\pm 2.53)	<0.001 ^b	--
Number of pregnancies (include actual) mean (\pm sd)	1.32 (\pm 1.54)	1.58 (\pm 1.75)	1.0 (\pm 1.17)	0.01 ^a	--
Abortion mean (\pm sd)	0.26 (\pm 0.72)	0.35 (\pm 0.87)	0.16 (\pm 0.46)	0.08 ^a	--
Ultrasounds mean (\pm sd)	1.18 (\pm 1.04)	1.51 (\pm 1.18)	0.77 (\pm 0.62)	<0.001 ^a	--
HIV testing mean (\pm sd)	2.04 (\pm 0.68)	1.92 (\pm 0.67)	2.19 (\pm 0.67)	<0.001 ^b	--
Syphilis testing (VDRL or quick test) mean (\pm sd)	2.25 (\pm 0.78)	2.21 (\pm 0.77)	2.29 (\pm 0.81)	<0.001 ^a	--
Hepatitis B testing mean (\pm sd)	1.19 (\pm 0.52)	1.19 (\pm 0.50)	1.19 (\pm 0.55)	0.96 ^b	--
Hepatitis C testing mean (\pm sd)	0.06 (\pm 0.24)	0.10 (\pm 0.30)	0.01 (\pm 0.10)	<0.001 ^a	--
Toxoplasmosis testing mean (\pm sd)	1.15 (\pm 0.52)	1.21 (\pm 0.50)	1.07 (\pm 0.55)	0.05 ^b	--
Rubella testing mean (\pm sd)	0.06 (\pm 0.24)	0.09 (\pm 0.29)	0.02 (\pm 0.14)	0.02 ^a	--
CMV testing mean (\pm sd)	0.05 (\pm 0.21)	0.08 (\pm 0.26)	0.01 (\pm 0.10)	0.02 ^a	--

Legend: CMV – Cytomegalovirus; sd – standard deviation; ^a Mann-Whitney U Test; ^b T-test; ^c Pearson's Chi-squared test.

Table 2. Perinatal and clinical characteristics of newborns, 2016 - 2020.

Variable	Group			P	Odds ratio IC 95%
	Total n= 213	Case n= 118	Control n= 95		
Gestacional age					
mean (± sd)	37,62 (±2,77)	36,35 (±3,03)	39,20 (±1,17)	<0,001 ^a	--
Sex					
Female	100 (46,9%)	65 (30,5%)	35 (16,4%)	<0,001 ^c	OR 2,10
Male	113 (53,1%)	53 (24,9%)	60 (28,2%)		IC95% 1,21–3,65
Birth weight					
mean (± sd)	2737,07 (±618,01)	2312,63 (±451,63)	3264,27 (±316,97)	<0,001 ^a	--
Length at birth					
mean (± sd)	46,48 (±3,45)	44,52 (±3,18)	48,93 (±1,84)	<0,001 ^a	--
Cephalic perimeter					
mean (± sd)	32,88 (±2,06)	31,73 (±1,88)	34,30 (±1,20)	<0,001 ^a	--
BC performance					
Yes n (%)	91 (42,7%)	39 (18,3%)	52 (24,4%)	<0,001 ^c	OR 0,40
No n (%)	122 (57,3%)	79 (37,1%)	43 (20,2%)		IC95% 0,23–0,71
TU performance					
Yes n (%)	15 (7,0%)	14 (6,6%)	1 (0,5%)	<0,001 ^c	OR 12,65
No n (%)	198 (93,0%)	104 (48,8%)	94 (44,1%)		IC95% 1,63–100

Legend: sd – standard deviation; BC – blood count; TU – Transfontanellar ultrasound; ^a Mann-Whitney U Test; ^c Pearson's Chi-squared test.

When we compared the case group (n=118) with the control group (n=95), we observed that the control group carried out more tests for HIV ($p<0.001$) and Syphilis ($p<0.001$), as well as a greater number of consultations ($p<0.001$) during prenatal care. These data reflect the fact that 57.6% of births in the group were premature, which implies fewer consultations and exams before birth.

Pregnant women in the study group had a higher number of pregnancies ($p=0.01$) and testing for infections that are not routine prenatal care, such as hepatitis C ($p<0.001$), rubella ($p=0.02$), and cytomegalovirus (CMV) ($p=0.02$). Newborns in the study group were more likely to be female ($p<0.001$) and undergo TFUS after birth ($p<0.001$). Gestational age, anthropometric parameters (weight, length, and height), and blood count in the newborns showed a statistical difference between the groups.

DISCUSSION

Early and adequate monitoring of pregnant women allows for the diagnosis and treatment of conditions that are commonly seen in prenatal care, reducing prematurity and, consequently, neonatal and infant mortality¹². Restricted intrauterine growth and low birth weight are more prevalent in underdeveloped countries and are common outcomes in the absence of adequate prenatal care^{7,13,14}.

Although 96.2% of the pregnant women were included in prenatal care, only 140 (65.7%) started monitoring in the

first trimester. However, the average number of consultations was adequate in both groups. According to the Brazilian Ministry of Health,³ monitoring should start in the first trimester, and all pregnant women should have access to at least six consultations. In 2016, the WHO published a manual recommending at least eight prenatal consultations to reduce perinatal mortality and improve care for pregnant women¹. The majority of pregnant women underwent at least one ultrasound scan, which are now recommended twice, in addition to fetal echocardiography, since 2023¹⁵.

Investigations for HIV and syphilis should be conducted in the first and third trimesters and at the time of delivery, totaling three tests during prenatal care. To prevent vertical transmission of hepatitis B, it is recommended that the investigation in the first trimester be carried out with HbsAg and that there be vaccination if necessary. The delivery approach depends on the evaluation of the vaccine schedule and anti-HBS serology^{14,16}. Serology for toxoplasmosis should be requested in the first trimester, and new tests are recommended only for susceptible patients at least every 3 months, and ideally monthly¹⁷. Until 2018, screening was conducted by the Congenital Toxoplasmosis Control Program of the State of Minas Gerais¹⁶, and has been recommended by the Ministry of Health since 2020¹⁸. In this study, although all pregnant women were investigated, it was observed that, on average, pregnant women underwent fewer tests for HIV and syphilis than recommended^{3,17,19}.

Hepatitis B was investigated in almost all pregnant women, but whether they were vaccinated was not usually reported in the medical records by the team, and anti-HBS was requested for only two pregnant women. Though the exam is recommended, it may not be routinely performed in low-risk prenatal care, according to the Ministry of Health protocol, since the recommended preventive measure is prior immunization or immunization during pregnancy²⁰.

Toxoplasmosis was investigated in 92.5% of pregnant women; 125 (58.7%) were susceptible, and 72 (33.8%) were immune. Based on these high number of pregnant women susceptible to toxoplasmosis and the average of 1.15 (SD=0.52) tests per patient, it is possible that not all susceptible pregnant women underwent a second prenatal test, as recommended³. In 2004 and 2005, a study by Carellos et al. (2008)²¹ found 56.3% of patients were not susceptible to toxoplasmosis (IgM negative and IgG positive) in the public healthcare system of Belo Horizonte, in contrast to 33.8% of non-susceptibility found in the present study. Although these populations are likely to have a similar socioeconomic profile, the lower seroprevalence and, therefore, greater susceptibility, can be attributed to the sample size or a change in the serological profile of these patients.

When comparing the study (n=118) and control (n=95) groups, the higher frequency of testing for congenital infections that are not part of routine prenatal testing (hepatitis C, rubella, and CMV), obstetric ultrasound, and performance of TFUS after birth can be attributed to investigation, according to institutional protocols, for premature-birth, small-for-gestational-age and low-birth-weight infants. The greater number of consultations and greater frequency of testing for HIV and syphilis in patients in the control group can be attributed to the fact that these patients were born at term, which allows for a greater number of consultations and third-trimester screening, as recommended by the Ministry of Health^{3,17}.

There is a tendency toward prematurity when the woman is multiparous, especially with more than five pregnancies.²² However, the mean number of pregnancies in the study group was 1.58. The chance of vaginal delivery was higher in the study group, which can be attributed to the selection criterion, and that may include newborns with unexplained preterm labor in this group since cases of mothers with comorbidities and indications for cesarean section were excluded from the study.

Regarding the newborns, the differences found in the gestational age and anthropometric parameters (weight, length, and height) can be attributed to the patient selection criteria. As for the workup performed in the newborns, there was a difference in the blood count between the study and control groups. However, a greater number of blood counts were performed in the control group since a repository sample of full-term newborns without comorbidities who underwent collection for other diagnoses, such as jaundice, was used. Furthermore, TFUS was performed more frequently in the case group, since it is recommended as a screening neuroimaging test to identify the presence and

extent of brain injury, such as germinal matrix hemorrhage or intraventricular hemorrhage, especially in premature infants under 32 weeks of gestational age, who are at risk for cognitive impairment and disability at school age²³.

In the national context, a study carried out by Martinelli et al. (2021)²⁴, from 2012 to 2019, revealed that the proportion of prematurity in Brazil is around 10%, being higher among women with advanced maternal age, those who are illiterate and with a number of prenatal care consultations below what is recommended by the Ministry of Health. In a northeastern capital, a study by Gonzaga et al. (2016)²⁵ that assessed risk factors associated with prematurity and low birth weight, showed a significant association of the outcome with low education and inadequate prenatal care. Historical analysis carried out in São Paulo pointed out that the increase in the number of prenatal consultations was associated with a reduction in the prevalence of low-birth-weight and/or preterm infants²⁶. Thus, the descriptive results obtained in the present study are in line with associations already demonstrated at the national level.

Among these limitations, this study is considered to be part of a larger study that investigated the frequency of congenital cytomegalovirus infection in small-for-gestational-age, premature, or low-birth-weight patients compared to full-term newborns without comorbidities. A cohort study including pregnant women during prenatal care, whose assessed outcome was prematurity and/or small-for-gestational-age and low-weight-newborns, could expand the evaluation of variables associated with the quality of prenatal care.

Although this study did not establish an association between the quality of prenatal care and the outcomes of prematurity, low weight, or inadequate weight for gestational age, it was observed that monitoring during pregnancy still does not occur as recommended by the Ministry of Health. It is undeniable that the number of follow-up visits (eight during prenatal care) recommended by the WHO can result in better neonatal outcomes. Understanding the causes of prenatal care limitations can help inform public policy with the objective of adapting follow-up during pregnancy.

Although pregnant women have access to prenatal care in the public healthcare system, the number of follow-up visits is below the minimum number recommended by the Ministry of Health.

Thus, although a small size for gestational age, a low birth weight, and prematurity were not associated with inadequate prenatal care, the implementation of new actions and strategies may improve maternal and neonatal mortality.

AUTHORS' CONTRIBUTIONS

Author contributions are structured according to the taxonomy (CRediT) described below:

HF Lino propôs a conceitualização, formulando as metas e objetivos da pesquisa. LMO Diniz realizou a curadoria dos dados e desenhou o método para que o estudo fosse possível. BHM Tarabai e LG Rezende participaram da coleta

e análise formal dos dados. LM Anchieta e RMC Romanelli supervisionaram e lideraram o planejamento e execução do projeto. LS Carvalho, MFP Lopes e FMS Alves redigiram o rascunho do artigo e ELDT Costa revisou e realizou a edição final do artigo.

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