







Relationship between the number of prenatal care visits and the occurrence of adverse perinatal outcomes

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SUMMARY

OBJECTIVE: The objective of this study was to analyze the relationship between the number of prenatal care visits and the occurrence of adverse perinatal outcomes in an average city in the state of Minas Gerais, Brazil.

METHODS: This was a prospective and observational study. The variables analyzed were obtained through a questionnaire administered to postpartum women (between 1 and 48 h postpartum) and information contained in prenatal cards. The pregnant women were classified into three groups: Group I, <3 prenatal care visits; Group II, 3–5 prenatal care visits; and Group III, ≥6 prenatal care visits.

RESULTS: Group I had a lower median weight (57.0 vs. 64.0 kg, $p<0.001$), body mass index (22.1 vs. 24.3 kg/m², $p<0.001$), and weight gain (9.0 vs. 12 kg, $p=0.002$) than Group III. The prevalence of admission to the neonatal intensive care unit (11.6 vs. 4.2%, $p=0.02$) and the newborn mortality rate within the first 72 h of life (2.3 vs. 0%, $p<0.001$) were higher in Group I than in Group III. Group II had a higher prevalence of admission to the adult intensive care unit (5.7 vs. 0.6%, $p<0.001$) and a higher newborn mortality rate within the first 72 h of life (1.6% vs. 0%, $p<0.001$) than Group III.

CONCLUSIONS: Having ≥6 prenatal care visits was associated with lower rates of admission to the neonatal and adult intensive care unit, as well as a lower newborn mortality rate within the first 72 h of life.

KEYWORDS: Prenatal care. Obstetric delivery. Pregnancy outcome.

INTRODUCTION

Prenatal care includes a set of actions aimed at reducing the risk and severity of maternal and fetal morbidity and mortality¹. The Brazilian Ministry of Health recommends at least six prenatal care visits: one, two, and three prenatal visits in the first, second, and third trimesters of pregnancy, respectively. In addition, these services must be indicated on the prenatal cards of pregnant woman, as this monitoring is used to diagnose and treat preexisting diseases or diseases that may arise during pregnancy².

Prenatal care can contribute to decrease adverse perinatal outcomes, especially in developing countries and socially disadvantaged populations³. A study conducted in a rural region of Rwanda reported that pregnant women who had only one prenatal care visit had higher rates of low birth weight and preterm delivery compared with those with ≥4 visits⁴. A study conducted in Ethiopia showed that ≤4 prenatal care visits was an independent predictor of adverse perinatal outcomes (i.e., stillbirths, fetal malformations, macrosomia, low Apgar scores)⁵. Likewise, among pregnant women from the traditional

Bedouin community, lack of prenatal care was associated with adverse perinatal outcomes, and it was found to be an independent risk factor for preterm birth, low birth weight, and perinatal mortality⁶.

In contrast, adequate prenatal care has been related to lower rates of obstetric complications, such as the hypertensive syndromes associated with pregnancy⁷. Prenatal supplementation with folic acid and iron reduced the risk of obstetric complications (e.g., postpartum bleeding, premature rupture of membranes, and puerperal sepsis) in pregnant women in a rural area of Nepal⁸.

The objective of this study was to assess the association between the number of prenatal care visits and adverse perinatal outcomes in an average city in the state of Minas Gerais, Brazil.

METHODS

This was a prospective, observational, and descriptive study developed between August 2019 and July 2020 in the Department

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of Obstetrics and Gynecology of Mário Palmério University Hospital, Uberaba, MG, Brazil. The study was approved by the Research Ethics Committee of the University of Uberaba (UNIUBE) under CAAE no. 96383118.7.0000.5145. Consent forms were signed by all participants who voluntarily agreed to participate.

The inclusion criteria were women undergoing vaginal delivery or cesarean section during the study period. The exclusion criteria were women who refused to participate in the study and who were unable to complete the data collection instrument due to their inability to understand it.

The relationship between the number of prenatal care visits and the occurrence of adverse perinatal outcomes was analyzed in patients from the public, supplementary, and private health care systems. The number of prenatal care visits was assessed by analyzing the prenatal cards of pregnant women.

Serology performance during the prenatal period was considered adequate when the patient underwent the following tests at least once or repeated them for every 3 months: HIV, syphilis (VDRL), toxoplasmosis IgM and IgG, rubella IgM and IgG, cytomegalovirus (CMV) IgM and IgG, hepatitis B (HBsAg), and hepatitis C (anti-HCV).

Ultrasound evaluation during the prenatal period considered first-trimester ultrasound when performed between 6 and 13 weeks and 6 days, second-trimester ultrasound when performed between 20 and 24 weeks, and third-trimester ultrasound when performed between 28 and 40 weeks of pregnancy.

The evaluated variables were age; weight; smoking; alcoholism; use of illicit drugs; number of pregnancies; parity; type of health service; number of miscarriages; high-risk pregnancy; number of prenatal care visits; ultrasound examination in the

first, second, and third trimesters; adequate serology (i.e., HIV, VDRL, toxoplasmosis, rubella, HBsAg, anti-HCV, and CMV); type of delivery (vaginal, nonelective cesarean section, elective cesarean section, or forceps); birth weight; 1-min Apgar score <7; admission to the neonatal intensive care unit (ICU); admission to the adult ICU; need for oxygen; neonatal hypotonia; intracranial hemorrhage; intestinal bleeding; neonatal infection; neonatal birth trauma; newborn death within the first 72 h of life; surgical site dehiscence/infection; maternal death; and composite perinatal outcomes.

The data were entered into an Excel 2010 spreadsheet (Microsoft Corp., Redmond, WA, USA) and analyzed using the SPSS version 20.0 and Prisma GraphPad software version 7.0 (SPSS Inc., Chicago, IL, USA). Quantitative variables were analyzed using the normality test (i.e., Kolmogorov–Smirnov) and presented as mean and standard deviation (SD) values. Variables with a non-normal distribution were presented as median, minimum, and maximum values. Categorical variables were described as absolute frequencies and percentages and represented in tables. The difference between categorical variables and their proportions was analyzed using the chi-square test. The Kruskal–Wallis test was used to assess the difference between continuous variables. Dunn's *post hoc* test was used to compare pairs. The significance level for all the tests was set at $p < 0.05$.

RESULTS

During the study period, the data were obtained from 1,048 parturients. They were divided into three groups, as shown in Figure 1.

The following parameters had significant effects on the perinatal outcomes of the study group: age ($p = 0.010$),

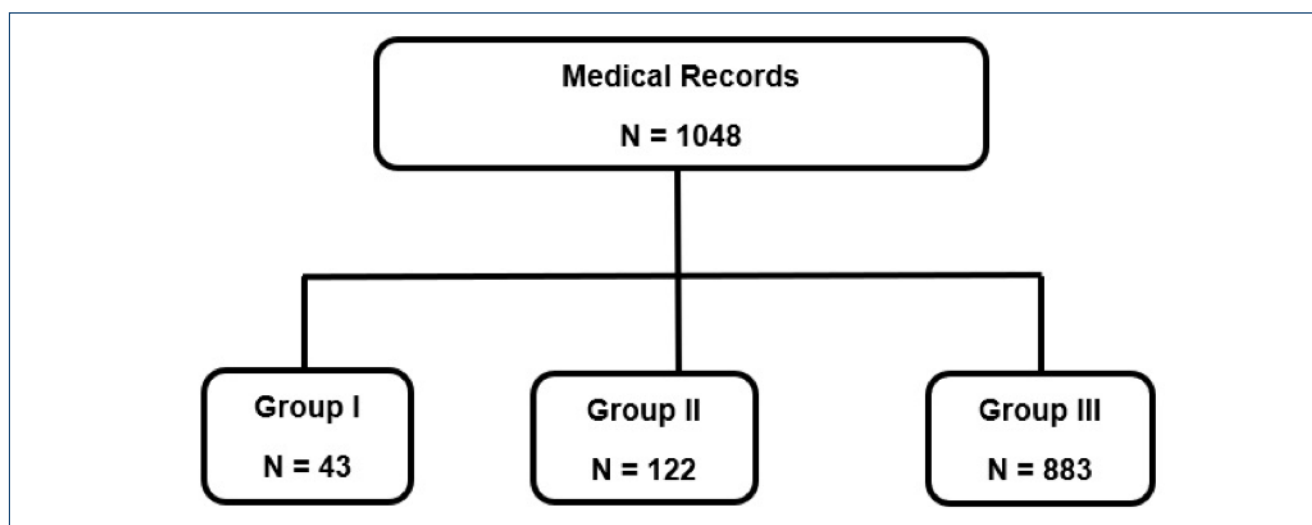


Figure 1. Flowchart of the cases included in the study.

weight ($p<0.001$), body mass index (BMI) ($p<0.001$), number of pregnancies ($p<0.001$), parity ($p<0.001$), weight gain ($p=0.002$), gestational age at delivery ($p=0.015$), and birth weight ($p=0.003$) (Table 1).

Comparison between pairs showed that Group I had a lower median maternal weight (57.0 vs. 64.0 kg, $p<0.001$), BMI (22.1 vs. 24.3 kg/m², $p<0.001$), and weight gain (9.0 vs. 12 kg, $p=0.002$) than Group III. Group II had a lower median maternal age (23.0 vs. 26.0 years, $p=0.010$), maternal weight (58.5 vs. 64.0 kg, $p<0.001$), BMI (22.7 vs. 24.3 kg/m², $p<0.001$), gestational age at delivery (38.9 vs.

39.0 weeks, $p=0.015$), and birth weight (3,078 vs. 3,210 g, $p=0.003$) than Group III (Table 1).

There was a significant association between the perinatal outcomes of the study group and smoking ($p<0.001$), alcoholism ($p=0.003$), illicit drug use ($p<0.001$), type of health service ($p<0.001$), first-trimester ultrasound ($p<0.001$), second-trimester ultrasound ($p<0.001$), third-trimester ultrasound ($p<0.001$), adequate serology, presence of a companion during labor ($p<0.001$), and type of delivery ($p<0.001$) (Table 1).

There was a significant association between the number of prenatal care visits of the study group and the prevalence of

Table 1. Clinical characteristics of the study population.

	Group I (n=43)	Group II (n=122)	Group III (n=883)	χ^2	p
Age (years)	25.0 (18–41)	23.0 (18–44) ^c	26.0 (18–48)	9.3	0.010 [†]
Weight (kg)	57.0 (40–100) ^b	58.5 (40.2–130) ^c	64.0 (30–135)	16.8	<0.001 [†]
Height (m)	1.60 (1.50–1.75)	1.60 (1.49–1.84)	1.62 (1.43–1.88)	2.2	0.328 [†]
BMI (kg/m ²)	22.1 (16.4–39.1) ^b	22.7 (14.7–50.1) ^c	24.3 (12.3–47.8)	17.9	<0.001 [†]
Smoking	34.9% (15/43) ^{ab}	9.8% (12/122)	5.2% (46/883)	57.5	<0.001 [†]
Alcoholism	27.9% (12/43) ^{ab}	13.9% (17/122) ^c	11.0% (97/883)	11.6	0.003 [†]
Illicit drug user	14.0% (6/43) ^{ab}	2.5% (3/122)	0.6% (5/883)	57.1	<0.001 [†]
High-risk pregnancy	65.1% (28/43)	70.5% (86/122)	64.6% (570/883)	1.7	0.434
Number of pregnancies	3 (1–6) ^b	2 (1–10)	2 (1–13)	26.2	<0.001 [†]
Parity	1 (0–5) ^b	1 (0–7) ^c	1 (0–9)	35.0	<0.001 [†]
Type of health service				29.5	<0.001 [†]
Public	95.3% (41/43) ^b	90.2% (110/122) ^c	71.7% (663/883)		
Insurance	4.7% (2/43) ^b	9.0% (11/122) ^c	26.0% (230/883)		
Private	0% (0/43)	0.8% (1/122)	2.3% (20/883)		
Weight gain (kg)	9.0 (-11 to 27) ^b	10.0 (-23 to 51) ^c	12 (-12.5 to 34)	12.9	0.002 [†]
First-trimester US	14.3% (6/42) ^{ab}	30.6% (37/121) ^c	68.7% (594/865)	108.0	<0.001 [†]
Second-trimester US	31.0% (13/42) ^{ab}	74.4% (90/121) ^c	90.4% (782/865)	134.0	<0.001 [†]
Third-trimester US	71.4% (30/42) ^b	75.2% (91/121) ^c	93.3% (807/865)	57.3	<0.001 [†]
Adequate serologies	42.9% (18/42) ^{ab}	69.4% (84/121) ^c	89.9% (792/881)	101.0	<0.001 [†]
Gestational age at delivery (weeks)	39.0 (23.1–41.6)	38.9 (26.4–41.1) ^c	39.0 (32.1–41.7)	8.4	0.015 [†]
Companion during the labor	86.0% (37/43) ^b	90.2% (110/122) ^c	97.3% (859/883)	25.6	<0.001 [†]
Type of delivery				35.1	<0.001 [†]
Vaginal	67.4% (29/43) ^b	63.1% (77/122) ^c	42.0% (371/883)		
Nonelective cesarean section	20.9% (9/43)	23.0% (28/122)	24.7% (218/883)		
Elective cesarean section	9.3% (4/43) ^b	13.1% (16/122) ^c	31.8% (281/883)		
Forceps	2.3% (1/43)	0.8% (1/122)	1.5% (13/883)		
Birth weight (g)	3,060 (305–3,765) ^b	3,078 (270–4,320) ^c	3,210 (1,260–4,970)	11.9	0.003 [†]
1-min Apgar score	8 (2–9)	8 (1–10)	8 (1–10)	1.4	0.488 [†]
5-min Apgar score	9 (2–10)	9 (1–10)	9 (4–10)	0.3	0.846 [†]

BMI: body mass index; US: ultrasound. [†]Chi-square: percentage (absolute number/total number). [†]Kruskal–Wallis: median (minimum–maximum). ^aDunn's post-hoc test: group I vs. group II, $p<0.05$. ^bDunn's post-hoc test: group I vs. group III, $p<0.05$. ^cDunn's post-hoc test: group II vs. group III, $p<0.05$.

Table 2. Comparison of the frequency of perinatal adverse outcomes between the three analyzed groups.

	Group I (n=43)	Group II (n=122)	Group III (n=883)	χ^2	p
1-min Apgar score <7	14.6% (6/41)	9.8% (12/122)	6.7% (59/881)	4.84	0.089
Neonatal ICU admission	11.6% (5/43) ^a	8.2% (10/122)	4.2% (37/883)	7.87	0.02
Adult ICU admission	2.3% (1/43)	5.7% (7/122) ^b	0.6% (5/883)	23.8	<0.001
Oxygen need	27.9% (12/43)	26.2% (32/122)	26.0% (230/883)	0.07	0.964
Neonatal hypotony	14.0% (6/43)	13.9% (17/122)	13.9% (123/883)	0.002	1
Intracranial hemorrhage	0% (0/43)	0.8% (1/122)	0.2% (2/883)	1.45	0.484
Intestinal bleeding	0% (0/43)	0% (0/122)	0.1% (1/883)	0.18	0.911
Neonatal infection	0% (0/43)	1.6% (2/122)	1.0% (9/883)	0.872	0.646
Neonatal birth trauma	0% (0/43)	0.8% (1/122)	1.6% (14/883)	1.1	0.578
Newborn death within the first 72 h	2.3% (1/43) ^a	1.6% (2/122) ^b	0% (0/883)	16.6	<0.001
Surgical site dehiscence/infection	0% (0/43)	0.8% (1/122)	1.7% (15/883)	2	0.536
Maternal death	0% (0/43)	0% (0/122)	0% (0/883)	*	*
Composite perinatal outcome	60.5% (26/43)	57.4% (70/122)	51.8% (457/883)	2.43	0.297

ICU: intensive care unit. Chi-square: percentage (absolute number/total number). ^aDunn's post-hoc test: group I vs. group III, $p < 0.05$. ^bDunn's post-hoc test: group II vs. group III, $p < 0.05$.

admission to the neonatal ICU ($p = 0.02$) and the adult ICU ($p < 0.001$), as well as the newborn mortality rate within the first 72 h of life ($p < 0.001$) (Table 2).

The prevalence of admission to the neonatal ICU (11.6 vs. 4.2%, $p = 0.02$) and the newborn mortality rate within the first 72 h of life (2.3 vs. 0%, $p < 0.001$) were higher in Group I than in Group III. Group II had a higher prevalence of admission to the adult ICU (5.7 vs. 0.6%, $p < 0.001$) and a higher mortality rate within the first 72 h of life (1.6% vs. 0%, $p < 0.001$) than Group III (Table 2).

DISCUSSION

The provision of adequate prenatal care is an important public health concern worldwide. Inadequate prenatal care is associated with unfavorable perinatal outcomes⁹. In Brazil, factors related to the quality of prenatal care were associated with a high chance of death in premature newborns¹⁰. Places with scarce resources and without adequate and qualified obstetric care have a higher probability of stillbirths¹¹. However, as demonstrated by Líbera et al.¹², for prenatal care assistance to effectively occur, it is crucial to involve pregnant women in issues related to their health.

Providing support for pregnant women and incorporating knowledge and skills through prenatal care can promote physical and mental health in minority women¹³. In this regard, the literature reports that geographic isolation, a major concern in

Brazil, still affects women's health care and is associated with worrisome perinatal data¹⁴.

In the present study, having ≥ 6 prenatal care visits was associated with more favorable perinatal outcomes, such as lower rates of neonatal and adult ICU admissions and newborn mortality within the first 72 h of life. These findings corroborate with the study by Santos et al.¹⁵ that showed that having a minimum frequency of six prenatal care visits was a protective factor against low birth weight and prematurity.

The present study shows congruence with the new prenatal care model recommended by the World Health Organization (WHO), which raised the recommendation of the minimum number of prenatal care visits from 4 to 8. Some studies showed that an increased number of visits are associated with a lower probability of stillbirths. This fact is explained by the better opportunity to detect and manage potential adverse outcomes. This change decreases perinatal deaths by up to 8 per 1,000 live births when compared to the minimum of four prenatal care visits¹⁶.

One of the limitations of the present study was that some of the data were collected from the prenatal cards of pregnant women, a document that always has a potential risk of adulteration, although this does not occur frequently. The relatively small sample size of the study patients may also have limited the accuracy of the results. The sample of the study patients may also represent a limiting element for obtaining even more

accurate data. The disparity between the public and private health systems in Brazil could also have been a hindering element in adequate data analysis.

Adequate prenatal care is influenced by complex elements that involve the acceptance of pregnancy and even the recognition of the need for specialized care at this important moment in life. To reach the minimum number of visits, there is need to overcome barriers such as lack of knowledge and the demand for population awareness programs. The training of health professionals and their engagement in prenatal care are considered important factors that can affect perinatal outcomes¹⁷.

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CONCLUSION

Having ≥ 6 prenatal care visits was associated with lower rates of neonatal and adult ICU admission and newborn mortality within the first 72 h of life.

AUTHORS' CONTRIBUTIONS

ABP: Conceptualization, Project administration, Supervision. **KMDR, CZ:** Data curation. **EFMS:** Formal Analysis, Writing – original draft. **CBOS:** Investigation. **EAJ:** Methodology, Writing – review & editing. **CZ:** Validation. **KMDR, CZ, EFMS, EAJ, CBOS, ABP:** Visualization.

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