







Evaluation of prenatal care and quality indicators of neonatal care in maternity hospitals of the Brazilian National Health System in a city in Minas Gerais

Avaliação do pré-natal e os indicadores de qualidade da assistência neonatal nas maternidades do sistema único de saúde em um município de Minas Gerais

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ABSTRACT

Introduction: Prenatal care includes procedures that must be provided to pregnant women, significantly affecting maternal-fetal health. There is an association between the quality of maternal and child health care during pregnancy and the negative outcomes of childbirth, which form the Quality Indicators of Neonatal Care. **Objective:** Evaluate the association between health care quality of pregnant women assisted by the Unified Health System (SUS) according to the hospitalization in a neonatal Intensive Care Unit (ICU). **Material and Methods:** Cross-sectional, prospective study, through the analysis of medical records and interviews with pregnant women, with newborns assisted in three SUS maternity hospitals, in Juiz de Fora (MG), from October 2017 to March 2018. A total of 716 births were studied in the period. **Results:** From the profile of the pregnant women, 58.24% were between 18 and 24 years old; 55.35% were single, and 37.35% had completed elementary school. Regarding prenatal examination, high coverage (98.18%) was identified; 64.1% of pregnant women start the service in the first trimester 17.02% and less than 6 consultations. As for the outcomes, 7.4% of newborns were hospitalized in the neonatal ICU, with a mean length of stay of 216.54 days. **Conclusion:** It is concluded that prenatal care in this period in Juiz de Fora has a compatible quality with the indicators established by the Ministry of Health and by the literature referring to Brazilian studies.

Keywords: Neonatal intensive care unit; Prenatal care; Neonatal morbidity; Primary health care.

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RESUMO

Introdução: A assistência pré-natal engloba procedimentos que devem ser oferecidos às gestantes, apresentando alto impacto na saúde materno-fetal. Há associação entre a qualidade da assistência à saúde da mãe e da criança na gestação e os desfechos negativos do parto, os quais formam os Indicadores de Qualidade de Assistência Neonatal. **Objetivo:** Avaliar a associação entre a qualidade da assistência das gestantes atendidas pelo Sistema Único de Saúde (SUS) conforme a internação em Unidade de Terapia Intensiva (UTI) neonatal. **Material e métodos:** Estudo transversal, prospectivo, por meio da análise de prontuários e de entrevistas a gestantes, com recém-nascidos assistidos em três maternidades do SUS de Juiz de Fora (MG), em 2017 e 2018. Foram analisados 716 nascimentos no período. **Resultados:** Do perfil das gestantes, 58,24% tinham entre 18 e 24 anos; 55,35% solteiras, tendo 37,35% realizado ensino fundamental completo. Sobre o exame pré-natal foi identificada alta cobertura (98,18%); 64,11% das gestantes iniciaram o atendimento no primeiro trimestre e 17,02% realizaram menos de 6 consultas. Quanto aos desfechos, encontrou-se 7,4% de internação dos recém-natos em UTI neonatal, sendo a média de permanência de 216,54 dias. **Conclusão:** Conclui-se que o atendimento pré-natal nesse período em Juiz de Fora apresenta qualidade compatível com os indicadores estabelecidos pelo Ministério da Saúde e pela literatura referente a estudos brasileiros.

Palavras-chave: Unidades de terapia intensiva neonatal; Cuidado pré-natal; Morbimortalidade neonatal; Atenção primária à saúde.

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INTRODUCTION

Prenatal care (APN) is a set of actions that are simultaneously preventive, health-promoting, diagnostic and curative, accompanying the good outcome of pregnancy for the woman and the newborn¹. For its effectiveness, it is recommended that it be started preferably up to 12 weeks of gestation, being necessary to guarantee access to the recommended number of consultations: equal to or greater than 6 consultations².

Quality prenatal care should welcome and ensure the development in all stages of pregnancy, the physical and psychological transformations, without generating impacts on maternal and newborn health. In addition, it should decrease mortality rates during this period and identify risk factors related to maternal and infant mortality². According to national data, in 2020, about 90% of infant deaths were due to perinatal causes resulting from problems during pregnancy, delivery, and birth, highlighting neonatal infections, hypoxia/neonatal anoxia, congenital malformations, prematurity, and syndromic diseases³.

The expansion of prenatal care has been helping to reduce maternal and infant mortality rates, since it makes

it possible to identify risk factors related to maternal and infant mortality⁴. In the literature, there is an association between the quality of health care for mother and child during pregnancy and the negative outcomes of childbirth, which form the Neonatal Care Quality Indicators, such as maternal and neonatal deaths and admissions to the Intensive Care Unit (ICU). In this sense, APN is related to the prevention of risks in pregnancy, reduction of complications in childbirth and puerperium, and reduction of maternal and infant mortality^{5,6}.

In recent years, following the global trend, the number of ICU beds has grown significantly. In 2018, it was quantified at 44,253 ICU beds in the country, 19.8% of which were neonatal ICUs^{3,7}. In Juiz de Fora (JF), according to the most recent data from 2020 from the Department of Informatics of the Unified Health System (DATASUS), the number of live births was 7,863, from these, 6,043 were from mothers residing in the city. This situation proves the fact that the municipality is considered a health hub, receiving great demand from neighboring municipalities³.

Moreover, the newborn at risk is defined as one who is exposed to situations in which there is a higher risk

of unfavorable evolution, besides presenting a higher than average chance of mortality and morbidity, being strongly associated with the need for hospitalization in a neonatal intensive care unit. In this sense, children at risk are considered those who present criteria such as low birth weight and/or prematurity⁸. In Juiz de Fora, in 2020, 45 deaths occurred between 0 to 6 days after birth (15 newborns were considered low birth weight) and 24 deaths occurred in the period from 7 to 27 days of life. Thus, the relevance of prenatal care in preventing negative outcomes becomes evident³.

The present study aims to evaluate the quality of prenatal care procedures in pregnant women assisted by the municipal SUS, prospectively associated with the hospitalization of neonates in the ICU.

METHODS

A cross-sectional and prospective study was conducted in order to address the association between the quality of prenatal care provided to pregnant women assisted by the Unified Health System (SUS) in the city of JF and the quantity of admissions to the Neonatal ICU.

Data collection took place at health services in JF that provide services through SUS in their reference maternity hospitals: Hospital Maternidade Terezinha de Jesus (HMTJ), Santa Casa de Misericórdia de Juiz de Fora (SCM), and Hospital João Penido (HJP). At SCM and HJP, the analysis occurred on alternate days due to the routine of the pregnant women and the newborns staying in the hospital for at least one day. At HMTJ, records were collected daily.

The data collection instrument was a questionnaire developed by the authors and filled out based on information from public health databases: A) records of the pregnant woman's and newborn's hospitalization, B) the birth certificate, C) the pregnant woman's prenatal card, and D) the newborn's discharge form.

The initial approach occurred in the admission of the parturient, where the research team filled out a form about the medical conditions of the mother and child from admission to discharge, including childbirth.

During the mother's and child's postpartum-hospitalization, the pregnant woman's records were analyzed to obtain indicators of prenatal quality. From the mother and child's hospital discharge until the next 30 days, priority follow-up of the child was conducted at pediatric clinics, seeking the occurrence of abnormal events, such as hospitalizations and medical emergencies in this post-hospital period.

The survey included all natural and cesarean births that occurred in the three maternity hospitals which assist the public health system in Juiz de Fora, from October 2017 to March 2018.

As an exclusion criteria, incomplete data in the forms was determined as one for this research.

All pregnant patients received detailed information about the project and its objectives, as well as the assurance of confidentiality of all personal information and records. Furthermore, they were invited to enroll in the study by signing the informed consent.

The data from the forms were inserted into the RedCap web platform, developed for the management of clinical and epidemiological research, and analyzed for comparison and error correction. In order to prevent duplicity of information, the platform avoided adding data from the same medical record twice.

Validated data were descriptively analyzed by conventional statistical techniques, addressing absolute and relative frequencies, means, medians and standard deviations, according to the nature of the indicator.

A modified Poisson Regression Model with Generalized Estimating Equations was used to estimate relative risks, considering the indication of admission to the neonatal ICU as the dependent variable.

The modeling strategy applied was "stepwise forward", embracing from the simplest model to the most complex. Variables with a *p*-value <0.20 in univariate analysis were arranged by descending order of *p*-value. Remained in the final model only statistically significant variables or those adjusted by at least one of the regression coefficients of the variables already in the model.

Since the aim of the study was to include all the births during the 6 months analyzed, the sample size was not previously calculated. However, assuming a simple random sample, the post-hoc provided by this sample is 89%, for a confidence level of 95% and Incidence Ratios of the order of 2.

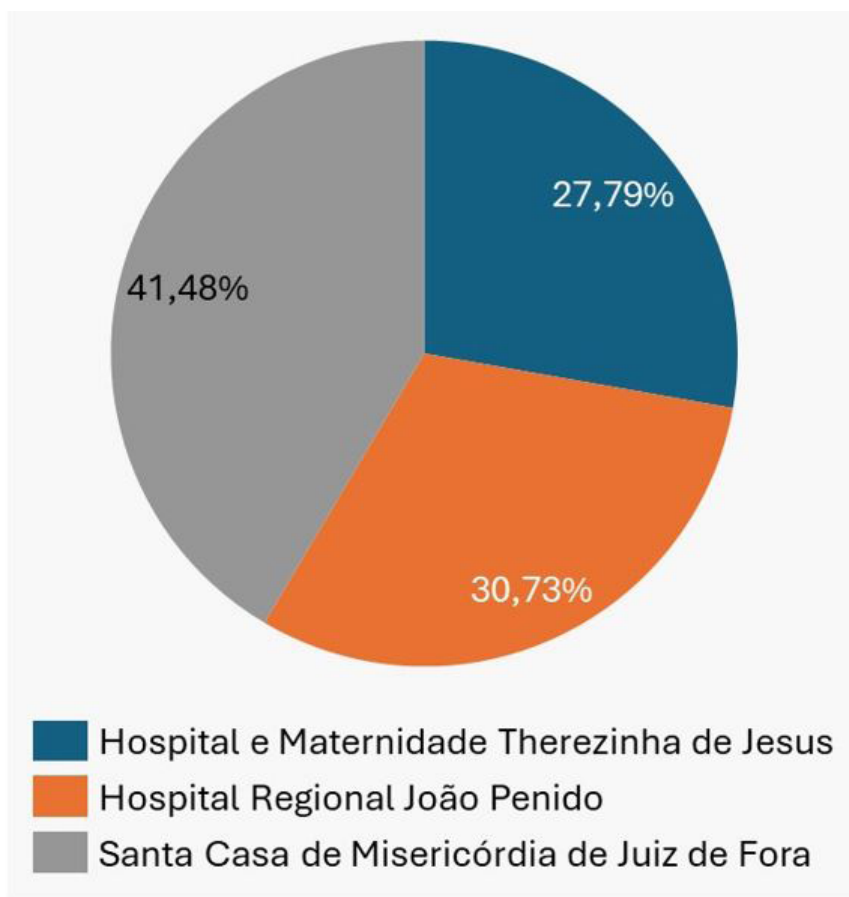
The research was submitted and approved by the Human Research Ethics Committee on the Plataforma Brasil (number 2,316,434) in October 2017 and CAAE: 70598117.9.3002.5119.

The analyses were performed using STATA 15 (Data Analysis and Statistical Software College Station, Texas, USA).

RESULTS

Information was collected from 716 births in the period, which is estimated to be 90% of all deliveries assisted by SUS in the city of Juiz de Fora. The distribution of the records collected by maternity is shown in graph 1, with a small predominance of deliveries performed at the SCM (41.5%).

The average profile of the pregnant women in the sample (Table 1) is characterized by 6.28% of pregnant women under 18 years of age, 58.24 between 18 and 29 years of age, 31.15% between 30 and 39 years of age, and 4.33% with 40 years of age or older. Regarding education, 19.03 were illiterate or had incomplete elementary school, 37.35% had complete elementary school, 36.19% had complete high school, and 7.42% had higher education. About 55.35% were single, 42.79% married and 1.86% divorced, and 25.95% came from other cities.



Graph 1. Distribution of medical records by maternity hospital.

Table 1. Average profile of the pregnant women in the sample.

	Freq.	%
Age		
Under 18 years old	45	6.28
Between 18 and 29 years old	417	58.24
Between 30 and 39 years old	223	31.15
40 years or older	31	4.33
Education		
Illiterate/Less which fund.	82	19.03
Elementary School complete	161	37.35
High school complete	156	36.19
Superior	32	7.42
Marital Status		
Single	357	55.35
Married	276	42.79
Divorced	12	1.86
Source		
Other municipalities	185	25.95
Juiz de Fora	528	74.05

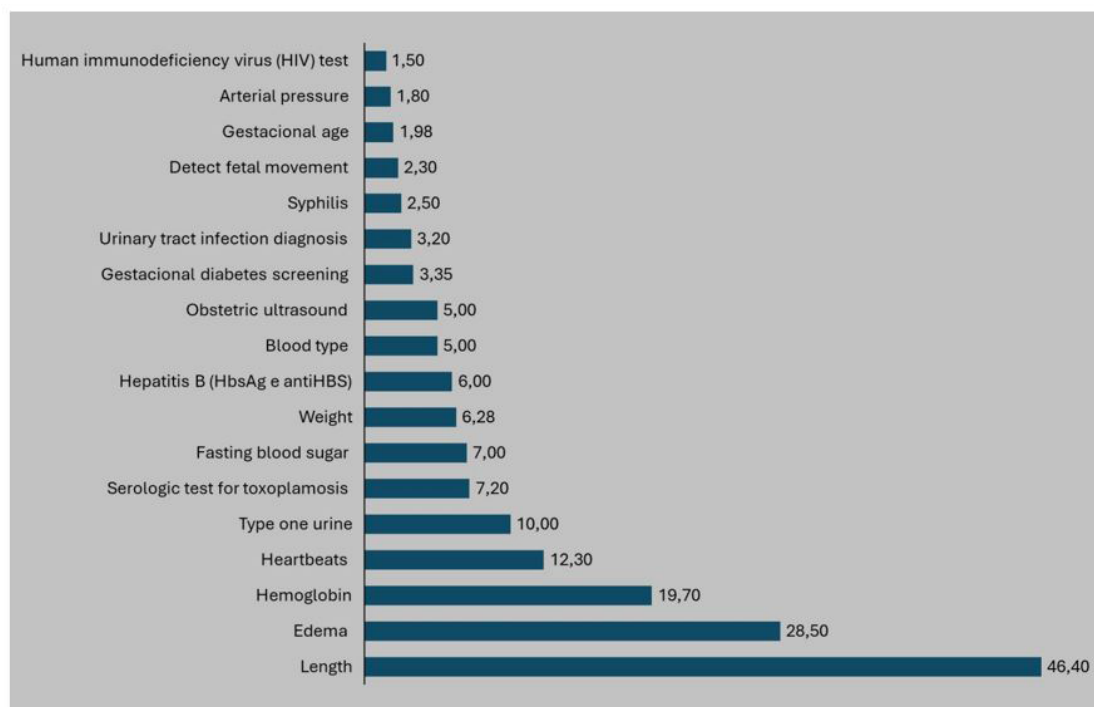
ABOUT PRENATAL EXAMS

High prenatal coverage (98.18%) was identified in JF, of which 17.32% had fewer than 6 consultations. About 64.11% of all pregnant women started prenatal care in the first trimester.

A great variety of models of the pregnant woman's card was observed with differences as to the presence of data. As shown below (graph 2), the time of admission, 5% of the pregnant women did not have ABO-Rh typing. Hb/Ht determination was not recorded in 19.7% of the cards, type 1 urine test in 10%, VDRL in 2.5% and blood glucose in 7%. Anti-HIV testing and obstetric USG were also not noted in 1.5% and 5% of the cards analyzed, respectively. Regarding gestational age and fetal heartbeat, the absence of this information in the cards was 1.96% and 12.3%, respectively. Stature and edema follow as the most incomplete data on the cards of pregnant women with 46.4% and 28.5%, respectively.

ABOUT DELIVERIES, OUTCOMES AND ASSOCIATIONS WITH PRENATAL CARE

Regarding the type of delivery, 43.99% were cesarean deliveries and 54.75% were vaginal deliveries. As for the outcomes of the delivery, 11.31% of newborns were characterized as preterm, 7.4% resulted in admission to the



Graph 2. Percentage distribution of missing data in the pregnant woman's cards, in ascending order.

neonatal ICU and, finally, 1.26% in neonatal death (Table 2). Graph 3 shows the association between the number of prenatal visits, categorized according to the minimum number of recommended visits, and the gestational ages of newborns. Among preterm infants, approximately 26% of mothers had fewer than 6 visits, while in term infants, 16% of mothers had medical services less frequently than recommended. It can be argued that this effect is due to the shorter gestation time among premature infants, especially when the first prenatal visit occurred too late. About 30% of pregnant women had their first visit after the 13th week, but when we tested the association of this variable with gestational age at birth, we found no association.

Two regression models were adjusted to estimate the effects of some indicators on the risk of hospitalization of the newborn. Since the major cause of hospitalization is prematurity, any effect of prenatal care should consider this factor in the adjustment, which can provide an estimate of the effect of the number of consultations, discounting the gestational age at delivery. The two models that best explain this relationship are presented, and although slightly different in their composition, they reinforce the same type of effect.

According to the models presented in Table 3, the risk of admission of the newborn to the ICU according to type 1, even controlling for prematurity, an increase in this risk of about 70% is still observed when prenatal care is not quantitatively performed according to the guidelines of the Ministry of Health, i.e., less than 6 visits. The incidence ratio of hospital admission due to prematurity was 10.7.

Model 2 uses gestational age in weeks, without categorization. Each gestational week that is added until

the date of delivery decreases the risk of ICU admission by 20%. Discounting this effect, not having prenatal care increases the risk of neonatal hospitalization by up to four times, emphasizing complementarily that the reduced number of prenatal consultations also increases this risk by about 40%. We tried, in models not presented in the text, to include sociodemographic factors in the analysis of data from pregnant women. However, no statistically relevant associations were found between the groups. We believe that the homogeneity of the target population explains this fact.

DISCUSSION

The research relates the influence of prenatal service with the occurrence of hospitalization in ICU and neonatal mortality, finding a high rate of coverage of prenatal consultation (98.18%). On the other hand, this scenario is not found in other municipalities of the country, since a lower percentage of women receive adequate care during pregnancy, contributing to the occurrence of potentially preventable diseases and hospitalizations⁹. Moreover, 35.89% of pregnant women started care later, a situation also observed in other Brazilian cities¹⁰.

Regarding prenatal coverage, a percentage of 98.18% was found, which contrasts positively with other locations in MG¹¹. On the other hand, when compared to coverage levels in JF in 2003, a subtle drop is noticed, where there was 99.04% prevalence¹².

In addition, 17.32% of pregnant women had fewer than 6 consultations. In contrast, in 2003, one-third (33.8%) of the patients did not attend the minimum of 6 appointments, including 5.1% who attended only one or

Table 2. Distribution of the types of childbirth and outcomes.

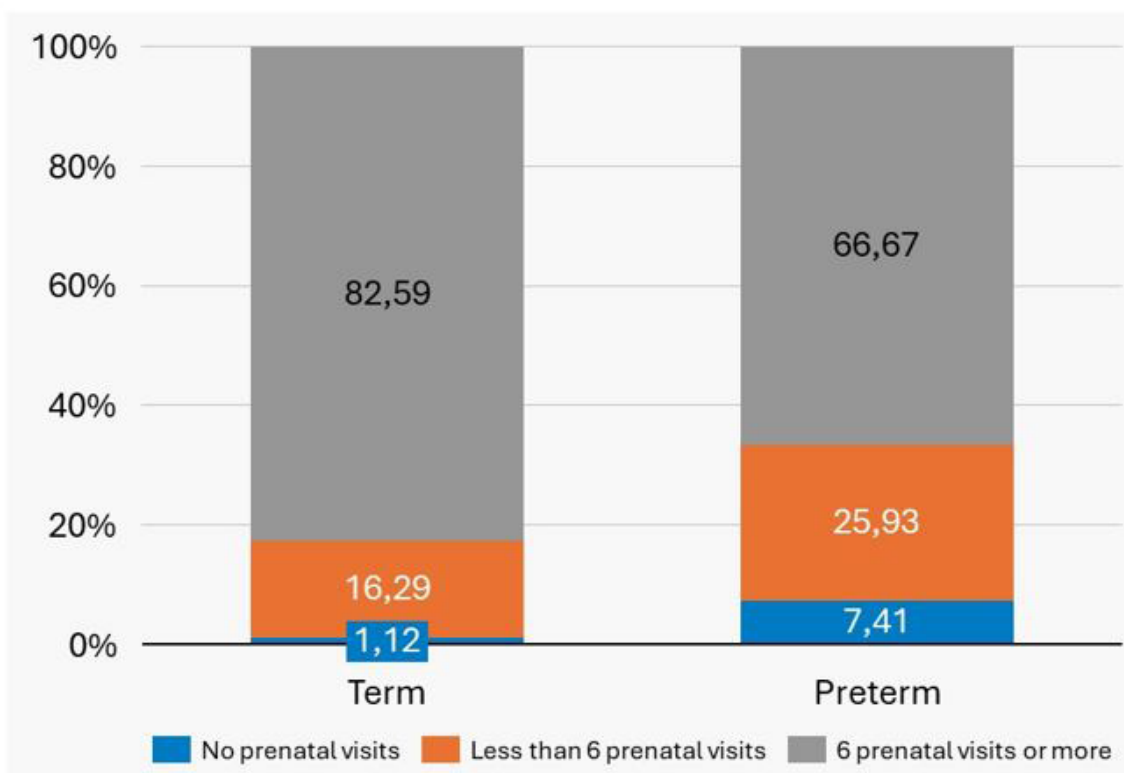
Type of delivery	Freq.	%
Vaginal/assisted	392	54.75
Cesarean section	315	43.99
Hospitalization in N-ICU	53	7.4
Preterm birth	81	11.31
Child Death	9	1.26
Death of the pregnant woman	1	0.14

Legenda: *UTI-N = Unidade de Terapia Intensiva Neonatal.

two appointments, showing a significant improvement in prenatal care compliance among pregnant women¹².

As recommended, the beginning of assistance to pregnant women until the fourth month of pregnancy was observed in 64.11% of all women assessed. When compared to the city's scenario between 2002 and 2004, there is a significant increase in the initial care in the first quarter¹⁰. Similar to this study, in other Brazilian states it was observed that more than half of the pregnant women started prenatal care before the 16th gestational week¹⁰. Despite the improvement of this parameter in the city in the last 20 years, the percentage of adequate prenatal follow-up still remains below the national data⁹.

While in Brazil and in Minas Gerais, in 2018, the percentage of pregnant women with less than 8 years of



Graph 3. Distribution of the number of prenatal visits, according to categories of gestational age of the newborn.

schooling was 17.44% and 13.04%, respectively, in JF, the frequency of illiterate pregnant women or with incomplete primary education was 19,03%⁹. It is known that low education impacts the mother's knowledge about exclusive breastfeeding (EBF), a crucial factor for child nutrition, impacting the health of the newborn¹³. In this scenario, health education, as recommended by the PHPN, plays a key role in filling this deficit¹⁴. Thus, it has been reported that mothers with more schooling have longer breastfeeding practice when compared to the others, due to the possibility of greater access to prenatal support and information on the advantages of breastfeeding, as well as on breast care during pregnancy¹⁵.

Prematurity is the leading cause of admission to the neonatal ICU, with an average stay of approximately 18 days and, in more severe cases, 216.54 days. Moreover, JF had an incidence of 2.9 preterm births per month for every 100 live births, similar to data from Brazil, the 10th among countries with the highest rate of births before 37 weeks of gestation⁹. These data are directly related to prenatal care, since in cases of prematurity about 30% of pregnant women had their first visit after the 13th week. Moreover, the prevalence of low birth weight and/or preterm birth decreases from 14% to 4% as the number of prenatal visits increases from 0 to 3 to 7 or more¹¹.

Table 3. Estimated effects of prenatal visits on N-ICU admission, adjusted for gestational age at delivery.

	Reason for incidence	p-Value	95% CI	
Model 1				
Prematurity	10.7	0.000	6.0	19.1
Visits				
6 or more	1.0	reference		
Less than 6 visits (including no prenatal care)	1.7	0.069	0.96	1.04
Model 2				
Gestational Age at Delivery (weeks)	0.8	0.000	0.8	0.9
Visits				
6 or more	1.0	reference		
Less than 6 visits	1.4	0.310	0.7	2.8
No prenatal care	4.0	0.010	1.4	11.5

Thus, it is revealed that a higher gestational age at birth can reduce the length of stay in the ICU. On the other hand, it was observed that birth weight, congenital anomalies, gestational age at birth, ethnicity, newborn gender, maternal age, and APGAR score increase the length of hospitalization¹⁶.

Furthermore, 12,6 neonatal deaths per 1000 live births were found. These data are lower than the global trend in neonatal mortality, since it was estimated 18,0 deaths per 1000 live births, showing that in JF, the number of neonatal deaths is more satisfactory compared to the global scenario¹⁷.

However, despite the positive numbers, many deaths in this population group could be avoided. These deaths occurred mainly due to causes related to inadequate care of the fetus, the newborn, and women during pregnancy and after birth¹⁸. In this sense, it is essential to adjust the number of consultations recommended by the Ministry of Health, since the probability of neonatal death decreases significantly as the frequency of prenatal consultations increases¹⁹.

Regarding sociodemographic factors, the study did not find relevant associations, given the homogeneity of the sample. However, social inequalities define access to and the quality of prenatal care²⁰, resulting in premature births and neonatal ICU admissions⁹. In another Brazilian city, it was analyzed that most fetal deaths occurred in public hospitals¹⁰.

Another group whose assistance is deficient are teenage pregnant women. This population has lower prenatal care coverage, which may be associated with lack of decision-making autonomy and social stigmas, making differentiated strategies necessary¹⁰. Moreover, pregnancy planning and women's satisfaction when discovering their pregnancy also affect prenatal care quality indicators¹¹.

As limitations, this study was conducted from a convenience sample, in a non-randomized manner, based on

data from medical records in specific forms of the services. Such characteristics reduce the level of evidence found, making it difficult to establish direct causal relationships.

Furthermore, studies regarding the occupancy time of neonatal ICU beds are necessary as a way to prevent negative outcomes and as a parameter for resource management.

Although the data presented have proven to be positive, in a general context, there is still great room for improvement in this scenario. Thus, it can be said that prenatal care is essential to guide mothers, and it is necessary to invest in measures that encourage the proper monitoring of pregnant women, as well as an early start and multidisciplinary care⁹.

CONCLUSION

The data show that there is no need for a municipal public policy to increase the number of neonatal ICU beds in Juiz de Fora, since there have been very similar data regarding prenatal coverage, an increase in coverage during the first trimester, and a decrease in low birth weight births—factors that prevent neonatal ICU admissions.

High prenatal consultation coverage was identified (98.18%) in JF, and of these, only 17.32% had fewer than 6 consultations. About 64.11% of all pregnant women started prenatal care in the first quarter.

As for the outcomes of childbirth, 11.31% of newborns were characterized as preterm, 7.4% resulted in admission to the neonatal ICU and, finally, 1.26% in neonatal death. The data represent optimal coverage of pregnant women in prenatal care in JF.

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AUTHOR'S CONTRIBUTION

We describe contributions to the papers using the taxonomy (CRediT) (<https://casrai.org/credit/>) provided below:

Conceptualization, research, methodology and writing: JACN, HDS, REF. *Statistical analysis - REF. Contribution to the development of the text and bibliographic review - AHOS, LPM, MCM.*

All authors approved the manuscript as submitted.

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