ORIGINAL ARTICLE

Maternal profile and neonatal outcomes of preterms born before 32 weeks in a neonatal ICU in the countryside of Rio Grande do Sul: A descriptive cross-sectional study

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Abstract

Objectives: to analyze the sociodemographic and obstetric profiles, clinical characteristics of mothers, and neonatal outcomes of preterms born less than 32 weeks in a neonatal intensive care unit.

Methods: this was a quantitative, descriptive, cross-sectional study conducted between 2024 and 2025 in a Neonatal Care Unit in the countryside of Rio Grande do Sul, Brazil. The article used the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist.

Results: twenty-eight mothers were interviewed; four had twins, totaling 32 preterm newborns. Regarding the maternal profile, 46.4% were adults, 57.1% had completed high school, 89.3% lived with a partner, and 35.7% reported a family income of less than two minimum wages. Regarding to skin color, 50.0% were white, 32.1% mixed-race, and 17.9% Black. Concerning gestational complications, 71.4% of the mothers were hospitalized before childbirth. In regards to the Neonatal ICU outcomes: 34.4% were discharged and sent home, 56.3% were transferred to other hospital units, and 9.3% died while still in the Neonatal ICU.

Conclusions: this research permitted to deepen the knowledge on mothers' profiles and needs, contributing to the planning on more effective public actions focused on maternal and child care and the improvement of neonatal outcomes.

Key words *Sociodemographic factors, Mothers, Premature newborn, Public health*

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Introduction

Premature birth is defined by the World Health Organization[1] as a birth occurring before 37 full weeks of gestation and can be classified as: extremely preterm (less than 28 weeks), very preterm (28–31 weeks), or moderate preterm (32–36 weeks). It is estimated that 13.4 million babies were born prematurely worldwide in 2020.[1,2] Currently, preterm births are the leading cause of death among children under 5 years of age.[3] Babies born prematurely require constant, specialized care to ensure the best possible survival and healthy development.[4]

In Brazil, between 2012 and 2022, a significant change in the prevalence of preterm births was observed, accompanied by variations across the macroregions. These variations largely reflect inequalities to access to health care, as well as socioeconomic and environmental factors and differing obstetric practices.[5] The national trend of increasing premature births, characterized by regional and social inequalities, suggests that these disparities may widen by the year 2030.[6]

Preterm birth is recognized as a multifactorial syndrome; its etiology includes infections, inflammation, uteroplacental insufficiency, excessive uterine distension, stress, and immunological processes.[7,8] Several factors can influence preterm birth, including genetic, sociodemographic, and environmental factors, and, most importantly, those related to pregnancy.[4,9]

In this context, understanding preterm birth and its determinants is essential to enhance health promotion and disease prevention actions. It should be noted that this phenomenon is closely linked to maternal conditions and the specific characteristics of each pregnancy. Thus, the objective of this study was to analyze the sociodemographic and obstetric profiles of the mothers, as well as the characteristics and outcomes of extremely preterm and very preterm newborns at a referral neonatal intensive care unit in the countryside of Rio Grande do Sul (RS).

Methods

This was a descriptive, quantitative cross-sectional study conducted between 2024 and 2025 at a referral Neonatal Intensive Care Unit (NICU) in the countryside of Rio Grande do Sul. This article was elaborated in accordance with EQUATOR Network guidelines, using the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist.[10]

The study was approved by the Ethics Committee of the *Universidade de Santa Cruz do Sul* on July 2, 2024, under approval Nº. 6,926,482 (CAAE: 80182424.1.0000.5343), and by the Teaching and Research Department of the referral hospital on October 18, 2024, under Opinion Nº. 23541.046583/2024-89.

The selected hospital is the largest referral facility in the central-western region of Rio Grande do Sul and serves as a regional referral center for 45 cities in specialized care. Initially, a search was conducted in the institutional records and the information system of the hospital to identify the number of births, deliveries, and hospitalizations to the Neonatal ICU.

This was a convenience sample, non-probabilistic, based on the annual average number of hospitalizations of preterm newborns between 2020 and 2023. In developing the research project, a survey was conducted in which all gestational ages of infants hospitalized between 2020 and 2023 in the Neonatal Care Unit of *Hospital Universitário de Santa Maria/Universidade Federal de Santa Maria* (HUSM/UFSM) (University Hospital of Santa Maria/Federal University of Santa Maria) were analyzed.

The data were stratified by the number of full-term, late preterm, very preterm, and extremely preterm newborns. Using these data, an annual average was calculated, which served as a reference for the sample. The inclusion criteria were mothers of preterms with a gestational age of less than 32 weeks admitted to the Neonatal ICU and agreed to participate in the study and signed the Informed Consent Form (ICF).

Twenty-eight mothers participated in this study, four of whom had twin births, totaling 32 preterm infants. Exclusion criteria were refusal to participate in the study or the infant's death prior to the commencement of the study, which resulted in the exclusion of two potential participants.

Data were collected through individual interviews in a reserved setting, using questions specifically developed for this study. A pilot study was conducted to validate the questionnaire. To control bias in data collection, a standardized instrument with objective questions was used, ensuring neutrality in the responses.

The sociodemographic variables analyzed included: age, skin color, schooling level (elementary school, high school, and higher education), occupation, household income, and marital status. The obstetric variables were: previous pregnancy loss, prior preterm birth, prenatal care provided by the *Sistema Único de Saúde* (SUS)(Brazilian public health system), and start of prenatal care, number of consultations, previous hospitalization and complications during pregnancy.

Neonatal data were obtained from the *Aplicativo de Gestão para Hospitais Universitários* (Management Applicative for University Hospital) and included: *Classificação Estatística Internacional de Doenças e Problemas Relacionados com a Saúde* (CID-10) (International Statistical Classification Codes of Diseases

and Related Health Problems), the baby's sex, gestational age, birth weight, Apgar scores at one and five minutes (less than seven and seven or higher), medical diagnosis at the time of admission, length of hospitalization, and outcome.

The Statistical Package for the Social Sciences (SPSS), version 23.0, was used for data analysis. Categorical variables were presented using absolute and relative frequencies, while numerical variables were described using measures of central tendency and dispersion. Given the descriptive nature of the study and the small sample size, the data were presented descriptively, stratified according to the groups of interest, without performing inferential statistical tests.

Results

The study included 28 puerperal women and 32 preterm newborns (4 of whom were twins). Regarding the maternal profile, it was found that 46.4% of the mothers were adults, 57.1% had completed high school, 89.3% lived with a partner, and 35.7% reported a household income below two minimum wages, as shown in Table 1. In addition, 50.0% of them were employed.

Regarding maternal self-reported skin color, half of the sample (50.0%) consisted of white women, followed by 32.1% who identified as mixed-race and 17.9% who identified as black. All mothers received prenatal care; 89.3% began in the first trimester, and 96% received care through SUS. Regarding the number of consultations, 17.9% of the patients had 1 to 4onsultations; the remaining 82.1% had 5 or more. This information is detailed in Table 1.

Regarding pregnancy complications and the need for pre-delivery hospitalization, 71.4% of the mothers required hospitalization with the following diagnoses: preeclampsia, intra-amniotic infection, premature rupture of membranes, thrombosis, pyelonephritis, premature dilation, loss of the mucous plug, fetal growth restriction, and oligohydramnios. One of the mothers required pre-delivery hospitalization at the adult ICU due to cardiovascular complications. Among all the conditions evaluated, 42.9% of the pregnant women had preeclampsia, and 17.9% developed gestational diabetes mellitus.

Urinary tract infection was present in 39.3% of the participants, while 35.7% experienced at least one episode of hemorrhagic complication. Obesity was also registred in 21.4% of the pregnant women, and cervical abnormalities in 32.1%. With regard to infectious diseases, there were no positive serological test results for syphilis or Human Immunodeficiency Virus (HIV).

Table 2 presents the perinatal characteristics and neonatal outcomes of the preterm newborns included in the study, in which was observed that 68.8% were born via cesarean section; 50.0% were female and 50.0% were male; 59.4% were very preterm (28 to 31 weeks of gestation); 43.8% had very low birth weight (1,000–1,499 g); 34.4% were extremely low birth weight (less than 1,000 g) and 21.8% were low birth weight; 59.4%

Table 1

Descriptive characteristics of the mothers and obstetric/prenatal history.

Characteristics		N	%
Skin color			
White		14	50.0
Mixed		9	32.1
Black		5	17.9
Maternal age			
15 – 19 years (Adolescents)		4	14.3
20 – 34 years (Adults)		13	46.4
35 years or more (Late-age)		11	39.3
Maternal schooling			
Elementary school		9	32.1
High school		16	57.1
Higher education		3	10.7
Marital status			
Lives with a partner		25	89.3
Does not live with a partner		3	10.7
Family income relative to minimum wage and socioeconomic class			
≤ 1	E	5	17.9
1.1 to 1.9	D	10	35.7
2 to 4.9	C	9	32.1
5 to ≥ 10	B	3	10.7
Does not know		1	3.6
Previous pregnancy loss			
Yes		8	28.6
No		20	71.4
Previous preterm birth			
Yes		7	25.0
No		21	75.0
Received prenatal care			
Yes		28	100.0
No		0	
Prenatal care provided by SUS			
Yes		27	96.4
No		1	3.6
Start prenatal care			
First trimester		25	89.3
Second trimester		3	10.7
Number of prenatal consultations			
1to 4 consultations		5	17.9
5 or more		23	82.1
Associated to AGAR			
Associated to AGAR		13	46.4
Not associated to AGAR		15	53.6

AGAR = High-Risk Pregnancy Clinic.

The total may not add up to 100% due to rounding.

had a 1-minute Apgar score of 7 or higher; 90.6% had a 5-minute Apgar score of 7 or higher.

Regarding to post-Neonatal ICU outcomes: 34.4% were discharged and sent home; 56.3% were transferred to other in-hospital units (37.5% to the Pediatric and Adolescent Inpatient Unit and 18.8% to the Pediatric Intensive Care Unit), and 9.3% died during hospitalization in the Neonatal ICU. Regarding to deaths: 1 was early (6 days of life), 1 was late (20 days of life), and 1 was post-neonatal (58 days of life).

The main codes from the *Classificação Estatística Internacional de Doenças e Problemas Relacionados com a Saúde* (CID-10)(International Statistical Classification of Diseases and Related Health Problems) registred in the Hospital Admission Authorizations were: P07.0—Extremely low birth weight (birth weight less than 1,000 g), P07.2 - Extreme immaturity (newborns with less than 28 full weeks of gestation), and P07.3 - Other preterm newborns (gestational age [GA] between 28 and 36 weeks and 6 days).

In addition to the initial diagnoses of preterm birth, the following medical diagnoses were also noted in the patients' medical records: weight-related intrauterine growth restriction (26), respiratory distress syndrome (22), suspected infections (4), trauma and injuries (3), congenital malformations (2), and pulmonary hemorrhage (1).

Table 2

Neonatal characteristics and outcomes of preterm infants.

	n	%
Type of delivery		
Cesarean	22	68.8
Vaginal	10	31.2
Apgar score at 1 minute		
Less than 7	13	40.6
Equal or higher than 7	19	59.4
Apgar score at 5 minutes		
Less than 7	3	9.4
Equal or higher than 7	29	90.6
Gestational age		
Extremely preterm (less than 28 weeks)	13	40.6
Very preterm (28 to 31 weeks)	19	59.4
Birth Weight		
Extremely low birth weight (less than 1,000 g)	11	34.4
Very low birth weight (1,000 -1,499 g)	14	43.8
Low birth weight (1,500-2,500 g)	7	21.9
Neonatal Outcome		
Transfer to Pediatric and Adolescent Unit	12	37.5
Discharge to go home	11	34.4
Transfer to the Pediatric ICU	6	18.8
Death in the Neonatal ICU	3	9.4
Mean ± Standard Deviation		
Gestational Age (weeks)	28.9 ± 2.0 weeks	
Birth Weight (grams)	1,203 ± 401 g	

SD = standard deviation; ICU = Intensive Care Unit.

Note: The total may not add up to 100% due to rounding.

Discussion

Regarding mothers' self-reported skin color, 50.0% of the sample consisted of white women, followed by 32.1% mixed-race women and 17.9% black women; this profile is consistent with studies that analyze race/ethnicity as a social determinant of preterm birth.[11] Most of the studies analyzed, identified a stronger association between prematurity and mothers of newborns who self-identified as black or mixed-race, consistent with findings from other regions of the country.[12,13] In this regard, an international study conducted in Colombia identified African descent as a factor associated with infant prematurity.[14]

Most of the sample consisted of mothers over 20 years of age: 46.4% classified as adults and 39.3% as late mothers. These data align with other regional studies in Rio Grande do Sul (RS), where an average age of 28.5 years was also identified in the central region of RS,[15] as well as at a university hospital in Porto Alegre (RS),[16] as well as in other studies in other states, such as Piauí, where the average age was 28.1 years,[13] and at a maternal and child referral hospital in Belém, Pará.[17]

Regarding to marital status, it was found that most mothers lived with a partner (89.3%) in a consensual union or an officially recognized marriage, consistent with other similar studies.[13,16,18,19] Regarding maternal schooling, the majority had completed high school (57.1%), followed by those who had only completed elementary school (32.1%). This profile is consistent with four other studies on maternal profiles at leading public institutions in different Brazilian regions; three of which are in the Northeast and one in the South.[13,18,20,21]

As for, maternal employment and household income, 50.0% of the mothers did not work outside the home, and 35.7% of them had a household income that classified them as Class D,[22] considered a segment of the population with lower purchasing power that face financial difficulties, which often limits access to health services. This economic profile of greater financial constraint is also evident in other national studies.[15,21,23]

International studies, such as those in the U.S.A., also have shown that vulnerable populations living in socioeconomicly disadvantaged areas have higher rates of preterm births.[24] In this respect, a study conducted in Utah (U.S.) found a positive association between partner-related, traumatic, financial, and emotional stressors during pregnancy and preterm birth.[25]

Economic factors, including household income, schooling, and occupation, have significant implications for adverse pregnancy outcomes, with income being the primary factor associated with social and health inequality,

affecting working conditions, housing, access to food, and health services, such as prenatal care.[11]

Attendance at prenatal care appointments was unanimous among the mothers, as was the number of consultations (five or more), which accounted for 82.1% of the sample, in accordance with the guidelines of the Ministry of Health.[26] In addition, 89.3% of them began prenatal care in the first trimester of pregnancy, and 46.4% received care at the specialized outpatient clinic of the referral hospital. These results are consistent with a similar study conducted at a specialized outpatient clinic for high-risk pregnancies in the West of Paraná.[19]

The recommended number for routine prenatal care consultations should be six or more; for high-risk pregnancies, visits should be monthly through the 28th week, every two weeks between 28 and 36 weeks, and weekly thereafter.[27] It is worth noting that, in addition to attendance at prenatal care consultations, the quality of care provided is very important, underscoring the need for rigorous and high-quality follow-up.

In the present study, several pathologies and pregnancy complications were detected, such as: hypertension, preeclampsia, urinary tract infection, gestational diabetes, obesity, cervical abnormalities, and hemorrhages. All of these are cited in the literature as conditions that complicate preterm births.

The study conducted in the Neonatal ICU of the Maternity Ward at the *Hospital de Clínicas* of the *Universidade Federal do Paraná*[23] analyzed mothers with hypertension and gestational diabetes. In contrast, the profile of the referral maternity hospital in the city of Fortaleza, Ceará, revealed more complications: preeclampsia; urinary tract infection; threatened preterm labor; diabetes; hemorrhage; intrauterine growth restriction; as well as syphilis. [18]

The profile of mothers treated at the outpatient clinic specializing in high-risk pregnancies in the West of Paraná included hypertension, obesity, and diabetes.[19] In this context, a Nigerian study conducted at more than 54 referral hospitals also linked hypertensive disorders to preterm birth and perinatal mortality.[28]

In the present study, in addition to the mothers, the infants were also characterized, highlighting information on sex, type of delivery, twin pregnancy, gestational age, birth weight, and Apgar scores at 1 minute and 5 minutes of life, length of hospitalization, and outcome. Maternal information was included in five national studies examining the sociodemographic profile of mothers of newborns treated in referral intensive care units in different Brazilian regions: Piauí,[13] Belém, Pará,[17] Fortaleza, Ceará;[18] Curitiba, Paraná;[23] and Manaus, Amazonas.[29]

However, neonatal characteristics were reported in only two studies,[17,18] with the following similar variables: type of delivery, [17] sex[17,18] (male or female), gestational age,[17] mean birth weight,[17,18] and Apgar scores at 1 minute and 5 minutes.[18] The study conducted in the state of Pará[17] showed some similarities in terms of sample size, a higher number of cesarean deliveries, as well as a larger proportion of very preterm newborns (less than 32 weeks' gestation) and average birth weights below 1,500 grams and above 500 grams.

A high cesarean section rate was recorded in other studies conducted in different regions of the country.[13,17,21] Although vaginal delivery is the most recommended option, some authors question the indiscriminate use of cesarean sections, which increases health risks and costs for SUS. [13,21] However, other authors attribute this high rate to pregnancy complications, such as severe preeclampsia, eclampsia, placental abruption, uterine rupture, and fetal distress.[11,17,18]

In 2024, a Mexican study conducted in Yucatán, Mexico, by the Ministry of Health, carried out a 13-year cohort analysis, correlating maternal sociodemographic characteristics (maternal age and educational level) with neonatal characteristics, such as gestational age, weight, and length. The twin rate increased substantially during the analyzed period in specific sociodemographic groups (such as women aged ≥30 years and those with higher levels of education).[30]

At the conclusion of the study, limitations related to sample size and the single-center nature of the research were identified, suggesting the need for broader investigations to better characterize the issue. Furthermore, the descriptive study design and the small sample size prevented comparisons among mothers based on the type of delivery. Thus, the data were presented descriptively, stratified according to the groups of interest, without conducting inferential statistical tests.

Convenience sampling this facilitated access to the participants, given the mothers' continuous presence at the health facility due to their babies' prolonged hospitalizations. Furthermore, the single-center design reflected the reality of a single public institution, which serves as a regional referral center for high-risk prenatal care.

Due to the cross-sectional nature of this aspect of the study, longitudinal follow-up of neonatal outcomes was not included. The occurrence of deaths in the Neonatal ICU reflects the case series of newborns born before 32 weeks; it should be noted that the low proportion observed (9.4%) risks being interpreted as the overall mortality rate for the group.

As for, methodological limitations, it was not possible to establish external validity, which limits the generalizability of the findings given the specificity of the study population. It should also be noted that the use of self-reporting for some variables prevented full verification of the information, which may introduce

measurement bias. Finally, there is a scarcity of regional studies aimed at characterizing the socioepidemiological profile of mothers of very and extremely preterm newborns in the State of Rio Grande do Sul.

It should be emphasized that the data generated in this study will provide public health authorities with relevant information regarding maternal and child health in the region. The study made it possible to characterize the sociodemographic and obstetric profiles of the mothers and the characteristics of extremely and very preterm newborns in a and very premature infants at a referral neonatal intensive care unit in the countryside of Rio Grande do Sul, located in the city of Santa Maria, RS.

Knowledge of this profile enabled the identification of priority areas for intervention in maternal and child health (high-risk prenatal care). The understanding of the team's families' reality is essential for providing support to mothers during care, thereby enhancing the health promotion of premature newborns.

Authors' contributions

Sales Snovarski ME: conceptualization, project management, design, research, data curation, methodology, formal analysis, analytical tools, development and testing, validation, securing funding, drafting and revising the manuscript.

Quaiatto Félix N: design, data curation, formal analysis, analysis tools, development and testing, drafting and revising the manuscript.

Koepp J: conceptualization, methodology, supervision, validation, drafting and revising the manuscript.

Moura Valim AR: conceptualization, project management, data curation, methodology, supervision, validation, manuscript drafting and revision.

All authors approved the final version of the article and declare that they have no conflict of interest.

Data availability

The entire dataset supporting the results of this study was published in the article itself.

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