

# Maternal and neonatal factors associated with hospital readmission of newborns of adolescent mothers

*Fatores maternos e neonatais associados à reinternação hospitalar de recém-nascidos de mães adolescentes*

*Factores maternos y neonatales asociados al reingreso hospitalario de recién nacidos de madres adolescentes*

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## How to cite this article:

Amthauer C, Cunha MLC. Maternal and neonatal factors associated with hospital readmission of newborns of adolescent mothers. Rev Gaúcha Enferm. 2023;44:e20220063. doi: <https://doi.org/10.1590/1983-1447.2023.20220063.en>

## ABSTRACT

**Objective:** To analyze the maternal and neonatal factors in newborns of adolescent mothers associated with hospital readmission in the neonatal period.

**Method:** Quantitative cross-sectional, retrospective and analytical study, with 489 newborns of adolescent mothers, born in 2019 and 2020 in a high-complexity public hospital in southern Brazil. Data were collected through a query and analyzed in the SPSS software using the chi-square or Fisher's exact tests. To control for confounding factors, the multivariate Poisson regression model was used.

**Results:** The prevalence of hospital readmissions for newborns of adolescent mothers was 9.2%, mainly due to respiratory conditions, being the most prevalent the diagnosis of acute bronchiolitis, at 22.3%.

**Conclusion:** Neonatal hospital readmission was associated with prematurity, 1st minute Apgar <7 and maternal origin.

**Keywords:** Infant, newborn. Premature birth. Pregnancy in adolescence. Neonatal nursing. Intensive care units, neonatal.

## RESUMO

**Objetivo:** Analisar os fatores maternos e neonatais de recém-nascidos de mães adolescentes associados à reinternação hospitalar no período neonatal.

**Método:** Estudo quantitativo transversal, retrospectivo e analítico, com 489 recém-nascidos de mães adolescentes, nascidos em 2019 e 2020 em um hospital público de alta complexidade, localizado na região Sul do Brasil. Os dados foram coletados por meio de uma *query* e analisados no software SPSS utilizando os testes qui-quadrado ou exato de Fisher. Para controle de fatores confundidores, empregou-se o modelo multivariado de Regressão de Poisson.

**Resultados:** A prevalência de reinternação hospitalar de recém-nascidos de mães adolescentes foi de 9,2%, principalmente por condições respiratórias, sendo o diagnóstico de bronquiolite aguda o mais prevalente, com 22,3%.

**Conclusão:** A reinternação hospitalar neonatal esteve associada à prematuridade, ao Apgar 1º minuto <7 e à procedência da mãe.

**Palavras-chave:** Recém-nascido. Nascimento prematuro. Gravidez na adolescência. Enfermagem neonatal. Unidades de terapia intensiva neonatal.

## RESUMEN

**Objetivo:** Analizar los factores maternos y neonatales de recién nacidos de madres adolescentes asociados al reingreso hospitalario en el período neonatal.

**Método:** Se trata de un estudio cuantitativo transversal, retrospectivo y analítico con 489 recién nacidos de madres adolescentes, nacidos en 2019 y 2020 en un hospital público de alta complejidad, ubicado en el sur de Brasil. Los datos fueron recolectados por una *query* y analizados en el software SPSS utilizando pruebas chi-cuadrada o exactas de Fisher. Para controlar los factores de confusión, se utilizó el modelo de Regresión de Poisson multivariante.

**Resultados:** La prevalencia de reingreso hospitalario de recién nacidos de madres adolescentes fue de 9,2%, principalmente por afecciones respiratorias, siendo el diagnóstico de bronquiolitis aguda el más prevalente, con 22,3%.

**Conclusión:** El reingreso hospitalario neonatal se asoció con prematuridad, Apgar minuto 1 <7 y origen materno.

**Palabras clave:** Recién nacido. Nacimiento prematuro. Embarazo en adolescencia. Enfermería neonatal. Unidades de cuidado intensivo neonatal.

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## INTRODUCTION

The first 28 days of life are the most vulnerable for a child's survival. The World Health Organization (WHO) report, aimed at hospital care for the most vulnerable newborns (NB) – small and sick – states that, globally, around 30 million NB require some level of hospitalization in a hospital setting every year. This includes NB with issues of prematurity, intrapartum brain injury, infections, jaundice and congenital conditions<sup>(1)</sup>.

Neonatal conditions are responsible for 47% of deaths in children under five years old. In 2017, more than 2.5 million NB died in the first 28 days of life, mostly from preventable causes. Premature births, childbirth complications, infectious diseases and congenital conditions are the main causes of the majority of these deaths, in addition to poor quality care or the absence of any health care for the newborn<sup>(1)</sup>. In Brazil, neonatal mortality has been responsible for almost 70% of deaths in the first year of life and appropriate care for newborn is one of the challenges to reduce neonatal and infant mortality rates<sup>(2)</sup>.

When reporting the NB of adolescent mothers, they face greater risks of premature birth, low birth weight (LBW) and severe neonatal conditions, which puts them in a situation of greater vulnerability and need for admission in hospital units. For the WHO, adolescent pregnancy is a social phenomenon that occurs in girls aged between 10 and 19<sup>(3)</sup> and, despite efforts to implement public policies aimed at ensuring quality prenatal care and reduce the global fertility rate in adolescents by 11.6% in the last 20 years, adolescent pregnancy continues to be a Public Health issue worldwide. The concern is mainly in middle and low-income countries, given the consequences for the health of adolescent mothers and their babies, especially younger adolescents<sup>(3)</sup>.

Frequently, the adverse effects resulting from an early pregnancy have been attributed to the mother's biological immaturity. However, its repercussions goes beyond the biological dimension when considering the social, educational and economic consequences to which adolescents are inserted. With the discovery of the pregnancy, many girls tend to leave school, which will directly compromise the future mother's education and job opportunities, as well as the conditions for the child's growth and development<sup>(3-4)</sup>.

Added to this, adolescents are less experienced regarding family planning and preventive health care<sup>(4)</sup>. Young mothers are less likely to have adequate prenatal follow-up and this happens for a lot of reasons, including fear of repercussions, the presence of an unwanted pregnancy, or lack of information and access to adequate resources. Regardless of the risk

associated with age, the lack of prenatal care in adolescent pregnant women significantly increases the risk of prematurity and LBW, with their children being more exposed to the risk of morbidity and mortality<sup>(4-5)</sup>.

Adverse clinical outcomes in newborns of adolescent mothers intensify the need for neonatal health care and interventions, as well as increase readmission rates in hospital units. Thus, this study is justified by the possibility of contributing to the construction of knowledge on the main maternal and neonatal clinical conditions responsible for the NB's readmission, in addition to the main reasons that caused this outcome during the neonatal period.

It is also evident the need to frame the theme that involves perinatal health and the detection of the health needs of adolescent mothers, essential to qualify maternal and child health care and for a positive prognosis in the postnatal period, focusing on reducing neonatal and infant morbidity and mortality rates. Thus, this study aims to answer the following guiding question: What are the maternal and neonatal factors associated with readmission of newborns of adolescent mothers in a hospital context? Based on this question, the objective is to analyze the maternal and neonatal factors of newborns of adolescent mothers associated with hospital readmission in the neonatal period.

## METHOD

Quantitative cross-sectional, retrospective and analytical study conducted following the recommendations of the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE).

Study developed at the *Hospital de Clínicas de Porto Alegre* (HCPA) a highly complex, public university hospital situated in the southern region of Brazil. The hospital has Gynecology and Obstetrics services, which offer care to the various areas of women's health, with care for gynecological and obstetric emergencies, including for high-risk pregnancies; and Neonatology, which monitors newborns from birth to discharge, including those who need hospitalization. Data collection took place in July and August 2021.

For the inclusion criteria, all adolescent mothers, aged between 10 and 19 years old, according to the WHO classification<sup>(3)</sup>, and their newborns, born between January 1, 2019 and December 31, 2020, in the HCPA. Moreover, newborns who, in need for hospital readmission, occurred within 28 days of extrauterine life were included. The mother-baby binomials that did not have the variable gestational age (GA) in the database made available through the query and

those newborns who were not born at the HCPA and/or were transferred from other hospitals were excluded from the research. After applying such criteria, 29 mother-baby binomials were excluded due to lack of GA records. Thus, considering the inclusion criteria, the final sample consisted of 488 adolescent mothers and their 489 newborns.

Hospital readmission in the neonatal period was considered as an outcome variable of the study. Predictor variables refer to neonatal and maternal characteristics. For the construction of these variables, it was based on the Basic Care Notebook number 32 of Low Risk Prenatal Care<sup>(6)</sup>.

Among the neonatal characteristics are: gender; birth weight (<2,500 grams or  $\geq$ 2,500 grams); prematurity (yes or no), Apgar score at the first minute (<7 or  $\geq$ 7); Apgar score at the fifth minute (<7 or  $\geq$ 7); hospital readmission within 28 days after birth (yes or no); reason for hospital readmission (according to the International Classification of Diseases – ICD-10); outcome of hospital readmission (discharge or death). It was considered premature newborns those with a GA of less than 37 completed weeks of gestation<sup>(7)</sup>. The birth weight variable was categorized according to the WHO classification, in which newborns weighing less than 2,500 grams are considered low birth weight, regardless of GA<sup>(8)</sup>.

The maternal characteristics were subdivided and categorized into: Sociodemographic data: maternal age (in years, categorized as 13 to 16 years old or 17 to 19 years old), city of origin (city where the hospital is located or other cities), education level (adequate or inadequate for the mother's age), marital status (with or without a partner, regardless of civil registration), occupation (related to work or studies); e, Gestational data: previous pregnancies (primiparous or multiparous), date of current delivery, gestational age at delivery (in weeks), type of delivery (vaginal or cesarean section), type of pregnancy (single or multiple), number of prenatal care consultations (adequate or inadequate for GA), risk factors (yes or no), childbirth complications (yes or no). It should be highlighted that risk factors refer to adverse conditions that the mother or fetus may have had or been exposed to during pregnancy and may cause adverse clinical outcomes in newborns.

For the categorization of the education level variable, the classification of the Ministry of Education was used as a reference, in which primary education must be completed between 7 and 14 years, secondary education between 15 and 17 years and higher education between 18 and 24 years old<sup>(9)</sup>.

The categorization of the variable number of prenatal consultations was based on the minimum number of

consultations for GA, recommended by WHO and the Ministry of Health<sup>(6)</sup>. Therefore, it was classified as adequate prenatal care for GA the mother who presented: two consultations up to 26 weeks of gestation, three consultations up to 32 weeks, four consultations up to 37 weeks, five consultations at 38 weeks of gestation and six consultations or more when 39 weeks or more of pregnancy. The categorization was based on the total number of prenatal consultations, ignoring the GA when the mother started prenatal care, as this information was not available.

As for complications during delivery, these refer to clinical conditions presented by the mother or baby during the parturition process, and the same mother may have presented more than one complication. From these, cases of perineal laceration, anal sphincter or vagina/cervix, cases of shoulder dystocia, retained placenta/postpartum uterine curettage and hematoma drainage/episiotomy abscess were registered.

Data collection took place through a query, requested from the Medical Archive and Health Information Service (*Serviço de Arquivo Médico e Informação em Saúde*), which has the data from the patients' medical records. The query is a way to investigate computerized medical records at the Institution and is requested by filling out an online research form, available in Microsoft Excel (electronic spreadsheet), in which the variables of interest to the study were included. It should be highlighted that this was a fully anonymous query, without identification of the participants, complied with the General Law for the Protection of Personal Data (*Lei Geral de Proteção aos Dados Pessoais* – LGPD).

Data were coded and analyzed using the Statistical Package for the Social Sciences (SPSS), version 18, with the variables categorized and expressed by absolute frequency and relative frequency. To verify the association between the outcome variables and the predictors, the data were submitted to the chi-square or Fisher's exact tests. To control for confounding factors, variables with  $p < 0.20$  were inserted in the multivariate Poisson Regression model. The significance level considered was 5% ( $p \leq 0.05$ ).

The research project was approved by the Research Ethics Committee of the responsible institution, under Certificate of Presentation for Ethical Appreciation (CAAE) No. 36972220,8,0000,5327 and Opinion number 4,812,039. The ethical principles in health ruled by Resolution 466/2012 of the National Health Council/Ministry of Health were respected. In addition, a Term of Commitment was signed for the use of data and a declaration of knowledge and compliance with the LGPD.

## RESULTS

From the total number of births, 33 (6.7%) were recorded as premature births, 3 (9.1%) of which were classified as very premature, with GA between 28 and 31 weeks and 6 days, 2 (6.1%) as moderate premature, with GA between 32 and 33 weeks and 6 days; and 28 (84.8%) as late preterm babies, with GA between 34 and 36 weeks and 6 days. The other neonatal characteristics are shown in Table 1.

Hospital readmissions in the neonatal period, recorded at the hospital under study, were observed in 45 (9.2%) NB. From the NB who required readmission, there was a higher prevalence of males, with LBW, premature, Apgar at the 1<sup>st</sup> minute < 7 and at the 5<sup>th</sup> minute > 7. From the total number of preterm babies who were readmitted, 5 (71.4%) were late preterm babies.

For the binary categorization of the outcome, this was expressed as: there was neonatal readmission or there was no neonatal readmission, which were associated with the other variables under study. Through bivariate analysis, after adjusting for residuals in the association between variables, gender, birth weight and Apgar score at the 5<sup>th</sup> minute of life did not show statistical significance ( $p > 0.05$ ) for the outcome. However, regarding prematurity ( $p = 0.024$ ) and Apgar at the 1<sup>st</sup> minute ( $p = 0.041$ ), there was statistical significance with the occurrence of hospital readmissions in the neonatal period. Thus, hospital readmission in the first 28 days of life was associated with prematurity and Apgar score in the 1<sup>st</sup> minute < 7, as shown in Table 1.

Regarding the causes that led to the newborn's hospital readmission, 23 different diagnoses were selected, according to the ICD-10, attributed by the medical professional who

**Table 1** – Distribution and association of neonatal factors with the occurrence of hospital readmissions in the neonatal period (n=489). Porto Alegre, Rio Grande do Sul, Brazil, 2019-2020

Variables*	Total sample (n=489)	Neonatal readmission		p-value
		Yes (n=45)	No (n=444)	
Gender				0.341 <sup>†</sup>
Male	244 (49.9)	26 (10.7)	218 (89.3)	
Female	245 (50.1)	19 (7.8)	226 (92.2)	
Birth weight				0.735 <sup>‡</sup>
<2.500 g	28 (5.7)	3 (10.7)	25 (89.3)	
≥ 2.500 g	461 (94.3)	42 (9.1)	419 (90.9)	
1 <sup>st</sup> minute Apgar <sup>§</sup>				<b>0.041<sup>‡</sup></b>
< 7	15 (3.1)	4 (26.7)	11 (73.3)	
≥ 7	470 (96.9)	41 (8.7)	429 (91.3)	
5 <sup>th</sup> minute Apgar <sup>§</sup>				1.000 <sup>‡</sup>
< 7	2 (0.4)	0	2 (100.0)	
≥ 7	483 (99.6)	45 (9.3)	438 (90.7)	
Prematurity				<b>0.024<sup>‡</sup></b>
Yes	33 (6.7)	7 (21.2)	26 (78.8)	
No	456 (93.3)	38 (8.3)	418 (91.7)	

Source: research data, 2021.

Notes: 1<sup>st</sup> and 5<sup>th</sup> minute Apgar scores of four newborns were not recorded.

\*variables described by n (%); <sup>‡</sup>chi-square test; <sup>†</sup>Fisher's exact test.

cared for the NB at the time of his hospital discharge, which are shown in Table 2. Acute bronchiolitis (22.3%) was the most

prevalent cause. Moreover, respiratory conditions are among the main causes for readmissions in the neonatal period. It

**Table 2** – Distribution of causes for hospital readmissions in the neonatal period, according to the International Classification of Diseases (ICD-10) (n=45). Porto Alegre, Rio Grande do Sul, Brazil, 2019-2020

Causes for hospital readmissions in the neonatal period*	Total sample (n=45)	%
Acute bronchiolitis	10	22.3
Acute nasopharyngitis (common cold)	4	8.9
Unspecified bronchitis	4	8.9
Unspecified acute bronchitis	4	8.9
Unspecified neonatal jaundice	3	6.8
Acute bronchiolitis due to respiratory syncytial virus	2	4.5
Healthy person accompanying sick person	2	4.5
Unspecified acute upper respiratory infection	1	2.2
Acute bronchiolitis due to other specified microorganisms	1	2.2
Unspecified newborn respiratory distress	1	2.2
Unspecified bronchopneumonia	1	2.2
Unspecified viral meningitis	1	2.2
Unspecified bacterial pneumonia	1	2.2
Unspecified bacterial infection	1	2.2
Unspecified septicemia	1	2.2
Other neonatal hypoglycemia	1	2.2
Unspecified urinary tract infection	1	2.2
Hyperosmolality and hypernatremia	1	2.2
Mucopurulent conjunctivitis	1	2.2
Carcinoma in situ of eye	1	2.2
Injury of brachial plexus	1	2.2
Poisoning by unspecified drugs primarily affecting the autonomic nervous system	1	2.2
Person encountering health services in unspecified circumstances	1	2.2

Source: research data, 2021.

\*causes described by n (%)

should be highlighted that in two cases the causes for readmission were due to a condition unrelated to the NB, which were classified as Healthy person accompanying sick person (ICD 10 Z76.3); and one case was classified as Person encountering health services in unspecified circumstances (ICD 10 Z76.9). All NB were discharged after hospital readmission.

Regarding maternal factors associated with the occurrence of NB's hospital readmissions, the distribution of socio-demographic and gestational characteristics of adolescent mothers is shown in Table 3. Only one mother had a twin pregnancy and there was no readmission of their NB. In

the bivariate analysis, no statistically significant association was found between maternal factors and the occurrence of neonatal readmissions (Table 3).

After the bivariate analysis, the maternal and neonatal variables that presented p-value <0.20 were inserted in the multivariate Poisson Regression model, in order to control for possible confounding factors. After adjustment, they maintained a statistical association with the occurrence of neonatal readmissions: prematurity, Apgar at the 1st minute and origin, as shown in Table 4.

**Table 3** – Distribution and association of sociodemographic and gestational variables of adolescent mothers with the occurrence of newborn hospitalization (n=488). Porto Alegre, Rio Grande do Sul, Brazil, 2019-2020

Variables*	Total sample (n=488)	Neonatal readmission		p-value
		Yes (n=45)	No (n=443)	
Maternal age				0.611 <sup>†</sup>
13 to 16 years old	110 (22.5)	12 (10.9)	98 (89.1)	
17 to 19 years old	378 (77.5)	33 (8.7)	345 (91.3)	
Origin				0.081 <sup>†</sup>
City where the hospital is located	365 (74.8)	39 (10.7)	326 (89.3)	
Other cities	123 (25.2)	6 (4.9)	117 (95.1)	
Education level				0.727 <sup>†</sup>
Adequate for age	102 (20.9)	8 (7.8)	94 (92.2)	
Inadequate for age	386 (79.1)	37 (9.6)	349 (90.4)	
Marital status				0.097 <sup>‡</sup>
With partner	30 (6.1)	0	30 (100.0)	
Without partner	458 (93.9)	45 (9.8)	413 (90.2)	
Occupation				0.499 <sup>†</sup>
With occupation	286 (58.6)	29 (10.1)	257 (89.9)	
Without occupation	202 (41.4)	16 (7.9)	186 (92.1)	
Previous pregnancies				0.595 <sup>†</sup>
Primiparous	392 (80.3)	38 (9.7)	354 (90.3)	
Multiparous	96 (19.7)	7 (7.3)	89 (92.7)	

**Table 3** – Cont.

Variables*	Total sample (n=488)	Neonatal readmission Yes (n=45) No (n=443)		p-value
Number of prenatal consultations				0.070 <sup>†</sup>
Adequate for GA	115 (23.5)	16 (13.9)	99 (86.1)	
Inappropriate for GA	374 (76.5)	29 (7.8)	345 (92.2)	
Type of delivery				0.758 <sup>†</sup>
Vaginal	376 (77.0)	36 (9.6)	340 (90.4)	
Cesarean section	112 (23.0)	9 (8.0)	103 (92.0)	
Risk factors				1.000 <sup>†</sup>
Yes	80 (16.6)	7 (8.6)	74 (91.4)	
No	408 (83.4)	38 (9.3)	370 (90.7)	
Childbirth complications				0.801 <sup>‡</sup>
Yes	51 (10.5)	5 (9.8)	46 (90.2)	
No	437 (89.5)	40 (9.2)	397 (90.8)	

Source: research data, 2021.

\*variables described by n (%); <sup>†</sup>chi-square test; <sup>‡</sup>Fisher's exact test**Table 4** – Multivariate analysis\* of maternal and neonatal factors independently associated with the occurrence of newborn's hospital readmission. Porto Alegre, Rio Grande do Sul, Brazil, 2019-2020

Variables	PR <sup>†</sup> (95% CI) <sup>‡</sup>	p-value
<b>Neonatal factors</b>		
Prematurity		
Yes	2.39 (1.19–4.81)	<b>0.015</b>
1 <sup>st</sup> minute Apgar		
< 7	3.81 (1.77–8.23)	<b>0.001</b>
<b>Maternal factors</b>		
Origin		
City where the hospital is located	2.20 (1.00–4.83)	<b>0.049</b>

Source: research data, 2021.

\*Poisson regression; <sup>†</sup>PR = Prevalence Ratio; <sup>‡</sup>95% CI = 95% confidence interval

## DISCUSSION

The results of this study showed that, from the 489 newborns of adolescent mothers, the hospital readmission in the neonatal period was verified in 9.2% of the newborns, a lower prevalence than that found in other Brazilian studies, with percentages of 12.8%<sup>(10)</sup> and 16.5% of neonatal readmissions<sup>(11)</sup>. Neonatal hospital readmission was more prevalent in male NB, with LBW, premature infants and Apgar score at the 1<sup>st</sup> minute <7 and >7 at the 5<sup>th</sup> minute. Often, prematurity and LBW come together. This finding is in line with a study conducted in Ethiopia, where the authors found a significantly low birth weight among premature births<sup>(12)</sup>, recognizing that prematurity associated with LBW is among the main factors that lead to NB morbidity and mortality<sup>(11,13)</sup>.

In this study, after multivariate regression analysis, neonatal readmissions remained associated with prematurity and the Apgar score at 1<sup>st</sup> minute, in which premature babies and babies with Apgar <7 at 1<sup>st</sup> minute of life had a higher prevalence of hospitalization. These results are similar to other findings in the literature, in which the risks of neonatal hospitalization were higher for premature births<sup>(10-11,14-15)</sup>, with LBW and Apgar scores at 1<sup>st</sup> and 5<sup>th</sup> minutes <7<sup>(11,13)</sup>. In the present study, however, Apgar at 5<sup>th</sup> minute <7 was not statistically significant, since only two NB were hospitalized with this condition, showing an improvement in the NB vitality and recovery in relation to the 1<sup>st</sup> minute of life.

Gestational maturity at birth has a big influence on neonatal clinical outcomes, with the occurrence of adverse outcomes for preterm NB increases with the decrease in GA at delivery<sup>(15-16)</sup>. As a result, preterm babies have higher neonatal morbidity, requiring more frequent neonatal intensive care<sup>(15)</sup>, longer hospital stays, as well as being more exposed to hospital readmission, largely due to difficulties with breastfeeding, higher rates of infections and neonatal jaundice<sup>(17)</sup>.

From the premature infants who needed hospital readmission in the neonatal period, 71.4% had late prematurity, reflecting the fact that this is a part of premature infants that is very present in health services and that has been growing in last years, in part due to the increase in obstetric complications rates and elective cesarean sections<sup>(18)</sup>. Therefore, for each additional week that the fetus remains in the uterus, there is an improvement in their development and a reduction in the frequency and severity of neonatal complications<sup>(15-17,19)</sup>.

In the same way that studies conducted in Brazil<sup>(20)</sup>, in-Australia<sup>(15)</sup> and in Saudi Arabia<sup>(16)</sup>, a study developed by the National Institute of Child Health and Human Development

(NICHD) Eunice Kennedy Shriver, in the USA, showed that late preterm infants have an increased risk of morbidity and mortality in the short and long term, when compared with those born at term<sup>(17)</sup>. This is because they are physiologically and metabolically less mature and, therefore, more susceptible to complications after birth<sup>(15)</sup>. In the American study<sup>(17)</sup>, it was also found that late premature birth was associated with greater morbidity even in the absence of any identifiable maternal or fetal risk factors.

Late premature births have been associated with a significant increase in neonatal morbidity and a greater need for hospitalization in this period, mainly due to causes related to respiratory distress, apnea, hypoglycemia, hypothermia, jaundice, feeding difficulties<sup>(16-18)</sup> and seizures<sup>(17)</sup>. In addition, late preterm infants are also at greater risk of hospital readmission after initial discharge and of developing pulmonary disorders during childhood and adolescence<sup>(17)</sup>.

In line with the aforementioned studies, in the present study, respiratory disorders were identified as the main causes of hospital readmissions in the neonatal period, with emphasis on acute bronchiolitis, which had a prevalence of 22.3%. Bronchiolitis is a disease commonly caused by a viral infection of the lower respiratory tract that affects children under two years of age, constituting the main cause of hospitalization among babies in their first year of life. It is characterized by acute inflammation, with edema, increased mucus production, and necrosis of epithelial cells lining the lower airways. Signs and symptoms usually start with rhinitis and cough, which may progress to tachypnea, wheezing, rales, use of accessory muscles, and/or flaring of the nasal ala. The most common etiology of bronchiolitis is respiratory syncytial virus (RSV), and infection by this virus does not confer permanent immunity, with common reinfections throughout life, especially in childhood<sup>(21)</sup>.

Brazilian<sup>(14)</sup> and Australian<sup>(15)</sup> studies corroborate these findings, in which respiratory conditions, such as difficulty and respiratory distress, are among the main causes of admission to neonatal Intensive Care Units (ICU). Moreover, prematurity already increases the risk of the NB to develop some neonatal morbidity, especially respiratory<sup>(16)</sup>.

The development of respiratory disorders, especially in premature NB, is associated to the immaturity of the respiratory system, leading to a delay in fluid absorption, deficiency of surfactant and the consequent impairment of gas exchange<sup>(18)</sup>, causing an increase in risk of respiratory infections and hospital readmissions due to such problems, and many children end up developing long-term chronic respiratory complications<sup>(22)</sup>.



As for maternal factors, despite no statistical association, readmissions in the neonatal period were higher in NB of younger adolescent mothers, aged between 13 and 16 years, with inadequate education level for their age, without a partner and with occupation. What is noteworthy is that from the 488 mothers participating in the study, 374 (76.5%) did not undergo adequate prenatal care for GA. Despite worrying, this finding coincides with studies available in the national<sup>(5)</sup> and international<sup>(6)</sup>, literature, reaffirming the need to (re)think prenatal care practices for adolescent girls, in addition to greater investment in sexual and reproductive health education activities for this group.

Teenage pregnancy is often associated with lower maternal education level, especially in girls who already have a more unfavorable socioeconomic status. With school evasion, the adolescent ends up compromising her future and that of the child, since the low educational level is characterized by a circle of poor education and poverty. In addition, low education level and impaired socioeconomic status increase the risk of adverse outcomes during pregnancy and after the childbirth<sup>(5)</sup>.

Studies conducted in Brazil, without stratifying maternal age, found that low maternal education, inadequate prenatal care<sup>(11,13)</sup> and an increase in the number of medical procedures, such as elective cesarean section, resulted in higher rates of NB's hospitalization<sup>(10)</sup>. Furthermore, newborns of mothers who had four or fewer prenatal consultations had a 20% increased risk of neonatal mortality<sup>(11)</sup>.

In the final analysis of this study, the origin was the only maternal factor that was associated with hospital readmissions, showing that the NB who were hospitalized the most were mothers residing in the city where the hospital was located. Such finding was expected, since, due to geographic reasons, mothers tend to seek care at a hospital in their city of origin. It should also be considered that the NB in this study may have been readmitted to other hospitals or health services in this city, or even to other municipalities, considering that many adolescent mothers who had their NB at the hospital under study live in other cities. Knowing these factors, it is presumed that the prevalence of hospital readmission of newborns of adolescent mothers may be even higher than what was found in this study.

The limitations of this study are the use of data from secondary sources, causing incompleteness, which makes it impossible to stratify certain variables. Another limitation is on the research population, which only investigated the NB of adolescent mothers who gave birth in the hospital under study and do not match all NB who may have been

readmitted to the hospital. Finally, there is little availability of current studies on aspects involving the hospital readmission of NB of adolescent mothers, most of what is available in the literature are not specific to NB of adolescent mothers, making it difficult to make a homogeneous comparison of the results obtained.

## ■ CONCLUSION

The prevalence of hospital readmissions in the neonatal period was 9.2% of NB of adolescent mothers who had delivery in the hospital under study, with a higher proportion of readmissions in male newborns, with LBW, premature, especially late, Apgar at the 1<sup>st</sup> minute <7 and at the 5<sup>th</sup> minute >7. As for neonatal factors, there was an association between prematurity and Apgar at the 1<sup>st</sup> minute of life <7 with the occurrence of the outcome. Regarding maternal factors, only the variable origin obtained a statistical association with neonatal readmissions, showing that NB of mothers from the city where the hospital was located had a higher prevalence of hospital readmissions within 28 days of life.

Different from most research on hospital readmissions in the neonatal period and its possible causes, this study focused on newborns of adolescent mothers, given the vulnerabilities that this population is exposed to and which overlaps with maternal age, considering the entire social, cultural, educational and economic context in which the adolescents are inserted, which can result in adverse outcomes for their newborns.

In addition, another result found in this study and that raises concern refers to the low adherence to prenatal care by pregnant adolescents. Access to prenatal care for this population has proven to be flawed and inadequate, and often without reaching the minimum number of recommended consultations and low compliance with official standards established by the WHO and the Ministry of Health. Thus, it is strongly recommended that health professionals incorporate practices that qualify prenatal care and that promote adherence and approach for adolescents and their support network with health services, in addition to recognizing the importance of effective and adequate follow-up to reduce unfavorable outcomes for maternal and child health.

Thus, the study contributes to the construction and advancement of knowledge, given the need to address the contributing factors for the occurrence of hospital readmissions of NB of adolescent mothers, as well as to identify the possible causes that led these NB to such outcome. This may help in the recognition of vulnerable groups to greater risks of

adverse clinical outcomes and collaborate with the direction of actions that can reduce neonatal morbidity and mortality. The efforts made to identify the association of maternal and neonatal factors with the occurrence of hospital readmission of newborns of adolescent mothers are necessary to monitor and develop public policies and safe and effective interventions to improve the supply and access to maternal and child health services, focusing on perinatal survival, from pregnancy to delivery, birth and the postnatal period.

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Received: 04.05.2022  
Approved: 07.26.2022

**Associate editor:**

Jéssica Teles Schlemmer

**Editor-in-chief:**

Maria da Graça Oliveira Crossetti