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ORIGINAL ARTICLE

Prevalence of rehospitalization of children born prematurely in a hospital in São Paulo

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infant, premature, morbidity, hospitalization.

Abstract

Introduction: The evolution of neonatal care led to the survival of premature newborn, but with a high rate of morbidity. Extreme prematures show respiratory system immaturity with prolonged use of mechanical ventilation and oxygen therapy, developing bronchopulmonary dysplasia and increasing the rate of morbidities after hospital discharge. **Objectives:** To evaluate the rate of readmission of children, who were born prematurely, report the main causes of readmission and compare it with the rate of readmission at term. **Method:** A retrospective observational study, realized in a pediatric unit of a public hospital in São Paulo, from January/2015 to June/2018. Hospital admission records were collected in the neonatal intensive care unit (ICU) database. After readmission was detected, searches for variables of interest were performed in electronic medical records. **Results:** The sample was 78 readmitted children (59 premature and 19 terms). Readmission was 14.5% premature and 7.8% terms. Readmissions varied from 1 to 8 times, mostly in preterm infants, and more frequently in the <1 year age group. The main cause of rehospitalization of premature babies was due to respiratory problems and other reasons in full-term children. The need for ICU and mechanical ventilation was frequent among premature babies (28.8 versus 15.8% and 32.2 versus 15.8%, respectively). Mortality rate: 2.6%. . **Conclusion:** The readmission of premature infants was high, with respiratory problems as the main cause. A special attention to the planning of hospital discharge for preterm infants is perceptible, with guidance to mothers for prevention and interdisciplinary monitoring, attending the needs of this population.

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INTRODUCTION

The term prematurity is defined, according to the World Health Organization (WHO, 2018)[1], as birth below 37 weeks of gestational age (GA). It can be classified as moderate to late preterm (32 to 36 weeks and 6 days of GA), very premature (28 to 31 weeks of GA) and extreme premature (less than 28 weeks of GA)[2].

Apparently, there is a great similarity between late preterm newborns (PTNBs) and term newborns (NTNs), but scientific evidence has shown that PTNBs are physiologically and metabolically immature, characterized, in this case, by birth between the 34th and 36th week and 6 days of pregnancy, reinforcing the idea that they continue to be premature and, consequently, vulnerable[3,5]. The RNT is defined by the birth occurring on the first day of the 38th week to the end of the last day of the 42nd week. The post-term is the birth from the beginning of the first day of the 43rd week[5].

Prematurity is a serious public health problem that affects 15 million children every year in the world[6], and in Brazil 340,000 babies were born prematurely in 2012 alone, indicating a prematurity rate that is twice the rate of some European countries[1,7]. In 2010, 14% of deaths of children under five years of age were due to complications of prematurity[7].

With the evolution of neonatal care in the last two decades, the survival of premature newborns (PTNBs), often at the limit of viability, has been high, with PTNB accounting for more than 70% of all preterm births[4]. The advent of Neonatal Intensive Care Units (NICU), the use of antenatal corticosteroids and surfactant therapy are advances that have greatly contributed in this regard. The greater survival of extremely premature infants seems to have contributed to the increase in morbidity during childhood, with problems related to the respiratory system being the most frequent causes of hospitalization in this population after discharge from the NICU, especially in those who made prolonged use of ventilatory support., evolving with bronchopulmonary dysplasia (BPD). Respiratory problems include coughing and wheezing , which may be associated with abnormal lung function, including airway obstruction and bronchial hyperresponsiveness[8].

The direct and indirect repercussions linked to these conditions have increased the number of neurological sequelae and morbidity that compromise the quality of life of this population, harming the child's future development[9]. Prematurity is the main factor of mortality in the first month of life[10]. From this scenario, some of the issues that cause concern are the frequency of readmissions , the complications resulting from these and the quality of life of babies in the face of the immaturity of the systems, which leads to the need for interdisciplinary monitoring that meets the specific needs of PTNBs. Physiotherapy plays a key role in preventing complications and monitoring the neuropsychosensorymotor development of these PTNBs.

In the first year of life, PTNBs tend to have a higher number of visits without an emergency room and readmissions, compared to PTNBs, especially those with very low birth weight (VLBW)[11]. A study carried out in Italy analyzed 90,545 newborns (NB) in which 0.7% were very premature , 6.8% were moderate and late preterm . Overall, 56% of children had at least one emergency visit and 36% had two or more. As for readmission , 34.3% of very preterm infants and 24.4% of moderate to late preterm infants had at least one readmission . The number of readmissions was 25,336, with a higher frequency in the first year, especially for very preterm and moderate to late preterm infants, having decreased later[12]. A study carried out in Pelotas, in the southern region of Brazil, revealed that of the 271 NB hospitalized in the NICU at birth, 49.1% were premature and, during the first year of life, 557 infants were readmitted , of which 8.4% had less than 34 weeks; 17.1% between 34-36 weeks; 74.5% from 37 weeks ($p < 0.001$)[13]. According to Nunes et al. (2015), 268 infants (under 2 years of age) were hospitalized, of which 23.88% were born prematurely and of these, 13.05% were late preterm[14]. According to Hayakawa et al. (2010), of 53 PTNB at the Regional Hospital of the North of Paraná, 31.3% required readmission in the first 6 months of life. Of the reasons for readmission, the most common were respiratory (56.3%), followed by drug intoxication (6.3%), conjunctivitis with palpebral cellulitis (6.3%), whooping cough (6.3%), correction of inguinal hernia (6.3%), correction of inguinal hernia, ventriculoperitoneal shunt (6.3%) and urinary tract infection (6.3%)[15].

The public hospital in the west of Greater São Paulo, where the study was carried out, is a regional reference for high-risk pregnancies and receives a large percentage of PTNBs and PMBs at birth. The interdisciplinary team actively participates in preparing these families to face adverse situations, which will certainly occur after hospital discharge, however, despite these efforts, the occurrence of readmissions in the first three years of life has been observed. Thus, the main objective of this study was to evaluate the proportion of readmissions of premature children born in this hospital and compare it with the proportion of children born at term. The results of this study may provide subsidies for the redirection of the assistance provided to this population and their families.

METHOD: Retrospective, cross-sectional and analytical study, carried out in a public hospital on the outskirts of São Paulo from January/2015 to June/2018. All records of NBs at risk who were hospitalized at birth in the NICU of the hospital evaluated and who required readmission to the pediatric units of the same institution were included; on the other hand, medical records that showed flaws in the notes were excluded, as it made data collection impossible. The record of admission to the NICU of the hospital under analysis was evaluated. With the registration number of the NBs admitted to the NICU during the study period, a search was carried out in the electronic medical records of their pediatric units, and those

who presented readmission records made up the sample. The variables of interest were collected from the electronic medical records in a protocol form, as follows: registration number, date of birth, GA, BW, diagnoses, use of ventilatory support, days in the ICU, number and causes of readmissions, need for ICU and ventilatory support, total readmission time and outcomes (hospital discharge and deaths). There was approval by the Research Ethics Committee (Opinion 2,550,793). Statistical analyzes were performed using the SPSS program (*Statistical Package for Social Sciences), version SPSS19 IBM SPSS Statistics,* Somers , NY, considering p<0.05 as significant.

RESULTS

During the study period, 726 newborns were hospitalized in the NICU and the sample composition is shown in Figure 1.

The means of GA and BW of PTNBs at birth were 30.8 ± 3.0 weeks and 1510.0 ± 628.9 grams, respectively, while the means of the full-term group were 39.5 ± 0.9 weeks and 3299.5 ± 730.8 grams.

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It was observed that the preterm group was hospitalized more frequently and the number of readmissions in the sample ranged from 1 to 8 times (table 1). Figure 2 demonstrates the prevalence of readmissions in the sample in the preterm and term groups.

Figure 3 shows the causes of readmissions . We can observe that among premature infants, respiratory problems such as bronchiolitis, pneumonia/bronchopneumonia and BPD were the main reasons that led to readmissions . While in the full-term group, other reasons were more prevalent, such as seizures, diarrhea, problems with tracheostomy and gastrostomy, among others. The following table shows the relationship between the ages in the first three hospitalizations, the need for ICU and ventilatory support during the readmission period . Although it did not reach statistical significance, the preterm group required more ICU and ventilatory support.

Table 2 lists the time of use of ventilatory support and hospital stay at birth and during readmission in both groups. It can be observed that preterm infants, at birth, remained longer on ventilatory support and hospitalized, while the average time of readmission was longer in the full-term group. One of the reasons is believed to be chronic non-evolutive encephalopathy (NCNE), which is quite common in children born at term with neonatal asphyxia and who remain on mechanical ventilation (MV) for a long time, awaiting hospital discharge.

Mortality was low in the period evaluated, as only two children (2.6%) died during the period of hospitalization and belonged to the group of children born at term.

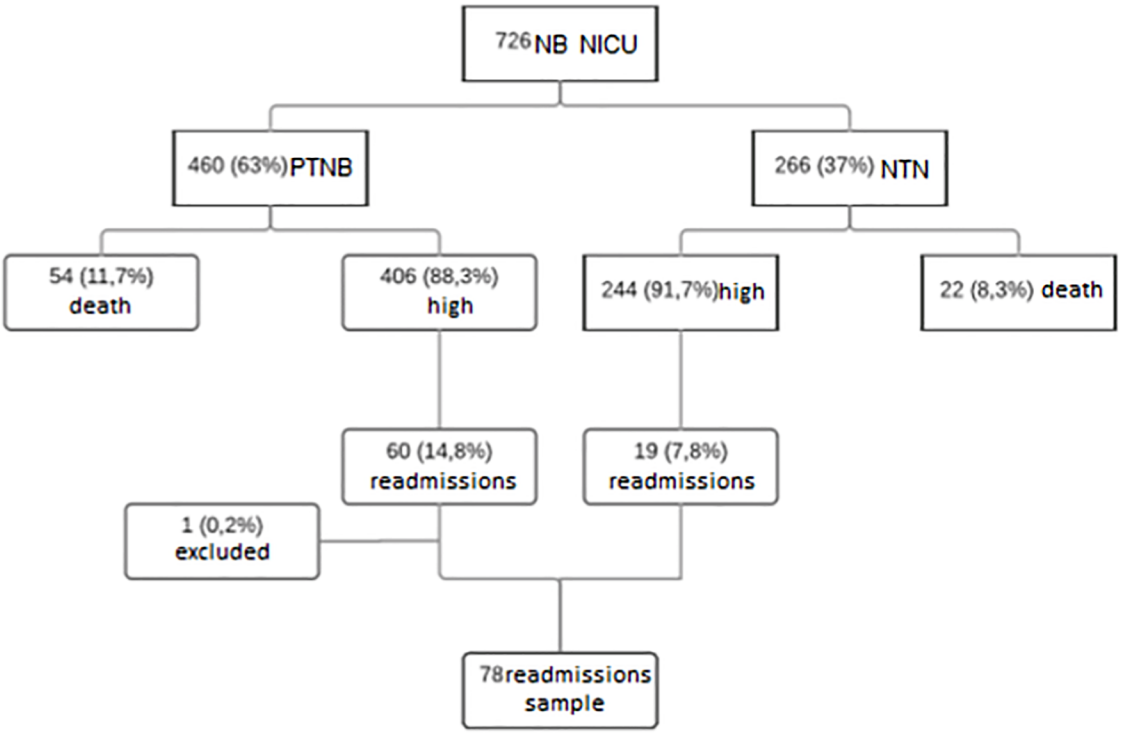

Figure 1. Flowchart of sample composition.

Table 1. General characteristics of the sample - 2018.

Variables	n (%)
Group	
Premature	59 (75.6)
at term	19 (24.4)
Genre	
Feminine	36 (46.2)
Male	42 (53.8)
gestational age	
≤ 30 weeks	25 (32.1)
> 30 weeks	53 (67.9)
birth weight	
≤1000g	20 (25.6)
>1000g	58 (74.4)
Diagnosis at birth	
Respiratory Distress Syndrome	34 (43.6)
Early Respiratory Discomfort	34 (43.6)
Bronchopulmonary Dysplasia	6 (7.7)
Others	44 (56.4)
Age at first admission	
0 - 28 days	6 (7,7)
29 days - 1 year	55 (70.5)
1-2 years	10 (12.8)
>2 years	7 (9)
Age at second hospitalization	
29 days - 1 year	26 (33.3)
1-2 years	5 (6.4)
> 2 years	3 (3.9)
Age at third hospitalization	
29 days - 1 year	10 (12,8)
1-2 years	7 (9)
Number of readmissions	
Only one	43 (55.1)
Two	22 (28.2)
more than two	13 (16.7)
Ventilatory support at birth	74 (94.9)
Intensive Care Unit at readmission	20 (25.6)
Ventilatory support at readmission	22 (28.2)
Mortality	2 (2.6)

DISCUSSION

According to the São Paulo Pediatric Society, prematurity is a serious public health problem that affects 15 million children every year around the world[6]. According to the Ministry of Health (2012)[7], in Brazil, 340,000 babies were born prematurely in 2012 alone, indicating a prematurity rate of 12.4%, double the rate of some European countries[7]. The survival of PTNBs has increased due to the development of technologies in neonatal care, but with a high rate of morbidities in this population. According to a survey by the Ministry of Health, in 2010, complications resulting from prematurity were responsible for 14% of deaths in children under five years of age[7]. Thus, the main objective of this study was to evaluate the prevalence of readmissions of children born prematurely in a public hospital on the outskirts of Greater São Paulo, and to compare with the prevalence of readmissions of children born at term, in addition to evaluating the reasons that led to readmissions.

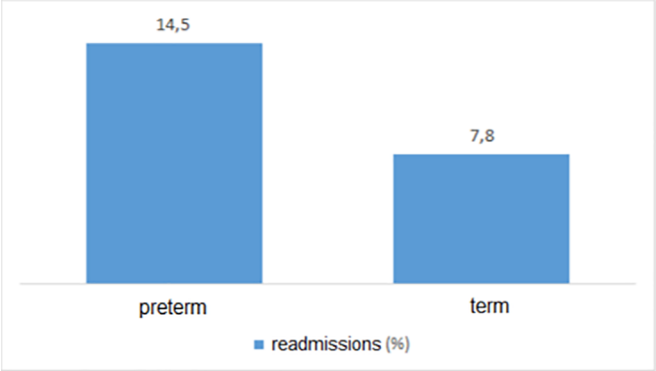

Figure 2. Prevalence of readmissions of preterm and term groups - 2018.

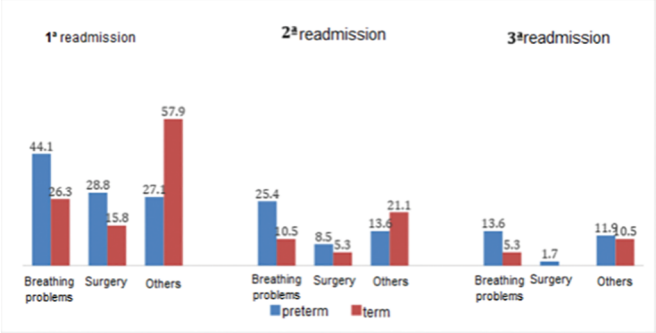

Figure 3. Reasons for readmission of premature and full-term groups - 2018.

Readmission prevalence found in the premature group was 14.5%, while in the full-term group it was only 7.8%. Analyzing the characteristics of the sample of the premature group, we can consider the distribution of readmissions low, the same can be said of the group at term. The prevalences found in the literature are quite varied. In the study by Cuevas et al. (2005), the readmission rate of the group of children born prematurely was 27% (14% born between 29 and 32 weeks and 24% between 33 and 36 weeks), while for those born at term, the rate was 23%[11]. Corchia et al. (2016) found a much higher rate, 34.3% for

Table 2. List of ages, need for ICU and Ventilatory Support at readmission in the premature and full-term groups - 2018.

Variables	groups		*p* value
	Premature	at term	
	n (%)	n (%)	
Age at 1st hospitalization			
Newborn	3 (5.1)	3 (15.8)	
29 days - 1 year	43 (72.9)	12 (63.2)	0.475
12 years	8 (13.6)	2 (10.5)	
>2 years	5 (8.5)	2 (10.5)	
Age at 2nd hospitalization			
29 days - 1 year	22 (37.3)	4 (21.1)	
12 years	5 (8.5)	0 (0.0)	0.042
> 2 years	1 (1.7)	2 (10.5)	
Age at 3rd hospitalization			
29 days - 1 year	9 (15.3)	1 (5.3)	0.119
12 years	7 (11.9)	0 (0.0)	
Intensive Care Unit at readmission	17 (28.8)	3 (15.8)	0.258
Mechanical ventilation at readmission	19 (32.2)	3 (15.8)	0.167

Table 3. Relation of ventilatory support times and length of stay (in days) in the preterm and full-term groups at two moments - birth and readmission - 2018.

Variables	groups		*p* value
	Premature	at term	
	Mean ± DP	Mean ± DP	
Time Ventilatory Support birth	11.5 ± 11.1	6.3 ± 6.7	0.055
Hospitalization time at birth	12.8 ± 7.7	8.3 ± 7.0	**0.025**
Time Ventilatory Support Readmission	7.7 ± 31.8	5.7 ± 24.3	0.840
Readmission time	28.3 ± 66.2	80.0 ± 276.4	0.190

very preterm infants, 24.4% for moderate to late preterm infants and 58.7% for term infants[12]. The study by Santos et al. (2017), found a rate of only 8.4% during the first year of life in children born with a GA less than 34 weeks, 17.1% for those born between 34 and 36 weeks, rising to 74.5% in term cases[13]. Some factors that can determine this wide variation in the distribution of readmissions of preterm infants are environmental conditions (contact with cigarette smoke, mold, animals, pollution), quality of multidisciplinary care during NICU stay (time on MV and oxygen therapy, occurrence of BPD and HPIV) , variation in study methodology and genetic predisposition, which was not the objective of this current study.

The number of readmissions found in the sample ranged from 1 to 8 times and it was observed that preterm infants were more frequently readmitted . Cuevas et al. (2013) reveal that the lower the GA and BW, the greater the time and need for readmission ; their study shows that children born with less than 31 weeks of GA remain hospitalized for 8 times longer and have higher hospital costs when compared to children born at term[11]. According to a study by Corchia et al. (2016), the number of PTNB readmissions was 25,336, with a higher frequency in the first year, especially for very preterm and moderate to late preterm infants, having decreased later[12].

It was observed that the main cause of readmissions in the premature group was due to respiratory problems, with 44.1% in the first hospitalization, 25.5% in the second and 13.6% in the third, while in the full-term group other reasons were more common. prevalent: vomiting, diarrhea, fever to be clarified and problems related to ECNE, such as tracheostomy, gastrostomy and convulsion. These results corroborate the literature. Hayakawa et al. (2010)[15] and Nunes et al. (2015)[14] evaluated the readmission rate of PTNBs, in which the first author found a rate of 56% and the second of 45% of readmissions for respiratory disorders. Er et al. (2017)[16], analyzed late preterm infants and 54% required hospitalization due to pulmonary infection. Ralser et al. (2014)[17], evaluating children aged between 3 and 5 years born prematurely, found the following rates of readmission for respiratory infections: 32% in the 3rd year of life, 34% in the 4th year and 22% in the 5th year.

NB have anatomical and physiological peculiarities that make them susceptible to respiratory distress with respiratory failure. In PTNBs, this fact is even more evident, as the lack of surfactant associated with high compliance of the rib cage, smaller airway caliber and greater resistance of the entire respiratory system, favors the collapse of the alveoli with significant hypoxemia, requiring transfer to the NICU. and need for ventilatory support. The use of MV with high fractions of inspired oxygen for a long time in premature infants favors the development of BPD, providing greater respiratory morbidity, especially in the first year of life[18]. In the group evaluated, 43.6% had respiratory distress syndrome at birth, 94.9% required MV and 7.7% developed BPD, demonstrating the risk profile of the sample. This fact justifies the higher prevalence of readmissions in the first year of life. In table 3, we can see that, in the first three readmissions, the age group in which the children most needed readmission was in the first year of life, with this prevalence being higher in preterm infants, with a statistically significant difference in the second hospitalization (p=0.042).

Despite technological advances increasing the survival of high-risk NBs, the morbidity rates presented remain high. Quality of life and survival in the early years may be limited by respiratory and neurological sequelae, intensified by manipulation and prolonged period of stay in neonatal units. In this sample, 94.9% of readmitted children used ventilatory support at birth, with the group born prematurely using this support longer (p=0.055) and, in addition , the length of stay was longer compared to the full-term group. (p=0.025), as seen in table 3.

Regarding the need for transfer to the Pediatric Intensive Care Unit (PICU) and use of ventilatory support in readmissions , the prevalence found in this sample was low, only 25.6% and 28.2%, respectively. It was observed that the preterm group needed PICU more frequently (28.8 versus 15.8% p=0.258) and ventilatory support (32.2 versus 15.85% p=0167). A study carried out by Sousa et al. (2017)[19], evaluated the readmission rate of children born prematurely in the PICU and found that this distribution is high due to a number of factors: longer length of stay in the NICU, use of ventilatory support at birth, early and prolonged separation from the family, and , consequently, a lower prevalence of breastfeeding. The hospitalization process generates varied impacts on the patient and his family. This can be explained by the intensive environment of the ICU, which, unlike the uterine environment, ideal for fetal growth and development, forces him to face an impersonal environment, full of bright and constant lights, noise, temperature changes and interruption of the sleep cycle. , thus causing discomfort and pain. This means makes the NB use external resources to complete its maturation, making it more susceptible to new hospitalizations.

Regarding the time of ventilatory support in re-admissions , it was found that there was no significant difference between the groups (p=0.840), however there was a greater tendency in the preterm group (31.8 versus 24.3 days). On the other hand, when the length of stay was evaluated, although it also did not reach a significant difference, there was a tendency for a longer time in the full-term group (80 versus 28.3 days); it is believed that one of the reasons why they remain hospitalized for longer is the presence of ECNE, which is quite common in children born at term with neonatal asphyxia and who remain on MV for a long time, awaiting hospital discharge.

In view of the results, we can conclude that the proportion of readmissions of children born premature was low, compared to the literature, and much higher than that of children born at term. The age group that presented the greatest need for readmission, premature or at term, was the one below one year and the main causes in the premature group were respiratory problems. Preterm infants needed PICU and ventilatory support more often, but readmission time was longer in the full-term group. the mortality was low, only 2.6%, occurring only in NB in the full-term group. Therefore, the need for special attention in planning the hospital discharge of PTNBs is evident, with specific guidelines for mothers for prevention and interdisciplinary follow-up that meets the needs of this population. This new reality refers to the need for professional improvement and updating, which includes a humanistic perspective.

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