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Temporal analysis of the birth and hospitalization of premature children in a Brazilian border town

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ABSTRACT

Introduction: Premature birth is a global public health problem responsible for high rates of infant deaths. **Objective:** To analyze the temporal trend of birth and hospitalization of premature children in a Brazilian border town. **Methods:** Cross-sectional study encompassing 951 medical records of premature newborns hospitalized receiving intermediate or intensive during 2013-2017 in Foz do Iguaçu, PR, Brazil. The comparisons involved birth and hospitalization variables distributed over the years, and the level of significance was $p<0.05$. **Results:** The incidence of premature birth was 10.3% and remained stable in the years studied, however, hospitalization increased from 37.7 to 50.1%. Extreme prematurity (12.2 to 9.5%) and complications (46.0 to 21.6%) showed a reduction, and the use of antibiotics increased (50.0 to 75.2%), with a statistically significant difference ($p<0.05$). The time of mechanical ventilation (347.2 to 123.9 h) and length of hospital stay (29 to 24.6 days) decreased in the years studied, with no difference in outcome (hospital discharge or death). The most frequent diagnosis at hospitalization was pulmonary disorders. Problems of infectious origin showed a reduction (7.6% to 3.7%), but in 2014 there was an increase in congenital malformations (11.1%) and 2016 perinatal asphyxia (33.7%). **Conclusion:** Although there was a reduction in extreme prematurity, complications, and days of hospitalization, there was an increase in the number of premature newborns hospitalized, showing the need for (re)planning and (re)organization of the care process.

Keywords: infant, premature; hospitalization; neonatal nursing; border health.

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INTRODUCTION

The World Health Organization (WHO) defines prematurity as birth occurring before 37 gestational weeks[1,2]. It is considered a public health problem because it causes high rates of infant morbidity and mortality, being the first cause of death in newborn babies and the second leading cause of death in children under five years of age[3]. Brazil ranks tenth among the countries where most premature children are born[4], its rate is 11.7% of total births and the world rate is 11.1%[5].

The fragility of preterm newborns and the increased morbidity require their hospitalization soon after birth[6], considering the need for specialized care for their survival[7]. However, the care provided during this period can bring serious risks to babies, leading to illness and death as a result of their greater vulnerability and susceptibility to

infections, aggravated by excessive handling and the prolonged period of hospitalization in the Neonatal Intensive Care Unit (NICU)[5].

Thus, the importance of quality prenatal follow-up is pointed out, since it refers to an opportune moment to prevent preterm birth, considering the alterations of greater occurrence in pregnancy, such as premature rupture of membranes and maternal infections[8]. And even in the face of its inevitability, the delivery must happen as close to term and under the best conditions, ensuring safety for a healthy birth[8]. And in the hospitalization of premature babies, efficient technologies and specialized assistance are required, as well as the humanization of assistance, seeking to value the recovery of the child's health, the formation, and maintenance of the bond, and understanding it as an integral part of care, to ensure the family's preparation and safety for care after discharge to the home[9].

A time-series study conducted in southern Brazil identified that although mortality among children born prematurely has been declining, this population segment still contributes to more than half of infant deaths, related especially to low family income[10].

Considering the risks that premature birth can trigger, this study proposal is justified by seeking to identify the (in)evolution of prematurity and the need for hospitalization for this segment in a Brazilian triple border municipality, considering that early birth may become a problem for the immediate health of the baby, a risk for family formation and community organization. And because it is a vulnerable scenario for belonging to a border region, health promotion and disease prevention may be compromised, considering the high population mobility in these regions, leading to unattended prenatal care and health follow-up of the prematurely born child[11,12].

Based on the above, the objective of this study was to analyze the temporal trend of birth and hospitalization of preterm infants in a Brazilian border municipal.

METHODS

This is an analytical, cross-sectional, quantitative study, with retrospective data collection, carried out in the municipality of Foz do Iguaçu-PR, southern Brazil, which belongs to the triple border, together with Ciudad del Este (Paraguay) and Puerto Iguaçu (Argentina).

The data sources were electronic medical records from the Medical and Statistical Archive System of the Hospital Ministro Costa Cavalcante, the only hospital that provides high-risk pregnancy and neonatal care to the cities of the ninth Health Care Region of the State of Paraná: Foz do Iguaçu, Medianeira, Matelândia, Itaipulândia, São Miguel do Iguaçu, Missal, Santa Terezinha de Itaipu, Serranópolis do Iguaçu, and Ramilândia. Besides serving these cities, the hospital also assists pregnant women from neighboring countries (Paraguay and Argentina), who spontaneously seek Brazilian health services, as well as pregnant women who are part of local tourism, Foz do Iguaçu's main economic activity.

This hospital has a NICU, a neonatal intermediate care unit (NIMCU), and a Kangaroo Unit. In these spaces, mothers can stay with their premature child during the daytime, except in the NICU, in which the mother can only enter the sector at times defined by the institution.

The study included all medical records of children born at less than 37 weeks gestational age, who were born in the aforementioned hospital and remained hospitalized in NICU or NIMCU between 2013 and 2017. The medical records of premature infants who remained hospitalized after the proposed period for data search were excluded. Thus, 951 records of premature children were part of the study.

Data collection was performed in 2017 and 2018 by a nurse with professional experience in neonatology and a nursing undergraduate student. A structured instrument was used, organized with the following variables: year of birth, maternal age, and nationality, number of pregnancies, prenatal consultations, maternal complications, Gestational Age (GA) type of childbirth, 1st and 5th minute Apgar score, birth weight, number of days of hospitalization, complications during hospitalization, invasive procedures required, use of antibiotics, and outcome (discharge, death, and transfer). It is noteworthy that the complications were identified from the medical evolution described in the medical record.

For data analysis, comparisons were made of the variables of birth and hospitalization of preterm infants distributed by year of occurrence. Frequencies, measures of central tendency, the chi-square test, and the Kruskal Wallis test were used. The p-value was considered statistically significant <0.05. Data analysis was performed using the SPSS 23.0 program.

This study was reviewed and approved by the Research Ethics Committee of the Universidade Estadual do Oeste do Paraná, under opinion number 2,009,310/2017, and met the standards of the Brazilian Resolution 466/2012 regarding research with human beings.

RESULTS

In the five years 2013-2017, there were 21,360 births, of these 2,195 (10.3%) with a GA of fewer than 37 weeks, and 951 (43.3%) were hospitalized, and these children were included in this research and had their records investigated.

Table 1 shows that in the years 2014 and 2017, there was a higher number of births, with statistically significant results (p=0.005). Preterm birth showed no significant difference, while hospitalization showed ascendancy among preterm infants, with significant results (p=0.001) in the years 2016 and 2017.

Table 2 shows a statistical difference between GA (p<0.015), with a slight tendency to reduce extreme prematurity (< 28 weeks) and increase moderate prematurity (32 and 33 weeks and 6 days). Furthermore, there was a reduction in complications in the hospitalization period of preterm infants with age (p<0.001), and an increase in the use of antibiotics (p<0.001), without statistical differences regarding the outcome.

Table 3 shows that there were no differences regarding birth weight (p=0.067), weight at hospital discharge (p=0.062), and length of hospital stay of preterm infants (p=0.480). However, important differences were observed regarding the time of Invasive Mechanical Ventilation (IMV) (p<0,001) and Noninvasive Mechanical Ventilation (NMV) (p<0,001).

Table 1: Analysis of general births, preterm births, and hospitalized preterm infants in a border municipality from 2013 to 2017. Foz do Iguaçu, PR, Brazil.

Year	General Births*		Premature		Hospitalized premature infants	
	n	%	n	%	n	%
2013	4223	19.8	393	9.3	148	37.7
2014	4381	20.5	466	10.6	204	43.8
2015	4168	19.5	450	10.8	176	39.1
2016	4158	19.5	443	10.6	201	45.4
2017	4430	20.7	443	10.0	222	50.1
Total	21360	100.0	2195	10.3	951	43.3
p-value **	0.005		0.145		0.001	

*Births in the institution.**Chi-square test for proportion.

Table 2: Analysis of variables of birth, interventions in the neonatal unit, and outcome by year, in the period from 2013 to 2017. Foz do Iguaçu, PR, Brazil.

Variables	2013		2014		2015		2016		2017		p
	n	%	n	%	n	%	n	%	n	%	
Sex											
Female	72	49.0	101	49.8	85	48.3	96	47.8	103	46.4	0.933*
Male	75	51.0	101	49.8	91	51.7	104	51.7	118	53.1	
Undefined	-	-	1	0.5	-	-	1	0.5	1	0.4	
Birth Weight											
≤ 1,000g	22	14.9	31	15.2	36	20.4	31	15.4	23	10.4	0.357*
1,001-1,500g	32	21.6	43	21.1	29	16.5	43	21.4	57	25.7	
1,501-2,499g	83	56.1	111	54.4	90	51.1	105	52.2	115	51.8	
2,500-3,999g	11	7.4	19	9.3	21	11.9	21	10.4	25	11.3	
≥ 4,000g	-	-	-	-	-	-	1	0.5	2	0.9	
GA**											
< 28 weeks	18	12.2	30	14.7	33	18.7	24	11.9	21	9.5	0.015#
28-31 weeks	41	27.7	45	22.1	35	19.9	60	29.8	52	23.4	
32-33 weeks	47	31.6	63	30.9	40	22.7	48	23.9	82	36.9	
34-36 weeks	42	28.4	66	32.3	68	38.6	69	34.3	67	30.2	
1st minute Apgar											
< 7	48	32.7	80	39.6	71	40.8	71	35.5	79	35.6	0.518*
≥ 7	99	67.3	122	60.4	103	59.2	129	64.5	143	64.4	
5th minute Apgar											
< 7	16	10.9	19	9.4	22	12.6	24	12.0	23	10.4	0.806*
≥ 7	131	89.1	183	90.6	152	87.4	176	88.0	199	89.6	
Antibiotics											
Yes	74	50.0	129	63.2	116	65.9	120	59.7	167	75.2	0.001#
No	74	50.0	75	36.8	60	34.1	81	40.3	55	24.8	
Complications											
Yes	68	45.9	95	46.6	65	36.9	79	39.3	48	21.6	0.001#
No	80	54.1	109	53.4	111	63.1	122	60.7	174	78.4	
Disposal											
Medical discharge	116	78.4	157	77.0	133	75.6	164	81.6	172	77.5	0.867*
Death	30	20.3	46	22.5	41	23.3	37	18.4	48	21.6	
Transfer	2	1.3	1	0.5	2	1.1	-	-	2	0.9	

*Fisher's exact test; # Chi-square test.**GA - Gestational Age.

Table 4 shows the predominance of pulmonary problems as a diagnosis in the hospitalization of premature babies in all the years studied. It is important to highlight that problems of infectious origin, although not significant, showed a reduction in the five years studied (7.6 to 3.7%), and in 2014 there was an increase in congenital malformations (11.1%), and in 2016 in perinatal asphyxia (33.7%).

Table 3: Variables related to the hospitalization of the premature newborn distributed by year, in the period from 2013 to 2017. Foz do Iguaçu, PR, Brazil.

	Valid	Average	Median	DP	Minimum	Maximum	p*
Birth weight (grams)							
2013	118	1844.6	1832.5	493.4	720	3295	
2014	158	1888.7	1922.5	522.5	700	3490	
2015	135	1922.7	1930.0	531.7	600	3500	0.067
2016	164	1875.9	1822.5	592.4	715	4555	
2017	174	1928.1	1852.5	623.6	810	5380	
Weight at hospital discharge (grams)							
2013	118	2010.4	1900.0	422.7	850	5140	
2014	155	2011.9	1908.0	331.8	1570	3325	
2015	134	2040.1	1966.5	314.3	1205	3790	0.062
2016	164	2058.5	1940.0	363.6	1630	4290	
2017	174	2079.7	1972.5	423.2	1400	4825	
IMV**(hours)							
2013	43	347.2	120	558.1	24	2640	
2014	59	238.8	96	356.1	24	1728	
2015	37	197.8	72	230.8	24	912	<0.001
2016	57	231.6	96	352.0	24	1968	
2017	129	123.9	48	183.3	24	1056	
NMV*** (hours)							
2013	26	116.3	72	125.7	24	648	
2014	28	79.7	72	46.2	48	216	
2015	29	70.3	48	61.8	24	360	<0.001
2016	20	72.0	48	44.7	48	240	
2017	69	55.7	48	19.9	24	120	
Length of hospitalization (days)							
2013	118	29.0	20	32.5	2	268	
2014	158	25.6	16	24.7	2	120	
2015	135	23.8	15.0	24.5	1	154	0.480
2016	164	25.0	16.5	23.0	2	116	
2017	174	24.6	19	19.8	2	85	

* Kruskal-Wallis test, ** Invasive Mechanical Ventilation; *** Noninvasive Mechanical Ventilation Mechanical

Table 4: Distribution of medical diagnoses in the hospitalization of the premature newborn distributed by year, in the period from 2013 to 2017. Foz do Iguaçu, PR, Brazil.

Diagnoses on admission	2013		2014		2015		2016		2017		p*
	n	%	n	%	n	%	n	%	n	%	
Lung problems	144	60.8	200	63.3	174	55.8	194	39.6	222	68.3	0.001
Infectious problems	18	7.6	18	5.7	12	3.8	15	3.1	12	3.7	0.062
Congenital malformations	15	6.3	35	11.1	17	5.4	15	3.1	10	3.1	0.001
Perinatal Asphyxia	41	17.3	54	17.1	61	19.6	165	33.7	57	17.5	<0.001
Small for gestational age	0	0.0	0	0.0	36	11.5	64	13.1	9	2.8	0.001
Chromosomal abnormalities	1	0.4	3	0.9	3	1.0	10	2.0	6	1.8	0.034
Metabolic problems	4	1.7	2	0.6	3	1.0	7	1.4	0	0.0	0.366
Neurological problems	4	1.7	0	0.0	3	1.0	6	1.2	2	0.6	0.535
Hematological problems	1	0.4	0	0.0	0	0.0	12	2.4	3	0.9	0.002
Cardiologic problems	9	3.8	2	0.6	2	0.6	2	0.4	1	0.3	0.508
Other	0	0.0	2	0.6	1	0.3	0	0.0	3	0.9	0.187
Total	237	100	316	100	312	100	490	100	325	100	

*Chi-square test for proportion.

DISCUSSION

In the five years studied, there was no significant increase in premature births; however, hospitalization was on the rise. It is necessary to consider that the cause of prematurity is multifactorial, and its reduction is linked to assistance to pregnant women in poor conditions, maternal age below 16 years or above 40 years, malnutrition, smoking, acute or chronic disease of the mother, black race, multiple pregnancies, polyhydramnios, previous premature births, uterine malformations and absence of prenatal care or poor quality of prenatal care[13]. Thus, it is inferred that in the scenario under study, actions related to risk identification and the entire care process, promotion, prevention, and treatment, are extremely relevant to reducing the incidence of preterm birth.

Other important aspects were observed, such as extreme prematurity, complications during hospitalization, duration of IMV/NMV use, and length of hospital stay showed an important reduction, but with an increase in antibiotic use.

These results corroborate other studies, which have shown that the highest prevalence of prematurity nowadays occurs in pregnancies between 32 and 36 weeks[5,14]. Considering the physiological immaturity of the premature newborn and the possible intercurrences and iatrogenies resulting from hospitalization[11], when the increase in GA is identified, it is possible to correlate it with the reduction of hospitalization time and also with complications related to hospitalization, considering that the longer the time the baby is in the womb, the better it will be formed, and consequently, it will reduce the complications that may arise at birth, making it possible to reduce in-hospital time.

One study draws attention to the presence of complex morbidities during hospitalization, such as patent ductus arteriosus, intracranial hemorrhage, and sepsis, the latter being recorded as the main complication of premature babies, and affecting more than 30% of hospitalized children, significantly influencing the length of hospital stay, since most babies with this diagnosis may be hospitalized for an average of 40 days[15]. It is worth noting that in this study, infectious problems showed a slight tendency to decrease.

Another finding in this study was the decrease in the time of use of IMV and NMV. Researchers have associated excessive use of IMV with pulmonary changes, with opacity as the complication most commonly found on chest radiographs[16].

Children born with a lower GA have greater pulmonary dysfunctions, considering the anatomical-physiological immaturity of the respiratory tract. If on the one hand there is a need for IMV/NMV, on the other hand, prolonged ventilation time is associated with high morbidity and mortality in the neonatal period, since excessive exposure may result in unintentional damage, including upper airway injury, nosocomial infection, pneumonia, bronchopulmonary dysplasia, and also tends to worsen the prognosis for neuropsychomotor development[17,18].

The increased use of antibiotics observed in this study corroborates scientific evidence that shows a future post-antibiotic era, in which mild infections will again cause serious consequences due to their incorrect and abusive use, also increasing levels of resistance to the point of making their clinical use unfeasible. Thus, it becomes relevant to reevaluate the care and therapeutic routines, in addition to encouraging the conscious and precise use of antibiotics in neonatology[19].

Concerning the diagnoses during the hospitalization of premature babies, respiratory problems were the most frequent in all years. It is worth pointing out that babies need at least 23 to 35 weeks gestational age to have a respiratory function (with surfactant production), and in the occurrence of birth before the period for pulmonary formation, the newborn may suffer complications and need ventilatory support in the first days of life, thus justifying the incidence of this diagnosis among premature babies[15].

Nevertheless, other diagnoses showed an increase in certain years in the municipality studied, such as 2014 the high rate of congenital malformations and 2016 of perinatal asphyxia, presenting similarities with Latin American countries, such as Peru, about perinatal asphyxia among premature babies[20], and also with other Brazilian regions, where it portrays congenital malformation as the third cause of death in premature babies[21].

A study showed that a large part of preterm births may be avoidable when there is adequate assistance to pregnant women through quality prenatal consultations, starting in the first trimester of pregnancy to provide effective monitoring of the maternal-infant segment, with laboratory and imaging tests, to identify and treat early complications inherent to pregnancy[22].

The increase in the hospitalization of premature babies reflects the disqualification of care during pregnancy and birth. In border regions, such as the one studied, the problem that converges this situation may be related to the population's demand for care beyond what is expected, which despite the efforts to improve health care, obstacles still prevent the implementation of an effective network of services, including obstetrics and neonatology services[23-25]. The main difficulties involve the programming of health promotion and disease prevention actions, due to differences in the health policies of the countries involved and the lack of human and structural resources for integrated health actions, especially for the most vulnerable segments[12].

In addition, other barriers can weaken maternal and child health care, which involves the geographical distance to get care, the need for persuasion of individuals to bypass the health system in favor of care on the Brazilian side of the border[11], the ethnic diversity, and languages present in these territories[26].

Research conducted in Foz do Iguaçu, Brazil showed that to get the health care they need, individuals seek strategies to cheat the health system, omitting that they live in the neighboring country of Paraguay, for fear of receiving inferior care to Brazilians or

having their right denied - thus, being doubly unassisted; added to the search for obstetric services late, to avoid the denial of care[11]. The cost of this behavior is high for the public system, especially because there is misinformation regarding the reproductive and gestational history, and this omission of important information for health professionals compromises the active search in case of grievances[11,27].

To improve this context, integrated health policies are needed that work in practice, and that do not leave pregnant women, regardless of their nationality, helpless in the gravitic puerperal process[25].

Another important aspect of the care of hospitalized preterm infants is the challenges faced by the professionals themselves in neonatal units, since the health team, especially the nursing team, must be trained to provide integral care to preterm infants and their families, respecting cultural and individual aspects, to develop culturally congruent care, since the essence of families must be present throughout the care process[28,29].

Investing in the technical qualification of professionals who are on the front line of high-risk maternal and child care is extremely important, to provide better conditions for the binomial so that they evolve positively. Therefore, primary level care through the Family Health Strategy is fundamental, since studies prove the need for quality and timely prenatal care to prevent preterm birth, and to follow up on their growth and development after hospital discharge[8,12].

The assistance to newborns at risk with technical-scientific knowledge, quality, and humanization is essential and requires planning and organization, considering the challenges to perinatal care, to ensure a safe and healthy birth, especially in more vulnerable regions.

In conclusion, the increase in the hospitalization of premature newborns in a border municipality, even with the reduction of extreme premature birth, the occurrence of complications, and the length of hospitalization, shows the need for (re)planning and (re)organization of the care process, especially in prenatal care and at the time of birth.

The limitations identified in this study refer to the incompleteness of the data, considering that a retrospective search was conducted. Thus, it is necessary to develop new studies that address the theme in border regions, to broaden the discussions and joint actions to improve public policies and maternal and child health care.

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