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NEONATAL DEATH IN PUBLIC MATERNITY OF REFERENCE: ASSOCIATED FACTORS

Óbito neonatal em maternidade pública de referência: fatores associados

Muerte neonatal en maternidad pública de referencia: factores asociados

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ABSTRACT

Objective: to investigate maternal and neonatal factors associated with neonatal deaths in a reference maternity hospital in southwestern Maranhão. **Method:** quantitative, observational retrospective study, with documental analysis in medical records. Medical records of 677 neonates born in a hospital in southwest Maranhão, in 2016 were selected. Results: of the 677 medical records of admitted newborns, there were 14.2% of deaths and 85.8% of discharges, prematurity was the diagnosis among 42.4%, followed by 41.9% of respiratory disorders. The adjusted analysis of the model showed that neonatal death was associated with height <35cm (OR: 38.40; p<0.001) and 35-39cm (OR: 6.65, p<0.002), head circumference <22 cm (OR: 38.58; p<0.002) and Apgar in the 5th. minute <3 (OR: 5.91; p<0.001). **Results:** Of the 677 medical records of newborns admitted, there were 96 deaths (14.2%) and 581 discharges (85.8%), with prematurity being the most frequent diagnosis 287 (42.4%), followed by respiratory disorders 284 (41 , 9%). The adjusted analysis of the model showed that neonatal death was associated with height <35cm (OR: 38.40; p <0.001), height of 35-39cm (OR: 6.65, p <0.002), head circumference <22 cm (OR: 38.58; p <0.002) and Apgar in the 5th. minute <3 (OR: 5.91; p <0.001). **Conclusion:** prematurity and respiratory disorders were the main causes of hospitalization. There is a need to review access to health services, as well as the implementation of qualified interventions in prenatal care, childbirth and birth.

DESCRIPTORS: Newborn; Infant Mortality; Intensive care units; Risk factors.

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RESUMO

Objetivo: investigar os fatores maternos e neonatais associados aos óbitos neonatais em maternidade de referência no sudoeste maranhense. **Método:** estudo retrospectivo observacional, quantitativo, com análise documental em prontuários. Selecionaram-se prontuários de 677 neonatos nascidos em estabelecimento hospitalar no sudoeste maranhense, no ano de 2016. **Resultados:** dos 677 prontuários de recém-nascidos admitidos, ocorreram 14,2% de óbitos e 85,8% de altas, a prematuridade foi o diagnóstico entre 42,4%, seguido de 41,9% de distúrbios respiratórios. A análise ajustada do modelo apontou que o óbito neonatal esteve associado à estatura <35cm (OR:38,40; p<0,001) e de 35- 39cm (OR:6,65, p<0,002), perímetro cefálico <22 cm (OR:38,58; p<0,002) e Apgar no 5º. minuto <3 (OR:5,91; p<0,001). **Conclusão:** a prematuridade e os distúrbios respiratórios foram as principais causas de internação. Há necessidade de rever o acesso aos serviços de saúde, assim como a implementação de intervenções qualificadas no pré-natal, parto e nascimento.

DESCRITORES: Recém-nascido; Mortalidade neonatal; Unidades de terapia intensiva neonatal; Fatores de risco.

RESUMEN

Objetivo: investigar los factores maternos y neonatales asociados a las muertes neonatales en una maternidad de referencia en el suroeste de Maranhão. **Método:** estudio retrospectivo cuantitativo, observacional, con análisis documental en historias clínicas. Se seleccionaron las historias clínicas de 677 neonatos nacidos en un hospital del suroeste de Maranhão en 2016. **Resultados:** de las 677 historias clínicas de recién nacidos ingresados, hubo 14,2% de muertes y 85,8% de altas, la prematuridad fue el diagnóstico entre 42,4%, seguido por 41,9% de los trastornos respiratorios. El análisis ajustado del modelo mostró que la muerte neonatal se asoció con altura <35cm (OR:38,40; p<0,001) y 35-39cm (OR:6,65, p<0,002), circunferencia de la cabeza <22 cm (OR:38,58; p<0,002) y Apgar en la 5ª. minuto <3 (OR: 5.91; p<0.001). **Conclusión:** la prematuridad y los trastornos respiratorios fueron las principales causas de hospitalización. Es necesario revisar el acceso a los servicios de salud, así como la aplicación de intervenciones cualificadas en la atención prenatal, el parto y el parto.

DESCRIPTORES: Recién-nacido; Mortalidad neonatal; Unidades de cuidados intensivos neonatales; Factores de riesgo.

INTRODUCTION

The global neonatal mortality rate has fallen from 36.7 in 1990 to 17.7 in 2018 per 1,000 live births[1] especially in sub-Saharan Africa and Ethiopia.[2] Neonatal mortality accounts for almost 70% of deaths in the first year of life and adequate care for the newborn (NB) has been one of the challenges to reduce infant mortality rates in Brazil, where the neonatal mortality rate has reduced from 11.2 in 2010 to 8.0 in 2018.[3]

Such reduction is due to the implementation of public policies aimed at poverty reduction, fertility, and female education among others. However, monitoring neonatal mortality remains a priority,[4] since 45% of deaths in children under 5 years of age occur in the neonatal period[1] and almost 70% of deaths in the first year of life[6] and in 99% of cases, they occur in low- and middle-income countries.[5]

It is estimated that in Brazil each year 300,000 infants require help to initiate and maintain breathing at birth, and about 25,000 very low birth weight preterm infants require ventilatory assistance and, consequently, the support that the neonatal intensive care unit (NICU) provides to prevent neonatal death.[7] Neonates are among a variable and unpredictable population class, where basic care can be difficult to manage, such as pain relief, feeding and breathing.[5]

NICUs focus on saving and/or prolonging the lives of NBs at risk of death, with prematurity being the most common cause (80%) of hospitalization and deaths in the NICU,[1,4] followed by other causes such as post-maturity, low birth weight,[8,9] congenital malformations, fetal distress, birth trauma, infections, and asphyxia.[2,4] The neonatal vitality index, Apgar, with a score < 6 indicates depressed vitality, and may be caused by maternal fever in labor, congenital infections, perinatal asphyxia, malformations, premature birth, and chorioamnionitis.[10]

Several studies point out that the quality of assistance to pregnant women, through timely diagnoses and successful interventions during prenatal, childbirth, and puerperium are determinants for health promotion and prevention of morbidity and mortality of the mother and NB, especially related to assistance to the neonate in NICUs.[7,11–12]

Moreover, regional inequalities arising from differences in development are considered a challenge to be overcome. From this perspective, knowing and monitoring causes of deaths and factors associated with neonatal mortality in Brazilian locations, with emphasis on avoidability, represent important steps, since they allow the construction of sensitive indicators to the quality of health care, mobilize research apparatus to elucidate the deaths and raise executions for their mitigation.[6,13]

There is a shortage of ICU beds in Brazil,14 including for children born before 37 weeks and presenting severe clinical conditions or requiring observation. Data from the Brazilian Ministry of Health (MSB) show that the number of NICU beds in the municipality where the study was carried out is 71 beds, and that in the hospital under investigation 63 beds are available.[15]

Thus, the objective was to investigate maternal and neonatal factors associated with neonatal deaths in a reference maternity hospital in southwestern Maranhão.

METHOD

This is a retrospective observational study with a quantitative approach, with documentary analysis of medical records, conducted at the NICU of a public hospital in Imperatriz, southwest of Maranhão, a regional reference in maternal and child care.

In the year of the study, 2016,7,426 deliveries occurred, being,3,912 normal deliveries and 3,514 cesarean sections. However,1,106 of the RNs were preterm between 30 to 37 weeks gestation, 112 were preterm < 30 weeks, 147 postterm, > 41 weeks and 6 days;870 NBs weighed < 2,500 g. Of this total number of deliveries,7,263 were born alive and 200 (3%) were stillborn.1,033 (12%) mothers were aged 12 to 17 years and 438 (6%) > 35 years.

The inclusion criteria were the records of newborns born in the same hospital who required admission to the NICU and were admitted alive to the NICU between January 1 and December 31, 2016; the records of newborns from other hospitals were excluded.1,000 NBs were admitted to the NICU during the study period, regardless of the time of birth or admission to the NICU, and 323 (24%) were excluded for having records with incomplete data. The research was conducted between January and June 2017 through a previously prepared standardized form, containing data related to maternal characteristics (maternal age, whether normal delivery or cesarean section) and aspects of the NB (gender, gestational age, birth weight, height, head circumference, Apgar).

The risk factors considered in the analysis were: birth weight (<1,000g / 1,000-1,499g / 1,500-2,499g / 2,500-3,499g / >3. 500g), gestational age (GA) (<30 weeks / 30-37 weeks / 38-42 weeks / > 42 weeks), sex (male / female), type of delivery (C-section / vaginal), diagnosis (Prematurity / low birth weight, respiratory failure, anoxia, sepsis, intestinal obstruction, Myelomeningocele / hydrocephalus, Syphilis, Neonatal jaundice, Shock, metabolic disorder, heart disease, seizure, malformation), Apgar score (<3, 4-7, 8-10), maternal age (<19, 20-30, 31-40, >40), height <35, 35-39, 40-46, 46-50, >500), head circumference (HC) (<22, 22-30, 31-40, >40).

After checking for errors and inconsistencies, descriptive analysis was performed using absolute and relative frequencies for all socio-demographic and clinical variables in relation to the outcome (discharge/death).

To quantify the association between exposure (socio-demographic and clinical variables) and outcome (response variable), simple and multiple logistic regression models were used, since the response was binary ("discharge", "death"). For the selection of the main risk factors, the univariate logistic analysis (unadjusted) was initially performed considering as selection criteria all the variables that presented a p value <0.20. Subsequently, multivariate logistic regression (adjusted) was performed with these selected variables to estimate the odds ratios, also known as odds ratio (OR), with confidence intervals of 95% and a significance level of 5% ($p < 0.05$).

All data were tabulated in Excel 2016 spreadsheet and the tests performed in IBM SPSS 24.0 program.

This research complied with the ethical precepts of Resolution 466/12 and, since it was a study that used secondary data, it did not require approval from the Research Ethics Committee.

RESULTS

Of the 1,000 NBs admitted to the NICU during the study period, 677 records that met the inclusion criteria were included for analysis. In the descriptive statistical analysis of discharges and deaths according to maternal and neonatal variables, 581 were discharged (85.8%) and 97 died (rate 14.2% / 1,000 live births). The mean maternal age of NBs who died was 24.1 years, most neonatal deaths were 56 females (58%), and most were cesarean sections 60 (62%). Although most NBs who died had a birth weight between 2,500 and 3,499 g, compared to the discharged NBs, 41.9% of deaths had a weight < 1,000 g, as well as shorter stature <35 cm (70.6), head circumference <22 cm (81.8), and Ápgar <3 (34.9). Among the factors associated with neonatal deaths in both unadjusted and adjusted analysis were stature between < 35cm (OR: 38.40; p<0.001), stature between 35-39 cm (OR: 6.65, p<0.002, BW < 22cm (OR: 38.58; p<0.002), 5th minute Apgar <3 (OR: 5.91; p<0.001), however birth weight <1. 000g (OR: 6.58; p<0.001) and BW 22-30 cm (OR: 2.06, p<0.002), were statistically significant only in the unadjusted analysis.

Among the causes of admission to the NICU, prematurity was the most frequent diagnosis 287 (42.4%), followed by respiratory disorders 284 (41.9%), the other diagnoses (15.7%) were less frequent (neonatal sepsis, metabolic disorders, malformation, cardiopathies).

Regarding maternal characteristics, it was observed that the mothers had a mean age of 24.1 years, and 44 (14.3%) had mothers aged 20 to 30 years; 9 (28.1%) of the babies who died were older than 42 weeks of gestation; 60 (14.9%) of the deaths were the result of cesarean sections. Considering the deaths among newborns, 56 (14.4%) were female, 18 (41.9%) weighed less than 1,000g, 12 (70.6%) had stature less than 35 cm, 9 (81.8%) had head circumference less than 22 cm, 29 (34.9%) had Apgar scores in the 5th minute of life less than 3 (Table 1).

Table 1 – Descriptive statistics of discharges and deaths according to maternal and neonatal variables. Reference hospital, southwest maranhense, 2016

	High n (%)	Death n (%)
Maternal Age (years)		
<19	177 (26)	29 (14)
20-30	264 (86)	44 (14)
31-40	127 (86)	21 (14)
>40	127 (80)	3 (20)
Gestational Age (weeks)		
<30	300 (88)	41 (12)
30-37	176 (88)	25 (12)
38-42	81 (79)	22 (21)
>42	23 (72)	9 (28)
Type of delivery		
Normal delivery	236 (86)	37 (14)
Cesarean section	344 (85)	60 (15)
Gender		
Female	332 (86)	56 (14)
Male	248 (86)	41 (14)
Birth Weight (g)[b]		
<1.000	25 (58)	18 (42)
1.000-1.499	76 (80)	19 (20)
1.500-2.499	228 (90)	25 (10)
2.500-3.499	187 (87)	28 (13)
>3.500	64 (90)	7 (10)
Height (cm)[c]		
<35	5 (29)	12 (71)
35-39	65 (71)	27 (29)
40-45	195 (91)	19 (9)
46-50	219 (87)	33 (13)
>50	96 (94)	6 (6)
Head circumference (cm)		
<22	2 (18)	9 (82)
22-30	162 (87)	39 (19)
31-40	403 (90)	47 (10)
>40	13 (87)	2 (13)
Apgar		
<3	54 (65)	29 (35)
4-7	327 (86)	53 (14)
8-10	199 (93)	15 (7)
Total	581 (86)	97 (14)

[a]n (%): number and percentage; [b](g): grams; [c]cm: centimeters
Source: research data, 2016

In the unadjusted analysis, it was observed that gestational age >42 weeks (28.1%; OR: 2.86; 95% CI: 1.24-6.61; p <0.014), birth weight < 1. 000g (41.9%; OR: 6.58; 95% CI: 2.45-17.68; p <0.001), height <35cm (70.6%; OR: 38.40; 95% CI: 10.16-145.18; p <0.001), height 35-39cm (29.3%; OR: 6.65; 95% CI: 2.60-16.00; p <0.001), head circumference <22cm (81.8%; OR: 38.58 8.09-183.93; p <0.002), head circumference of 22 to 30cm (19.4%; OR: 2.06; 95% CI: 1.30-3.28; p <0.002), Apgar score at the 5th. minute Apgar score <3 (34.9%; OR: 5.91; 95% CI: 2.74-12.79; p <0.001), were associated with neonatal deaths (Table 2).

Table 2 – Unadjusted analysis of factors associated with neonatal deaths. Reference hospital, southwest maranhense, 2016

VARIABLES	Death (%)	OR (IC95%)	p-value
Maternal Age			
<19 years	14,1	1,00	
20-30 years	14,3	1,02 (0,61-1,69)	0,947
31-40 years	14,2	1,01 (0,55-1,85)	0,976
>40 years	20,0	1,52 (0,41-5,74)	0,532
Gestational Age			
<30 weeks	12,0	1,00	
30-37 weeks	12,4	1,04 (0,61-1,77)	0,887
38-42 weeks	21,4	1,99 (1,12-3,52)	0,119
>42 weeks	28,1	2,86 (1,24-6,61)	0,014
Type of delivery			
Normal delivery	13,6	1,00	
Cesarean section	14,9	1,61 (0,94-2,75)	0,084
Gender			
Female	14,2	1,00	
Male	14,4	1,01 (0,61-1,66)	0,976
Birth Weight			
<1.000g	41,9	6,58 (2,45-17,68)	<0,001*
1.000-1.499g	20,0	2,29 (0,90-5,78)	0,081
1.500-2.499g	9,9	1,00 (0,41-2,42)	0,996
2.500-3.499g	13,0	1,37 (0,57-3,29)	0,482
>3.500g	9,9	1,00	
Height			
<35 cm	70,6	38,40 (10,16-145,18)	<0,001*
35-39 cm	29,3	6,65 (2,60-16,00)	<0,001*
40-45 cm	8,9	1,56 (0,60-4,03)	0,360
46-50 cm	13,1	2,41 (0,98-5,94)	0,056
>50 cm	5,9	1,00	
PC (head circumference)			
<22 cm	81,8	38,58 (8,09-183,93)	0,002*
22-30 cm	19,4	2,06 (1,30-3,28)	0,002*
31-40 cm	10,4	1,00	
>40 cm	13,3	1,31 (0,29-6,03)	0,720
5th minute Apgar score			
<3	34,9	5,91 (2,74-12,79)	<0,001*
4-7	13,9	1,66 (0,87-3,17)	0,121
8-10	7,0	1,00	

95%CI: 95% confidence interval; OR: odds ratio; *: statistically significant.
Source: Survey data, 2016

After model adjustment, only stature <35 cm (OR: 22.29; 95% CI: 3.75-132.61; p<0.001), stature 35-39 cm (OR: 5.34; 95% CI: 1.45-19.67; p<0.01), head circumference <22 cm (OR: 16.53; 95% CI: 1.26-21.60; p<0.03) and 5th minute Apgar score <3 (OR: 5.75; 95% CI: 2.75-12.03; p<0.001) were associated with neonatal death (Table 3). minute <3 (OR: 5.75; 95% CI:2.75-12.03; p <0.001) (Table 3).

Table 3 – Adjusted analysis of factors associated with neonatal deaths. Reference hospital, southwest maranhense, 2016

VARIABLES	Odds ratio	Confidence Interval 95%	p-value
Gestational Age			
<30 weeks	1,01	0,33-3,10	0,99
30-37 weeks	1,29	0,38-4,40	0,69
38-42 weeks	1,03	0,33-3,16	0,96
>42 weeks	1,00	-	-
Birth Weight			
<1.000g	0,81	0,21-3,18	0,76
1.000-1.499	0,89	0,27-3,00	0,85
1.500-2.499	1,45	0,50-4,26	0,50
2.500-3.499	1,15	0,44-3,03	0,77
>3.500	1,00	-	-
Height			
<35 cm	22,29	3,75-132,61	0,001*
35-39 cm	5,34	1,45-19,67	0,01*
40-45 cm	2,31	0,73-7,33	0,16
46-50 cm	3,47	1,30-9,29	0,11
>50 cm	1,00	-	-
PC (head circumference)			
<22 cm	16,53	1,26-21,60	0,03*
22-30 cm	1,52	0,23-10,29	0,67
31-40 cm	1,39	0,20-9,66	0,74
>40 cm	1,00	-	-
Apgar 5th. minute			
<3	5,75	2,75-12,03	0,001*
4-7	1,71	0,91-3,19	0,09
8-10	1,00	-	-

95%CI: 95% confidence interval; OR: odds ratio; *: statistically significant.
Source: Survey data, 2016

DISCUSSION

In the present casuistic, the mortality rate found in the NICU was 14.2% (142 per 1,000 live births). A higher rate was found in Ethiopia (5.7%, 57 per 1,000 live births)2 and Burkina Faso (5.3%, 53 per 1,000 live births),[16] lower than the findings in Cameroon (15.7%, 157 per 1,000 live births).[17] Although the causes of neonatal mortality differ among developed countries, which are usually due to unavoidable causes such as malformations, compared to developing countries, where the causes are usually preventable, such as asphyxia at birth, infections, and prematurity.[18] In a study in Jordan, the mortality rate was higher among preterm infants (123 per 1,000 live births) compared to term infants (4 per 1,000 live births).[19]

In this study, the main cause of admission to the NICU was prematurity and respiratory disorders, 42.3% and 41.9% of cases, respectively. These events are considered risk factors for early neonatal mortality.[8,16–17]

Most neonatal deaths occur in the first week of life, usually due to complications occurring during pregnancy and delivery,[4,17] particularly in the first 24 hours of life, especially due to problems during labor, delivery, immediate postpartum, and care practices.[2]

A study conducted in the United States in 2013 pointed out that the five leading causes of neonatal mortality were congenital malformations (20%), prematurity/low birth weight (18%), sudden death syndrome (7%), maternal complications (7%), and accidental injuries (5%).[20]

In Brazil, specifically, the main cause of infant deaths occurring in the first week of life in all regions of the country and the second cause of death is asphyxia/hypoxia, in the North and Northeast Regions, and in the other regions congenital malformations predominate.[21]

As for sex, in this study, there was no statistically significant difference between male and female sex, similar to a study conducted in the city of Cuiabá, Mato Grosso, Brazil.[7] However, in

the multivariate analysis, male sex was considered a risk factor for premature birth,19 which makes it a risk factor for neonatal death.

Birth weight <1,000g showed a statistically significant risk for neonatal mortality. Birth weight <750g significantly increased the risk of mortality.[9,17] The main risk factors associated with low birth weight and neonatal morbidity and mortality are maternal age, education and socioeconomic status, smoking, multiple pregnancies, metrorrhagia in the second and third trimesters, and maternal diseases such as diabetes and hypertension.[7] However, except for maternal age, these factors were not investigated in this study.

The results also showed an association between height and neonatal death; children born with a height < 35 cm and those born with a height of 35 to 39 cm were 22.29 and 5.34 times more likely to die, respectively, when compared to those born with greater height. A study conducted in Florianópolis (SC), Brazil, showed that the average height of children at birth was 39.9 cm,[22] data similar to those found in the present investigation.

With regard to head circumference, in a NICU in the state of Pará with premature newborns, the mean head circumference at birth was 26.2 cm and respiratory distress was the prevalent morbidity.[12] In the present study it was observed that neonates with head circumference < 22 cm had a 16.53 greater chance of death when compared to those born with a head circumference above this.

The statistical regression analysis also showed a significant association of neonatal death with Apgar score. This indicator is used to assess the risk of neonatal morbidity and mortality, and is very useful in verifying the need for neonatal resuscitation.[10]

An Apgar score lower than 7, especially in the 5th minute, increases the chances of neonatal mortality.17 Several studies have shown that different Apgar scores were associated with neonatal death.[23–25]

In our series, it was observed that children born with an Apgar score in the 5th minute of life < 3 were 5.75 times more likely to die when compared to those born with a higher score. The Apgar score < 7, has the risk of developing brain damage, especially if it is < 3 at the 10th minute, has an increased risk of developing cerebral palsy.[10]

As a limitation of this study, the inconsistency of data from patients coming from other facilities is pointed out, because despite there being 1,000 admissions to the HRMI NICU in 2016, it was only possible to collect data from RNs born in the hospital itself (677). It would be important that there was commitment from professionals so that all data were adequate.

CONCLUSION

It was evidenced that prematurity and respiratory disorders were the main causes of admission to the neonatal intensive care unit of the Hospital Regional Materno Infantil de Imperatriz. Furthermore, infants born with stature less than 35 cm, head circumference less than 22 cm, and Hunger Index < 3 at the 5th minute had a higher chance of dying when compared to infants born with greater stature, head circumference and Hunger Index.

As for maternal factors, maternal age or type of delivery were not statistically significant for neonatal death, but children born above 42 weeks had a 2.86 greater chance of dying when compared to children born at another gestational age.

The findings also point to the need for future studies that show how the access to health services happens, as well as the implementation of qualified interventions in prenatal care, deliveries, and birth, in order to avoid episodes of vulnerability and offer appropriate support aimed at the survival of the neonate.

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