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Factors associated with perinatal mortality in a Brazilian Northeastern capital

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Abstract *This study investigated factors associated with perinatal mortality in São Luís, Maranhão, Northeastern Brazil. Data on perinatal mortality were obtained from the BRISA birth cohort and from the Mortality Information System, including records of 5,236 births, 70 of which referred to fetal deaths and 36 to early neonatal deaths. Factors associated with mortality were investigated using a hierarchical logistic regression model, resulting in a perinatal mortality coefficient equal to 20.2 per thousand births. Mothers with low education level and without a partner were associated with an increased risk of perinatal death. Moreover, children of mothers who did not have at least six antenatal appointments and with multiple pregnancies (OR= 9.15; 95%CI:4.08–20.53) were more likely to have perinatal death. Perinatal death was also associated with the presence of congenital malformations (OR= 4.13; 95%CI:1.23–13.82), preterm birth (OR= 3.36; 95%CI:1.56–7.22), and low birth weight (OR=11.87; 95%CI:5.46–25.82). In turn, families headed by other family members (OR= 0.29; 95%CI: 0.12 – 0.67) comprised a protective factor for such condition. Thus, the results indicate an association between perinatal mortality and social vulnerability, non-compliance with the recommended number of prenatal appointments, congenital malformations, preterm birth, and low birthweight.*

Key words *Perinatal mortality, Risk factors, Newborn*

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Introduction

Perinatal mortality comprises the death of a child during pregnancy (fetal mortality) or up to seven days after birth (early neonatal mortality). Fighting perinatal mortality has been a major challenge for the care of pregnant women and their children worldwide, especially in the middle- and low-income countries[1].

In Brazil, regional socioeconomic inequalities influence perinatal mortality rates, which rise as socioeconomic vulnerability increases[2,3]. Moreover, despite its reduction, this mortality indicator decreased slower than other indicators, such as infant mortality[4].

Studies chose perinatal mortality as the most appropriate indicator of the quality of prenatal and neonatal care and health service use[3]. Fails to detect and treat gestational diseases early and prevent complications during pregnancy, childbirth, and the puerperium cause preventable deaths, which contribute to maintain perinatal mortality as a public health issue in Brazil, despite its decreasing rates[5].

Brazil still underreports perinatal deaths. Thus, analyzing this indicator in information obtained in population-based surveys can provide more accurate estimates[6,7]. Moreover, many important variables associated with perinatal mortality remain unavailable, and their study could improve the effectiveness of perinatal and prenatal care policies[8,9]. This explains the low number of Brazilian publications on the factors associated with perinatal mortality. Studies conducted in Brazil show that low socioeconomic status, late maternal ages, low birth weight, and prematurity relate to perinatal mortality[2,10,11]. It remains unclear whether these factors can vary significantly according to local socioeconomic development and health service accessibility, which differ considerably among Brazilian regions[12].

Studying the factors associated with perinatal mortality allows strategies for the more effective reduction of one of the most resilient mortality indicators. Given this context, this study aims to evaluate the sociodemographic factors associated with perinatal mortality in São Luís, Maranhão.

Methods

This is a cross-sectional study, part of a population-based cohort initiated in 2010 entitled "*Fatores etiológicos do nascimento pré-termo e consequências dos fatores perinatais na saúde da criança: coorte de nascimento em duas cidades brasileiras*" (Etiological factors of preterm births and consequences of perinatal factors on children's health: a birth cohort from two Brazilian cities) – BRISA, which analyzes births in São Luís, in the state of Maranhão, and Ribeirão Preto, in the state of São Paulo, Brazil. This study aims to evaluate the perinatal deaths in São Luís identified in the birth cohort.

São Luís is the capital city of the state of Maranhão, inhabited by 1.014.837 citizens in 2010. It is in the northeastern region of Brazil, one of the poorest in the country. Its human development index (HDI) is 0.768, 14th among Brazilian capitals, behind all southern, southeastern, and midwestern capitals of the country[13].

The São Luís birth cohort was conducted from January 1 to December 31, 2010, and included births in both public and private services, whose institutions performed at least 100 deliveries per year. In 2010, 98% of deliveries occurred in hospitals; and only 3.3% of births in the city were excluded from this study. Our sample was systematically stratified by maternity, proportional to the number of deliveries performed. Each surveyed hospital had an initial causal number (drawn from 1 to 3) with a sampling interval of three, i.e., one in three women were interviewed. An interview and birth control form was prepared in which deliveries were registered chronologically and included live and dead newborns. There was a 4.6% loss due to refusals by mothers to participate, or early discharge, resulting in a final sample of 5,236 births[14].

Only newborns whose mothers lived in São Luís in the last three months were included in the sample. In 2010, SINASC (the Information System on Live Births) registered 17,544 live and dead births in São Luís (by place of residence). Thus, our final cohort sample accounted for 29.8% of all deliveries in the city.

Interviews were conducted in the first 24 hours after delivery, based on two standardized questionnaires on the pregnancy, mother, and newborn. Birth weight was obtained from maternal medical records. Gestational age was collected from maternal reports of their last menstrual period and their medical records. Both sources were compared, and mothers were prioritized in case of discrepancies. All questionnaires were applied by trained professionals after the informed consent form was signed.

The dependent variable was perinatal death, defined as fetal or neonatal deaths occurring between 22 weeks of gestation and less than seven

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days of postnatal life[1]. These were identified in the BRISA cohort and confirmed by the 2010 Mortality Information System (SIM). To detect early neonatal mortality, the BRISA and SIM databases were cross-referenced. The Maranhão State Health Department provided the latter upon our formal request. Linkage was used via the Data Link software. To identify perinatal deaths, the information was filtered for age (code < 400) and São Luís (code 211130). After filtering, the data was used to cross-reference the databases (mothers' names, newborns' sex, dates of birth, and birth weight). Subsequently, the software generated a table with possible links to be evaluated. To identify stillbirths, only the age was modified in the filter. Type of death = 1 was reported; the code for fetal deaths in death certificates. Cross-referencing and verification followed the same procedure as that for early neonatal deaths.

SIM registered 398 perinatal deaths in São Luís in 2010. By cross-referencing the databases, 106 perinatal (26.6% of the total in the city), 70 fetal, and 36 early neonatal deaths were identified. Of these, 46 fetal deaths were identified in hospital interviews and, subsequently, 24 by SIM. All 36 early neonatal deaths were identified via the SIM database after the interviews.

Variables were divided into three levels of a hierarchical theoretical model (Figure 1), aiming to prioritize the theoretical plausibility of the complex interrelations between variables and not only the statistical associations among them. Variables were interpreted at their levels, rather than at later ones, to prevent underestimating their effect due to the presence of mediators[15]. In our hierarchical model, outcomes were affected by newborns' biological characteristics (proximal level), which, in turn, were influenced by maternal and reproductive factors (intermediate level), impacted by socioeconomic and demographic variables (distal level).

Socioeconomic and demographic data were included in level 1: newborns' sex, maternal education (0-4 years, 5-8 years, 9-11 years, > 12 years), family income in Reais (divided into tertiles – high, medium, and low), mothers' marital status (with or without a partner), the head of the family (i.e., the one with the highest income: mother, partner, or other), and ethnicity (white or other). The recorded ethnicity was self-reported. Women who were married or living in consensual unions were considered with a partner, whereas those who reported being single, divorced, or widowed, without a partner.

Maternal and reproductive characteristics were included in Level 2 as intermediate variables: smoking during pregnancy (yes or no), maternal age (< 20 years, 20-34 years, and ≥ 35 years), parity (1 delivery, 2-4 deliveries, or ≥ 5 deliveries), previous miscarriages (yes or no), previous preterm births (yes or no), attended prenatal consultations (≥ 6 or < 6), type of delivery (vaginal or cesarean), pregnancy type (single or multiple) and hospital where the delivery occurred (public or private).

Congenital malformations, preterm births, and newborns' birth weight were included in Level 3 as proximal variables. Congenital malformations were reported by the mothers. Newborns under 2500g were classified as low-weight births. Newborns whose gestational ages were under 37 weeks were considered preterm births.

For the statistical analysis, the SPSS 14.0 software was used. After categorizing the variables of interest, data were described via relative and absolute frequencies. Two models were adjusted to associate independent variables with perinatal deaths: a simple logistic regression, and subsequently, a hierarchical one. A 5% significance level was adopted.

The multiple logistic regression analysis analyzed the factors associated with perinatal mortality, with variables inserted in levels following the hierarchical theoretical model. Variables showing a p-value < 0.1 in their level were included in the next level. This strategy was used to verify which variables in the theoretical model were potential mortality predictors since spurious associations may be made, and true associations, diluted by the many variables in the multiple model, leading to imprecise confidence intervals[16]. The clinical and scientific plausibility of the associations found was considered in all stages. The effect of each variable on the outcome was only evaluated at its level for those variables showing a p-value < 0.05.

This study met the fundamental requirements of Resolution No. 196/96 and its complementary ones of the National Health Council, being approved by the Research Ethics Committee in the University Hospital at the Universidade Federal do Maranhão under protocol no. 4771/2008-30.

Results

The perinatal mortality rate in São Luís was 20.2/1000 births, 66% of which were fetal deaths (Table 1).

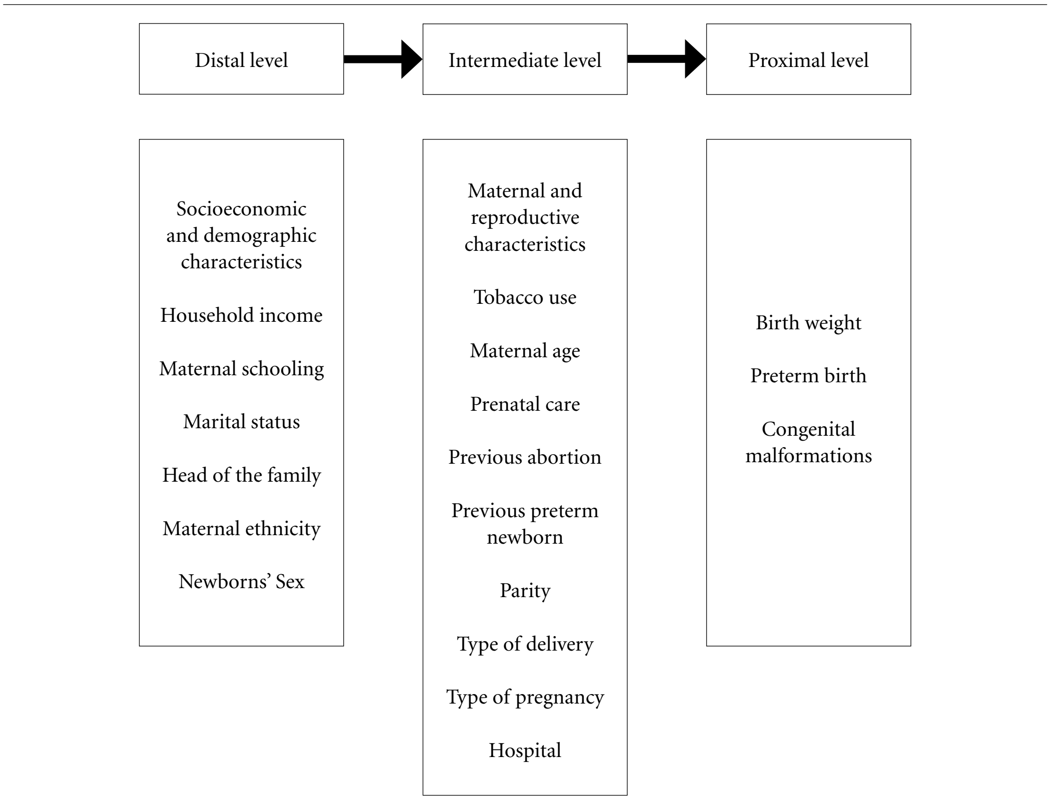

Figure 1. Hierarchical model for the analysis of perinatal mortality.

Source: Authors.

The bivariate analysis shows that chances of perinatal death were lower among families headed by a partner or another family member (Table 2) but higher among women with less than four years of schooling (OR: 4.9; 95% CI: 1.8 – 13.32), without a partner (OR: 2.16; 95% CI: 1.36 – 3.43), and in families whose income were in the medium (OR: 2.75; 95% CI: 1.33 – 5.73), or low tertiles (OR: 2.69; 95% CI: 1.30 – 5.59)

The maternal and reproductive characteristics analyzed show perinatal death was more likely among mothers who smoked during pregnancy (OR: 2.6; 95% CI: 1.24 – 5.46), who attended less than six prenatal consultations (OR: 6; 95% CI: 3.53 – 10.18), had more than five deliveries (OR: 2; 95% CI: 1.23 – 5.77), with multiple pregnancies (OR: 9.6; 95% CI: 5.03 – 18.33) delivered in public hospitals (OR: 5.01; 95% CI: 1.58 – 15.91). On the other hand, mothers who underwent cesarean sections (OR: 0.45; 95% CI: 0.28 – 0.73) (Table 3) experienced perinatal deaths. The bivariate analysis shows that congenital malformations, preterm births, and low birth weights characterized the higher chance of perinatal death (Table 3).

Once adjusted for the variables of each level, the multiple analysis showed that perinatal death was almost four times more likely among newborns of mothers with less than four years of schooling (OR: 3.86; 95% CI: 1.14 – 13.03), and 2.44 times as high for those without a partner (OR: 2.44; 95% CI: 1 – 5.93). Families headed by another family member had a lower chance to experience perinatal death than mother-headed families (OR: 0.29; 95% CI: 0.12 – 0.67).

Children whose mothers attended less than six prenatal consultations (OR: 4.61; 95% CI: 2.43 – 8.74) and with multiple pregnancies (OR: 9.15; 95% CI: 4.08 – 20.53) had a higher chance of perinatal death. The final model showed that congenital malformations (OR: 4.13; 95% CI: 1.23 – 13.82), preterm births (OR: 3.36; 95% CI:

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1.56 – 7.22) and low birth weight (OR: 11.87; 95% CI: 5.46 – 25.82) characterized newborns with a higher chance of perinatal death (Table 4).

Discussion

The perinatal mortality rate in São Luís was 20.2/1000 births, associated with mothers with low educational attainment, heading families, without a partner, who attended less than six prenatal consultations whose children had either congenital malformations, preterm births, or low birth weights.

Our coefficient resembles the average for the Brazilian Northeast (20.9/1000) in 2009, above the national average (17.3/1000), and the developed regions of the country, such as the South (13.9/1000). Other studies observed similar coefficients in other northeastern capitals, such as Recife (16.6/1000)[10] and Salvador (19.2/1000)[2].

Carvalho *et al.*[4] analyzed the changes in infant mortality indicators in the Ribeirão Preto, Pelotas, and São Luís birth cohorts. They showed a significant reduction in the perinatal mortality in Ribeirão Preto (from 42.1/1000 in 1978/79 to 10.6/1000 in 2010) and Pelotas (from 32.2/1000 in 1982 to 18/1000 in 1993). However, more recently, Ribeirão Preto had a lower reduction, and Pelotas, a stagnation. São Luís had a 44.8% reduction in its perinatal mortality coefficient from 1997/98 to 2010, from 36.6 to 20.2/1000 births, the highest perinatal mortality out of the three cities in the last period studied[4]. Thus, despite the reduction, the coefficients remain very high, especially when compared with those from Brazilian southern and southeastern cities, such as Curitiba, São Paulo, and Ribeirão Preto[4,17,18].

We noted that coefficients vary according to socioeconomic development. Underdeveloped African countries, like Ethiopia, have very high perinatal mortality rates (41/1000 births). On the other hand, high-income countries presented rates of around 6/1000 births[19]. These great differences may relate to socioeconomic and health service inequalities, suggesting different accesses to prenatal and perinatal care[19]. Thus, the perinatal mortality rate in São Luís is much higher when compared with that of high-income countries.

We attested the influence of socioeconomic inequalities since mothers with fewer schooling years were more likely to experience perinatal deaths. Kale *et al.*[20] analyzed fetal and neonatal mortality evolution in Rio de Janeiro from 2000 to 2018. They noted that the low-schooling group was the only one with high and increasing mortality rates, evidencing how social inequalities influence healthcare. Low schooling can compromise the acquisition and understanding of important care information, especially about prenatal care. Moreover, women belonging to extreme categories of low schooling form a group with higher concentrations of risk factors as education levels rise[21].

We observed a greater vulnerability to perinatal deaths among mothers heading families and those without partners. These conditions probably expose these women to an overload of domestic functions, childcare, home support, and the lack of emotional support that may entail psychosocial risks[22].

We considered attending less than six prenatal consultations a factor for perinatal mortality. Berhan & Berhan[23] and Wondemagegn *et al.*[24] showed in meta-analyses that women who had adequate prenatal care were less prone to perinatal mortality, were more likely to diagnose early gestational diseases, fetal alterations, and help to reduce the barriers between pregnant women and specialized health services[25]. Moreover, prenatal consultations are learning experiences in which healthcare providers can intervene, disseminating information on risk warnings during pregnancy, adequate postpartum health, and breastfeeding[24]. Thus, adequately developed prenatal care can positively influence maternal

Table 1. Perinatal mortality in São Luís, Maranhão, Brazil, 2010.

Indicators	
Number of births	5,166
Fetal deaths	
Number	70
Coefficient per thousand	13.4
% of perinatal deaths	66
Early neonatal deaths	
Number	36
Coefficient per thousand	7
% of perinatal deaths	34
Perinatal deaths	
Number	106
Coefficient per thousand	20.2
% of perinatal deaths	100
Total number in the city	398
% of the total population	26.6

Source: Authors.

Table 2. Socioeconomic characteristics (level 1) according to perinatal deaths. São Luís, Maranhão, Brasil, 2010.

	Perinatal death				Gross OR
	Yes[b]		No		
	Variables	n	%	n	
Sex[a]					
Female	33	42.31	2.518	49.08	Ref.
Male	45	57.69	2.612	50.92	1.31 (0.84 – 2.07)
Maternal ethnicity					
White	12	14.63	949	18.51	Ref.
Other	70	85.37	4.177	81.49	1.33 (0.72 – 2.45)
Head of the family					
Mother	15	18.29	481	9.44	Ref.
Partner	46	56.1	3.101	60.83	0.48 (0.26 – 0.86)
Other	21	25.61	1.516	29.74	0.44 (0.23 – 0.87)
Household income – (tertile)[a]					
High	10	15.62	1.414	33.56	Ref.
Medium	27	42.19	1.382	32.8	2.76 (1.33 – 5.73)
Low	27	42.19	1.417	33.63	2.69 (1.3 – 5.59)
Maternal education (years of schoolinag)[a]					
> 12	7	8.75	778	15.43	Ref.
9 – 11	41	51.25	2.914	57.81	1.56 (0.7 – 3.5)
5 – 8	23	28.75	1.145	22.71	2.23 (0.95 – 5.23)
< 4	9	11.25	204	4.05	4.9 (1.8 – 13.32)
Marital status					
With a partner	54	65.85	4.138	80.66	Ref.
Without a partner	28	34.15	992	19.34	2.16 (1.36 – 3.43)
Total	82		5130		

[a] Variable with unknown values; b24 perinatal deaths lacking information about independent variables. OR: Odds ratio. Ref.: Category of reference.

Source: Authors.

and child health, increasing newborns' chances of survival[26].

Besides complying with the recommended number of prenatal consultations, other aspects are also important, especially regarding the quality of prenatal care provided. Martins[27], in Belo Horizonte, State of Minas Gerais, showed that failures in prenatal care were among the main causes of perinatal mortality — especially regarding its late beginning; the non-compliance with municipal protocols on consultation frequency; performance of tests, procedures, and recommended referrals; and failure to control diseases and infections during pregnancy. In recent years, Brazil has virtually universalized prenatal care, so we must invest in improving its quality, which might help further reduce perinatal mortality[28].

Multiple pregnancies are also an important risk factor for perinatal mortality. They increase the risk of intrauterine growth restriction, premature membrane rupture, and preterm births, increasing perinatal morbidity and mortality[29,30]. Thus, these pregnancies require careful prenatal monitoring, good-quality delivery care, and timely postnatal support.

This study also associates preterm births and congenital malformations with perinatal mortality. Preterm birth complications are the leading cause of infant mortality worldwide. Respiratory distress syndrome, bronchopulmonary dysplasia, necrotizing enterocolitis, periventricular sepsis, and leukomalacia are some conditions that may compromise the life of newborns who survive preterm delivery, decreasing their chances of survival[31]. A Dutch study found preterm births to be the greatest risk factor for perinatal mortality, followed by congenital abnormalities and intrauterine growth restriction[32]. Brazil must further reduce preterm birth rates, as recent interventions have had a limited influence on re-

Table 3. Maternal, gestational (intermediate level), and neonatal characteristics (proximal level) according to perinatal deaths. São Luís, Maranhão, Brasil, 2010.

Variables	Perinatal death				Gross OR
	Yes[a]		No		
	n	%	n	%	
Tobacco use					
No	74	90.24	4.925	96	Ref.
Yes	8	9.76	205	4	2.6 (1.24 – 5.46)
Prenatal consultations					
≥ 6	18	22.78	3.112	63.89	Ref.
< 6	61	77.22	1.759	36.11	6 (3.53 – 10.18)
Previous miscarriage					
No	59	71.95	4.026	78.48	Ref.
Yes	23	28.05	1.104	21.52	1.42 (0.87 – 2.31)
Previous preterm birth					
No	69	98.57	4.674	92.81	Ref.
Yes	1	1.43	362	7.19	0.19 (0.03 – 1.35)
Parity					
2-4 deliveries	42	51.85	2.521	49.14	Ref.
1 delivery	31	38.27	2.429	47.35	0.77 (0.48 – 1.22)
≥ 5 deliveries	8	9.88	180	3.51	2.67 (1.23 – 5.77)
Maternal age (years)					
20-34	59	71.95	3.779	73.66	Ref.
≥ 35	11	13.41	402	7.84	1.75 (0.91 – 3.36)
< 20	12	14.63	949	18.5	0.81 (0.43 – 1.51)
Type of delivery					
Normal	58	70.73	2.686	52.36	Ref.
Cesarean Section	24	29.27	2.444	47.64	0.45 (0.28 – 0.73)
Type of pregnancy					
Single	70	85.37	5.040	98.25	Ref.
Multiple	12	14.63	90	1.75	9.6 (5.03 – 18.33)
Hospital					
Private	3	3.66	820	15.99	Ref.
Public	79	96.34	4.309	84.01	5.01 (1.58 – 15.91)
Congenital malformation					
No	61	91.04	5.076	99.14	Ref.
Yes	6	8.96	44	0.86	11.35 (4.66 – 27.62)
Premature birth					
No	22	26.83	4.396	85.69	Ref.
Yes	60	73.17	734	14.31	16.33 (9.96 – 26.79)
Low birth weight					
No	17	27.87	4.697	91.77	Ref.
Yes	44	72.13	421	8.23	28.88 (16.35 – 50.99)
Total	82		5130		

Source: Authors.

ducing this indicator. In Europe, some countries have changed the active management of preterm deliveries and improved the quality and efficacy of medical care, increasing survival without increasing hospital morbidity rates[33].

Congenital malformations are the second cause of infant mortality in Brazil, following only preterm births. They cause structural, functional abnormalities, and metabolic disorders, which can provoke miscarriages or preclude postnatal

Table 4. Results of the multiple logistic regression model - factors associated with perinatal mortality. São Luís, Maranhão, Brasil, 2010.

Variables	OR	95% CI
Distal level		
Sex		
Female	Ref.	
Male	1.35	0.8 — 2.28
Head of the family		
Mother	Ref.	
Partner	0.63	0.27 — 1.49
Other	0.29	0.12 — 0.67
Household income – (tertile)a		
High	Ref.	
Medium	2.29	0.98 — 5.31
Low	1.95	0.8 — 4.75
Maternal educational (years of schooling)		
> 12	Ref.	
9-11	1.12	0.42 — 3.02
5-8	1.7	0.57 — 5.04
< 4	3.86	1.14 —13.03
Ethnicity		
White	Ref.	
Other	0.9	0.44 — 1.81
Marital status		
With a partner	Ref.	
Without a partner	2.44	1 — 5.93
Intermediate level		
Smoking during pregnancy		
No	Ref.	
Yes	1.25	0.49 — 3.21
Prenatal consultations		
≥ 6	Ref.	
< 6	4.61	2.43 — 8.74

it continues

Table 4. Results of the multiple logistic regression model - factors associated with perinatal mortality. São Luís, Maranhão, Brasil, 2010.

Variables	OR	95% CI
Previous miscarriage		
No	Ref.	
Yes	1.52	0.84 — 2.75
Previous preterm birth		
No	Ref.	
Yes	0.23	0.03 — 1.71
Parity		
2-4 deliveries	1	
1 delivery	1.64	0.9 — 3.02
≥ 5 deliveries	1.26	0.45 — 3.54
Maternal age (years)		
20-34	1	
≥ 35	2.12	0.92 — 4.86
< 20	0.82	0.38 — 1.77
Type of delivery		
Normal	1	
Cesarean Section	0.62	0.33 — 1.16
Type of pregnancy		
Single	1	
Multiple	9.15	4.08 — 20.53
Hospital		
Private	1	
Public	1.58	0.39 — 6.38
Proximal level		
Congenital malformation		
No	1	
Yes	4.13	1.23 — 13.82
Premature birth		
No	1	
Yes	3.36	1.56 — 7.22
Low birth weight		
No	1	
Yes	11.87	5.46 — 25.82

95% CI: 95% confidence interval; OR: odds ratio. Ref.: Category of reference.

Source: Authors.

lives. Moreover, they may relate to preterm births and low birth weights, increasing the risk of perinatal death[34].

We expected low birth weight to increase perinatal mortality since it is one of its most important determinant factors[10,35]. Low birth weight relates to other clinical risks, such as preterm births and restricted intrauterine growth. Unfavorable socioeconomic conditions and failures in prenatal care may also cause low birth weight[36], increasing the risk of infant mortality[35].

This study's strengths are data from a large, systematic, population-based birth cohort providing information on many variables that could be risk factors for perinatal mortality. As a limitation, we cite the lack of information on 24 perinatal deaths recorded in the SIM database. Moreover, since mothers reported most of the information obtained, there might be a memory bias. The exclusion of maternities with less than 100 births per year from the sample may have led to the underreporting of perinatal deaths. However, we believe this effect is minimal since only 3.3% of deliveries in 2010 in São Luís occurred in these maternities. Our results indicate risk factors for perinatal mortality, one of the most resilient infant mortality indicators. Although the literature reports reduced rates in Brazil and São Luís, we found that the perinatal mortality rate in the city is higher than that of other cities in the country and even higher when compared with the rates in high-income countries. Knowing the factors associated with this indicator may guide public policies seeking more effective actions to reduce perinatal mortality.

We highlight the importance of improving socioeconomic factors (which require structural changes in human and social development), prenatal care, and characteristics of pregnancies and newborns, such as multiple pregnancies, congenital malformations, preterm births, and low birth weight. Therefore, the minimum schedule of prenatal visits must be monitored and be of sufficient quality to ensure early detection of gestational morbidities and congenital malformations. Adequate prenatal follow-ups may intervene in behavioral risk factors, infection control, and maternal morbidities, helping to reduce adverse outcome rates, such as preterm births and low birth weight. Moreover, we must reinforce the need for rational medical interventions to avoid iatrogenic prematurity.

Collaborations

SC Serra and VMF Simões contributed to the conception and study design, data analysis and interpretation, writing and final review. CA Carvalho worked on data analysis and interpretation and in the final review of the article. PCAF Viola, AAM Silva, RFL Batista and EBAF Thomas contributed to the data analysis and interpretation and critically reviewed the article.

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