Cogitare Enfermagem

ORIGINAL ARTICLE

Factors associated with congenital abnormalities in children who have evolved into infant mortality: Brazilian population-based study

HIGHLIGHTS

1. National population study with data from 2011 to 2020.
2. Advanced maternal and cesarean section increase the risk of congenital abnormalities.
3. Teenage and low-educated mothers showed a lower risk.
4. Results support public policies in the context of SUS.

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ABSTRACT

Objective: Identify the factors associated with infant deaths due to congenital anomalies in Brazil between 2011 and 2020. **Method:** Population-based study with data from the Mortality Information System, including all infant deaths due to congenital abnormalities. Maternal sociodemographic variables and fetal, pregnancy, childbirth, and death characteristics were analyzed, adjusting the *Poisson* multiple regression model. **Results:** Increased risk of death from congenital anomaly: maternal age between 35 and 40 years (RR: 1,30; 1,25-1,36) and over 41 years old (RR; 2,03; 1,91-2,16), reside in the Northern regions (RR: 1,29; 1,21-1,37), Northeast (RR: 1,22; 1,16-1,29), Midwest (RR: 1,16; 1,09-1,24) and Southeast (RR: 1,16; 1,10-1,22), birth by cesarean (RR; 1,56; 1,51-1,62) and gestational age between 32 and 36 weeks (RR; 1,18; 1,15-1,23). **Conclusion:** The results show regional inequalities and obstetric factors that influence infant deaths due to congenital abnormalities, pointing to the need for qualified prenatal care.

DESCRIPTORS: Child Health; Congenital Abnormalities; Infant Mortality; Risk Factors; Socioeconomic Factors.

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INTRODUCTION

Congenital abnormalities are structural or functional changes that originate during intrauterine life and can compromise the survival and quality of life of the newborn. Globally, it is estimated that around 300,000 newborns die in the neonatal period due to these conditions[1], which affect approximately 2 to 3% of live births, with variations depending on genetic, ethnic-racial, environmental, and regional factors[2]. In Brazil, the overall prevalence ranges between 2% and 5%, and in 2021, more than 22,000 cases were registered in live births, becoming the second leading cause of death in children under five years old[3].

This is a serious public health problem, especially in middle and low-income countries, where access to early diagnosis, specialized services, and ongoing care is still limited. Cardiovascular malformations, neural tube defects, and gastrointestinal abnormalities are among the most common and are associated with infant mortality[4-5]. Its etiology is multifactorial: between 40% and 60% of cases have unknown causes, and the rest are related to genetic, environmental factors, or the interaction between both[6]. Among the environmental factors are congenital infections, use of teratogenic substances, chronic maternal diseases, low prenatal coverage, and exposure to pesticides[7].

Despite the epidemiological relevance, there is an important gap in national scientific production on the factors associated with infant deaths due to congenital anomalies, with population cuts, disaggregated by maternal, neonatal, and regional characteristics, over an extended period of analysis. Most studies in Brazil are restricted to local or hospital cuts, which limits their generalization and applicability in public policies. In addition, few studies integrate an extended approach to the social determinants of health, as recommended by the World Health Organization (WHO) and the SUS model, which recognizes socioeconomic, regional, and access to services conditions as determinants of health outcomes.

In this sense, this study adopts the social determination of health, which emphasizes that the health-disease process is historically and socially produced, resulting from a set of living and working conditions that determine the form of illness and death in the population[8]. This perspective allows us to understand that the observed inequalities are not just individual differences or isolated risk factors, but the expression of the social, economic, cultural, and political conditions that structure the lives of people, families, and communities.

Thus, this work seeks to identify the factors associated with infant deaths due to congenital anomalies in Brazil between 2011 and 2020. The results are expected to show how these deaths relate to social injustice, offering subsidies for public policies that strengthen health care and, consequently, reduce preventable deaths.

METHOD

This is a descriptive and population-based study, referring to the years 2011 to 2020, using secondary data from the Mortality Information System (SIM), available by the Department of Informatics of the SUS (DATASUS)[9] on infant deaths that occurred in Brazil in the period between 2011 and 2020. The research report was guided by the tool *Strengthening the Reporting of Observational Studies in Epidemiology* (STROBE)[10].

All infant deaths (less than one year) occurring in Brazil between 2011 and 2020 were included, whose basic cause registered in the death certificate corresponded to congenital abnormalities, classified by the codes Q00–Q99 of the ICD-10. The data was obtained by downloading the database directly from DATASUS on March 29, 2021. The SIM presented an incompleteness rate of less than 5.0% in a study conducted with data from 2000 to 2019, a result considered excellent[11]. During the study period, the underlying causes of child death were described according to the International Statistical Classification of Diseases and Related Health Problems - 10th edition (CID-10)[12].

Variables related to maternal characteristics, the baby, pregnancy, delivery, and death were analyzed (Chart 1).

Chart 1. Variables, type, and expression of the maternal characteristics, of pregnancy and delivery, of the fetus, and related to death and the corresponding International Classification of Diseases. Sao Paulo, SP, Brazil, 2011-2020

(continue)

Independent variables	Type	Expression
Motherly characteristics		
Region of residence	Category	North, Northeast, Midwest, South, Southeast
Age (years)	Category	10-19, 20-34, 35-40, ≥41
Schooling (years)	Category	Up to 7, ≥8
Paid Activity	Dichotomy	Yes, no.
Number of living children	Category	0, 1-2, 3-4, ≥5
Number of children killed	Category	0, 1-2, 3-4, ≥5
Features of the fetus		
Sex	Category	Male, Female, Ignored
Race/skin color	Category	White, Brown, Black, Yellow, Indigenous, Ignored
Data on pregnancy and childbirth		
Type of pregnancy	Category	Single, Multiple, Ignored
Type of birth	Category	Vaginal, Caesarean, Ignored
Gestational age	Category	≤21, 22-27, 28-31, 32-36, 37-41, ≥42
Dependent variables		
Data on death and corresponding CIDs		
Congenital abnormalities of the nervous system	Q00-Anencephaly and similar abnormalities, Q01-Encephalocele, Q02-Microcephaly, Q03-Congenital Hydrocephaly, Q04-Other congenital brain abnormalities, Q05-Bifid spine, Q06-Other congenital spinal cord abnormalities, Q07-Other congenital nervous system abnormalities	
Down and Edwards syndrome and other trisomies	Q90-Down syndrome, Q91-Edwards syndrome, Q92-Other autosomal partial trisomies and trisomies not elsewhere classified	
Congenital respiratory abnormalities	Q30-Congenital Anomaly of the nose, Q31-Congenital Anomaly of the larynx, Q32-Congenital Anomaly of the trachea and bronchi, Q33-Congenital Anomaly of the lung, Q34-Other Congenital Anomaly of the respiratory tract	

Chart 1. Variables, type, and expression of the maternal characteristics, of pregnancy and delivery, of the fetus, and related to death and the corresponding International Classification of Diseases. Sao Paulo, SP, Brazil, 2011-2020

(conclusion)

Dependent variables	
Data on death and corresponding CIDs	
Congenital abnormalities of the digestive tract	Q38-Other congenital abnormalities of the tongue, mouth and pharyngeal, Q39-Congenital abnormalities of the esophagus, Q40-Other congenital abnormalities of the upper digestive tract, Q41-Absence, atresia and congenital stenosis of the small intestine, Q42-Absence, atresia and congenital stenosis of the colon, Q43-Other congenital abnormalities of the intestine, Q44-Congenital abnormalities of the gallbladder, gallbladder and liver, Q45-Other congenital abnormalities of the digestive tract
Unspecified congenital abnormalities	Q89- Other congenital anomalies not elsewhere classified.

Source: The authors (2025).

The research on possible factors associated with congenital anomalies death was carried out by adjusting the multiple regression model in response to the *Poisson*, inserting, in the deterministic component of the model, the factors that were significantly associated with the level of *p*-value <0.20 in the bivariate exploration phase. In the multiple regression model, the associations were considered statistically significant if *the p-value was < 0.05*. The analysis was done with the software *Statistical Package for the Social Sciences* (SPSS) 21.

The research was conducted using publicly accessible secondary databases, guaranteeing the confidentiality and anonymity of all participants, in accordance with the recommendations of Resolution 466 of the National Council of Health of December 12, 2012, so no referral was necessary for evaluation by the Research Ethics Committee.

RESULTS

In the period between 2011 and 2020, 196,744 children died in Brazil. More than half of these deaths occurred in the Southeast and Northeast regions: 125,322 (63.6%); among the maternal characteristics, 124,110 (63.1%); mothers were in the age group between 20 and 34 years of age; 132,816 (67.5%) had eight years or more of schooling; and 112,424 (57.1%) had no paid work (Table 1).

The majority of deaths, 177,142 (90.0%), occurred in single pregnancies, and those born by cesarean surgery, 98,589 (50.1%). Term pregnancies totaled 62,698 (31.9%) of the cases. In relation to fetal data, male sex predominated 109,138 (55.5%) and brown race/color 97,960 (49.8%) (Table 2).

Table 1. Maternal characteristics of cases with congenital malformations that have evolved into child death. Sao Paulo, SP, Brazil, 2011-2020

Motherly characteristics	n (%)
Region of residence	
Southeast	73,330 (37.3)
Northeast	51,992 (26.4)
South	29,684 (15.0)
North	24,104 (12.3)
Midwest	17,634 (9.0)
Age (years)	
10-19	41,791 (21.2)
20-34	124,110 (63.1)
35-40	25,062 (12.7)
≥41	5,781 (3.0)
Schooling (years)	
Up to 7	63,928 (32.5)
≥8	132,816 (67.5)
Paid work	
Yes	84,320 (42.9)
No	112,424 (57.1)
Live children	
0	54,185 (27.5)
1-2	105,920 (53.8)
3-4	27,187 (13.8)
≥5	9,452 (4.9)
Dead children	
0	148,947 (75.7)
1-2	43,950 (22.3)
3-4	3,215 (1.6)
≥5	632 (0.4)

Source: Authors (2025).

Table 2. Fetal, pregnancy, and childbirth characteristics of cases with congenital malformations that have evolved into child death. Sao Paulo, SP, Brazil, 2011-2020

(continue)

Fetal characteristics	n (%)
Sex	
Female	87,606 (44.5)
Male	109,138 (55.5)
Race/skin color	
White	90,851 (46.2)
Brown	97,960 (49.8)
Black	4,923 (2.5)
Indigenous	2,657 (1.3)
Yellow	353 (0.2)

Table 2. Fetal, pregnancy, and childbirth characteristics of cases with congenital malformations that have evolved into child death. Sao Paulo, SP, Brazil, 2011-2020

(conclusion)

Fetal characteristics	n (%)
Gestational age (weeks)	
≤21	12,562 (6.4)
22-27	49,799 (25.3)
28-31	31,168 (15.8)
32-36	38,732 (19.7)
37-41	62,698 (31.9)
≥42	1,785 (0.9)
Type of pregnancy	
Unique	177,142 (90.0)
Multiple	19,602 (10.0)
Type of birth	
Vaginal delivery	98,155 (49.9)
Caesarean	98,589 (50.1)

Source: The authors (2025).

The congenital abnormalities as the primary cause of death were responsible for 18,297 (9.3%) of deaths, with the majority being related to the nervous system (38.0%), followed by the unspecified congenital abnormalities (26.4%), Down syndrome *and Edwards* syndrome and other trisomies (19.0%) and respiratory and digestive malformations, respectively, 16.0% and 0.6% (Data not shown in the table).

The maternal, gestational and childbirth variables associated as a risk factor for child death from congenital abnormalities in bivariate analysis were: Maternal age between 35 and 40 years and over 40 years (RR 1.37; 95% CI 1.32; 1.43) and (RR 2.31; 95% CI 2.18; 2.46), respectively; reside in the North regions (RR 1.37; 95% CI 1.30; 1.45), Northeast (RR 1.25; 95% CI 1.18; 1.31), Central-West (RR 1.22; 95% CI 1.14; 1.21; 1.30) and Southeast of the country (RR 1.13; 95% CI 1.07; 1.10); birth through cesarean surgery (RR 1.19; 95% CI 1.15; 1.23) (RR 1.18; 95% CI 1.12; 1.24).

Protection factors for child death from congenital abnormalities in bivariate analysis were mothers aged between 10 and 19 years (RR; 0.83; 95% CI 0.80; 0.86), who had up to seven years of study (RR; 0.87; 95% CI 0.84; 0.90), without paid work (RR; 0.96; 95% CI 0.93; 0.99), with three or four dead children (RR; 0.89; 95% CI 0.78; 1.00) and five or more dead children (RR; 0.73; 95% CI 0.54; 0.98) and whose pregnancies were multiple (RR; 0.36; 95% CI 0.33; 0.39).

Gestational age ≤21 weeks, between 22 and 27 weeks of gestation, between 32 and 36 weeks or more than 42 weeks of gestational age was also associated as a protective factor for child death from congenital abnormalities, respectively (RR; 0.29; IC95% 0.27; 0.32), (RR; 0.18; IC95% 0.16; 0.19), (RR; 0.56; IC95% 0.80; 0.85) and (RR; 0.68; IC95% 0.58; 0.79), as well as with the occurrence of death outside the hospital environment (RR; 0.44; IC95% 0.40; 0.48), male (R; 0.95%; 0.66% and IC95% 0.80; 0.77; 0.95% for congenital proteases).

Table 3. Bivariate associations by simple Poisson regression with relative risk (RR) and confidence interval (IC95%) to explain child death from congenital abnormalities. São Paulo, SP, Brazil, 2011-2020

(continue)

Variables	RR	(IC95%)	p-value
MATER			
Age (years)			
20-34	1.00		
10-19	0.83	0.80-0.86	**<0.001**
35-40	1.37	1.32-1.43	**<0.001**
≥41	2.31	2.18-2.46	**<0.001**
Schooling			
Up to 7 years	0.87	0.84-0.90	**<0.001**
≥8 years	1.00		
Paid work			
No	0.96	0.93-0.99	**0.022**
Yes	1.00		
Region			
North	1.37	1.30-1.45	**<0.001**
Northeast	1.25	1.18-1.31	**<0.001**
Central West	1.22	1.14-1.30	**<0.001**
Southeast	1.13	1.07-1.10	**<0.001**
South	1.00		
GESTATION AND PART			
Number of living children			
0	1.00		
1-2	1.19	1.15-1.23	**<0.001**
3-4	1.18	1.12-1.24	**<0.001**
≥5	1.03	0.95-1.11	0.481
Number of children killed			
0	1.00		
1-2	0.97	0.93-1.00	0.067
3-4	0.89	0.78-1.00	**0.049**
≥5	0.73	0.54-0.98	**0.038**
Single pregnancy			
No	0.36	0.33-0.39	**<0.001**
Yes	1.00		
Gestational age (weeks)			
≤21	0.29	0.27-0.32	**<0.001**
22-27	0.18	0.16-0.19	**<0.001**
28-31	0.56	0.53-0.58	**<0.001**
32-36	1.25	1.21-1.29	**<0.001**
≥42	0.68	0.58-0.79	**<0.001**
37-41	1.00		
Type of birth			
Caesarean	2.19	2.13-2.26	**<0.001**
Vaginal delivery	1.00		

Table 3. Bivariate associations by simple Poisson regression with relative risk (RR) and confidence interval (IC95%) to explain child death from congenital abnormalities. São Paulo, SP, Brazil, 2011-2020

(conclusion)

Variables	RR	(IC95%)	p-value
GESTATION AND PART			
Hospital occurrence			
No	0.44	0.40-0.48	**<0.001**
Yes	1.00		
KIDS			
Sex			
Male	0.82	0.80-0.85	**<0.001**
Female	1.00		
Race/skin color			
Brown	0.78	0.76-0.81	**<0.001**
Black	0.63	0.56-0.70	**<0.001**
Yellow	0.83	0.59-1.19	0.310
Indigenous	0.66	0.57-0.77	**<0.001**
White	1		

Legend: RR=Relative Risk; 95% CI=95% Confidence Interval.

Source: Authors (2025).

In the analysis of multiple regression, independently, the following variables were associated as risk factors for child death due to congenital abnormalities: maternal age between 35 and 40 years and over 41 years, respectively (RR; 1.30; 95% IC 1,25; 1.36) and (RR; 2.03; 95% IC 1,91; 2.16), residing in the regions North, Northeast, Midwest and Southeast of the country, respectively (RR; 1.29; 95% IC 1,21; 1.37, (RR; 1.22; 95% IC 1,16; 1.29), (RR; 1.16; 95% IC 1,09; 1.24) and (RR; 1.16; 95% IC 1,10; 1.22), born by cesarean surgery (RR; 1.56; 95% IC 1,51; 1.23), and with gestational age between 32 and 36 weeks (RR; 1.18; 95% IC 1,15; 1.23).

Independently, the protection factors for child death from congenital abnormalities were: children of mothers aged between 10 and 19 years (RR; 0.95; 95% CI 0.91; 0.99), who had up to seven years of study (RR; 0.92; 95% CI 0.88; 1.00), who did not have paid work (RR; 0.97; 95% CI 0.94; 1.00; 95% CI 0.47; 0.55) and had five or more live children (RR; 0.85; 95% CI 0.79; 0.93), respectively, who had one or two dead children (RR; 0.96; 0.95% CI 0.93; 1.00) and whose multiple pregnancies were 0.5 (RR; 0.64; 1.00) and whose multiple pregnancies were 0.5 (RR; 0.84; 95% CI 0.95; 0.85; 0.95; 0.33; 0.33; 0.33; RR; 22; 0.33; R; 22; R; 32; R; 32; R; 0.18;

The occurrence of death outside the hospital environment (RR; 0.42; 95% CI 0.36; 0.46) and among those of male sex (RR; 0.83; 95% CI 0.80; 0.85) were also independently associated as a protective factor for child death from congenital abnormalities (Table 4).

Table 4. Multiple associations by simple Poisson regression with Relative Risk (RR) and Confidence Interval (IC95%) to explain child death from congenital abnormalities. São Paulo, SP, Brazil, 2011-2020

(continue)

Variables	RR	(IC95%)	p-value
MATER			
Age (years)			
20-34	1.00		
10-19	0.95	0.91-0.99	**0.018**
35-40	1.30	1.25-1.36	**<0.001**
≥41	2.03	1.91-2.16	**<0.001**
Schooling (years)			
Up to 7 years	0.92	0.88-0.95	**<0.001**
≥8	1.00		
Paid work			
No	0.97	0.94-1.00	**0.042**
Yes	1.00		
Region of residence			
North	1.29	1.21-1.37	**<0.001**
Northeast	1.22	1.16-1.29	**<0.001**
Central West	1.16	1.09-1.24	**<0.001**
Southeast	1.16	1.10-1.22	**<0.001**
South	1.00		
GESTATION AND PART			
Number of living children			
0	1.00		
1-2	1.01	0.97-1.05	0.607
3-4	0.97	0.92-1.02	0.422
≥5	0.85	0.79-0.93	**<0.001**
Number of children killed			
0	1.00		
1-2	0.96	0.93-1.00	**0.042**
3-4	0.92	0.81-1.04	0.176
≥5	0.82	0.61-1.11	0.206
Single pregnancy			
No	0.51	0.47-0.55	**<0.001**
Yes	1.00		
Gestational age (weeks)			
≤21	0.33	0.30-0.36	**<0.001**
22-27	0.18	0.17-0.20	**<0.001**
28-31	0.54	0.51-0.57	**<0.001**
32-36	1.18	1.15-1.23	**<0.001**
≥42	0.75	0.64-0.88	**<0.001**
37-41	1.00		
Type of birth			
Caesarean	1.56	1.51-1.62	**<0.001**
Vaginal delivery	1.00		

Table 4. Multiple associations by simple Poisson regression with Relative Risk (RR) and Confidence Interval (IC95%) to explain child death from congenital abnormalities. São Paulo, SP, Brazil, 2011-2020

(conclusion)

Variables	RR	(IC95%)	p-value
GESTATION AND PART			
Hospital occurrence			
No	0.42	0.36-0.46	**<0.001**
Yes	1.00		
KIDS			
Sex			
Male	0.83	0.80-0.85	**<0.001**
Female	1.00		
Race/color			
Brown	0.93	0.90-0.96	**<0.001**
Black	0.75	0.67-0.84	**<0.001**
Yellow	0.93	0.65-1.32	0.666
Indigenous	0.94	0.81-1.09	0.404
White	1.00		

Legend: RR=Relative Risk; 95% CI=95% Confidence Interval.

Source: Developed by the authors (2025).

DISCUSSION

This study allowed to describe the evolution of infant deaths associated with congenital abnormalities occurred in Brazil in the period from 2011 to 2020. A high rate of this condition was observed as the primary cause of death. Independently, a higher risk of death was observed in children of mothers aged ≥ 35 years, residing in the North, Northeast, Midwest and Southeast regions, born by cesarean and with premature gestational age. In contrast, characteristics such as maternal age from 10 to 19 years, low schooling, multiparity, multiple pregnancies, brown or black race/color, in addition to the occurrence of death outside the hospital, showed an inverse association.

As in the present study, advanced maternal age was associated with a higher risk of infant deaths due to congenital abnormalities in international and national studies13[1314], with mothers in the age range of 30 to 55. In the perspective of the social determination of health, the more advanced maternal age also inscribes itself in a social and reproductive context in which these women may present pre-existing comorbidities, such as hypertension and diabetes, as well as by resorting more often to assisted reproduction technologies, factors that alter the profile of pregnancies and obstetric management. Interpreting the association of maternal age with deaths from congenital anomalies therefore requires consideration of pre-existing biological vulnerability and health conditions and access to quality care throughout the reproductive cycle[15].

Regarding the regions of the country, residing in the North, Northeast, Midwest or Southeast increased the risk of death from congenital anomaly when compared to the South. These inequalities are reflections of social determination, insofar as the unequal distribution of healthcare infrastructure, economic and educational differences, and variations in access to diagnostic examinations and reference services, can determine

the spatial distribution of the abnormalities and deaths resulting from them, confirming that the position in the social and territorial space strongly conditions the risk of mortality from congenital causes[16]. A study conducted in the USA that examined trends in racial/ethnic, socioeconomic and geographic disparities in infant mortality by age and specific cause during 1915-2017 also identified that there were marked and widened differences between the regions of the country[13].

As regards gestational age at birth, the risk of having congenital abnormalities was higher in premature babies (pregnancy age less than 37 weeks), which is described in the literature as an expected outcome[17], since this is one of the main determinants of child death from congenital abnormalities, as premature babies have greater clinical vulnerability and less access to specialized interventions, depending on the region of birth[18].

As for the association with the highest prevalence of surgical and hospital delivery, it may be related to the programming of care for the newborn with congenital anomaly, which potentially requires specialized medical care[19]. Thus, the higher incidence of deaths related to cesarean and childbirth performed in hospital environment can be explained by the recommendations directed to mothers for the performance of the procedure in question: degree B, that is, has a high indication, based on consensus with the opinion of specialists, in situations where the fetus is diagnosed early with congenital abnormalities[7]. This can reflect both the severity of cases and inequalities in access and quality of obstetric care, as well as inappropriate practices in certain contexts.

The finding of association as a protective factor between maternal age of 10–19 years and child death due to congenital abnormalities should be interpreted with caution. The literature reveals heterogeneous patterns: while chromosomal anomalies increase with advanced maternal age, certain non-chromosomal malformations are more common in adolescent mothers. Recent review indicates that both very young and very advanced ages can increase the risk of certain defects, depending on the type of anomaly [20].

Another finding that diverges from the literature refers to maternal schooling, and women who had seven years or less of study had a lower risk of experiencing child death due to congenital abnormalities. A study conducted in Turkey demonstrates that mothers with lower education have a higher risk of child mortality from congenital abnormalities, due to less access to prenatal care, less adherence to screening tests, worse socioeconomic conditions and greater exposure to risk factors[21].

As a protective factor for death from congenital anomalies, women with five or more living children were observed in this study, a result different from what was found in a study conducted in a tertiary hospital in Guwahati Assam, northeastern India, where maternal parity showed significant association with congenital anomalies, and the probability of malformations in children of multiple mothers was higher compared to primipares[22]

The association between the absence of paid work and the lower risk of death as a protective factor is found to be contrary to what is pointed out in the literature[23] and the possible cause for this result is the greater availability of time for these women to adhere to prenatal and conduct examinations, which favors early detection and appropriate referral. However, there may be underreporting of abnormalities in the group of unemployed women, which often occurs in strata of lower income and less access to specialized services, generating apparent protective effect.

A study showed that in 2016, black babies had a 2.5 to 2.8 times higher risk of mortality from perinatal conditions, sudden infant death syndrome, flu/pneumonia and unintentional injuries, and 1.3 times higher risk of mortality from congenital defects compared to white babies [13]. Data that also differ from the present study where black or brown-skinned babies were a protective factor for child death from congenital abnormalities.

A study conducted in Rio Grande do Norte found a higher prevalence of child death due to congenital abnormalities among mothers with one or two dead children, corroborating the findings of this study, reaffirming the recurrence of changes in the gestational process[7].

Regarding multiple pregnancies as a protective factor for malformation death, a national population-based study that evaluated live births with malformation between the years 2001 and 2015 presented data similar to this study[24]. Another study in Africa also revealed a low prevalence of deaths from congenital anomalies in twins of [25]. There is controversy in the literature about these findings as a greater number of cases of malformations in multiple pregnancies is expected, due to the chance of errors in cell division and chromosomopathies[24].

As for extreme prematurity as a protective factor of death from congenital abnormalities, no studies have been found that bring these associations. Considering the extreme prematurity, a possible explanation for the protective factor for death is in relation to the priority for stabilization of the neonate, with less initial focus on the diagnosis of congenital abnormalities. This can lead to sub-reporting of these conditions in the neonatal period and identifying them only later, which can distort the incidence data[26].

It was found that the late neonatal and post-neonatal period also constituted a protective factor for infant mortality when compared to the early neonatal period. These data corroborate a study conducted in the U.S. that demonstrated a declining trend of 18.0% in infant mortality due to congenital abnormalities in the post-neonatal period[27]. This trend may be related to the improvement in the levels of care provided.

On the variable gender there are many differences in the literature; a study conducted in Kenya on characterization of live births with congenital malformation reveals male sex as a protective factor [28]. A study developed in Brazil, with the same goal, brings male as a risk factor [24]. The present study already shows the male sex as a protective factor for the outcome, unlike a study developed in the province of Hamadan in Iran, which found a statistically significant relationship between being male and having congenital abnormalities[29].

Given the above, it is understood that the risk of child death due to congenital abnormalities does not result only from biological aspects, but is also influenced by regional inequalities, access to health services, socioeconomic conditions, maternal education and care practices. These inequalities are produced by historical, political and economic processes, evidencing that the reduction of child mortality due to congenital anomalies will require intersectoral public policies, the promotion of equity and the strengthening of SUS[30].

It is pointed out as a weakness of this study that it has used secondary databases, since there is a dependence on the quality of the data provided. The data were obtained from the Mortality Information System (SIM), issued by the Department of Informatics of the Single Health System (DATASUS) and accessible online without access restrictions.

On the other hand, the fact that a population database has been used, relative to a decade, from a country like Brazil, which has continental dimensions, is highlighted.

It is worth noting that since 1976, the SIM has collected information from the standard death certificates in use in the national territory, retrieving essential data to produce mortality statistics, fundamental for the analysis of the health situation and for the surveillance, monitoring and evaluation of public policies. The system that presented the highest completeness was rated as excellent (with less than 5.0% incompleteness). Despite the disparities in the quality of different SIM dimensions, studies indicate that improvements have been made over time in the death records of the Brazilian population[10].

It is suggested that new studies similar to this research be developed, seeking to remedy the vulnerabilities identified in the literature, such as the insufficiency of studies that could contribute to the discussion about maternal age (adolescent pregnancy as a protective factor against child deaths due to congenital abnormalities) and gestational age at birth (extreme prematurity and post-datism as protective factors against deaths).

CONCLUSION

This study identified socio-demographic and clinical factors associated with child deaths from congenital abnormalities in Brazil between 2011 and 2020. Independently, a higher risk of death was observed in children of mothers aged ≥ 35 years, residing in the North, Northeast, Midwest and Southeast regions, born by cesarean and with premature gestational age. In contrast, characteristics such as maternal age from 10 to 19 years, low schooling, multiparity, multiple pregnancies, brown or black race/color, in addition to the occurrence of death outside the hospital, showed reverse association.

These findings highlight regional inequalities and barriers to access to diagnosis and care, suggesting the need to strengthen prenatal care, ensure early detection of malformations and expand access to reference centers, especially in more vulnerable regions. This study is expected to contribute to the planning of public policies aimed at reducing infant mortality due to congenital abnormalities, pointing out critical points for surveillance and intervention in maternal and infant health.

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