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PREVALENCE AND ASSOCIATED FACTORS OF CONGENITAL ABNORMALITIES IN NEWBORNS

Prevalência e fatores associados às anomalias congênitas em recém-nascidos

Prevalencia y factores asociados con las anomalías congénitas de recién-nacidos

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ABSTRACT

Objective: To describe the prevalence and analyze the associated factors of congenital abnormalities in newborns (NBs). **Methods**: Cross-sectional study based on 33,141 Live Birth Certificates (LBCs) of babies whose mothers were living in Salvador, Bahia, Brazil, in 2014. A descriptive analysis was initially performed, followed by bivariate analysis of the association between congenital abnormalities and maternal, pregnancy, and newborns characteristics, with estimation of prevalence ratio (PR) and 95% confidence intervals (95% CI). After the bivariate analysis, the multivariate logistic regression was performed. **Results**: The prevalence of congenital abnormalities was 1.0%, and the leading causes were conditions related to the musculoskeletal system (52.1%). The multivariate analysis evidenced higher prevalence of abnormalities in male newborns (PR=1.40; 95%CI: 1.12-1.74), with low birth weight (PR=2.34; 95% CI: 1.77-3.08) and unsatisfactory five-minute Apgar score (PR=3.34; 95%CI: 2.30-4.82), whose mothers were under 18 or over 35 years of age (PR=1.69; 95%CI: 1.17-2.43) and underwent cesarean delivery (PR=1.46; 95%CI: 1.17-1.83). **Conclusion:** A low prevalence of congenital abnormalities was found, and this outcome was associated with mothers at an extreme age and adverse clinical condition at birth, such as low weight and unsatisfactory Apgar score.

Descriptors: Congenital Abnormalities; Risk Factors; Newborn; Epidemiology; Health Information Systems.

RESUMO

Objetivo: *Descrever a prevalência e analisar os fatores associados às anomalias congênitas em recém-nascidos (RN).* ***Métodos:*** *Estudo transversal com base em 33.141 declarações de nascidos vivos (DNVs) de bebês cujas mães eram residentes em Salvador, Bahia, em 2014. Inicialmente foi realizada uma análise descritiva, seguida de análise bivariada da associação entre anomalias congênitas e características maternas, gestacionais e dos RN, com estimação de razão de prevalência (RP) e intervalos de confiança de 95% (IC95%). Após a análise bivariada, procedeu-se a análise de regressão logística multivariada.* ***Resultados:*** *A prevalência de anomalias congênitas foi 1,0%, sendo as principais causas condições ligadas ao sistema osteomioarticular (52,1%). A análise multivariada evidenciou maior prevalência de anomalias em recém-nascidos do sexo masculino (RP=1,40; IC95%:1,12-1,74), com baixo peso ao nascer (RP=2,34; IC95%:1,77 - 3,08) e escore de Apgar insatisfatório ao quinto minuto (RP=3,34; IC95%: 2,30 – 4,82), cujas mães tinham menos de 18 anos ou mais de 35 anos (RP=1,69; IC95%: 1,17-2,43) e realizaram parto cesárea (RP=1,46; IC95%:1,17-1,83).* ***Conclusão****: Encontrou-se baixa prevalência de malformações congênitas, sendo esse desfecho associado às mães em extremo de idade e quadro clínico adverso ao nascimento, como baixo peso e Apgar insatisfatório.*

Descritores: *Anomalias Congênitas; Fatores de Risco; Recém-nascido; Epidemiologia; Sistemas de Informação em Saúde.*

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RESUMEN

Objetivo: *Describir la prevalencia y analizar los factores asociados con las anomalías congénitas de recién-nacidos (RN).* ***Métodos:*** *Estudio transversal basado en 33.141 declaraciones de nacidos vivos (DNVs) de bebés cuyas las madres vivían en Salvador de Bahía en 2014. A principio fue realizado un análisis descriptivo seguido de un análisis bivariado de la asociación entre las anomalías congénitas y las características de las madres, de las gestaciones y de los RN con la estimación de una razón de prevalencia (RP) e intervalos de confianza del 95% (IC95%). Después del análisis bivariado se dió el análisis de regresión logística multivariada.* ***Resultados:*** *La prevalencia de anomalías congénitas fue del 1,0%, teniendo como las principales causas las condiciones asociadas al sistema osteomioarticular (52,1%). El análisis multivariado evidenció mayor prevalencia de anomalías en recién-nacidos del sexo masculino (RP=1,40; IC95%:1,12-1,74), con bajo peso al nacer (RP=2,34; IC95%:1,77 - 3,08) y la puntuación del Apgar insatisfactoria en el quinto minuto (RP=3,34; IC95%: 2,30 – 4,82), cuyas madres tenían menos de 18 años o más de 35 años (RP=1,69; IC95%: 1,17-2,43) y que habían realizado el parto por cesárea (RP=1,46; IC95%:1,17-1,83).* ***Conclusión****: Se encontró baja prevalencia de mal formaciones congénitas que estuvo asociado a las madres con extrema edad y cuadro clínico adverso al nacimiento, bajo peso y el Apgar insatisfactorio.*

Descriptores: *Anomalías Congénitas; Factores de Riesgo; Recién Nacido; Epidemiología; Sistemas de Información en Salud.*

INTRODUCTION

Congenital abnormalities or malformations are structural or functional disorders that occur during the period of fetal developmental and can be detected during prenatal care, delivery, or after birth[1,2]. It is estimated that 3% of children worldwide are affected by congenital malformations[3]. In 2013, of 2.76 million deaths recorded within the neonatal period, approximately 10% were due to congenital malformations[2]. In Brazil, congenital an abnormalities rank second in the list of causes of infant deaths, reaching about 3% of all live births and, each year, 60,000 cases of these diseases are registered[4].

Estimates indicate that 60% of congenital disorders have unknown etiology. However, studies have demonstrated an association between birth defects and environmental, genetic and maternal conditions, such as the use of certain illicit drugs and tobacco smoking. Other factors, such as inadequate maternal-infant care and low socioeconomic status, are also identified as factors associated with congenital malformations, especially in poor and developing countries[5-8]. Some recent research emphasize the concern with the increase in the incidence of microcephaly related to the Zika virus (ZIKV) epidemic in Brazil[9], given that puerperae without prior exposure to already known risk factors, but infected with this virus during the first trimester of pregnancy, gave birth to babies diagnosed with microcephaly[10]. In this context, a recent systematic review evidenced an increase in the number of cases of newborns with congenital malformations, especially microcephaly, resulting from Zika infections in pregnant women residing in the Northeast region of Brazil[11].

Besides the high mortality, congenital abnormalities are frequent causes of physical disability in newborns, many of which are irreversible and pose psychological distress to their parents or caregivers. The social repercussions of congenital malformations require of the health services the organization of a continuous care network, in order to guarantee comprehensive care, which must be offered by multiprofessional teams that provide physical rehabilitation to the babies and psychological support to the family nucleus[4,8].

In Brazil, birth and other outcomes of interest for studying some health problems of the population have their records stored in Health Information Systems, managed by the Department of Informatics of the Brazilian Unified Health System (*Departamento de Informática do Sistema Único de Saúde - DATASUS*). One of these systems is the Live Birth Information System (*Sistema de Informações sobre Nascidos Vivos - SINASC*), created in 1990 to gather information about the birth conditions of the newborns (Apgar score, weight, presence of congenital abnormalities), along with maternal, prenatal and childbirth data. This system is fed by the Certificate of Live Birth, which is mandatorily issued throughout the national territory[12]. In addition to its administrative function, SINASC also provides data that allows research and monitoring of health characteristics of the maternal-child population. From its data, it is possible to subsidize interventions related to the health of women and children within the scope of the Unified Health System (SUS). In Brazil, secondary databases have been increasingly used in research and this interest grows as data availability and quality are improved[13].

In the context of maternal-infant health care, health promotion actions are indispensable for care quality since the prenatal period up to the child development in early childhood. In this sense, newborns with congenital abnormalities and their families need to be targets of a set of activities that go beyond clinical and outpatient care, incorporating other actions of intersectorial scope, with an expanded approach to the health needs of this population.

Knowing the prevalence of and factors associated with congenital abnormalities should be considered a priority in Brazil, since these diseases represent one of the main causes of infant mortality and have serious repercussions on the life of the child and his family. Therefore, the objective of this study was to describe the prevalence and analyze the associated factors of congenital abnormalities in newborns.

METHODS

This is an exploratory cross-sectional epidemiological study with secondary, public access data. The data sources were the Certificates of Live Birth issued for mothers residing in Salvador, between January and December 2014, made available by the Live Birth Information System, managed by the Unified Health System Department of Information. This period was chosen because of the availability of data in SINASC, given that, at the time of collecting the information, that was the most recent year.

The database was cleaned prior to statistical analysis, with the purpose of ensuring the selection of Certificates of Live Birth that contained valid information for the outcome variable and other covariables used in this study. Between January and December 2014, 36,634 births were reported in Salvador, Bahia. Initially, a description of the variables was performed in order to identify the missing values and the observations that did not contain information regarding the presence of congenital abnormalities (n=1,503) were excluded. Following that, the certificates lacking data about type of delivery, antenatal consultations, sex of the newborn, 5-minute Apgar score, type of gestation and type of pregnancy were excluded. Afer finishing the cleaning routine, 33,141 Certificates of Live Birth remained for analysis, representing 90.4% of all births available in SINASC. It should be emphasized that descriptive analyses and associations of interest were performed before and after the exclusions, and no differences in percentages or association measures were noted. This procedure indicates that the cleaning of the variables did not result in selection bias, inasmuch as it guaranteed the same number of observations for all variables analyzed.

The variables selected for analysis in this study were dichotomized and divided into two groups: aspects related to the mother, gestation and delivery, and characteristics of the newborn. The group of maternal characteristics consisted of: age of the mother ("18 to 35 years" or "< 18 years or > 35 years"), type of pregnancy ("single" or "multiple") and type of delivery ("vaginal" or "cesarean section"). The variables related to the newborns were: sex of the newborn ("female" or "male"), prematurity ("yes" or "no"), low birth weight ("yes" or "no"), unsatisfactory 5-minute Apgar score ("yes" or "no") and presence of congenital abnormality ("yes" or "no"). The presence of congenital abnormality considered the diagnosis of at least one of the following codes of the 10th International Classification of Diseases (ICD-10): Spina bifida (Q05); Other congenital malformations of the nervous system (Q00-Q04, Q06-Q07); Congenital malformations of the circulatory system (Q20-Q28); Cleft lip and cleft palate (Q35-Q37); Absence, atresia and stenosis of the small intestine (Q41); Other congenital malformations of the digestive system (Q38-Q40, Q42-Q45); Undescended testis (Q53); Other malformations of the genitourinary system (Q50-Q52, Q54-Q64); Congenital deformities of hip (Q65); Congenital deformities of feet (Q66); Other malformations and congenital deformities of the musculoskeletal system (Q67-Q79); Other congenital malformations (Q10-Q18, Q30-Q34, Q80-Q89); Chromosomal abnormalities not elsewhere classified (Q90-Q99); Hemangioma and lymphangioma (D18); Dentofacial anomalies (K07); Other conditions compromising the integument specific of the fetus and newborn (P83).

Prematurity was defined as gestation lasting less than 37 weeks. All babies weighing less than 2,500 grams at birth were considered with Low birth weight (LBW). The 5-minute Apgar score with a value lower than seven indicated an unsatisfactory score. The "presence of congenital abnormality" was chosen as the outcome of the study (dependent variable). Besides these variables, the main causes of abnormalities in newborns were also described.

The descriptive analysis of the data comprised absolute and relative frequency calculation of all the variables. The total prevalence of congenital abnormality in newborns and their prevalence in the subgroups of variables related to maternal and newborn characteristics were estimated. The prevalence ratios (PR) and the respective 95% confidence intervals (95% CI) were also estimated. Additionally, the Pearson's chi-square test was used to test the association of covariables in relation to the presence of abnormality, being considered statistically significant those associations whose p value <0.05.

In addition to the bivariate analysis, multivariate models were constructed to describe the factors associated with the occurrence of congenital abnormalities in newborns. The model was chosen by means of stepwise logistic regression with backward elimination. Being a variable associated with the outcome with a p value <0.1 was used as the criterium for inclusion in the model and, for permanence in the model, $p<0.05$. For the selection of the final model, which represents the one that best fits the study data, the likelihood ratio test and Pearson's chi-square test were performed for model fit quality. Because this is a study with an outcome of low prevalence, the use of odds ratio (OR) as a measure numerically equivalent to the prevalence ratio is accepted, being thus justified the use of logistic regression in this study, which presents a cross-sectional design.

Considering that this study was performed with secondary data of public access and that such data do not allow the personal identification of mothers or newborns, it did not require the approval of an Ethics Committee for research involving humans, and is in agreement with the Resolution 466/12 of the National Health Council.

RESULTS

Analysis of the characteristics related to the mother, pregnancy and delivery showed that 99.0% of the mothers of live births in Salvador were between 18 and 35 years of age, 97.6% had a single pregnancy and 53.0% of births occurred via C-section (Table I).

Table I - Characteristics of mothers, pregnancy and type of delivery, Salvador, Bahia, Brazil, 2014.

Variables	n	%
Mother's age		
18-35 years	32,809	99.0
<18 years or >35 years	332	1.0
Type of pregnancy		
Unique	32,334	97.6
Multiple	807	2.4
Type of birth		
Vaginal	15,587	47.0
Cesarean	17,554	53.0

Source: SINASC / Ministry of Health.

Regarding the characteristics of the newborn, it was observed that 51.0% of them were male and 10.4% were born preterm. Low birth weight was observed in 9.4% of the newborns and 2.7% of the NBs an unsatisfactory Apgar score at the fifth minute of life. The prevalence of congenital abnormality was 1.0%. The main causes of malformations in the 332 live births with congenital anomalies were related to the conditions associated with the osteomioarticular system (52.1%) and the genitourinary system (11.4%) (Table II).

Table II - Characteristics and causes of congenital abnormalities in newborns, Salvador, Bahia, Brazil, 2014.

Variables	n	%
Sex of the newborn		
Female	16,225	49.0
Male	16,916	51.0
Prematurity		
No	29,708	89.6
Yes	3,433	10.4
Low birth weight (<2500g)		
No	30,043	90.6
Yes	3,098	9.4
Unsatisfactory 5-min Apgar score		
No	32,241	97.3
Yes	900	1.7
Congenital abnormality		
No	32,809	99.0
Yes	332	1.0
Causes of congenital malformation (n=332)		
Malformations of the Osteomyoarticular System	173	52.1%
Malformations of the Genitourinary System	38	11.4%
Malformations of the Nervous System	21	6.3%
Malformations of the Digestive System	21	6.3%
Malformations of the Circulatory System	16	4.9%
Other congenital malformations	63	19.0%

Source: SINASC / Ministry of Health

The prevalence of congenital abnormality was higher in newborns whose mothers were under the age of 18 years or over 35 (PR=1.78, 95% CI: 1.24-2.54), with multiple pregnancies (PR=2.30, 95% CI: 1.44-3.67) and cesarean delivery (PR=1.47, 95% CI: 1.18-1.83). With respect to the characteristics of the newborns, there were higher prevalences of abnormalities in male (PR=1.38, 95% CI: 1.11-1.72), preterm infants (PR=2.35, 95% CI: 1.81-3.05), who presented low birth weight (PR=2.88, 95% CI: 2.23-3.71) and unsatisfactory 5-minute Apgar score (PR=4.63, 95% CI: 3.32-6.45). It should be noted that, in the bivariate analysis, all the described characteristics presented statistically significant association with the presence of congenital abnormalities in the newborn (Table III).

Table III - Prevalence and prevalence ratios (PR) of congenital abnormality, according to maternal ages, aspects of pregnancy and delivery, and characteristics of newborns from Salvador, Bahia, Brazil, 2014.

	Congenital abnormality				
	n	%	PR	CI	p value
Mother's age					0.001
18-35 years	299	1.0	1.00	-	
<18 years or >35 years	33	1.7	1.78	(1.24-2.54)	
Type of pregnancy					<0.001
Unique	314	1.0	1.00	-	
Multiple	18	2.2	2.30	(1.44-3.67)	
Childbirth					0.001
Vaginal	125	0.8	1.00	-	
Cesarean	207	1.2	1.47	(1.18-1.83)	
Sex of the newborn					0.003
Female	136	0.8	1.00	-	
Male	194	1.2	1.38	(1.11-1.72)	
Prematurity					<0.001
No	261	0.9	1.00	-	
Yes	71	2.1	2.35	(1.81-3.05)	
Low birth weight					<0.001
No	256	0.8	1.00	-	
Yes	76	2.5	2.88	(2.23-3.71)	
Unsatisfactory 5-min Apgar score in					<0.001
No	294	0.9	1.00	-	
Yes	38	4.2	4.63	(3.32-6.45)	

Source: SINASC / Ministry of Health

After the bivariate analysis, a multivariate logistic regression model was constructed, adjusted for all variables that presented a p value lower than 0.1 (p value <0.1) in Table III. In the saturated model, it was observed that the association between congenital abnormalities and the variables "type of pregnancy" (p=0.488) and "prematurity" (p=0.500) did not remain statistically significant. In the final, multivariate model, the presence of congenital abnormality maintained statistically significant association (p < 0.01) with "maternal age", "type of delivery", "sex of the newborn", "low birth weight" and "unsatisfactory 5-minute Apgar score" were statistically significant (p <0.01). After the construction of the two models, it was verified, by means of the Pearson's chi-square test, used to adjust the quality of the model (p=0.333), and the likelihood ratio test (p=0.598), that the final model provided good fit to the data (Table IV).

Table IV - Multivariate analysis of the association between congenital abnormality and maternal age, aspects of pregnancy and delivery, and characteristics of newborns from Salvador, Bahia, Brazil, 2014.

	Saturated model			Final model*, **		
	OR	CI	p value	OR	CI	p value
Mother's age			0.005			0.005
18-35 years	1.00	-		1.00	-	
<18 years or >35 years	1.69	(1.17-2.43)		1.69	(1.17-2.43)	
Type of pregnancy			0.488		-	
Unique	1.00	-				
Multiple	1.20	(0.72-2.00)				
Childbirth			0.001			0.001
Vaginal	1.00	-		1.00	-	
Cesarean	1.45	(1.16-1.82)		1.46	(1.17-1.83)	
Sex of the newborn			0.003			0.003
Female	1.00	-		1.00	-	
Male	1.40	(1.12-1.74)		1.40	(1.12-1.74)	
Prematurity			0.500			
No	1.00	-				
Yes	1.14	(0.78-1.66)				
Low birth weight			<0.001			<0.001
No	1.00	-		1.00	-	
Yes	2.10	(1.45-3.03)		2.34	(1.77-3.08)	
Unsatisfactory Apgar			<0.001			<0.001
No	1.00	-		1.00	-	
Yes	3.27	(2.25-4.75)		3.34	(2.30-4.82)	

Source: SINASC / Ministry of Health. * Likelihood ratio test: p value = 0.598
*** Pearson's chi-square test for quality fit of the regression model: p value = 0.333

DISCUSSION

The prevalence of congenital malformations in live births found in the present study was below the worldwide estimated percentage[3]; however, it was similar to the findings in the cities of São Paulo[8] and Pelotas[14]. The difference between the prevalence of congenital abnormalities of the current study and the international findings is related to several factors external to the mother-baby binomial. One of these factors may be the source of the data used in the studies, since research conducted in referral hospitals for high-risk pregnant women may receive cases with a previous diagnosis of malformation, tending to present a higher proportion of babies with abnormalities[15].

In the context of studies with secondary data in the country, the improvement in the quality of SINASC data is highlighted, which is reflected in Certificates of Live Birth filled out in a more complete and reliable way. Despite being noteworthy, in these certificates, the improvement in the quality of data filled in, it is important to point that the underreporting of cases of congenital malformation still occurs in Brazil, leading, in some cases, to rates that are lower than the actual situation[16].

When analyzing the main causes of malformations, the highest frequencies were observed for congenital abnormalities related to the osteomioarticular system and defects in the formation of the nervous system. The findings in the literature corroborate the results of the current study, since such abnormalities are more easily detected during the physical examination soon after birth[17].

In regard to the maternal characteristics in the present study, cesarean delivery and presence of mothers at extremes of age were variables that showed association with congenital abnormality in newborns. Despite the contradiction in the literature regarding the indications of cesarean delivery for congenital abnormalities, the association with high cesarean rates is related to the need for more complex care for the newborn, including surgical interventions in the neonatal period[18]. As observed in this study, a positive association between congenital abnormality and cesarean delivery was found in different regions of the country[19], which may be related to the medical indication due to the intrauterine diagnosis of malformation.

In the present study, a high percentage of cesarean deliveries were observed in Salvador. Given the large proportion of cesarean deliveries in Brazil[20] and the complications associated with its utilization, the Federal Council of Medicine (*Conselho Federal de Medicina - CFM*) defined, through Resolution no. 2,144 of 2016, that cesarean delivery can only be performed in compliance with the following criteria: pregnant woman informed about the procedure, its benefits and risks; having the Informed Consent Form filled out; and gestational age equal to or greater than 39 weeks[21]. This initiative could reduce the

percentage of cesarean deliveries performed in the country and the negative outcomes that affect mothers and babies associated with this practice when done in an inopportune way.

Several studies show the advanced age of the pregnant woman (above 35 years) as a risk factor for the presence of congenital anomaly in newborns[22,23]. In the present study, a higher prevalence of malformation was observed in infants born to mothers at extreme age. Such results are compatible with the findings of a survey conducted in Chile between 1996 and 2005, which observed an increase in the risk of congenital abnormalities among pregnant women under the age of 19 and over 40 years, compared to pregnant women aged 25 to 29 years[24]. In general, this set of evidence may indicate a relationship between the pregnant woman's extreme age as a proxy for biological aspects that increase the risk of pregnancy complications.

The present study evidenced that the occurrence of congenital abnormalities was higher in low birth weight infants with an unsatisfactory 5-minute Apgar score, even after adjusting for variables related to the mother, childbirth and prenatal period. Furthermore, the current study pointed to higher prevalences of abnormalities in male babies, a result that is in line with other findings in the literature[8]. It should be emphasized that prematurity was not associated with the presence of abnormalities in newborns in the multivariate model. Despite this, the bivariate analysis showed a higher prevalence of prematurity in neonates with some anomaly, a result similar to that described by a study carried out in maternity hospitals in Rio de Janeiro[25].

The association between the presence of congenital malformations and adverse outcomes at birth, such as low birth weight and unsatisfactory Apgar score at the fifth minute of life, is well reported in the scientific literature. A research conducted in Mexico evidenced that the mean birth weight was lower in newborns with congenital anomaly and, moreover, this difference was greater in some types of malformations, such as those related to the digestive and musculoskeletal systems[26]. Both cross-sectional and case-control studies have demonstrated that low birth weight is associated with a higher occurrence of congenital anomalies in African countries[6,27]. In Brazil, studies with different methodological approaches indicate that neonates diagnosed with congenital anomalies are more likely to present low birth weight and an unsatisfactory Apgar score at birth[28].

The increase in the proportion of low birth weight and respiratory problems at birth, indicated by an unsatisfactory 5-minute Apgar score, can be explained by the effects of the malformation on the intrauterine development of the neonate, since there is evidence that defects in neural tube formation are associated with low weight and low vitality[29]. Another hypothesis that can be considered to explain such association is that infants with adverse outcomes at birth are usually treated in intensive care units, which would increase the likelihood of a more detailed investigation of their health conditions and, consequently, the discovery and registration of the congenital anomaly[29].

As a limitation of the study, one can point the use of secondary data from the Live Birth Information System, since it is beyond the control of the researchers the quality of filling in the certificates of live births used to feed this system. Therefore, the option was made to exclude the Certificates of Live Birth that did not contain the variables used in this study, resulting in loss of information. Despite these losses, the cleaning process maintained the same total of observations, whether in descriptive, bivariate and multivariate analyses. Another point to be highlighted is that, because this is a cross-sectional study, the identification of associated factors does not guarantee that such variables can be considered risk factors. Despite these limitations, the option of using the SINASC microdata, substituting the more traditional methodologies that investigate the abnormalities by means of ecological studies or with smaller samples, enabled the access to almost all birth records, facilitating the operationalization of a cross-sectional study applied to a rare outcome.

The findings of the present research point to the need to offer specialized care to these newborn infants, provided in intensive care units, in order to avoid both mortality and the onset of other neonatal morbidities.

The recent Zika Virus epidemic in Brazil[9,10], followed by the increase in the number of babies born with microcephaly, are events that warn of the need to have policies for maternal and child health care put into effect, with special emphasis on the theme of congenital malformations. Among these policies, we highlight *Rede Cegonha* (whose Portuguese denomination is equivalent to Stork Network), which needs to be expanded in order to guarantee quality assistance to the mother-baby binomial, including adequate care during the prenatal period, childbirth and the puerperium.

CONCLUSION

The results indicate a low prevalence of congenital malformations, and this outcome is associated with mothers at an extreme age and adverse clinical status at birth, such as low weight and unsatisfactory Apgar score.

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