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CONGENITAL ANOMALIES IN NEWBORNS

Anomalias congênitas em nascidos vivos

Anomalías congénitas de nacidos vivos

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ABSTRACT

Objective: To analyze the prevalence and factors potentially associated with congenital anomalies in a municipality of the State of Acre. **Methods**: Descriptive cross-sectional study of data from the Live Birth Information System (Sistema de Informações sobre Nascidos Vivos – SINASC) of the municipality of Rio Branco, Acre, Brazil, from 2001 to 2013. The outcome variable was the presence of congenital anomalies and the independent variables were related to the mother and the live birth. Odds Ratios (OR) and Confidence Intervals of 95% were estimated by logistic regression. **Results:** The prevalence of congenital anomalies was 0.2% in live births in the analyzed period, and the most frequent were musculoskeletal deformities (41.3%) followed by malformations of the nervous system (17.9%); they were associated with the age of the mother <15 and ≥35 years old (OR 1.72, 95%CI 1.03, 2.87), cesarean section (OR 1.85, 95%CI 1.29, 2.65), lower Apgar score at 1 (OR 3.54, 95%CI 1.69, 7.42) and 5 minutes (OR 13.65, 95%CI 4.00, 46.61) and birth weight ≤1.499g (OR 5.09; 95%CI 2.32, 11.19). **Conclusion**: The chance of having congenital anomaly was higher in the live births of mothers aged <15 and ≥35 years old; preterm births with less than 32 gestational weeks; cesarean births; live births who presented a degree of severe difficulty for Apgar 1 and for Apgar 5, and neonates who presented extreme low weight.

Descriptors: Congenital Abnormalities; Birth Certificates; Cross-Sectional Studies.

RESUMO

Objetivo: *Analisar a prevalência e possíveis fatores associados às anomalias congênitas em um município do estado do Acre.* ***Métodos:*** *Estudo transversal, descritivo, baseado nos dados do Sistema de Informações sobre Nascidos Vivos (SINASC) do município de Rio Branco, Acre, Brasil, no período de 2001 a 2013. A variável desfecho foi a presença de anomalias congênitas e as variáveis independentes estavam relacionadas à mãe e ao nascido vivo. Odds Ratio (OR) e intervalos de confiança de 95% foram estimados por regressão logística.* ***Resultados:*** *A prevalência de anomalias congênitas esteve presente em 0,2% dos nascidos vivos no período analisado, e as mais frequentes foram: as deformidades osteomusculares (41,3%), seguidas das malformações do sistema nervoso (17,9%); observando-se associação com a idade da mãe, <15 e ≥35 anos (OR 1,72; IC95% 1,03; 2,87), o parto cesáreo (OR 1,85; IC95% 1,29; 2,65), o menor escore de Apgar no 1º (OR 3,54; IC95% 1,69; 7,42) e 5º minutos (OR 13,65; IC95% 4,00; 46,61) e o peso ao nascer ≤1.499g (OR 5,09; IC95% 2,32; 11,19).* ***Conclusão:*** *A chance de apresentar anomalia congênita foi maior entre: nascidos vivos de mães muito jovens ou em idade avançada; pré-termos com menos de 32 semanas gestacionais; nascidos de parto cesáreo; nascidos vivos que apresentaram grau de dificuldade grave para Apgar 1º e 5º; e neonatos que apresentaram extremo baixo peso.*

Descritores*: Anormalidades Congênitas; Declaração de Nascimento; Estudos Transversais.*

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RESUMEN

Objetivo: *Analizar la prevalencia y posibles factores asociados con las anomalías congénitas de un municipio del estado de Acre.* ***Métodos:*** *Estudio transversal y descriptivo basado en los datos del Sistema de Informaciones sobre Nacidos Vivos (SINASC) del municipio de Rio Branco, Acre, Brasil, en el periodo entre 2001 y 2013. La variables de desfecho fue la presencia de anomalías congénitas y las variables independientes se relacionaron a la madre y al nacido vivo. Odds Ratio (OR) e intervalos de confianza del 95% fueron estimados a través de regresión logística.* ***Resultados:*** *La prevalencia de anomalías congénitas estuvo presente en el 0,2% de los nacidos vivos del período analizado siendo las más frecuentes: las deformidades osteomusculares (41,3%) seguidas de las malformaciones del sistema nervoso (17,9%); observándose asociación con la edad de la madre, <15 y ≥35 años (OR 1,72; IC95% 1,03; 2,87), el parto por cesárea (OR 1,85; IC95% 1,29; 2,65), la menor puntuación del Apgar en el 1º (OR 3,54; IC95% 1,69; 7,42) y 5º minutos (OR 13,65; IC95% 4,00; 46,61) y el peso al nacer ≤1.499g (OR 5,09; IC95% 2,32; 11,19).* ***Conclusión:*** *La oportunidad de presentar anomalía congénita fue mayor entre los nacidos vivos de madres muy jóvenes o en edad avanzada; los pre términos con menos de 32 semanas de gestación; los nacidos de parto por cesárea; los nacidos vivos que presentaron grado de dificultad grave para el 1º y 5º; y los neonatos que presentaron bajo peso extremo.*

Descriptores*: Anomalías Congénitas; Certificado de Nacimiento; Estudios Transversales.*

INTRODUCTION

Congenital anomalies are morphological, structural or functional changes that can be detected in intrauterine life or after birth. According to the World Health Organization (WHO), an estimated 303,000 newborns, i.e., 7% of the total, died within the first month of life[1] in 2016. They may be linked to genetic (chromosomal anomalies) or environmental (teratogenic) factors, or be multifactorial or caused by mixed factors (genetic inheritance and environment)[2].

Exposure of pregnant women to teratogenic agents accounts for 2% to 10% of cases of congenital malformations. These agents can be classified into: chemical agents (licit drugs, illicit drugs and medicines), biological agents (infections) and physical agents (ionizing radiation and temperature). The combination of two or more agents is common and potentializes the harmful effects of teratogens[2,3].

Health promotion actions are put into effect by recognizing the main factors associated with congenital anomalies. The analysis of the risk and protective allow interventions to be carried out in the preconceptional and gestational period, as well as during the delivery[2-4].

Some congenital anomalies are more frequent in certain ethnic groups. For instance, polydactyly is more common among Chinese and Native Americans. Other malformations, such as single palmar crease, syndactyly and supernumerary fingers, are more frequently observed in the black population. Although major and multiple malformations are more prevalent in the white population, other risk factors are highlighted in the scientific literature: advanced maternal age (>35 years), increased number of previous pregnancies, C-section, shorter pregnancy, drug misuse, smoking, drinking, nutritional deficiencies, presence of preexisting diseases, occupational exposure to teratogenic agents, unfavorable socioeconomic conditions, low birth weight and low Apgar score[2-5].

Brazil, as well as other countries, has developed some programs and actions to prevent congenital malformations. Fortification of wheat and corn flours with folic acid has been mandatory since 2002, and the country has also implemented programs that recommend the use of folic acid adequately during pregnancy in order to reduce the occurrence of defects in the formation of the neural tube of the fetus[6].

Primary prevention includes family planning measures to avoid unexpected pregnancies, which are not identified early, and pregnancies in women with advanced age[2], the rubella vaccine[7], the control of the commercialization of abortifacients[8], and campaigns to avoid maternal habits considered harmful[3].

Secondary measures are those related to the early detection of major congenital anomalies, particularly adequate prenatal care, which doubles the possibilities of detection, and investments in new diagnostic technologies for pregnancy, such as obstetric ultrasonography, nuchal translucency measurement, fetal karyotyping, biochemical markers test and combined screening[9-11].

In order to collect, record, analyze and disseminate data on births, Brazil's Ministry of Health (MOH) established in 1990 the Live Birth Information System (*Sistema de Informação sobre Nascidos vivos – SINASC*), whose standard document is the Certificate of Live Birth (CLB). In 1999, the item 34, which addresses congenital anomalies detected at the time of birth, was included in the system. This item consists of the "V block" and its adequate filling allows to know and measure the frequency and nature of these events, to develop demographic and health indicators, and to monitor associated factors and risk exposure[12].

Despite the relevance of studies on congenital malformations to support public policies aimed at maternal and child health, there are currently no published studies on congenital anomalies in the state of Acre. Thus, the present study aims to analyze the prevalence and factors potentially associated with congenital anomalies in a municipality in the state of Acre.

METHODS

This is a retrospective and descriptive cross-sectional study of data from the Live Birth Information System (*Sistema de Informações sobre Nascidos Vivos – SINASC*) of the municipality of Rio Branco, Acre, Brazil, from 2001 to 2013. The data were obtained from the Certificates of Live Births in the SINASC available on the website of the Department of Informatics of the Unified Health System (*Departamento de Informática do Sistema Único de Saúde – DATASUS/MS*). The data were extracted from the information system between May and June 2015. The study period was selected based on the last annual update of the system, which provided data on the year 2013.

Rio Branco is the capital of the state of Acre and also its largest population, commercial, cultural and industrial center. In 2010, it had the highest Human Development Index (HDI) in the state (0.727), which was below the national index (0.755). In 2016, it had an estimated population of 377,057 inhabitants, corresponding to 47.3% of the total population of Acre. In the same year, 89.4% of the population of Rio Branco lived in urban areas, as reported by the Brazilian Institute of Geography and Statistics[13].

Data were collected as follows: access to http://www2.datasus.gov.br/DATASUS/index.php?area=0901 → Data file → SINASC → File mode "Data" → Type of file "CLB – Certificates of Live Births" → Year "2001-2013" → FS "AC" → Send). Data were extracted in ".dbc" format and specified by year of birth. They were then exported to Excel in ".xlsx" format for further grouping and compatibilization of the variables.

The dependent variable, "presence or absence of congenital anomalies", was obtained from item 34 of the CLB. The anomalies found were classified using codes referring to the classification of diseases and a wide variety of signs, symptoms, and abnormalities. A single category was assigned to each health condition. It consisted of a code of up to six characters, which is called the International Statistical Classification of Diseases and Related Health Problems. The WHO International Classification of Diseases, Tenth Revision (ICD-10), which is used worldwide for morbidity and mortality statistics, was used.

The independent variables were those related to the: congenital anomalies, mother (education, marital status, age, parity); current pregnancy (type of pregnancy, number of prenatal consultations and duration of pregnancy); delivery (year, place and type of delivery) and live birth (Apgar at 1 and 5 minutes, sex, skin color and birth weight).

The scientific literature was used as a parameter to describe the variables as follows: place of delivery (hospital, home, and others); age of the mother (up to 19 years, 20 to 34 years, ≥35 years); marital status of the mother (with or without partner); education of the mother (none, 1 to 9 years of study, 10 to 13 years of study, 14 to 16 years of study, 17 or more years of study); duration of pregnancy (up to 27 weeks, from 28 to 31 weeks, from 32 to 36 weeks, from 37 to 41 weeks, and 42 weeks or more); type of pregnancy (singleton and twin); number of prenatal visits (none, 1 to 3, 4 to 6, 7 or more); type of delivery (vaginal or cesarean); number of live births (none, 1 to 3, 4 or more); number of stillbirths (none, 1 to 2, 3 or more); sex of the live birth (boy and girl); race/skin color of the live birth (white, black, yellow, *pardo* (mixed-race Brazilians) and indigenous).

The logistic regression analysis included only the variables with completeness above 75%[14]. For the analysis, the following variables were grouped and recategorized: age of the mother divided into two categories (15 to 34 years and <15 and ≥ 35 years) and presence of congenital anomaly by affected organ system (malformations of the nervous system (Q00-Q07), of the eye, ear, face and neck (Q10-Q18), of the circulatory system (Q20-Q28), of the respiratory system (Q30-Q34), cleft lip and cleft palate (Q35-Q37), other malformations of the digestive system (Q38-Q45), malformations of the genital organs (Q50-Q56), malformations and deformations of the musculoskeletal system (Q65-Q79), other congenital malformations (Q80-Q89), chromosomal abnormalities (Q90-Q99).

Maternal education was grouped according to years of study. The analyses of the Apgar score and birth weight were performed using the WHO criteria, which are adopted by the Department of Informatics of the Unified Health System (*Departamento de Informática do Sistema Único de Saúde – DATASUS*) and are available at: www.datasus.gov.br/cid10/V2008 /WebHelp/definicoes.htm. Apgar was then divided into: optimal conditions (8 to 10), mild disability (7), moderate disability (4 to 6), and severe disability (1 to 3), and birth weight was classified into extreme low weight (up to 999g), very low weight (1000g to 1499g), low weight (1500g to 2499g) and normal weight (≥ 2500g).

Malformations were classified into major and minor according to the criteria recommended by the European Surveillance of Congenital Anomalies (EUROCAT) and the level of medical, functional and cosmetic impairment. Chromosomal abnormalities were included into major defects[15].

The data were analyzed using the Statistical Package for the Social Sciences (IBM SPSS), version 22.0. Data were analyzed using bivariate and multiple logistic regression. The multiple logistic regression model included the variables that presented $p<0.20$ in the simple analysis. The stepwise forward method was used to select the variables. The method consisting in beginning the model with only the constant and then adding the independent variables one at time based on specific criteria; the variable with the most significant score is added to the model. Thus, the model was adjusted according to the likelihood ratio test and it included only those variables that maintained the most parsimonious model, that is, the model that involved the minimum possible parameters to be estimated that explained well the behavior of the response variable. The association measures were estimated by crude and adjusted Odds Ratios with 95% confidence intervals ($p<0.005$).

Complying with the National Health Council (*Conselho Nacional de Saúde – CNS*) Resolution No. 510, of April 7, 2016, which provides for research using public and unrestricted information, and Law 12,527, of November 18, 2011, the present study used information obtained from secondary databases with no possibility of individual identification. Therefore, the study did not need registration and approval by the National Research Ethics Council (*Conselho Nacional de Ética em Pesquisa – CEP/CONEP*).

RESULTS

From 2001 to 2013, 0.2% of the 110,946 live births in the municipality of Rio Branco had some congenital anomaly. In all, 57,197 (51.6%) births were males and 16 cases (0.01%) were classified as undetermined sex. The highest prevalence of congenital anomalies (0.4%) occurred in 2004, and the lowest prevalence rate was 0.1% in 2011 (Table I).

Table I - Prevalence of congenital anomalies in live births by year of birth. Rio Branco, Acre, Brazil, 2001 - 2013.

Year of birth	Number of births	Prevalence of congenital anomalies	
		n	%
2001	8202	21	0.3
2002	8500	27	0.3
2003	8509	17	0.2
2004	8180	35	0.4
2005	8502	15	0.2
2006	8322	14	0.2
2007	8268	17	0.2
2008	8670	10	0.1
2009	8146	9	0.1
2010	8173	18	0.2
2011	7889	8	0.1
2012	5573	12	0.2
2013	7309	14	0.2
Total	104243	217	0.2

The age of the mothers in the present study ranged from 11 to 60 years: 26.8% (29,781) were 19 years old, 66.1% (73,337) were 20-34 years old and 7.1% (7,821) were 35 years old or older. In all, 6.1% of the women had preterm live births, 41.3% reported having attended 4 to 6 prenatal visits, 3.7% reported they have not attended any prenatal consultations, and 99.7% of the deliveries were performed in hospital settings. The mean weight of live births was 3,199g (SD=557g), but 8.5% of them were weighing below 2,500g (Table II).

Table II - Distribution of live births according to socioeconomic and demographic variables, maternal and prenatal characteristics, and type of delivery. Rio Branco, Acre, Brazil, 2001 - 2013.

Variable	n	%
Place of delivery		
Hospital	110.658	99.7
Home	260	0.2
Other	28	0.1
Age of the mother		
Up to 19 years	29.781	26.8
20-34 years	73.337	66.1
≥ 35 years	7.821	7.1
Marital status of the mother		
With partner	77.246	71.8
Without partner	30.219	28.2

Education of the mother		
None	3.165	2.9
1 to 9 years of study	14.001	12.8
10 to 13 years of study	28.942	26.4
14 to 16 years of study	36.966	33.7
17 years of study or more	26.595	24.3
Duration of pregnancy (weeks)		
Up to 27	476	0.4
28 to 31	1.201	1.1
32 to 36	4.940	4.6
37 to 41	99.951	92.6
42 and more	1.286	1.2
Type of pregnancy		
Singleton	108.904	98.2
Twin	1970	1.8
Number of prenatal consultations		
None	4.109	3.7
1 to 3	20.034	18.3
4 to 6	45.308	41.3
7 and more	40.248	36.7
Type of delivery		
Vaginal	67.038	60.5
Cesarean	43.810	39.5
Number of live births		
None	18.107	20.4
1 to 3	59.460	67.0
4 or more	11.192	12.6
Number of stillborns		
None	61.983	82.6
1 to 2	12.202	16.3
3 or more	818	1.1
Sex of the live birth		
Male	57.197	51.6
Female	53.733	48.4
Race/skin color of the live birth		
White	9.744	9.3
Black	437	0.4
Yellow	194	0.2
Pardo	94.278	89.8
Indigenous	294	0.3
Apgar score 1		
Optimal conditions (8 to 10)	78.375	91.9
Mild disability (7)	3.834	4.5
Moderate disability (4 to 6)	2.096	2.5
Severe disability(1 to 3)	1.012	1.2
Apgar score 5		
Optimal conditions (8 to 10)	83.760	98.1
Mild disability (7)	657	0.8
Moderate disability (4 to 6)	401	0.5
Severe disability(1 to 3)	544	0.6
Birth weight		
Extreme low weight (up to 999g)	586	0.5
Very low weight (1000g to 1499g)	855	0.8
Low weight (1500g to 2499g)	8.023	7.2
Normal weight (≥ 2500g)	101.349	91.5

Of the total live births, 7.0% presented more than one type of anomaly, the most frequent being malformations and deformations of the musculoskeletal system (41.3%), malformations of the nervous system (17.9%), malformations of genital organs (8.9%) and chromosomal abnormalities (8.1%) (Table III). Failure to complete the item corresponding to the congenital anomalies occurred in 6,703 (6.0%) of the CLB. The item related to the presence of stillbirths and live births in previous pregnancies was not filled in 32.4% and 20.0% of the certificates respectively. The other variables presented incompleteness below 3.0%.

Table III - Characterization of congenital anomalies in live births. Rio Branco, Acre, Brazil. 2001-2013. (n=104.026)

Variable	n	%
Classification of anomalies (ICD-10)*		
Malformations of the nervous system (Q00-Q07)	42	17.8
Malformation of eye, face and neck (Q10-Q18)	7	3.0
Malformations of the circulatory system (Q20-Q28)	2	0.9
Malformations of the respiratory system (Q30-Q34)	3	1.3
Cleft lip and cleft palate (Q35-Q37)	13	5.5
Other malformations of the digestive system (Q38-Q45)	18	7.7
Malformations of the genital organs (Q50-Q56)	21	8.9
Malformations and deformations of the musculoskeletal system (Q65-Q79)	97	41.3
Other congenital malformations (Q80-Q89)	13	5.5
Chromosomal abnormalities (Q90-Q99)	19	8.1
Number of anomalies per live birth		
One	202	93.0
Two	13	6.0
Three	1	0.5
Four	1	0.5
Category of anomalies per live birth		
Major	177	75.3
Minor	58	24.7

*ICD-10: International Statistical Classification of Diseases and Related Health Problems, ICD-10.

The odds of presenting congenital anomaly were higher among: live births of mothers aged <15 and ≥35 years (OR 1.54; 95%CI 1.03; 2.32); preterm births (OR 3.63; 95%CI 2.38; 5.53); births at 32-36 weeks of pregnancy (OR 9.15; 95%CI 5.89; 14.20); births before 32 gestational weeks (OR 3.63; 95%CI 2.38; 5.53); cesarean deliveries (OR 2.05; 95%CI 1.56; 2.68); live births with severe disability in Apgar at 1 minute (OR 13.30; 95%CI 8.15; 21.70) and Apgar at 5 minutes (OR 18.66; 95%CI 11.19; 31.12); and newborns with extreme low weight (OR 14.17; 95%CI 9.43; 21.29). The odds of anomaly were lower among mothers with more live births (OR 0.89; 95%CI 0.80; 0.99) (Table IV).

After logistic regression, in the adjusted analysis, the variables “age of the mother”, “type of delivery”, “Apgar score at 1 and 5 minutes” and “birth weight” remained associated and remained statistically significant. Sex of the live birth and number of live births lost statistical significance; however, they were kept in the model because they adjust it better. The inclusion of these variables substantially decreases the value of the likelihood ratio of the model and enhance its power of explanation.

Table IV - Prevalence and crude and adjusted analysis of the factors associated with congenital anomalies. Rio Branco, Acre, Brazil. 2001 - 2013. (n=110.946)

Variable	Prevalence n	Prevalence %	$OR_{(Crude)\ 95\%CI}$	p value[a]	$OR_{(Adjusted)\ 95\%CI}$	p value[b]
Age of the mother				0.032		0.038
15 to 34 years	190	0.2	1		1	
< 15 and ≥ 35 years	27	0.3	1.54 (1.03;2.32)		1.72 (1.03;2.87)	
Marital status of the mother				0.405		
With partner	143	0.2	1			
Without partner	65	0.2	1.13 (0.84;1.51)			
Education of the mother				0.760		
Up to 13 years of study	122	0.2	1			
14 years of study or more	92	0.2	0.95 (0.73;1.25)			
Duration of pregnancy				0.001		
≥ 37 weeks	162	0.1	1			
32 to 36 weeks	25	0.6	3.63 (2.38;5.53)			
< 32 weeks	23	1.5	9.15 (5.89;14.20)			
Type of pregnancy				0.901		
Singleton	213	0.2	1			
Twin	4	0.2	1.06 (0.39;2.86)			
Number of prenatal consultations				0.426		
7 and more	77	0.2	1			
4 to 6	81	0.1	0.92 (0.67;1.26)			
≤ 3	55	0.2	1.16 (0.82;1.64)			
Type of delivery				0.001		0.001
Vaginal	93	0.1	1		1	
Cesarean	124	0.3	2.05 (1.56;2.68)		1.85 (1.29;2.65)	
Sex of the live birth				0.084		0.060
Female	87	0.1	1		1	
Male	118	0.2	1.27 (0.96;1.68)		1.41 (0.98;2.02)	
Apgar score 1				0.001		0.003
Optimal conditions	115	0.1	1		1	
Mild disability	11	0.3	1.93 (1.04;3.58)		1.67 (0.80;3.49)	
Moderate disability	27	1.4	9.12 (5.98;13.9)		3.54 (1.69;7.42)	
Severe disability	19	2.0	13.3 (8.15;21.7)		1.12 (0.33;3.81)	
Apgar score 5				0.001		0.001
Optimal conditions	138	0.2	1		1	
Mild disability	7	1.2	6.86 (3.19;14.72)		1.47 (0.45;4.83)	
Moderate disability	11	2.9	17.45 (9.3632.54)		4.99 (1.80;13.79)	
Severe disability	17	3.2	18.66(11.19;31.12)		13.65 (4.00;46.61)	
Birth weight				0.001		0.001
≥ 2,500g	152	0.1	1		1	
1,500 to 2,499g	37	0.5	3.12 (2.17;4.47)		2.64 (1.60;4.35)	
≤ 1,499g	28	2.2	14.17 (9.43;21.29)		5.09 (2.32;11.19)	
Number of live births						
Continuous variable	-	-	0.89 (0.80;0.99)	0.064	0.95 (0.84;1.06)	0.373

a) Pearson's Chi-squared test. b) Wald's Chi-squared test.

DISCUSSION

The results of the present study showed that 0.2% of the live births in Rio Branco, Acre, between 2001 and 2013 presented some congenital anomaly. The main associated factors were: age of the mother <15 and ≥35 years, prematurity, low birth weight, lower Apgar scores at 1 and 5 minutes, cesarean delivery, and mothers with more live births.

The prevalence of congenital anomalies found in the present study is lower than those reported by other national and international studies[4,5,16-19], which can be a result of potential underreporting of anomalies at the time of birth due to difficulties in detecting anomalies such as malformations of the cardiovascular and digestive systems when compared to the visible ones, such as those of the genital organs and musculoskeletal system. Another relevant aspect of such a complex situation is the

specific description of the anomaly, which requires that professionals have the knowledge and dedication to describe it based on the second and third digits of ICD-10. These aspects have been analyzed by studies that have identified different results depending on the type of institution where the baby was born, the professional responsible for completing the CLB, and training and qualification of the team[12,16,20-22].

In Rio de Janeiro, researchers found a prevalence rate of congenital anomalies of 0.8% between 2000 and 2006, and the same prevalence rate appears in another study of data from the years 2000 to 2004 in the same municipality[17,23]. In Vale do Paraíba Paulista, the prevalence rate was 1.5% in 2003 and 2004[4]. A study carried out in São Luís do Maranhão found a prevalence rate of 0.4% between the years 2002 and 2011[5]. According to data from the Latin American Collaborative Study of Congenital Malformations (*Estudio Colaborativo Latino Americano de Malformaciones Congenitas – ECLAMC*), the prevalence of congenital anomalies in Chile was 3.9% in the period from 2001 to 2010[24]. Another study using the same ECLAMC data from 1995 to 2008 compared prevalence rates in all Latin American countries participating in the group and found a global prevalence of 2.6%, with Brazil ranking first (4.0%), followed by Chile (3.1%), Uruguay (2.4%), Venezuela (2.3%), Paraguay and Argentina (2.2%), Colombia (1.8%), Bolivia (1.7%), and Ecuador (1.4%)[18]. In Mexico, an analysis of the live births from 2009 and 2010 found a prevalence rate of congenital anomalies of 0.7%[19].

There are controversies surrounding the classification of anomalies into major and minor, since the simplest anomaly can have extremely relevant consequences for its bearer; further, several research centers consider this classification dysmorphologically incorrect, limited and exclusive[15]. However, the present study classified the anomalies in a descriptive way not to discuss the merit of the classification into major or minor anomalies, but to point out that the most serious and perceptible anomalies at the time of birth are described in the CLB, since 75.3% of the anomalies were classified into major. These findings leads to doubts and questions about the underreporting of birth defects considered minor at birth[15,21,23].

The highest prevalence rates found in 2001, 2002 and 2004 highlight the impact of the inclusion of Item 34 in the CLB, which occurred in 1999. After this period, training programs were carried out to promote more accurate identification and description of congenital anomalies at birth[12]. Therefore, attention should be drawn to analyzing an increase or association of an outcome in a times series that has been affected by a new public policy such as the inclusion of Item 34 in the CLB. Thus, some studies of interrupted time series have gained strength in scientific publications[25].

The findings of the present study point to an association between the age of the mother and the occurrence of congenital anomaly. Studies highlight maternal age as a risk factor for the development and worsening of cases of congenital anomalies. For very young mothers, particularly adolescents (between the ages of 10 and 19 according to the WHO), there is an increased risk for malformations of the musculoskeletal and nervous systems and also for those caused by external factors, such as misuse of abortion drugs[5,8,24,26,27]. There is a strong association of chromosomal anomalies with live births of women aged over 35 years. Additionally, preexisting chronic maternal morbidities, such as hypertension and diabetes, appear to be related to congenital anomalies of the heart; however, it is unclear whether the anomaly is related to the presence or the continuous treatment of the disease[28,29].

In the present study, there was no association between congenital anomalies and use of alcohol or tobacco by the mother during pregnancy; however, these maternal factors are described in the literature as potential risk factors for the presence of anomalies, particularly cleft lip and cleft palate[3,9,26-29].

One variable in the present study that was not associated with the occurrence of congenital anomalies in Rio Branco was the level of maternal education. This finding is in disagreement with the findings of other national studies and studies in Latin America[4,18,19,24]. This variable is cited as a protection factor for both identification of congenital anomalies and minimization of their sequelae. The relationship between education and social determinants is widely discussed, since women with higher levels of education generally belong to a select social stratum, with better economic conditions and access to health services, healthier eating habits and greater capacity to interpret potential risks during the gestational period[14,26].

Still with regard to social determinants, the marital status of the mother, namely marital stability, positively contributes to the decrease in reproductive risk (number of partners and communicable diseases like syphilis) and to better food security conditions as women's household income also comprises that of her partner[4,17,24,27].

Factors related to pregnancy and childbirth are generally described as risk factors for this particular outcome, but the data should be carefully discussed, since there are limiting aspects in determining such associations. One such factor is the duration of pregnancy. The present study, in agreement with others[2,4,17], revealed a higher occurrence of congenital anomalies among women with shorter pregnancies. This may occur in cases in which the identification of the congenital anomaly still occurs in the intrauterine life and pregnancy is then interrupted for interventions in the anomaly, or in cases where the anomaly itself is a factor compromising fetal development and leads to preterm delivery[4]. Likewise, the type of delivery should be highlighted, since the interruptions are usually performed by surgical deliveries. In addition, other risk factors, such as the age of the mother, preexisting morbidities and early detection of anomalies, also determine the performance of cesarean sections[2,4,17,18]. In the present study, the type of delivery was associated and remained associated in the final model.

When discussing the characteristics of live births, the literature reports a greater identification of anomalies among male newborns[2,4,10,17]. The findings of the present study are similar, but they did not remain statistically significant after a sex-

adjusted analysis. Given that, in 16 cases of anomalies of the genital organs, it was not possible to identify the sex of the live birth. This figure may be influencing the direction of this analysis given the total number of cases in the present study. The greater occurrence of anomalies among male live births is widely discussed[4,5,17]; it is known that some anomalies, especially chromosomal anomalies, are by nature more frequent among these individuals. Thus, the inclusion of chromosomal anomalies in the total number of congenital anomalies should be carefully taken into consideration in order to analyze the possible associations with the sex of the live birth.

The factors associated with congenital malformations found in the present study, namely Apgar scores at 1 and 5 minutes and birth weight, are corroborated by other studies[4,5]. There is a higher chance of congenital anomaly occurring among live births with an Apgar score classified as severe or moderate disability both at 1 and 5 minutes, and this association was confirmed after adjustment, remaining statistically significant. It is known that some anomalies, especially those associated with the circulatory and respiratory systems, compromise the vital functions of the newborn and are used as the main parameters for Apgar assessment at 1 and 5 minutes. Therefore, a live birth with an anomaly of the circulatory or respiratory systems may also present with lower Apgar scores[2,5,27].

In the present study, congenital anomalies were more likely to occur in underweight newborns compared with those at normal weight. This variable remained statistically significant even after adjusted analysis. Several studies have explained the association and the rationale based on the relationship between prematurity and the delay in fetal development due to the anomaly itself. Low birth weight is associated with congenital heart disease, musculoskeletal defects, and some encephalopathies[2,5,26].

The predominant anomalies include those related to malformations and deformations of the musculoskeletal system, followed by those of the central nervous system, genitourinary system, and chromosomal anomalies. The data of the present study are similar to those found in two other studies, one in Rio de Janeiro[17] and another that compares several Latin American countries[18]. Deformities of the musculoskeletal system and anomalies of the central nervous system and genitourinary system stand out for being identifiable at birth – in some cases they are identified during the prenatal period, during examinations such as morphology ultrasound and nuchal translucency measurement, which enable a more accurate postpartum diagnosis[2,16].

Understanding health promotion as a set of strategies and ways of producing health, both individually and collectively, aiming to meet social health needs and guarantee the improvement of the quality of life of the population[30], it is important to establish the prevention of congenital anomalies as a viable and effective action, since evidence-based primary care strategies can be implemented both to reduce risk factors and to disseminate protective factors and behaviors at the individual and collective levels[31].

It is worth noting that the main primary evidence-based prevention actions targeted mainly to families with women of childbearing age are the prophylactic use of supplements (iron and folic acid) in the preconceptional period, the maintenance of the couple's reproductive health and family planning activities[32].

Taking into consideration the actions recommended in the protocols of care for pregnant women, the narrowing between theory and practice in primary health care centers should include: risk-benefit assessment in cases of therapeutic need; vaccination policies; actions to avoid exposure to environmental risk factors; identification of genetic predisposition factors; and women's empowerment to make lifestyle choices. These actions constitute strategies for coping with and reducing congenital anomalies in the population[32,33].

Although the SINASC data are unrestricted and available to the entire population, a lack of studies carried out in the state of Acre has also been observed in the present study. It is important to carry out other studies with the available data, which need to be used for the collective construction of knowledge and for developing management strategies in the health care system.

Researchers[12,16,21,22] agree with the demand for better standards for the reliability and consistency of the data from Item 34 of CLB, as suspected underreporting is increasingly evident and there is a need for training and awareness of the professional for the adequate filling and detailing of the data. Therefore, further studies are suggested to reduce/eliminate the limiting factors of the present research.

The possible limitations of the current present research are those related to cross-sectional studies with secondary data, which depend on the quality of the data based on reliability and completeness. Importantly, there is the possibility of failures in CLB filling, which are generally attributed to the little recognition and poor use of the information produced, the poor training of professionals and administrative technicians, the failure to enter data in the database, and the incomplete filling of medical records, since many congenital malformations may not be detected at the time of birth and, therefore, are not included in SINASC. It is important to emphasize the reverse causality, which does not allow to determine the cause and consequence of the facts.

The findings of the present study are expected to support the improvement of the quality of SINASC information in the municipality of Rio Branco, Acre, and in the Northern region of Brazil. Additionally, they may encourage the use of the system to monitor maternal and child health conditions. Knowledge of the prevalence of and factors associated with congenital anomalies in the municipality may be useful for planning actions and health services, implementing new diagnostic methods, directing prenatal follow-up for pregnant women at risk (<15 and ≥ 35 years) and instituting prevention and screening measures that allow interventions when necessary.

CONCLUSION

In the municipality analyzed, the odds of presenting congenital anomaly were higher among: live births of mothers aged <15 and ≥35 years; preterm newborns with less than 32 gestational weeks; cesarean deliveries; newborns with severe disability in Apgar at 1 and 5 minutes; and newborns who presented extreme low weight.

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