Risk factors for child mortality in towns of Paraná State (South Brazil), from 1997 to 2008

Fatores de risco para mortalidade infantil em municípios do Estado do Paraná, de 1997 a 2008

Factores de riesgo para mortalidad infantil en municipios de la Provincia de Paraná (Brasil), de 1997 a 2008

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ABSTRACT

Objective: To identify and analyze the risk factors associated to infant mortality in the towns that comprise the 9th Health Regional, State of Parana (South Brazil), from 1997 to 2008.

Methods: This is a retrospective study using secondary data from Information System on Live Births (SINASC) and Information System on Mortality (SIM). The dependent variable was death during the first year of life and as independent variables: gender, birth weight, gestational age, place of death, type of pregnancy and parturition, maternal age and maternal education. The risk factors associated to death were evaluated by univariate analysis.

Results: Between 1997 and 2008, 92,716 births were registered by SINASC and 1,535 deaths in children under one year old were registered by SIM. Risk factors associated to mortality were: male gender (OR 1.09; 95%CI 1.04–1.15), low birth weight (OR 4.37; 95%CI 4.14–4.62), preterm births (OR 4.83; 95%IC 4.18–5.58), vaginal delivery (OR 1.11; 95%CI 1.05–1.17), adolescent mothers (OR 1.11; 95%CI 1.02–1.22) and low educational level (OR 1.97; 95%CI 1.84–2.10).

Conclusions: The data showed a decrease in the infant mortality and the percentage of ignored information in the databases. The identified risk factors suggest the need of prenatal care attention on the most vulnerable groups.

Key-words: infant mortality; information systems; risk factors.

RESUMO

Objetivo: Identificar e analisar os fatores de risco para a mortalidade infantil nos municípios que compõem a 9ª Regional de Saúde do Estado do Paraná, entre os anos de 1997 a 2008.

Métodos: Estudo retrospectivo, com dados secundários a partir do Sistema de Informações de Nascidos Vivos (SINASC) e do Sistema de Informação sobre Mortalidade (SIM). Foi considerado variável dependente o óbito antes do primeiro ano de vida e variáveis independentes: sexo, peso ao nascer, duração da gestação, local de ocorrência do óbito, tipo de gravidez, tipo de parto, idade materna e escolaridade da mãe. Os fatores de risco associados ao óbito foram avaliados por meio da análise univariada.

Resultados: Entre os anos de 1997 e 2008, foram registrados 92.716 nascimentos pelo SINASC e 1.535 óbitos em crianças menores de um ano pelo SIM. Foram fatores de risco para a mortalidade nascidos vivos do sexo masculino (OR 1,09; IC95% 1,04–1,15), com baixo peso (OR 4,37; IC95% 4,14–4,62), prematuros (OR 4,83; IC95% 4,18–5,58), nascidos vivos de parto vaginal (OR 1,11; IC95% 1,05–1,17), mães adolescentes (OR 1,11; IC95% 1,02–1,22) e com baixa escolaridade (OR 1,97; IC95% 1,84–2,10).

Conclusões: Os dados mostram diminuição da mortalidade infantil e de informações consideradas ignoradas nos bancos de dados e identificam os fatores de risco sugerindo atenção dos profissionais da saúde para o grupo de maior vulnerabilidade desde a assistência no pré-natal.

Palavras-chave: mortalidade infantil; sistemas de informação; fatores de risco.

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RESUMEN

Objetivo: Identificar y analizar los factores de riesgo para la mortalidad infantil en los municipios que componen la 9ª Regional de Salud de la provincia de Paraná (Brasil), entre los años de 1997 a 2008.

Métodos: Estudio retrospectivo, con datos secundarios a partir del Sistema de Informaciones de Nacidos Vivos (SINASC) y del Sistema de Informaciones sobre Mortalidad (SIM). Se consideró variable dependiente el óbito antes del primer año de vida y variables independientes el sexo, el peso al nacer, la duración del embarazo, el local de ocurrencia del óbito, el tipo de embarazo, el tipo de parto, la edad materna y la escolaridad de la madre. Los factores de riesgo asociados al óbito fueron analizados con el uso del análisis univariado.

Resultados: Entre los años de 1997 y 2008, el SINASC registró 92.716 nacimientos, y el SIM registró 1.535 óbitos en niños menores de un año. Fueron factores de riesgo para la mortalidad nacidos vivos del sexo masculino (OR 1,09; IC95% 1,04-1,15), con bajo peso (OR 4,37; IC95% 4,14–4,62), prematuros (OR 4,83; IC95% 4,18–5,58), nacidos vivos de parto vaginal (OR 1,11; IC95% 1,05–1,17), madres adolescentes (OR 1,11; IC95% 1,02–1,22) y con baja escolaridad (OR 1,97; IC95% 1,84–2,10).

Conclusiones: Los datos muestran reducción de la mortalidad infantil y de informaciones consideradas ignoradas en las bases de datos e identifican los factores de riesgo sugiriendo atención de los profesionales de la salud al grupo de mayor vulnerabilidad desde la asistencia en el pre-natal.

Palabras clave: mortalidad infantil; sistemas de información; factores de riesgo.

Introduction

Health indicators are important data in the field of Public Health. Infant mortality rates are one of the most relevant instruments to assess a community's health status, since they are determined by social, economic and cultural aspects[1]. They also contribute in the analysis of programs, besides providing information for the planning of activities in epidemiological vigilance and actions in health[1-3].

Biologic and social factors as well as those regarding medical assistance, which are determinant to infant mortality and survival, are concerns of the Brazilian an the international scientific community. Societies, governmental and non-governmental institutions find that the struggle for the maintenance of increasingly lower rates of this indicator is challenging, since it also reflects the country's social inequalities and the difficulty to access, in a timely manner, qualified and efficient health services[4].

In Brazil, health and demographic studies have shown that, in recent decades, infant mortality has been decreasing gradually[5-6], from 35.20 deaths in children under 1 year old, in 1997, to 24.32 per thousand live births, in 2007[5]. Infant mortality rates are low in regions with greater economic development, such as Southeast (17.7%) and South (16.1%), whereas North and Northeast have the highest rates (25 and 35.6%, respectively) and the Midwest has intermediate rates (18.9%)[5].

In order to face such challenge, the region has established, among other strategies, the Committees for the Prevention of Infant Mortality, which aim to structure, at the national level, the investigation of infant deaths as a strategic action to improve the quality of records, research and identification of causes of death in the first year of life, as well as providing support to public policies on preventive measures to promote children's lives, each one according to their reality, interest and operating[7].

In the state of Paraná, the State Committee for the Prevention of Infant Mortality has been in activity since November 1997, working in coordination with the Regional and Municipal Committees. A study on child mortality in the state of Paraná found that, between 1997 and 2005, the risk of death in children younger than 1 year decreased from 19.91% in the first triennium, to 18.01%, in the second triennium, and 15.48%, in the third triennium. The state of Paraná consists of 399 municipalities, divided into 22 Health Regionals. In relation to the 9th Regional Health Center, there was a decrease of 22.30% between the first and the third triennium[8].

To understand the profile of mortality is critical to establishing appropriate public policies to each situation and formulate strategies that enable their control. Thus, in order to develop the discussion on infant mortality, the aim of this study was to identify and analyze risk factors for infant mortality in the municipalities that comprise the 9th Regional Health Center, in the state of Paraná, between 1997 and 2008.

Method

Retrospective cohort study, quantitative approach, using secondary data from the Information system on live births (SINASC) and of the Information system on

mortality (SIM), with variables related to births and deaths of children under 1 year, children of mothers living in the municipalities that comprise the 9th Health Regional of Paraná, in the period between 1997 and 2008. This regional is located in the western region of the state and comprises nine municipalities, two of them with less than 5,000 inhabitants (Ramilândia with 4,134 inhabitants and Serranópolis do Iguaçu with 4,568), one with less than 10,000 (Itaipulândia with 9,026 inhabitants), two with 10 to 20,000 inhabitants (Missal with 10,474 inhabitants and Matelândia with 16,078), three with more than 20 and less than 50,000 inhabitants (Santa Terezinha de Itaipu with 20,841 inhabitants, São Miguel do Iguaçu with 25,769 and Medianeira with 41,827) and, finally, Foz do Iguaçu with 256,088 inhabitants. The region has an average (ranging from 0.573 to 0.788) human development index (HDI), different from the education HDI, which is considered high (ranging from 0.875 to 0.905), except for the municipality of Ramilândia, which has an average education HDI (0.781). It is worth mentioning that Foz do Iguaçu is a municipality bordering Argentina and Paraguay, which is known internationally for the Iguaçu Falls and the Itaipu Hydroelectric Power Plant; while the remaining municipalities have their economies based primarily on agro-industrial production.

The year of 1997 was chosen because it was in 1997 that, in the state of Paraná, the movements of observation and investigation of infant death were started, in coordination with the Regional and Municipal Committees; and 2008 was chosen due to the availability of information on infant deaths on the Information System on Mortality. To reduce rates instability, the data were grouped by three-year periods: the first period covers the years 1997–1999; the second three-year period includes the years 2000–2002; the third triennium covers the years 2003–2005; and the fourth, the years of 2006–2008.

The infant mortality rate was obtained by the number of deaths in children aged under 1, in the determined periods and places divided by the number of live births in the same area and period, expressed per thousand live births, with data available in the SIM, and SINASC, through the Datasus website – Brazilian Ministry of Health[9].

To characterize deaths and the analysis of risk factors, death before the first year of life was considered as a dependent variable, and the exposition variables were: a) Neonatal variables – sex (male or female), birth weight (less than 2,500g and equal or greater than 2,500g), length of

gestation (less than 36, from 37 to 41 weeks and greater than or equal to 42 weeks), place of death (hospital or others); b) Obstetric variables – type of pregnancy (single or multiple), type of delivery (vaginal or cesarean); c) Maternal variables – age (less than 20 years, 20 to 34 years, equal or grater than 35 years), education (up to seven years of study; eight or more years of study). The discarded information was considered in the characterization of deaths but not on the analysis of risk factors.

All data were processed and treated with the Statistica 7.0 program. The association between variables was tested by univariate analysis using Odds Ratio, chi-square tests and Mantel-Hanzel, studying the independent variables in relation to death, with significance level of 95%. The presence of association of was set at $p<0.05$.

The STATA 11.0 software was used for all statistical analysis. The association between the independent variables and mortality was tested though the univariate analysis, using the Odds Ratio, chi-square and Mantel-Hanzel tests, considering significant $p<0.05$. Poisson regression was applied to estimate the relative risk (RR) and confidence interval of 95% (95%CI) of death according to the independent variables in each triennium. The Walde test of linear trend was used to test, respectively, the heterogeneity between the dichotomous or nominal variables and the ordinal categorical variables.

The development of the study occurred in accordance with the recommendations of the n. 196/96 CNS/MS Resolution and the project was examined and approved by the Permanent Committee of Ethics in Research with Humans of the Universidade Estadual de Maringá

Results

During the period of the study (1997–2008), SINASC recorded 92,716 births and, SIM recorded 1,535 deaths in children under 1 year old, offspring of mothers living in the municipalities that comprise the 9th Health Regional. The greatest number of deaths was found in the first triennium. Although the reduction in infant mortality rates did not show to be similar in the nine municipalities over the trienniums, it was found that the risk of death in children under 1 year, decreased, in general, since mortality rates were 18.92, 17.23, 14.69, and 14.37% of deaths in children under 1 year per thousand live births, in the first, second, third and fourth trienniums, respectively.

Regarding the characterization of deaths in children under 1 year old, the data concerning neonatal variables showed that most children were male, presented low birth weight, gestation of less than 36 weeks and in about 80%, the place of death was the hospital (Table 1). As for the obstetric variables, the highest percentage of deaths was from single pregnancies with vaginal delivery.

Regarding the maternal variables, it was found that, in more than half of infant deaths, mothers were 20–34 years old, followed by adolescents and women over 35 years. Despite the high percentage of no information on maternal education in the first triennium (52.3%), which undermines any conclusion regarding this variable in this period, there was a decrease in the proportion of deceased children whose mothers had up to seven years of study over the three triennials (56.48, 55.45 and 44.33% respectively).

The lack of information was also observed for the variables: birth weight, gestational length, place of occurrence, type of pregnancy, type of delivery and maternal age

Table 1 - Characterization of deaths in children under 1 year, in trienniums, according to neonatal, obstetric and maternal variables, in the municipalities of the 9th Health Regional of Paraná – 1997 to 2008

	First triennium		Second triennium		Third triennium		Fourth triennium	
	532 deaths		409 deaths		312 deaths		282 deaths	
	n	%	n	%	n	%	n	%
Sex								
Male	320	60.15	224	54.77	173	55.45	143	50.70
Female	212	39.95	185	45.23	139	44.55	139	49.30
Birth weight (g)								
<2500	241	45.30	212	51.83	182	58.33	171	60.64
≥2500	196	36.84	168	41.08	122	39.10	92	32.62
Unknown	95	17.86	29	7.09	8	2.56	19	6.74
Gestation length (weeks)								
≤36	173	32.52	208	50.86	173	55.45	168	59.57
37 to 41	121	22.74	155	37.90	131	41.99	96	34.04
≥42	13	2.44	9	2.20	1	0.32	3	1.06
Unknown	225	42.30	37	9.05	7	2.24	15	5.32
Place of occurrence								
Hospital	330	62.03	337	82.40	293	93.91	256	90.78
Outros	42	7.89	47	11.49	19	6.09	26	9.22
Unknown	160	30.08	25	6.11	–	0.00	–	0.00
Type of pregnancy								
Single	419	78.76	351	85.82	276	88.46	231	81.91
Multiple	44	8.27	27	6.60	31	9.94	36	12.77
Unknown	69	12.97	31	7.58	5	1.60	15	5.32
Type of delivery								
Vaginal	287	53.95	233	55.61	173	55.45	140	49.65
Cesarean	177	33.27	140	33.41	132	42.31	123	43.62
Unknown	68	12.78	36	10.98	7	2.24	19	6.74
Maternal age (years)								
10 to 19	114	21.43	123	30.07	85	27.24	71	25.18
20 to 34	282	53.01	222	54.28	196	62.82	156	55.32
≥35	42	7.89	40	9.78	26	8.33	31	10.99
Unknown	94	17.67	24	5.87	5	1.60	24	8.51
Maternal education (years)								
Until 7	81	15.23	231	56.48	173	55.45	125	44.33
8 or more	172	32.33	133	32.52	133	42.63	132	46.81
Unknown	279	52.44	45	11.00	6	1.92	25	8.87

Source: SIM/Datasus (Brazilian Ministry of Health).

with significant decrease of unknown/missing information over the four trienniums.

Table 2, shows that being male was a risk factor for mortality in the first, second and third study periods, and the relative risk was higher in the first period, suggesting that, over the years, the risk of death for being male decreased in children under 1 year old. Moreover, in all study periods, low birth weight showed a high risk of mortality in children under 1 in the area studied, a fact that was also observed for gestational ages below 36 weeks. Another important result to be emphasized in Table 2 was that, for all periods, low maternal education was associated with significant risk for mortality in children until 1 year old.

Table 3 presents univariate Odds Ratio, identifying as risk factors for mortality in the first years of life: male sex, low birth weight, gestational length inferior to 36 weeks, vaginal delivery, mothers aged between 10 and 19 years

and low maternal education. The variables: place of death and live birth from single pregnancies were protecting factors for infant mortality.

Discussion

According to the present study, the risk of death in children under 1 year, whose mothers live in each of the municipalities of the 9th Regional, suffered a decrease of 24.5% between the first and the fourth trienniums; a similar reduction to those that took place on the state of Paraná (22%), Southern Region (17%) and Brazil (20%)[8].

In Brazil, the decrease in infant mortality rates by 68%, between 1980 and 2002, was primarily due to the drop of the post-neonatal factor, a situation that can be determined by the implementation of actions aimed at health promotion and protection, advances in medical technologies, increased education of women and decreased fertility rates.

Table 2 - Relative Risk for mortality in each triennium according to the independent variables analyzed

Variables	First triennium 532 deaths		Second triennium 409 deaths		Third triennium 312 deaths		Fourth Triennium 282 deaths	
	RR	95%CI	RR	95%CI	RR	95%CI	RR	95%CI
Sex	*p*<0.001		*p*=0.026		*p*<0.001		*p*=0.481	
Male	1.73	(1.46–2.05)	1.24	(1.03–1.51)	1.47	(1.18–1.83)	1.09	(0.86–1.37)
Female	1.00		1.00		1.00		1.00	
Birth weight (g)	*p*<0.001		*p*<0.001		*p*<0.001		*p*<0.001	
<2500	6.86	(5.66–7.81)	7.95	(6.71–9.41)	12.97	(10.88–15.46)	9.38	(8.28–10.62)
≥2500	1.00		1.00		1.00		1.00	
Gestation length (weeks)	*p*=0.009		*p*=0.026		*p*=0.001		*p*=0.014	
≤36	2.07	(1.20–3.57)	3.70	(2.01–6.82)	17.46	(4.28–71.14)	3.69	(1.30–10.52)
37 to 41	0.64	(0.36–1.12)	0.89	(0.46–1.74)	4.07	(0.67–24.80)	0.66	(0.21–2.06)
≥42	1.00		1.00		1.00		1.00	
Place of occurrence	*p*<0.001		*p*<0.001		*p*<0.001		*p*<0.001	
Hospital	1.00		1.00		1.00		1.00	
Others	6.26	(4.74–8.27)	9.53	(7.45–12.21)	4.79	(3.15–7.26)	19.82	(14.94–26.31)
Type of gestation	*p*<0.001		*p*=0.023		*p*=0.001		*p*<0.001	
Single	1.00		1.00		1.00		1.00	
Multiple	2.08	(1.54–2.81)	1.56	(1.06–2.30)	1.79	(1.24–2.57)	2.79	(2.00–3.90)
Type of delivery	*p*<0.001		*p*<0.001		*p*<0.001		*p*<0.001	
Vaginal	1.00		1.00		1.00		1.00	
Cesarean	0.31	(0.26–0.37)	0.24	(0.20–0.30)	0.19	(0.16–0.23)	0.11	(0.09–0.13)
Maternal age	*p*=0.261		*p*=0.038		*p*=0.899		*p*=0.004	
10 to 19	0.95	(0.76–1.17)	1.51	(1.22–1.88)	1,06	(0.82–1.37)	1,37	(1.04–1.80)
20 to 34	1.00		1.00		1.00		1.00	
≥35	1.2	(0.87–1.66)	1.42	(1.02–1.98)	1.03	(0.68-1.54)	1.75	(1.20-2.56)
Maternal education (years)	*p*=0.562		*p*<0.001		*p*<0.001		*p*<0.001	
Until 7	0.93	(0.71–1.20)	3.60	(2.95–4.38)	3.93	(3.19–4.83)	5.55	(4.47–6.88)
8 or more	1.00		1.00		1.00		1.00	

RR: relative risk; 95%CI: confidence interval of 95%.

Table 3 - Univariate analysis of deaths in children under 1 year, according to neonatal, obstetric and maternal variables in the municipalities of the 9th Health Regional of Paraná – 1997 to 2008

	Odds Ratio	95%CI	*p*-value
Sex			
Male	1.09	1.04–1.15	<0.001
Birth weight (g)			
<2500	4.37	4.14–4.62	<0.001
Gestation length (weeks)			
≤36	4.83	4.18–5.58	<0.001
≥42	1.19	0.91–1.55	0.18
Place of occurrence			
Hospital	0.21	0.19–0.23	<0.001
Type of pregnancy			
Single	0.43	0.39–0.47	<0.001
Type of delivery			
Vaginal	1.11	1.05–1.17	<0.001
Maternal age			
10 To 19	1.11	1.02–1.22	0.01
≥35	1.12	0.99–1.26	0.05
Education (years)			
Until 7	1.97	1.84–2.10	<0.001

95%CI: confidence interval of 95%

However, neonatal mortality became, since the 90s, the main component of infant mortality, but it is well known that the actions for its control, though existing, are still incipient and must converge to the development of services for maternal-infant health[7].

The highest prevalence of deaths in male children in the 9th Regional is consistent with what was observed in the state of Paraná as a whole during the same period, corresponding to 57%[8]. In cohort studies conducted in Pelotas from 1982 to 1993, it was verified higher infant mortality rates for boys[10], a situation confirmed by another study conducted in Porto Alegre between 2000 and 2003, in which there were more deaths under among 1-year-olds in boys than in girls[11].

The prevalence of deaths in males may be due, on the one hand, to the earlier pulmonary maturity in females during the neonatal period, resulting in a greater number of hospitalizations in the first year of live in the male sex[11]; besides the fact that more boys are born than girls, and still, the higher probability of deaths in males for all age groups.

As already studied in several other studies in Brazil and worldwide[12-17], in the present study, the variables birth weight and prematurity constitute risk factors that are strongly associated with infant mortality. The infants with low birth weight, for instance, were 4.9-fold more likely to die than those with a weight equal or greater than 2500g. Prematurity, in turn, has an important role on infant mortality, which is worrying, since there has been an increased prevalence of prematurity since the 1990s in Brazil[15]. In a study conducted in a municipality in northeastern Brazil, it was identified that preterm babies presented a much higher risk of death than term babies (RR 12.92; 95%CI 8.91-18.74)[16]; a risk for infant mortality that was almost three times greater than that of this study. Literature points out as the main mechanisms involved in the etiology of prematurity: premature labor, early termination of pregnancy due to problems associated with the mother, the fetus or other factors, such as early placental abruption, vaginal bleeding and pregnancy hypertension[15,16].

However, it is important to emphasize that the variables related to birth weight and gestational length should not be studied as isolated risk factors, but, rather, associated with maternal biological and socio-economic characteristics, such as: education, lifestyle and access to health services – which are also considered determinant factors on infant mortality[13]. This aspect gains more importance when one considers that the present study examined mortality in children under 1 year old in several municipalities, which, though belonging to the same region, may have different characteristics.

Finally, it should be emphasized that the magnitude of the association between low birth weight and prematurity with infant death signals the need for greater attention to gestations of women with unfavorable conditions, so as to prevent the high incidence of low birth weight and preterm delivery.

In the present study, cesarean section did not appear as a risk for infant death, on the contrary, it showed to be a protecting factor. Literature has pointed out, though not consensually, the protecting effect of the cesarean delivery for neonatal mortality in private hospitals and this may be associated with the quality of access to health services, delivery care and socio-economic status, among others[16,17]. The study by Morais Neto and Barros[16], for instance, shows that births by cesarean section are at 45% lower risk of death when compared to those born from vaginal delivery.

The association between infant mortality and multiple gestations has been reported by several authors[16,18,19]. The

babies of single pregnancies were less likely to die. It is noteworthy that premature and low birth weight births are more common in multiple pregnancies[16,20], and are factors that lead to greater like likelihood of death in this group[20], therefore, some studies examining risk factors for infant morality disregard, in the analysis, cases of twin pregnancies[16].

Pregnancy at the extremes of reproductive life is associated with infant mortality[19]. In the present study, this association occurred in mothers aged under 20, what differs from the findings in the study conducted in Pelotas[10], which identified a higher frequency of deaths in under 1-year-olds who were children of mothers older than 35. However, in a study conducted also in South Brazil, more precisely in Porto Alegre[11], there was no evidence of association between maternal age and infant mortality, though 24.1% of mothers of the studied children were aged less than 20 years. Although the socio-demographic and economic profile of mothers aged 10–19 years in the sample is unknown, it is known that, generally, during teenage pregnancy there is a low commitment to prenatal care, with the consequent reduction in the number of consultations and inadequate monitoring of pregnancy, increasing the chances of complications during pregnancy in adolescence.

Many studies, including the present one, indicate low education as a risk factor for infant death[11,16,19]. It can be considered that, in most cases, low education reflects the mother's low socio-economic standard, being associated with a higher risk to mother and child, since it hinders the access to information and guidance and the ability to care and assist.

In mortality studies that make use of the consultation of secondary banks, a problem to be faced is the lack of information. This was no different in this study, especially in relation to the variables: birth weight, gestational length and place of occurrence, maternal age and education. However, for the five variables, an important decrease in missing information (unknown) was observed over the four periods (79, 93, 100, 74 and 91% respectively for birth weight, gestational length, place of occurrence, maternal age and education). In a study conducted in 2002 on information systems and perinatal mortality in eight Brazilian federal units, (Distrito Federal, Espírito Santo, Mato Grosso, Paraná, Rio de Janeiro, Rio Grande do Sul, Santa Catarina and São Paulo), it was observed that the state of Paraná, together with Mato Grosso do Sul, stood out in terms of quality of records of the variables related to neonatal births, presenting lack of information of only 8.93% for the variable birth weight, 7.03% for length of gestation, 8.93% for maternal age, 17.22% for maternal education and 6.13% for type of pregnancy[21].

The implementation of national information systems in the Brazilian public Unified Health System provides a growing number of studies; however, due to the large regional differences in Brazil, it is necessary to consider the quality of the declaration of live births and deaths[22]. Therefore, the opportunity to analyze information regarding infant births and deaths on the SINASC and SIM promotes new possibilities of identifying determinants of infant mortality in order to support the verification of services and to organize the assistance network.

Thus, the present study made use of births and deaths databases and pointed out the need for continued vigilance regarding the provision of adequate assistance to the subgroup of infants with higher risk of mortality and also, the need for the managers to make every effort to guarantee quality prenatal assistance for the general population and, in particular, for women with less favorable socio-economic characteristics. It is worth highlighting that the analysis of information generated through secondary data always requires caution. This occurs particularly in the construction of the infant mortality rate, which is very sensitive to the limitations of the Health Information Systems in Brazil. However, it is believed that, despite the limitations of the use of secondary data sources, the present study achieved its purposes, because from the data analysis, it was found that the municipalities of the 9th Regional presented a decrease in their infant mortality rates. However, it is necessary that these values be reduced further, which may occur through specific and integrated actions between the government, the health services and society, favoring a more pronounced decrease in infant mortality not only in this Health Regional, but also in all Brazilian states.

The reduction of child mortality, besides political will, requires the training of health professionals and multidisciplinary care for an early diagnosis of the child's vulnerability as well as carrying out measures to prevent the occurrence of death. The findings suggest that the reduction of infant mortality in the municipalities studied may be associated with the presence of the Municipal Committees on Infant Mortality and with the improvement on the quality of primary care and the expansion of the Family's Health Strategy, in all municipalities of the 9th Health Regional.

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