RESEARCH

DETERMINANTS OF INFANT MORTALITY IN CITIES OF THE JEQUITINHONHA VALLEY, MINAS GERAIS, BRAZIL

DETERMINANTES DA MORTALIDADE INFANTIL EM MUNICÍPIOS DO VALE DO JEQUITINHONHA, MINAS GERAIS, BRASIL

DETERMINANTES DE MORTALIDAD INFANTIL EN MUNICIPIOS DEL VALLE DE JEQUITINHONHA, MINAS GERAIS, BRASIL

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ABSTRACT

Objective: To analyze the determinants of infant mortality in Araçuaí, Joaíma, Jordânia, and Novo Cruzeiro, cities located in the Jequitinhonha Valley, Minas Gerais State, Brazil. **Methods:** This was a case-control study including 36 infant deaths that occurred in 2008 and 72 live births, which did not evolve to death, randomly selected in the same period as controls. Demographic and socioeconomic data, maternal obstetric history, prenatal and childbirth care, and biological conditions of mothers and newborns were obtained using a structured questionnaire. Multivariate analyses of hierarchical logistic regression were conducted to evaluate the association of infant death and the study variables. **Results:** Deaths in the neonatal period (55%) were predominant. Children from mothers with a history of stillbirth ($p<0.001$) and children who were born preterm ($p=0.01$), or with some type of malformation ($p<0.001$) remained independently associated with mortality. Children whose families did not receive government aid and resided in households with less favorable conditions had a higher chance to die in the first year of life. **Conclusions:** perinatal causes were important determinants of infant mortality in this study, although poor socioeconomic conditions also interfered significantly in the occurrence of deaths, indicating social problems and poor access to health services. The challenge of reducing infant deaths in the studied cities include the need for improvements in access and quality of maternal and child health care and demand for public policies that aimed at reducing socioeconomic inequalities.

Keywords: Infant Mortality; Epidemiologic Factors; Case-control Studies; Risk Factors; Child Health.

RESUMO

Objetivo: *analisar os determinantes da mortalidade infantil nos municípios de Araçuaí, Joaíma, Jordânia e Novo Cruzeiro, localizados no Vale do Jequitinhonha-MG, Brasil.* ***Métodos:*** *estudo caso-controle, sendo os casos 36 óbitos infantis ocorridos em 2008 e controles 72 nascidos vivos e que não evoluíram para óbito, sorteados aleatoriamente. Os dados demográficos e socioeconômicos, de antecedentes obstétricos maternos, atenção ao pré-natal e ao parto e condições biológicas das mães e recém-nascidos foram obtidos utilizando-se questionário estruturado com as mães. Análise de regressão logística hierarquizada foi realizada para avaliar a associação do óbito infantil com as variáveis do estudo.* ***Resultados:*** *predominaram os óbitos no período neonatal (55%). Filhos de mulheres com história prévia de natimorto ($p<0,001$) e crianças que nasceram prematuras ($p=0,01$) ou com alguma malformação ($p<0,001$) permaneceram independentemente associados à mortalidade. Crianças cujas famílias não recebiam auxílio governamental e residiam em moradias com condições desfavoráveis também exibiram mais chances de morrer no primeiro ano de vida.* ***Conclusões:*** *causas perinatais foram importantes determinantes da mortalidade infantil na população estudada, embora precárias condições socioeconômicas ainda interfiram significativamente na ocorrência dos óbitos infantis, mostrando problemas sociais e dificuldades de acesso aos serviços de saúde. O desafio de redução dos óbitos infantis nos municípios estudados engloba a necessidade de melhorias no acesso e na qualidade dos serviços de saúde materno-infantil e a demanda por políticas públicas que visem à redução das desigualdades socioeconômicas.*

Palavras-chave: *Mortalidade Infantil; Fatores Epidemiológicos; Estudos de Casos e Controles; Fatores de Risco; Saúde da Criança.*

RESUMEN

El presente estudio buscó analizar los determinantes de mortalidad infantil en Araçuaí, Joaíma, Jordânia y Novo Cruzeiro, municipios del Valle de Jequitinhonha, MG, Brasil. Se trata de un estudio de caso y control, con 36 casos de muerte infantil en 2008 y 72 controles de niños nacidos vivos, seleccionados al azar, que no fallecieron. Los datos demográficos y socioeconómicos, antecedentes obstétricos maternos, atención prenatal, parto y condiciones biológicas de las madres y de los recién nacidos se obtuvieron mediante un cuestionario estructurado dirigido a las madres. Se realizó un análisis de regresión logística jerárquica para evaluar la asociación de la mortalidad infantil con las variables del estudio. Los resultados señalaron que los óbitos predominaron en el período neonatal (55%). Los hijos de madres con antecedentes de muerte fetal (p<0,001) y los niños nacidos prematuros (p=0,01) o con alguna malformación (p<0,001) permanecieron independientemente asociados a la mortalidad. Los niños cuyas familias no recibían ayuda del gobierno y vivían en hogares en condiciones desfavorables también eran más propensos a morir el primer año de vida. Las causas perinatales fueron determinantes importantes de mortalidad infantil en esta población, aunque las condiciones socioeconómicas también interfieren de manera significativa en la incidencia de muerte infantil, mostrando los problemas sociales y el escaso acceso a los servicios de salud. Reducir la mortalidad infantil en las ciudades estudiadas implica la necesidad de mejorar el acceso y la calidad de los servicios de salud materno- infantil y exigir políticas públicas destinadas a reducir las desigualdades socioeconómicas.

***Palabras clave**: Mortalidad Infantil; Factores Epidemiológicos; Estudios de Casos y Controles; Factores de Riesgo; Salud del Niño.*

INTRODUCTION

Infant mortality (IM), still considered a public health problem in many countries, such as Brazil, is an indicator of inequities, sensitive to the social and health context of a population. Approximately 6.6 million children under five years old die every year worldwide, and deaths in the first year of life represent 73% of that number.[1]

The reduction of these early deaths is part of the "Millennium Goals," a commitment of the United Nations (UN) to achieve more worthy living conditions for the world population.[1] The goal of reducing mortality in children under five years old by two thirds between 1990 and 2015 has required renewed national and international efforts. In the regionalization of health care in Brazil, the expansion of primary care enabled more people to access basic health services, important for the health of women during prenatal care and after pregnancy, and of their children after hospital discharge. This action contributed to the reduction of IM, particularly in poor municipalities.[2] In Brazil, almost all children are born in hospitals and assisted by doctors.[2]

However, despite the decline of IM in Brazil, which went from 52 deaths for every one thousand live births (LB) in 1990 to an estimated average of 13 deaths for every one thousand LB in 2012,[1] the current values are still incompatible with the level of economic and technological development of the country and represent two to six times the IM of countries such as Chile, Canada, Cuba, and Japan.[1,3] In addition, national data show persistent inequities in the distribution of deaths among geographic regions and population subgroups within regions, states, and municipalities.

There are several risk factors for infant mortality, understood as indicators of the different dimensions of living conditions, including, biological, social, economic, demographic, and health care.[4,5] The main predictors for the occurrence of deaths are factors such as maternal education, birth weight, prematurity, difficult to access services, and health care characteristics.[4-6] These factors are organized hierarchically according to their relevance in determining death.[7] In general, factors related to health care and biological characteristics of the mother and newborn are more strongly associated with deaths.[8]

Regional inequalities contribute to maintaining the Brazilian IM rate at higher levels than those of other countries in Latin America.[1] In the Jequitinhonha Valley, for example, one of the most impoverished regions in the state of Minas Gerais, the IM rate is about 7% higher compared to the national rate, and from 33.5 to 49.5% higher when compared to the Southern and Southeastern regions of the country.[9] In this scenario, the study of risk factors for infant death helps to identify health needs of subgroups in the population that are exposed to different risk factors, understanding the elements in the chain of events related to the determination of IM in this specific population in addition to being essential to support public health interventions aimed at reducing the risk of infant mortality.[10] Infant mortality represents premature deaths and mostly considered preventable through the intervention of health services, among other actions and policies.[3] Therefore, the study was carried out to analyze the determinants of IM in the municipalities located in the Jequitinhonha Valley, Minas Gerais.

METHODS

A case-control epidemiological study was carried out as part of the research project "Conditions of birth and assistance to childbirth and children under one year of age in a sample of small and medium-sized municipalities in Northern and Northeastern Brazil and Vale do Jequitinhonha in Minas Gerais", developed by the Oswaldo Cruz Foundation (FIOCRUZ) in collaboration with the Federal University of Minas Gerais (UFMG). The municipalities included in this study were Araçuaí, Joaíma, Jordânia, and Nova Cruzeiro located in the Jequitinhonha Valley, the northeastern region of Minas Gerais,

Brazil. These municipalities present Human Development Index (HDI) (between 0.500 and 0.599) and average development (between 0.600 and 0.699) considered low.

The four municipalities have 31 basic health units and are assisted by family health teams. Araçuaí and Novo Cruzeiro have one polyclinic each. In the secondary health care, there are three hospitals classified as low-risk units (Novo Cruzeiro, Joaíma, and Jordânia) and one as medium risk (Araçuaí). All these units act as reference centers for childbirth providing care to normal childbirth without dystocia and, with the exception of Jordânia, to normal childbirth with dystocia and surgical.

The eligible population for the study was selected from the Mortality Information System (SIM) and Live Births Information System (SINASC). In addition, an active search for infant mortality was performed by comparing occurrences listed in the SIM and other multiple sources of the municipalities' official (registry offices, hospitals, and basic health units) and unofficial records (cemeteries, churches, services and health professionals, police stations, funeral homes and pharmacies, key informants such as traditional midwives, community leaders, and healers).

The cases consisted of all LBs who died before their first year of life between January 1 and December 31, 2008. The controls were selected by random drawing (two controls for each case, matched by municipality) among children born in the same period and who have not died. The cases and controls were children from mothers living in the municipalities considered in the study.

The data collection used a structured questionnaire in interviews with the mothers or guardians. The instrument contained demographic and socioeconomic information, maternal obstetric history, prenatal and childbirth care, and biological conditions of mothers and children. The data collection was conducted in February of 2011 by three previously trained interviewers.

The analyzed variables were organized by level of proximity to the occurrence of death as: a) distal determinants: color and maternal marital status, educational level and occupation of the mother and head of household, place of residence (rural/urban), government support, possession of goods (domestic appliances, car/motorcycle), housing conditions (type of wall and floor, running water, bathroom); b) intermediate determinants: previous history of stillbirth; smoking and alcohol consumption during pregnancy, prenatal care (attendance, date of initiation and number of visits, reasons for not attending prenatal care), delivery (type and time of ruptured membranes), access to delivery health care services (number of sought out services, intercity commuting for delivery, waiting time for service, performed by health professionals); c) proximal determinants: maternal age, type of pregnancy, prematurity, birth weight, and malformations. These are arranged in Figure 1 according to the adaptation of the hierarchical theoretical model developed by Mosley and Chen.[7]

After the interviews, still in the research sites, all questionnaires were reviewed for identification of missing or conflicting data. Double typing and matching of data was performed in the Epi Info version 3.5.3 program to identify errors, inconsistencies, and blank data. After corrections, the data were transported to the Statistical Package for Social Sciences (SPSS) version 15.0 software where the statistical analyses were performed.

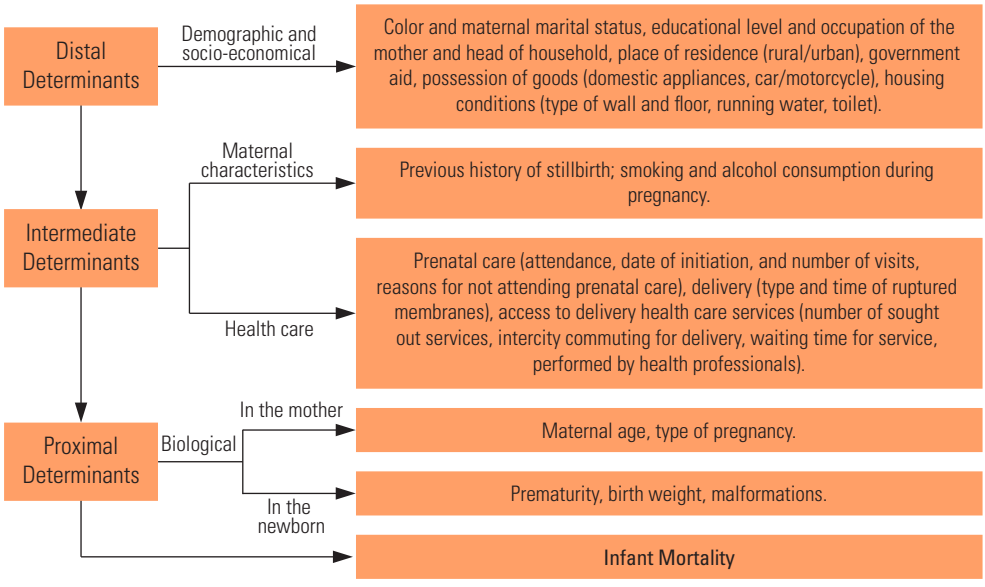

Figure 1 - Explanatory model for infant mortality with the study variables.
Source: adapted from Mosley and Chen.[7]

The number of deaths evidenced in the study and number of LB registered in the SINASC were used to calculate the Infant Mortality Coefficient (IMC). Logistic binary regression models were performed in the analysis of associations between the occurrence of infant death and the study variables. The odds ratios (OR) with 95% confidence interval (95% CI) were estimated in the univariate analysis. Variables that were significant at $p \leq 0.20$ were selected for inclusion in the multivariate phase.

To control possible confusing factors and investigate possible interactions in the multivariate analysis, the hierarchical level of each variable, in the causal chain of infant mortality, was considered for the inclusion of variables in the model as described in Figure 1. First, all eligible distal variables were included and by the Stepwise Backward Wald method, those less significant were removed until the model was maintained with all the significant variables at the level of $p \leq 0.05$. Subsequently, eligible variables were inserted at the intermediate level and, after adjustment of this second model, the variables in the proximal level were added.

In the final model, the adjusted OR estimates and their 95% ICs for all variables that remained significant at $p = 0.05$ level were calculated. The effect of each variable in relation to IM was interpreted as adjusted for the variables belonging to the hierarchically lower levels (more distal) and for the effects of those belonging to the same level. The quality of adjustment in the models was evaluated using the Hosmer & Lemeshow test in the three steps of the multivariate analysis.

The study was approved by the Ethics Committee in Research from the Federal University of Minas Gerais – number 0574.0.203.000-11. All mothers and/or guardians of cases and controls provided a signed volunteer informed consent term at the time of data collection.

RESULTS

One case was lost in the city of Araçuaí due to family relocation, thus, the case population consisted of 13 infant deaths in Araçuaí, 6 in Joaíma, 2 in Jordânia, and 15 in Novo Cruzeiro, totaling 36 cases. Four of these deaths were identified by active search, two in Araçuaí and two in Novo Cruzeiro. The control population totaled 72 LB who survived. The IMC during the study period was 23.6 deaths for every one thousand LB in Araçuaí, 24.2 in Novo Cruzeiro, 24.3 in Joaíma, and 27.4 in Jordânia.

Out of the total number of infant deaths, 20 (55.5%) occurred in the neonatal period, before 28 days of life, and 17 (47.2% of the total) in the early neonatal period, that is, before seven days of life. In the municipalities of Joaíma and Jordânia, the proportion of neonatal and post-neonatal deaths (28 days to one incomplete year of life) were similar (50.0%), while in Araçuaí, the number of neonatal deaths remained slightly predominant (53.8%), and was higher in Novo Cruzeiro (60.0%).

The age of the mothers was similar in both groups, ranging from 15 to 42 years old with an average of 24.7 years (SD = ± 7.2 years) among cases, and 16 to 38 years old with an average of 25.1 years (SD = ± 5.9 years) among controls. With regard to the mothers' occupations among cases and controls, 24.1% worked in agriculture, 32.4% were employed, and 42.5% had no occupation. In general, the heads of families were employed (40.7%) and/or rural workers (46.3%). Almost half of the study population (49.1%) received government assistance through the Bolsa Família Program.

Difficulty in access to care was among the reasons raised for not attending prenatal care (3.7%) or beginning it after the fourth month of pregnancy (23.1%) highlighted by 33.3% of mothers of infant who died, almost double than by mothers of surviving infants (17.3%). Mothers in both groups reported seeking the hospital from the municipality of their residence at the time of delivery and waiting less than two hours for assistance. It is noteworthy that over 70% of them had less than 12 hours as time of ruptured membranes. The deliveries were mostly assisted by health professionals (95.4%). More than half of the studied children were males (59.3%) and about 20% were premature; 88% of cases and 82% of controls did not present low birth weight.

Table 1 shows through distal determinants that newborns whose mothers had no partner, with less than nine years of education, low socioeconomic status (up to one domestic appliance and no car/motorcycle), and poor housing conditions (house with dirt or cement floor and without access to piped water) were more likely to die. Among the investigated intermediate and proximal determinants, the attendance to less than six prenatal consultations, history of stillbirth, prematurity, and newborn malformation were also statistically significant related to infant mortality (Table 1).

In addition to the statistically significant determinants in the univariate analysis shown in Table 1, the following were also eligible for the multivariate analysis: maternal color, education of head of household, government aid (Bolsa Familia Program), place of residence (rural or urban area), smoking and alcohol consumption during pregnancy, attendance and beginning of prenatal care (≥ 04 or <04 months of pregnancy), number of pregnancies (single or multiple), and type of delivery (normal or cesarean). It is worth mentioning also that the variables occupation of mother and head of household, presence of toilet, reasons for no prenatal care, time of ruptured membranes, number of services sought out for delivery, intercity commuting for delivery, time to receive childbirth care and assistance by a health professional, maternal age, and birth weight were not statistically significant in the univariate analysis and thus, were not selected for the multivariate analysis.

Table 1 - Frequency, odds ratio (OR), and confidence intervals (95% CI) of statistically significant distal, intermediate and proximal determinants of infant mortality. Araçuaí, Joaíma, Jordânia, and Novo Cruzeiro, Minas Gerais, 2008

Determinants	Cases N (%)	Controls N (%)	OR	CI 95%	p-value
Distal:					
Mother´s marital status					
Without a partner	05 (16.1)	02 (2.8)	5.64	1.03 – 30.70	0.04
With a partner	31 (83.9)	70 (97.2)	1.00	–	–
Mother´s education (years of study) (n = 107)					
< 09	27 (77.1)	40 (55.6)	2.70	1.08 – 6.74	0.03
≥ 09	08 (22.9)	32 (44.4)	1.00	–	–
Domestic appliances (n = 107)					
None or 01	11 (31.4)	10 (13.9)	2.84	1.06 – 7.55	0.03
02 or more	24 (68.6)	62 (86.1)	1.00	–	–
Car/ motorcycle (n = 107)					
No	09 (25.7)	07 (9.7)	3.21	1.08 – 9.53	0.03
Yes	26 (74.3)	65 (90.3)	1.00	–	–
Wall type in the residence (brick) (n = 106)					
No	20 (58.8)	23 (31.9)	3.04	1.39 – 7.07	0.01
Yes	14 (41.2)	49 (68.1)	1.00	–	–
Type of floor in the residence (ceramic) (n = 106)					
No	28 (82.3)	36 (50.0)	4.66	1.72 – 12.62	<0.001
Yes	06 (17.7)	36 (50.0)	1.00	–	–
Piped water in the residence (n = 107)					
No	14 (41.2)	13 (18.1)	3.17	1.28 – 7.88	0.01
Yes	20 (58.8)	59 (81.9)	1.00	–	–
Intermediate:					
History of stillbirth (n =107)					
Yes	04 (11.4)	01 (1.4)	9.16	0.98 – 85.33	0.05
No	31 (88.6)	71 (98.6)	1.00	–	–
Number of prenatal consultations (n = 103)					
< 06	16 (51.6)	13 (18.1)	4.84	1.91 – 12.21	<0.001
≥ 06	15 (48.4)	59 (81.9)	1.00	–	–
Proximal:					
Prematurity					
Yes	12 (33.3)	12 (16.7)	2.50	0.98 – 6.33	0.05
No	24 (66.7)	60 (83.3)	1.00	–	–
Newborn malformation (n =105)					
Yes	11 (33.3)	03 (4.2)	11.5	2.94 – 44.97	<0.001
No	22 (66.7)	69 (95.8)	1.00	–	–

Source: authors´ database.

After adjustments for variables, determinants were identified in all associated proximity levels regardless of the occurrence of infant death. The highest chance of dying in the first year of life was observed among children from women with a history of stillbirth as well as among children born premature or with some type of malformation and among newborns whose families had disadvantaged living conditions. The multivariate model also showed that the fact that families did not

receive government aid by the Bolsa Família Program also increased the chance of mortality (Table 2).

Table 2 - Multivariate logistic regression of distal, intermediate, and proximal determinants of infant mortality. Araçuaí, Joaíma, Jordânia, and Novo Cruzeiro, Minas Gerais, 2008

Determinants	Death in the first year of life		
	OR	CI 95%	p-value
Distal:			
Government aid			
No	11,60	2,50 – 53,74	0,02
Yes	1,00	-	-
Type of floor (ceramic)			
No	11,12	2,32 – 53,08	0,03
Yes	1,00	-	-
Piped water in the residence			
No	12,05	2,87 – 50,52	0,01
Yes	1,00	-	-
Intermediate:			
History of stillbirth			
Yes	61,91	3,98- 963,03	<0,001
No	1,00	-	-
Proximal:			
Prematurity			
Yes	6,24	1,42 – 27,38	0,01
No	1,00	-	-
Newborn malformation			
Yes	13,16	2,55 – 67,78	<0,001
No	1,00	-	-

Source: authors´ database.
Note: Hosmer and Lemeshow test: p = 0.816.

DISCUSSION

The IMC found in the investigated municipalities, between 23 and 27 deaths for every thousand LB in 2008 were higher than that from national data and the state of Minas Gerais, with an average of 19 and 17 deaths for every one thousand LB, respectively, in the same period.[11] This shows that in addition to achieving one of the "Millennium Development Goals" for IM, Brazil still has the challenge of reducing the important IMC heterogeneity between regions, states, and municipalities.

As in other regions in Brazil and in the world, including developed countries,[2,12] neonatal deaths were predominant. In fact, the neonatal mortality represents more than two-thirds of deaths in the first year of life and has been widely discussed, especially by the difficulty in being reduced and because it requires high costs and complex measures to improve the quality of pre-natal and perinatal care.[2,6]

However, it is noteworthy that this study also revealed significant proportions of post-neonatal deaths, especially in Joaíma and Jordânia, corroborating a reality similar to that of other municipalities in the Northeast region of Brazil.[3] This fact raises the importance of further discussion and investigation about socioeconomic determinants and its inequalities, since currently, perinatal and neonatal factors have been emphasized in discussions related to child mortality. Although the decrease in post-neonatal mortality represents the most important factor that has contributed to the IM reduction in Brazil, its levels remain high in some regions, such as the municipalities investigated in this study, compared to the national average and that of countries with better social development.[2]

Systematically, infant mortality is more incident among less favored social groups.[13] Even with the advances in health indicators and public policies to reduce social inequality and poverty, better distribution of income and improvements in sanitation, education, and health,[2] several authors also found a significant association between poverty and death in the first year of life, from indicators of deprivation of essential goods such as lack of access to piped water and sewage.[6,13-15] Such results demonstrate the socioeconomic inequality in infant mortality where the risk of dying in the first year of life is always greater in areas with high poverty rates.[6,13]

Besides poverty, maternal marital status was found to be indirectly associated with the deaths among the distal determinants that influence the occurrence of child deaths. Results found in other studies demonstrate that in different regions in Brazil and in the world, children of single women are more likely to die in the first year of life.[16,17] This association can be explained because this variable, among other factors, shows social exclusion conditions and low socioeconomic status. In addition, the presence of a partner can positively interfere with child survival, not only due to financial assistance but also psychosocial support.[16]

The mothers´ low level of education is another determinant of IM much emphasized in the literature.[5,13,17] This association was identified in this study and has been justified by the fact that the level of education also represents an important socioeconomic marker and women with more education tend to satisfy important aspects for child survival such as better housing, access/utilization of health services, and nutrition for their children.[18]

Although maternal and head of household occupation was not associated with mortality, the data showed increased chances of mortality in those families without government aid. The Brazilian program of income transfer reduced 19.4% of mortality among children in municipalities with high coverage, and this reduction was even greater when considering mortality specifically resulting from some causes such as malnutrition

and diarrhea. The increase in income due to transfer of benefits allows access to food and other health-related goods. These factors help in reducing family poverty, improving living conditions, eliminating some difficulties in the access to health and, consequently, contributing reducing deaths among children.[19]

Among the intermediate determinants that incorporate maternal and child health care characteristics, previous history of stillbirth was an important determinant of infant mortality as addressed in other studies.[6,17] High percentage of infant deaths were also observed in children from mothers who smoked and consumed alcohol during pregnancy, although these differences were not statistically significant. Studies performed in other scenarios show significant mortality risks in the first year of life related to smoking and alcohol consumption during pregnancy.[5,20]

Regarding the prenatal care aspects in Brazil, the early identification of pregnant women, with the first consultation within 120 days from the beginning of pregnancy, and having at least six prenatal consultations are criteria recommended by the Ministry of Health.[21] In this study, as observed by other authors,[4,5] there was a relationship between the higher number of consultations during pregnancy and less chance of death in the first year of life. However, access and quality of care, not only the number of consultations, are determinants in improving prenatal care.[5] The difficulty of access to prenatal care was reported by some mothers of children in the study, reinforcing the need to evaluate different aspects related to this assistance.

In the case of proximal determinants, which are in most cases direct causes of child deaths, greater proportions of deaths were identified in children who had some type of malformation at birth, as shown by different authors.[4-6] Even with improved prognosis for some types of birth anomalies, resulting from improvements in perinatal care, increased IM caused by malformations, a phenomenon first observed in developed countries, is considered one of the most profound alterations in the pattern of IM structure.[22]

The biological condition of prematurity also influenced the occurrence of child deaths in the investigated municipalities, as described in other studies.[6,17] Premature infants present high risk of mortality and high morbidity vulnerability to a wide range of morbidities, which gives them higher chances to die during the first year of life.[23]

Low birth weight is cited as the most influential factor in determining infant mortality by different authors.[4,5] However, in this study, no association was found between low birth weight and infant death. This result can possibly be explained by the homogeneous distribution of newborns with low birth weight among the cases and controls.

Regarding the maternal proximal factors, maternal age was not a determinant for IM. The literature reports conflicting results in this context. While several authors have shown increased risk of perinatal and infant mortality among children of mothers at ages considered at the top of reproductive life, that is, below 20 and above 34 years old, others did not find such association.[4]

This study presents some limitations and implications to be considered in future research such as the susceptibility bias of remembering facts and information since the data on deaths and births were collected approximately two years after the occurrence of these events, and the small sample size, which may have affected the analysis of relevant variables in research about infant deaths. Conversely, the performance of an active search for underreported cases in the municipalities of the study were highlighted as the potential of this study due to underreporting problems in infant deaths existing in different regions in the country in addition to obtaining primary data using questionnaires as the data collection instrument since the data quality of national information systems is questioned by different authors.[25]

CONCLUSION

Perinatal causes were important determinants of mortality in this study population, although poor socioeconomic and housing conditions also significantly interfere with the occurrence of infant deaths suggesting the presence of social problems and poor access to health services. The results provide elements to locally face problems and show that the challenge to reduce infant deaths includes the need for improvements in access and quality of care services in maternal and child health care and the demand for public policies aimed at reducing socioeconomic inequalities that fit the epidemiological profiles and characteristics of local health resources.

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