ORIGINAL ARTICLE

# Mortality among children under the age of one: analysis of cases after discharge from maternity*

Mortalidade entre menores de um ano: análise dos casos após alta das maternidades

Mortalidad entre menores de un año: análisis de los casos tras el alta de las maternidades

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**ABSTRACT**

**Objective:** To analyze infant death after discharge from maternity in the time period between 2000 and 2013. **Method:** A cross-sectional retrospective quantitative study in a municipality northward in the state of Paraná. Data were analyzed using the SPSS®, and were subjected to Chi-square test, logistical regression, 95% confidence interval, and a significance level of p<0.05. **Results:** Two hundred forty-nine children were born, discharged from maternity and subsequently died; 10.1% in the neonatal period and 89.9% in the post-neonatal period. Pregnancy follow-up, birth, and child monitoring took place mainly in the public health system. There was a statistically significant association between the infant component and place of delivery (*p*=0.002; RR=1.143; IC95%=1.064-1.229), and a lower number of childcare medical visits (*p*=0.001; RR=1.294; IC95%=1.039-1.613). The causes of death in the neonatal period were perinatal conditions (40%); external causes (32%); and congenital malformations (20%). In the post-neonatal period, congenital malformations (29.9%), external causes (24.1%); and infectious-parasitic diseases (11.2%) were the causes of death. **Conclusion:** Virtually all children were born in conditions of good vitality that were worsened due to potentially preventable diseases that led to death.

**DESCRIPTORS**

Infant Mortality; Health Services; Health Care; Underlying Cause of Death; Pediatric Nursing.

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## INTRODUCTION

In Brazil, births are gradually decreasing. In 2000 there were 20.3 born-alive infants to every 1,000 inhabitants and in 2011 this figure dropped to 15.6[1]. The differences between regions remained, with the North region reducing from 27.8 to 17.3 and the South region from 17.8 to 13.8 in the same period[1]. Comparisons between Brazilian birthrates and those for developed countries show a huge difference. For example, in Canada in 2011 the birthrate was 4.9/1,000 inhabitants, while in Brazil it was three times larger (15.6/1,000 inhabitants)[2].

According to studies performed, programs implemented in the field of maternal-infant health over several decades, as well as investments made in the social, educational, and infrastructure areas have improved indicators of birth, morbidity, and mortality in Brazil[3-4].

When it comes to the infant mortality indicator, this has significantly dropped, but reaching lower rates remains a challenge mainly related to regional inequities in the country. Despite progress in public policies over the years, strong economic and social inequalities remain and are reflected in the population's living conditions, mainly the conditions of children living in regions such as the North and Northeast regions where economic development was not as conspicuous compared to that of the Center-South[5].

The neonatal (0 to 27 days of life) component maintains the highest rate in the infant mortality component (0 to 364 days), notably the early neonatal period that comprises the period from birth up to seven days. In 1990, the mortality rate in the neonatal period was 23.1 deaths to every 1,000 born-alive infants; in 2000 it was 16.7 and in 2010 it was 11.1/1,000 born-alive[6]. The main risks remain those associated with prenatal care quality, care during delivery, and care of the newborn[7]. The post-neonatal period (28 to 364 days of life) presented a sharper drop, from 24/1,000 born-alive in 1990 to 9.4 in 2000 and 4.9 in 2010[6]. In that period, vulnerability to socio-economic conditions, basic sanitation, health care, and access to preventive and healing services remains[7].

Most deaths were in the first days of life, while infants were still in the neonatal and pediatric intensive care units as a consequence of premature birth, intrapartum asphyxia, and gestational condition[8]. On the other hand, children released from maternity after birth are expected to be monitored by the health service: to control growth and development; and because this age group is more susceptible and vulnerable to diseases. This monitoring should consistently evaluate the socio-economic, environmental, and cultural context. This is also the group that most demands resources, care, and infrastructure that, if nonexistent or insufficient, will expose children to higher risks of disease and dying[3,9]. Because of this, since the 1970s programs have been implemented to promote health surveillance by the *Sistema Único de Saúde* (Unified Health System – SUS) professional team. Considering the epidemiological profile and regional peculiarities, surveillance should intervene with measures oriented to prevention, promotion, and rehabilitation at different care levels, ensuring the constitutional rights of the woman and the child[10-11].

Health actions at different care levels help to improve maternal and infant care quality and, as such, the early detection of diseases and reduction of deaths. If these are not implemented or coordinated serious diseases and injuries will surely happen. Consequently this study aimed to analyze infant deaths after discharge from maternity between the years 2000 and 2013.

## METHOD

This is a cross-sectional retrospective quantitative study with a population composed of children under the age of one year who died subsequent to discharge from maternity between the years 2000 and 2013, in a municipality in the north region of the state of Paraná, South region of Brazil.

Data were obtained through study and pooling of information from the Certificate of Born-alive, Certificate of Death, and records of death investigation from the Municipal Committee to Prevent Maternal and Infant Mortality (MCPMIM) filed at the Center of Information on Mortality (CIM) of the Municipal Health Department. During the study time span, from 2000 to 2013, there were 1,098 infant deaths in the municipality[1]. Of this total, 249 children were born and discharged from the hospital, subsequently dying, and compose the population of this study.

The inclusion criteria were as follows: children under the age of one year residing in urban and rural areas, who had been discharged from the hospital after birth, and deaths analyzed by the MCPMIM. The study variables refer to maternal characterization: socio-economic and obstetrics; and to infant characterization: birth conditions; monitoring at health service after discharge from maternity; place of death; and basic cause. It excluded deaths that did not characterize the object of study and those where information was unknown.

Data were input in the computer software Epi Info 2002, version 6®, while the Statistical Package for the Social Sciences 20® was used to the analysis. The study began with the descriptive analysis of all variables; then, the Chi-square test was performed to compare the death component (neonatal and post-neonatal) and the selection of variables. The binary logistical regression analysis was performed with a 95% confidence interval and a significance level of $p<0.05$ to verify the correlation between maternal and infant variables and mortality components.

The research proposal was submitted to the Research Ethics Committee of the Universidade Estadual de Londrina (UEL) for evaluation, and approved according to protocol 059/2013 on May 16, 2013, CAAE 01079112.3.0000.5231.

## RESULTS

Of the 249 infant deaths, 10% were in the neonatal period and 90% were post-neonatal. The children's average age was 137.4 days, with a minimum of three and maximum of 355 days.

Figure 1 shows the development of infant mortality over 14 years. Deaths accounted for 18.1% between 2000 and 2001, with 11.6% in the neonatal component and 6.5% in the post-neonatal; from 2004 to 2005 these were reduced to 12.4%, increased to 14.8% in the 2006-2007 biennium, and then oscillated a little – between 14% and 15% – in the following biennia. The deaths of children that were born, discharged from maternity, and subsequently died totaled 5.1% between 2000 and 2001, dropping in the following three biennia, with a slight increase between 2008 and 2009 (3.4%) and further reduction.
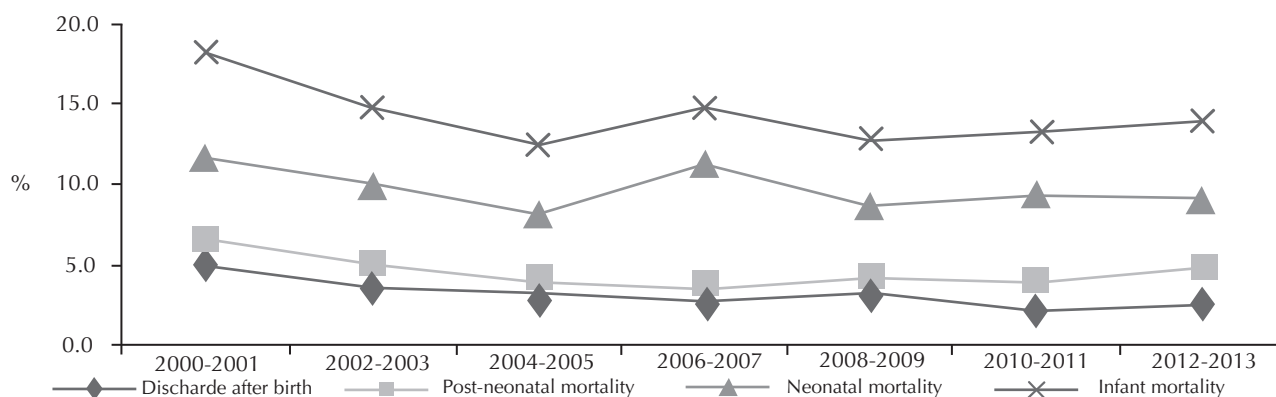


**Figure 1 –** Development of infant mortality and components (neonatal and post-neonatal) in biennia – Londrina, Paraná, Brazil, 2000 to 2013.

Regarding socio-economic variables, Table 1 shows that most of the women in both components were over 20 years old, in non-remunerated occupations, with more than eight years of education, and an income lower than two minimum wages. Concerning prenatal monitoring, more than 80% used the public health system, most had more than seven medical visits, and almost half had developed diseases.

The majority of women in both components had no addiction: 52% in the neonatal and 69.7% in the post-neonatal period. Regarding delivery route, 64% of children that subsequently died in the neonatal period and 51.3% in post-neonatal were born by vaginal delivery. Hospitals with maternity providing care to low- and medium-risk pregnant women, with no neonatal and pediatric intensive care unit (NPICU) were the place of delivery of virtually all mothers (92%) whose children died at up to 27 days of life, with 61.6% of those with more than 28 days of life. There was a statistically significant association only between the place of delivery and the infant component ($p=0.002$; RR=1.143; IC95%=1.064-1.229).

**Table 1 –** Correlation between socio-economic and maternal obstetric variables and the infant mortality component (neonatal and post-neonatal) – Londrina, Paraná, Brazil, 2000 to 2013.

| Variables* | Neonatal | | Post-neonatal | | RR | CI 95% | P value |
|---|---|---|---|---|---|---|---|
| | n | % | n | % | | | |
| | 25 | 10.0 | 224 | 90.0 | | | |
| **Age group (in years)** | | | | | | | |
| ≤ 19 | 2 | 8.0 | 60 | 26.8 | 0.575 | 0.205-1.609 | 0.338 |
| ≥ 20 | 23 | 92.0 | 164 | 73.2 | 1.054 | 0.970-1.145 | |
| **Occupation** | | | | | | | |
| Without | 16 | 64.0 | 142 | 64.2 | 0.900 | 0.457-2.147 | 1.000 |
| With | 9 | 36.0 | 79 | 35.8 | 1.001 | 0.917-1.093 | |
| **Education (in years)** | | | | | | | |
| 0 to 7 | 9 | 36.0 | 102 | 47.3 | 0.674 | 0.310-1.466 | 0.398 |
| 8 and above | 16 | 64.0 | 114 | 52.7 | 1.045 | 0.961-1.136 | |
| **Income (in minimum wage)**** | | | | | | | |
| ≤ 2 | 13 | 81.2 | 95 | 59.4 | 2.728 | 0.807-9.225 | 0.109 |
| > 2 | 3 | 18.8 | 65 | 40.6 | 0.920 | 0.844-1003 | |

...continuation

| Variables* | Neonatal | | Post-neonatal | | RR | CI 95% | P value |
|---|---|---|---|---|---|---|---|
| | n | % | n | % | | | |
| | 25 | 10.0 | 224 | 90.0 | | | |
| **Pre-natal site** | | | | | | | |
| Public | 20 | 83.3 | 156 | 80.0 | 1.222 | 0.440-3.389 | 1.000 |
| Private | 4 | 16.7 | 39 | 20.0 | 0.977 | 0.876-1.090 | |
| **# of pre-natal medical visits** | | | | | | | |
| ≤ 6 medical visits | 9 | 37.5 | 85 | 42.5 | 0.830 | 0.379-1.815 | 0.669 |
| ≥ 7 medical visits | 15 | 62.5 | 115 | 57.5 | 1.022 | 0.934-1.119 | |
| **Maternal diseases** | | | | | | | |
| With | 11 | 44.0 | 90 | 40.2 | 1.151 | 0.545-2.433 | 0.830 |
| Without | 14 | 56.0 | 134 | 59.8 | 0.984 | 0.903-1.072 | |
| **Addictions** | | | | | | | |
| With | 12 | 48.0 | 66 | 30.3 | 1.953 | 0.934-4.080 | 0.111 |
| Without | 13 | 52.0 | 152 | 69.7 | 0.924 | 0.827-1.020 | |
| **Kind of delivery** | | | | | | | |
| Surgery | 9 | 36.0 | 109 | 48.7 | 1.601 | 0.736-3.486 | 0.292 |
| Vaginal | 16 | 64.0 | 115 | 51.3 | 0.950 | 0.875-1.032 | |
| **Place of delivery** | | | | | | | |
| With NPICU*** | 2 | 8.0 | 84 | 38.4 | 0.160 | 0.039-0.661 | 0.002 |
| Without NPICU*** | 23 | 92.0 | 135 | 61.6 | 1.143 | 1.064-1.229 | |

*Excluding unknown information; ** Income classification according to the Economic and Social Development Institute of Paraná (IPARDES, 2012); ***NPICU: Neonatal and Pediatrics Intensive Care Unit.

The variables in Table 2 refer to birth and care to children in the health service and are associated with the infant mortality component. Most children in both components were male and white.

As regards vitality conditions, more than 80% of the children were born with no asphyxia in the first minute. A birth weight of ≥2.500 grams and gestational age ≥37 weeks prevailed in both components, above 84% in neonatal and higher than 66.7% in post-neonatal. After discharge from maternity, 80.7% of the babies received care from the health service during childcare medical visits. The association between childcare medical visits and the mortality component (p=0.001)

showed that the highest risk of death was for those with no care (RR=1.294; CI 95%=1.039-1.613), and it was 23.6 times higher for those making up to two medical visits (p=0.000).

Care was delivered in public facilities to almost 93% of the children that died in the neonatal period and 77.6% in post-neonatal. Deaths in the neonatal and pediatric intensive care units (NPICU) happened to more than 60% of the children both in neonatal and post-neonatal period. On the other hand, almost 40% of the children in both components died with no intensive care assistance, and among those dead at home 3.6% were in the neonatal and 18.8% were in the post-neonatal period.

**Table 2** – Correlation between birth and children care in health services and the infant mortality component (neonatal and post-neonatal) – Londrina, Paraná, Brazil, 2000 to 2013.

| Variables* | Neonatal | | Post-neonatal | | RR | CI 95% | P value |
|---|---|---|---|---|---|---|---|
| | n | % | n | % | | | |
| | 25 | 10.0 | 224 | 90.0 | | | |
| **Sex** | | | | | | | |
| Female | 8 | 32.0 | 95 | 42.4 | 0.667 | 0.299-1.487 | 0.394 |
| Male | 17 | 68.0 | 129 | 57.6 | 1.044 | 0.962-1.132 | |
| **Race** | | | | | | | |
| White | 20 | 80.0 | 173 | 77.2 | 1.161 | 0.456-2.953 | 1.000 |
| Others | 5 | 20.0 | 51 | 22.8 | 0.984 | 0.895-1.082 | |
| **Apgar 1st minute** | | | | | | | |
| 0 to 6 | 1 | 4.2 | 43 | 20.0 | 0.377 | 0.193-1.389 | 0.091 |
| ≥ 7 | 23 | 95.8 | 172 | 80.0 | 1.108 | 1.035-1.186 | |

...continuation

| Variables* | Neonatal | | Post-neonatal | | RR | CI 95% | P value |
|---|---|---|---|---|---|---|---|
| | n | % | n | % | | | |
| | 25 | 10.0 | 224 | 90.0 | | | |
| **Weight at birth** | | | | | | | |
| ≤2.499g | 4 | 16.0 | 74 | 33.3 | 0.413 | 0.147-1.162 | 0.110 |
| ≥2.500g | 21 | 84 | 148 | 66.7 | 1.083 | 1.003-1.170 | |
| **Gestational age** | | | | | | | |
| ≤ 36 weeks | 3 | 12.0 | 63 | 28.8 | 0.368 | 0.114-1.188 | 0.096 |
| ≥ 37 weeks | 22 | 88.0 | 156 | 71.2 | 1.089 | 1.009-1.175 | |
| **Underwent childcare medical visit** | | | | | | | |
| Yes | 14 | 60.9 | 187 | 89.1 | 0.248 | 0.117-0.524 | 0.001 |
| No | 9 | 39.1 | 23 | 10.9 | 1.294 | 1.039-1.613 | |
| **Childcare medical visits** | | | | | | | |
| ≤ 2 | 14 | 93.3 | 52 | 31.3 | 24.394 | 3.281-181.34 | 0.000 |
| 3 and above | 1 | 6.7 | 114 | 68.7 | 0.795 | 0.700-0.902 | |
| **Childcare site** | | | | | | | |
| Public | 13 | 92.8 | 163 | 77.6 | 1.847 | 0.252-13.513 | 1.000 |
| Private | 1 | 7.2 | 24 | 22.4 | 0.965 | 0.881-1.056 | |
| **Place of death** | | | | | | | |
| With NPICU** | 16 | 61.5 | 138 | 61.6 | 1.097 | 0.505-2.382 | 1.000 |
| Without NPICU** | 9 | 38.4 | 86 | 38.4 | 0.990 | 0.910-1.077 | |

*Excluding unknown information; **NPICU: Neonatal and Pediatric Intensive Care Unit.

Table 3 shows that the basic cause of death among children under one year old is heterogeneously distributed from first to fourth cause, because the main one in the neonatal period was due to perinatal diseases (40%). Regarding those resulting from congenital malformations, 29.9% were in the post-neonatal period (first cause) and 20% in the neonatal (third cause).

External causes were the second most frequent in both components, 32% in the neonatal and 24.1% in the post-neonatal. The third cause in the post-neonatal period was represented by some infectious-parasitic diseases (11.2%). Respiratory diseases were the fourth cause, and accounted for 4% in the neonatal period and 7.6% in post-neonatal period.

**Table 3** – Basic cause of death by Chapter of IDC-10, according to the infant component (neonatal and post-neonatal) – Londrina, Paraná, Brazil, 2000 to 2013.

| Basic cause of death | Neonatal | | Post-neonatal | |
|---|---|---|---|---|
| | n | % | n | % |
| | 25 | 10.0 | 224 | 90.0 |
| I. Some infections and parasitic diseases (A00-B99) | – | – | 25 | 11.2 |
| II. Neoplasm [tumors] (C00-D48) | – | – | 6 | 2.7 |
| IV. Endocrinal, nutritional and metabolic diseases (E00-E90) | – | – | 5 | 2.2 |
| VI. Nervous system diseases (G00-G99) | – | – | 9 | 4.0 |
| X. Respiratory system diseases (J00-J99) | 1 | 4.0 | 17 | 7.6 |
| XI. Digestive system diseases (K00-K93) | – | – | 5 | 2.2 |
| XVI. Some diseases originated in the perinatal period (P00-P96) | 10 | 40.0 | 14 | 6.3 |
| XVII. Congenital malformation, chromosomal deformities and abnormities (Q00-Q99) | 5 | 20.0 | 67 | 29.9 |
| XVIII. Symptoms, signs and abnormal findings in clinical and lab exams, not classified in another part (R00-R99) | 1 | 4.0 | 14 | 6.3 |
| XX. External causes of morbidity and mortality (V01-Y98) | 8 | 32.0 | 54 | 24.1 |
| Other causes | – | – | 8 | 3.5 |

## DISCUSSION

Many determinants of infant mortality are complex because of their association with social, cultural, and biological factors as well as access to health services; however, these determinants are being gradually minimized. One of the main causes for this minimization is the reduced post-neonatal mortality indexes led by the implementation of programs for maternal and infant health prevention and promotion. Nonetheless, huge efforts are required to cope with the difficulties of each region and the difference between regions so as to reach satisfactory levels[12].

This reduction is also related to the fall of fertility among women. In the last decades, the fertility rate among women of more than 20 years of age dropped, but among those under 20 years of age the rate in Latin American and Caribbean countries increased. Maternal age by the time of delivery is an important factor related to infant death, but there is no consensus about the extremes of age because these depend on several behavioral, socio-economic, and biological factors[13]. In this study the largest number of infant deaths was among mothers of more than 20 years old, in both the neonatal and post-neonatal components.

Higher education among mothers belonging to higher economic classes, who have fewer children and consume more goods and services, mainly health-related, are considered to be factors of protection to the child, resulting in reduced risk of death[14]. In this study, however, education for more than eight years did not show lower risk of death when compared with education for up to seven years.

Studies show a direct correlation between socio-economic conditions and health status, and this correlation is not exclusive to underdeveloped countries. A study in the United States and Western Europe showed that social inequalities explain the variations of infant mortality rates, which is an indication of a higher risk of death in social strata with worse socio-economic conditions[15]. In Italy, income inequality and unemployment have significantly increased the risk of infant mortality in that country[16].

Regarding prenatal monitoring, almost all mothers of children under one year old have used public services. Similar data were found in another study where most of the medical visits were in the public health network[17]. However, results of a study carried out in Rio Grande do Sul showed that pregnant women served by the public health system were disadvantaged in comparison with those served by the private health system that had better socio-economic, demographic, reproductive conditions, and coverage[18].

Regarding coverage of medical visits in the prenatal period, more than half of the women in this study received ≥7 medical checks. Gestational diseases affected part of the population and did not show a statistically significant correlation with the neonatal and post-neonatal components. Studies show that more important than the number of medical visits is the quality of these visits. The studies also show that professionals must be ready to provide services to pregnant women in a way that they can identify potential problems and risks to the woman and the fetus, promoting the reduction of diseases such as: prematurity; low weight at birth; and long hospitalization in intensive care units that increase public expenses related to potentially preventable morbidity and mortality during pregnancy[5,8]. The improvement of prenatal care quality in Brazil could prevent those maternal and infant deaths considered to be preventable. This demands evaluating health services in order to qualify that care[19].

Most of the women in this study had no addiction; however, among those with some addiction the risk of death of the child has clearly doubled. This demands proper management of prevention against the use of legal or illegal drugs during pregnancy, mainly in the prenatal period[20].

More than half of the births analyzed in this study were by vaginal deliveries and at hospitals that had no neonatal and pediatric intensive care unit, which is an indication for the classification of low-risk delivery. Vaginal delivery was considered a risk factor for neonatal mortality when compared to surgical delivery. That is so because of the poor quality of care during vaginal delivery that exposes children to anoxia, thus leading to a high incidence of cesarean sections in Brazil and distortions regarding the recommendation of delivery routes, that is, surgical to low-risk and vaginal to high-risk deliveries. This increases neonatal deaths related to obstetric care[21].

Virtually all deliveries were in a hospital environment. However, although deliveries are assisted by professionals and have access to intensive care services, extending the children's lifetime and reducing deaths, quality in the delivery care is crucial, considering that most of the newborns' diseases in Brazil are related to inefficacious and inefficient obstetric care[11,21-22]. In this setting the health team must be ready to provide care for cardiopulmonary resuscitation in the delivery room to prevent perinatal asphyxia and/or anoxia; this is an important mechanism to reduce neonatal mortality[23].

Regarding the characteristics of birth, male sex presented a higher percentage when compared to the female sex in the neonatal period. Studies show that male sex presents a higher risk of developing respiratory problems, which is one of the main causes of death in the neonatal period, because male infants' pulmonary maturation is slower and later[24]. White race prevailed in the subject municipality and the 2010 Brazilian census confirmed that the white population in the state of Paraná was 7,344,122 individuals, while the sum of the other races was 3,100,404 – virtually three times more[25]. In the literature, however, the brown and black races, added to the population with a lower socio-economic level, present the highest infant death index[22].

Good vitality conditions at birth such as an Apgar score higher than seven, proper weight at birth, and gestational age ≥37 weeks occurred to most of the children that died in the neonatal and post-neonatal period in this study. In general, the survivors from poor vitality conditions (neonatal anoxia) and low weight at birth demand long periods of hospitalization in high-complexity neonatal units, exposing them to events typical to hospitalization periods such as early and late neonatal sepsis. This exposure can result in neurological deficits or sequelae related to physical and cognitive development, implying public expenses for programs

on rehabilitation and social insertion, as well as in specialized centers to consistently monitor children[12].

Approximately 30% of the children studied presented low weight at birth and gestational age, as well as anoxia. Regarding the Apgar, the study found that born-alive infants scoring less than seven in the fifth minute of life presented a risk of death in neonatal period 8.7 times higher compared to those with scores above seven[14]. Many studies associate low weight at birth with the relative risk of infant death as one of the main determinants of neonatal mortality[14,26].

Most of the children were monitored after discharge from maternity, mainly in public health services. However, this was not a reality for all children, showing a gap in care. A referral to primary care service to monitor the child until two years old should be included in the planning of discharge of new mothers and newborns to promote adherence to childcare medical visits. According to the Ministry of Health, seven is the number of medical visits established for the first year of life of the child, with two in the first 27 days of life and then one at every two months[10]. In this study, however, although the lowest percentage of deaths was found in the neonatal period and almost all children had two medical visits in the public health system, as defined in the ministerial protocols, the outcome was unfavorable.

Because of their weaker condition, children should be granted priority actions in health, mainly in primary care, aiming at a systematic evaluation that allows early diagnosis of problems related to growth, nutritional status, and neural-psychomotor and behavioral development, in addition to the prevention of diseases and promotion of healthy habits, among others[10,27].

Primary health care has improved over the years, but there are huge difficulties related to care delivered to and monitoring of children. Difficulties remain regarding the implementation of more efficient remedial practices and interventions that could prevent many hospitalizations[27]. Gaps are not related exclusively to hospitalization, but are worsened when the causes of death are observed. In developing countries today most of the cases of infant morbidity and mortality are due to several risk factors related to living conditions, access to health services, and poor care and availability of public health services, making these preventable factors the strongest causes of neonatal and post-neonatal harm[12].

In this study, almost 40% of the children who died had no access to specialized care, and some died at home. Perinatal diseases were one of the main causes of death in the neonatal period, and another study corroborates this fact[11]. It is noteworthy that external cause was the second most frequent cause in both neonatal and post-neonatal components, specifically due to gastric aspiration. This result was confirmed in another study that showed that death from gastric aspiration was outstanding among deaths from external causes[28].

Most of these events occur with no medical assistance, at home or on the way to the health service. Therefore, care should be focused on prevention and coordination with different care levels for each stage of development of the child, and quick access to proper instructions in the event of accident[28].

That is why childcare starts in the prenatal period with group activities for pregnant women. After delivery, health service physicians and nurses should continue this care in individualized and systematic interspersed medical visits to intervene with preventive measures and health promotion, preventing potential diseases typical to each stage of infant development[10,27].

In this study, the percentage of deaths from congenital malformations was higher in the post-neonatal period. Most of deaths from this cause are considered to be little reduced because of the difficulty of control, considering that each type has peculiarities related to the disease system. On the other hand, technological progress has extended the survival time and, in general, the cause of death is not related to the malformation itself, but to chronicity-related complications such as infectious and respiratory diseases. However, the incidence of congenital malformation can be reduced through the implementation of programs on genetic counseling and rehabilitation; multi-professional care during prenatal, delivery, and post-birth; specialized hospital care with timely interventions to minimize complications; and updating and adjustment of vaccines as preventive measures[29].

Infectious-parasitic and respiratory diseases were other causes of death of children under one year old, notably in the post-neonatal period. Notwithstanding, in Brazil, diarrhea and pneumonia are outstanding diseases with unfavorable outcomes in this age group, despite the expansion of the vaccine schedule and exhaustive scientific knowledge about proper management of gastrointestinal diseases[30]. These diseases that lead to unfavorable outcomes are directly related to the inefficacious and inefficient care provided to the population or absence of this care, notably in regions where access to health services is difficult[15,26]. However, the subject municipality is the second largest one in the state, and counts on a health system that provides mostly public services at different levels of care.

## CONCLUSION

This study showed that children that died in the first year of life, after being discharged from maternity, were born in good conditions of vitality, weight, and gestational age adequate to the age. Low education levels and low income prevailed among mothers, but did not present a statistical association with the infant mortality component.

Most prenatal, delivery, and child care were delivered at public health services. Access to hospitals with specialized services at the time of death prevailed, although some of the participants did not access it. The main causes of death in the neonatal and post-neonatal period together were in the following order: malformations; external causes; some infectious-parasitic diseases; and perinatal diseases.

Data show the need for investment in primary health care and hospital care to enable proper starting and monitoring at each vital cycle, mainly to children under one year of age, to prevent unfavorable outcomes of the diseases that affect them, because these are potentially preventable causes if comprehensive and remedial care exists.

**RESUMO**

**Objetivo:** Analisar as mortes infantis após alta das maternidades ocorridas entre 2000 e 2013. **Método:** Pesquisa quantitativa retrospectiva transversal, em município no norte do Paraná. Os dados foram analisados no SPSS®. Aplicaram-se teste qui-quadrado, regressão logística, intervalo de confiança 95% e nível de significância $p<0,05$. **Resultados:** 249 crianças nasceram, receberam alta e evoluíram para óbito, 10,1% no período neonatal e 89,9% no pós-neonatal. O acompanhamento gestacional, nascimento e seguimento da criança ocorreram, predominantemente, no serviço público. Houve associação estatisticamente significativa entre componente infantil e local de parto ($p=0,002$; RR=1,143; IC95%=1,064-1,229); realizar menos consultas de puericultura ($p=0,001$; RR=1,294; IC95%=1,039-1,613). As causas de morte no período neonatal foram afecções perinatais (40%), causas externas (32%) e malformações congênitas (20%). No pós-neonatal, malformações congênitas (29,9%), causas externas (24,1%) e doenças infectoparasitárias (11,2%). **Conclusão:** A quase totalidade das crianças nasceu em boas condições de vitalidade, apresentou agravos por doenças potencialmente preveníveis que culminaram no óbito.

**DESCRITORES**

Mortalidade Infantil; Serviços de Saúde; Atenção à Saúde; Causa Básica de Morte; Enfermagem Pediátrica.

**RESUMEN**

**Objetivo:** Analizar las muertes infantiles después de alta de las maternidades sucedidas entre 2000 y 2013. **Método:** Investigación cuantitativa retrospectiva transversal, en municipio en el norte de Paraná. Los datos fueron analizados en el SPSS®. Se aplicaron prueba chi cuadrado, regresión logística, intervalo de confianza al 95% y nivel de significación $p<0,05$. **Resultados:** 249 niños nacieron, tuvieron alta y fallecieron, el 10,1% en el período neonatal y el 89,9% en el post neonatal. El acompañamiento gestacional, nacimiento y seguimiento del niño ocurrieron, predominantemente, en el servicio público. Hubo asociación estadísticamente significativa entre componente infantil y lugar del parto ($p=0,002$; RR=1,143; IC95%=1,064-1,229); realizar menos consultas de puericultura ($p=0,001$; RR=1,294; IC95%=1,039-1,613). Las causas de muerte en el período neonatal fueron afecciones perinatales (40%), causas externas (32%) y malformaciones congénitas (20%). En el post neonatal, malformaciones congénitas (29,9%), causas externas (24,1%) y enfermedades infectoparasitarias (11,2%). **Conclusión:** La casi totalidad de los niños nació en buenas condiciones de vitalidad, pero presentó agravios por enfermedades potencialmente prevenibles que culminaron con el fallecimiento.

**DESCRIPTORES**

Mortalidad Infantil; Servicios de Salud; Atención a la Salud; Causa Básica de Muerte; Enfermería Pediátrica.

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