# Trends in avoidable causes of infant mortality in Belo Horizonte, Brazil, 1984 to 1998

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**Keywords**
Infant mortality. Postneonatal mortality. Death certificates. Medical records. Information systems. Mortality rate.

**Abstract**

**Objective**
To analyze the infant mortality trend in a metropolitan area, from 1984 to 1998. The main focus was on avoidable causes of neonatal and post-neonatal mortality.

**Methods**
Sources of data were the Sistema de Informações em Mortalidade do Ministério da Saúde (SIM-MS) [Mortality Information System of the Ministry of Health] and Fundação Instituto Brasileiro de Geografia e Estatística (IBGE) [Brazilian Institute of Geography and Statistics Foundation] (official live birth and death records) for the metropolitan region of Belo Horizonte, in the State of Minas Gerais. A simple linear regression model was used to evaluate time-trends of mortality rates. Statistical significance of the inclination of the regression curves was considered for the $p<0.05$ level.

**Results**
During the 15 year period in question, the infant mortality rate declined from 48.5 to 22.1/1,000 live births. However, the most accentuated decrease was observed during the last four years of the study period. The post-neonatal group was greatly responsible for this decline both in the capital and in the other districts within the metropolitan region of Belo Horizonte.

**Conclusions**
Although a significant decrease in the infant mortality rate has been observed, particularly in the post-neonatal mortality, it is still larger than the rates found in developed countries. Deaths due to perinatal morbidities as well as the group of causes represented by diarrhea-pneumonia-malnutrition still present an important potential for reduction. The authors discuss the role of the health services in improving the rates of these avoidable causes of infant mortality.

## INTRODUCTION

The rate of infant mortality (IMR) represents one of the most commonly employed indicators utilized in the analysis of a country's health situation. It is divided into two periods, classically: the neonatal period, which estimates the risk of death in the first 27 days of life and the post-neonatal period, which estimates the risk of death from the 28th day of life to the end of the first year of life. Whereas neonatal mortality is intrinsically related to health conditions during pregnancy and birth, as well as the physical integrity of the child itself, post-neonatal mortality is more closely associated to socio-economic and environmental conditions, with a predominance of the infectious causes.

In both infant mortality components, however, an important part of the responsibility is attributed to the health services. It is acknowledged that adequate sanitary conditions and accessible, good quality health services may play a positive role in reducing infant mortality. In spite of the unfavorable living

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conditions, infant mortality in general – neonatal and post-neonatal – has presented a tendency to decrease in the last few decades, in Brazil and throughout the world.[1] There are, however, differentiated decreases in the rates of infant mortality among the diverse Brazilian regions and even among regions of a single State. This fact could be the result of differentiated policies of infant health care.[17]

Some causes of death in the neonatal period are considered to be reducible given adequate assistance is provided during pregnancy and birth, and still other causes are considered evitable by means of early diagnosis and intervention.[4,10,12] In the post-neonatal period, the principal causes of death are also considered evitable and intervention is thought to be easy for they are more related to precarious basic sanitary conditions and access to health care.[5,20] In the developed countries, the post-neonatal component is not very significant, but in Brazil, despite accelerated decline in the past few years, there are still elevated levels of mortality that are unacceptable ethically.[18] This fact is particularly important when one considers that low effectiveness of infant health services represents one of the determinants of post-natal mortality due to acknowledgedly evitable causes.[2]

The purpose of establishing criteria for classifying diseases and infant deaths as evitable or not, according to present medical and scientific knowledge, is to keep a track of certain causes of death that may be significantly reduced by means of measures that are almost always simple and low cost.[12,15] Knowledge concerning the behavior of clusters of evitable causes, both in the neonatal and in the post-natal period, makes it possible to undertake a more thorough analysis of the situation, propitiating greater comprehension of the dynamic process that has characterized infant mortality in the past few years and provides relevant subsidiary information for planning efficient interventions.

However, it is still difficult to establish the evolution of infant mortality with precision, for the entire country, since the rate of sub registration of deaths is not negligible and the number of late birth registers also jeopardizes the quality of the estimates.[16] So, greater part of the available data on infant mortality is derived from indirect estimates, that frequently do not make it possible to evaluate short term tendencies nor obtain estimates for recent periods. The objective of this paper is to present the evolution of infant mortality rates, analyzing their behavior, with particular emphasis on the principal causes of neonatal and post-natal death, particularly the cluster of perinatal diseases and diarrhea-pneumonia-malnutrition, considered as evitable causes of death.

## METHODS

The area being studied was the metropolitan region of Belo Horizonte (MRBH) and the time frame for this analysis was restricted to the period from 1984 to 1998. The region was constituted by 18 districts or municipalities in 1984. These were: Belo Horizonte, Betim, Brumadinho, Caeté, Contagem, Esmeraldas, Ibirité, Igarapé, Lagoa Santa, Mateus Leme, Nova Lima, Pedro Leopoldo, Raposos, Ribeirão das Neves, Rio Acima, Sabará, Santa Luzia and Vespasiano. In 1993, there were two more municipalities (Juatuba e São José da Lapa) and in 1997, another three were added on: Mário Campos, São Joaquim de Bicas e Sarzedo. This increase in the number of districts did not impede a temporal analysis, for the new municipalities included were the result of the process of municipalization which led to the dismemberment of some of the districts in existence at the beginning of the study period. It is presumed that available data concerning the MRBH is of better quality than data concerning districts outside the metropolitan area, for the proportion of deaths due to ill-defined causes is lower and sub registration is negligible. The number of deaths was obtained from the *Subsistema de Informações de Mortalidade do Ministério da Saúde* (SIM/MS) [Subsystem of Information on Mortality of the Ministry of Health] and the number of live births was obtained from the *Estatísticas do Registro Civil da Fundação Instituto Brasileiro de Geografia e Estatística* (IBGE). [Statistics of the Civil Registry of the Foundation of the Brazilian Institute of Geography and Statistics]. Although the Ministry of Health has its own registry of live births, the *Sistema de Informações de Nascidos Vivos* (SINASC/MS) [Data System of Live Births], it has only recently been implanted, and thus it is not feasible to utilize it for a larger temporal series. It is acknowledged that data referring to the Civil Registry does not correspond to the real number of live births, for a significant portion of live births is only registered later on, years after the date of birth.[6,7] In order to minimize the effect of sub-registration, the Giraldelli & Wong,[7] method was employed. The point of departure of the latter is a preliminary analysis of the proportion of late birth registries per cohort and per period. The initial proposal was to verify if there was a similarity in the behavior of late registries when these were considered in two distinct manners: a series of births registered late in a specific year "*x*" (transversal series or "period") and another series of births that occurred in the specific year "*x*" and that were registered in the following years(cohort). The proportion of births registered late in the *period x* represents the relation between the

births that occurred in the year *x-a* (being *a* the number of years between birth and its registration) that were registered in the year *x* and those that were born and registered in the year *x*. The proportion of late registers in a specific *cohort x* represents the relation between those born and registered in the year *x+a* and those born and registered in the year *x*. When the method was applied and both analyses were compared, it is possible to verify if the two series are compatible, thus making it possible to utilize the transversal series to estimate sub registration. If this similarity exists, a first approximation to the sub registration correction for a calendar year *x*, would be the sum of the quotients of those born in the year *x-a* and registered in the year *x* and the total of live births that occurred and were registered in the same year. In order to obtain more stable correction factors, the method proposes to make two successive adjustments: initially the proportion of late birth registers is described by means of a logarithmic model based on time and then the parameters of this model are adjusted by the logistic function, being then utilized to estimate the cumulative proportions of late registers.

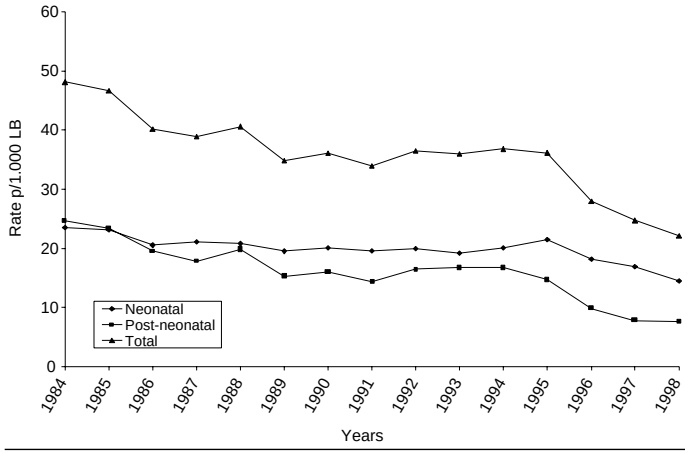


**Figure 1** - Infant mortality: neonatal and post-natal components for the Metropolitan Region of Belo Horizonte, MG, 1984-1998.

Four major groups of causes of mortality were considered, according to the Ninth and Tenth Revision of the International Classification of Diseases (the ICD-9 was utilized for the years 1984 to 1995 and the ICD-10 for the years 1996 to 1998). These groups of causes were : "certain conditions originating in the perinatal period" (ICD-9 codes 760-779 and ICD-10 codes P00-P96), "congenital malformations, deformations and chromosomal abnormalities" (ICD-9 codes 740-759 and ICD-10 codes Q00-Q99) and "diarrhea-pneumonia-malnutrition" (ICD-9 codes 001-009, 480-486, 260-269 and ICD-10 codes A00-A09, J12-J18, E40-E46). The remaining codes were classified in the category "other causes". Perinatal conditions represent the principal group of evitable causes among the neonatal deaths being due, in the majority of cases, to fetal malnutrition, prematurity, hypoxia, perinatal asphyxia, as well as respiratory and cardiovascular conditions that occur in the perinatal period. The diarrhea-pneumonia-malnutrition cluster represents the principal component of causes in which intervention is possible among the post-neonatal deaths (among these are included intestinal infectious diseases, nutritional deficiencies, particularly protein-energy malnutrition, and the pneumonias).

The Epi Info and SAS (Statistical Analyses System) programs were utilized for processing and analyzing data. Tendency curves were adjusted utilizing linear regression in order to estimate the inclination of the infant curves and their components. The value $p<0,05$ was considered as the level of significance for beta.

## RESULTS

Table 1 presents the number of deaths in each year, the number of live births and the correction factor utilized to obtain the best estimate for the rate of infant mortality for both the capital and the remaining districts within the metropolitan region. It is noteworthy that the infant mortality coefficient decreased significantly in the MRBH in the study period, having gone from 48.5 per thousand live births to 22.1 per thousand live births, corresponding to a decrease of approximately 54% (beta =-0.56;$p<0.0001$).

Figure 1 presents the evolution of neonatal and post-neonatal mortality and makes it possible to observe that there was a greater decrease in the post-neonatal mortality. From the third year of the series under study (1986) onwards the neonatal component was larger than the post-neonatal component and this tendency was maintained in the following years.

The decreases observed during the fifteen years analyzed were of approximately 38% for the neonatal mortality (beta =-1.60; $p=0.0003$) and 69% for the post-neonatal mortality (beta =-0.82; $p<0.0001$). An average decrease of 2.5% per year in the neonatal mortality and of 4.6% in the post-neonatal mortality could be inferred. However, a regular decrease was not observed in the curves throughout the years under study. It is possible to note more accentuated decreases in the first and last years of the series studied and a stable behavior during the largest part of the period analyzed. From 1986 to 1995 no decrease was observed in the infant mortality nor in its neonatal or

post-neonatal components in the municipalities within the MRBH (within this period the linear regression analyses presents values that are not significant for beta).

As to the evolution of the major groups of causes of infant mortality in Belo Horizonte and the rest of the metropolitan region surrounding it, it was verified that the greatest variation occurred in mortality due to conditions originating in the perinatal period and the diarrhea-pneumonia-malnutrition cluster (see Table 2). The rate of mortality due to congenital anomalies was relatively stable throughout the period, whereas mortality attributed to "other causes" presented

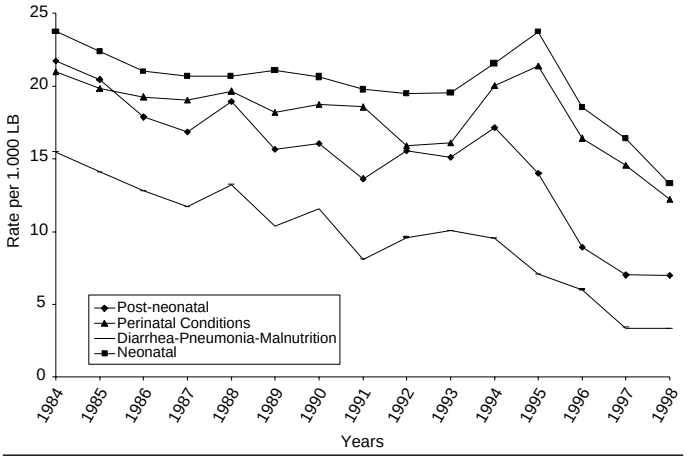


**Figure 2** - Infant neonatal and post-neonatal mortality and main groups of causes, Belo Horizonte, MG, 1984-1998.

**Table 1** - Evolution of the total number of infant deaths, of the number of live births registered (with the respective correction factor) and rate of infant mortality, Metropolitan Region of Belo Horizonte, MG, 1984-1998.

| Year | Total number of infant deaths | Number of live births registered/year | Correction factor for the number of lb* | Rim (per 1.000 lb) |
|---|---|---|---|---|
| 1984 | | | | |
| Capital | 2,310 | 45,640 | 12.3 | 45.1 |
| Region | 1,411 | 23,634 | 10.0 | 54.3 |
| 1985 | | | | |
| Capital | 2,143 | 44,032 | 13.6 | 42.8 |
| Region | 1,365 | 22,708 | 11.1 | 54.1 |
| 1986 | | | | |
| Capital | 2,043 | 46,277 | 13.4 | 38.9 |
| Region | 1,119 | 23,442 | 11.9 | 42.6 |
| 1987 | | | | |
| Capital | 1,994 | 47,766 | 11.3 | 37.5 |
| Region | 1,100 | 24,006 | 9.4 | 41.8 |
| 1988 | | | | |
| Capital | 2,041 | 46,396 | 11.0 | 39.6 |
| Region | 1,196 | 25,791 | 9.4 | 42.3 |
| 1989 | | | | |
| Capital | 1,799 | 43,763 | 11.9 | 36.7 |
| Region | 1,044 | 29,864 | 9.4 | 31.9 |
| 1990 | | | | |
| Capital | 1,638 | 40,461 | 10.3 | 36.7 |
| Region | 1,129 | 29,304 | 9.0 | 35.3 |
| 1991 | | | | |
| Capital | 1,439 | 39,052 | 10.3 | 33.4 |
| Region | 1,120 | 29,580 | 9.2 | 34.7 |
| 1992 | | | | |
| Capital | 1,501 | 38,305 | 11.9 | 35.0 |
| Region | 1,273 | 29,890 | 10.8 | 38.4 |
| 1993 | | | | |
| Capital | 1,541 | 39,341 | 12.9 | 34.7 |
| Region | 1,345 | 32,058 | 11.7 | 37.6 |
| 1994 | | | | |
| Capital | 1,710 | 39,591 | 11.5 | 38.7 |
| Region | 1,203 | 31,481 | 11.0 | 34.4 |
| 1995 | | | | |
| Capital | 1,344 | 31,230 | 14.1 | 37.7 |
| Region | 1,257 | 32,138 | 12.8 | 34.7 |
| 1996 | | | | |
| Capital | 1,162 | 37,623 | 12.5 | 27.4 |
| Region | 1,109 | 34,356 | 12.9 | 28.6 |
| 1997 | | | | |
| Capital | 1,025 | 38,335 | 14.3 | 23.4 |
| Region | 1,040 | 34,959 | 13.6 | 26.2 |
| 1998 | | | | |
| Capital | 844 | 35,805 | 16.5 | 20.2 |
| Region | 985 | 35,260 | 16.1 | 24.1 |

Sources: *Sistema de Informações sobre Mortalidade do Ministério da Saúde e Instituto Brasileiro de Geografia e Estatística* (IBGE) [Information System on Mortality of the Ministry of Health and Brazilian Institute of Geography and Statistics]
*Correction Factor obtained by the Giraldelli-Wong Method
Rim: Rate of infant mortality
Ib: Live births
Region: Metropolitan Region surrounding Belo Horizonte, excluding the capital

irregular behavior, with a more notable decrease only in the last few years.

Figure 2 presents the evolution of infant mortality in the municipality of Belo Horizonte alone, distinguishing the neonatal and post-neonatal components. The most conspicuous clusters of causes in each component are also presented. It may be observed that the cluster of perinatal conditions and diarrhea-pneumonia-malnutrition were the major determinants of neonatal and post-neonatal death, respectively. Figure 3 presents the same curves, but in reference to the metropolitan region surrounding, but not including Belo Horizonte.

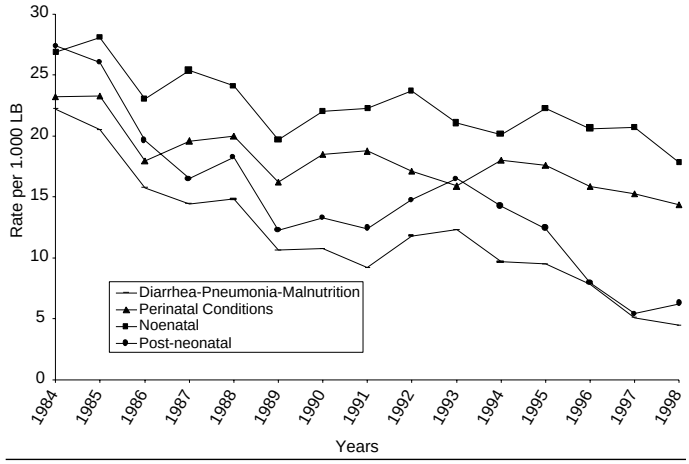


**Figure 3** - Infant neonatal and post-neonatal mortality and main groups of causes in the Metropolitan Region surrounding Belo Horizonte, MG, 1984-1998.

Three distinct moments in the evolution of post-neonatal mortality stand out in Figures 2 and 3. A frankly declining tendency is observed between 1984 and 1991, despite the ascending peak in the year 1988. From 1991 onwards the post-neonatal mor-

**Table 2** - Evolution of the main groups of causes of infant mortality, Metropolitan Region of Belo Horizonte, MG, 1984-1998.

| Year | Causes | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Congenital | | Perinatal | | DPM | | Others | |
| | Rate** | % | Rate** | % | Rate** | % | Rate** | % |
| 1984 | | | | | | | | |
| Capital | 3.5 | 7.7 | 21.0 | 46.1 | 15.4 | 33.9 | 5.6 | 12.4 |
| Region | 3.0 | 5.5 | 23.2 | 42.8 | 22.2 | 40.9 | 5.9 | 10.8 |
| 1985 | | | | | | | | |
| Capital | 3.6 | 8.5 | 19.8 | 46.3 | 14.1 | 32.9 | 5.3 | 12.3 |
| Region | 3.2 | 6.0 | 23.3 | 43.0 | 20.5 | 37.9 | 7.0 | 13.0 |
| 1986 | | | | | | | | |
| Capital | 2.8 | 7.1 | 19.3 | 49.5 | 12.8 | 32.9 | 4.1 | 10.5 |
| Region | 3.5 | 8.2 | 17.9 | 42.1 | 15.7 | 36.9 | 5.5 | 12.8 |
| 1987 | | | | | | | | |
| Capital | 2.8 | 7.4 | 19.1 | 50.8 | 11.7 | 31.2 | 4.0 | 10.6 |
| Region | 3.4 | 8.1 | 19.6 | 46.8 | 14.4 | 34.5 | 4.4 | 10.6 |
| 1988 | | | | | | | | |
| Capital | 3.1 | 7.9 | 19.7 | 49.6 | 13.2 | 33.4 | 3.6 | 9.1 |
| Region | 3.1 | 7.3 | 20.0 | 47.2 | 14.8 | 35.0 | 4.4 | 10.5 |
| 1989 | | | | | | | | |
| Capital | 3.1 | 8.5 | 18.2 | 49.5 | 10.3 | 28.2 | 5.1 | 13.8 |
| Region | 2.5 | 7.8 | 16.2 | 50.7 | 10.7 | 33.4 | 2.6 | 8.1 |
| 1990 | | | | | | | | |
| Capital | 2.6 | 7.1 | 18.7 | 51.1 | 11.6 | 31.5 | 3.8 | 10.3 |
| Region | 2.8 | 7.8 | 18.5 | 52.3 | 10.7 | 30.4 | 3.4 | 9.5 |
| 1991 | | | | | | | | |
| Capital | 3.2 | 9.7 | 18.6 | 55.6 | 8.1 | 24.2 | 3.5 | 10.6 |
| Region | 2.9 | 8.3 | 18.8 | 54.1 | 9.2 | 26.6 | 3.8 | 10.9 |
| 1992 | | | | | | | | |
| Capital | 3.6 | 10.3 | 15.9 | 45.4 | 9.6 | 27.4 | 5.9 | 16.8 |
| Region | 3.0 | 7.8 | 17.1 | 44.5 | 11.8 | 30.7 | 6.5 | 17.0 |
| 1993 | | | | | | | | |
| Capital | 2.8 | 8.2 | 16.1 | 46.4 | 10.1 | 29.1 | 5.7 | 16.3 |
| Region | 2.4 | 6.3 | 15.9 | 42.3 | 12.3 | 32.8 | 7.0 | 18.6 |
| 1994 | | | | | | | | |
| Capital | 2.9 | 7.4 | 20.0 | 51.7 | 9.5 | 24.6 | 6.3 | 16.3 |
| Region | 1.9 | 5.5 | 18.0 | 52.4 | 9.7 | 28.1 | 4.8 | 14.0 |
| 1995 | | | | | | | | |
| Capital | 4.1 | 10.9 | 21.4 | 56.7 | 7.1 | 18.7 | 5.2 | 13.8 |
| Region | 2.9 | 8.5 | 17.6 | 50.7 | 9.5 | 27.4 | 4.7 | 13.5 |
| 1996 | | | | | | | | |
| Capital | 2.8 | 10.3 | 16.4 | 59.8 | 6.0 | 21.9 | 2.2 | 7.9 |
| Region | 2.9 | 10.0 | 15.9 | 55.5 | 7.8 | 27.4 | 2.0 | 7.1 |
| 1997 | | | | | | | | |
| Capital | 3.0 | 12.8 | 14.6 | 62.2 | 3.4 | 14.4 | 2.5 | 10.6 |
| Region | 3.2 | 12.2 | 15.3 | 58.3 | 5.1 | 19.4 | 2.6 | 10.0 |
| 1998 | | | | | | | | |
| Capital | 1.9 | 9.6 | 12.2 | 60.4 | 3.3 | 16.5 | 2.8 | 13.5 |
| Region | 2.1 | 8.6 | 14.3 | 59.6 | 4.5 | 18.6 | 3.2 | 13.2 |

DPM: Cluster of causes : diarrhea-pneumonia-malnutrition
*Rate per thousand live births

tality presented increasing rates both in the capital and in the metropolitan region surrounding it. This elevation presented its greatest peak in 1993 in the metropolitan region surrounding Belo Horizonte and, in 1994 in Belo Horizonte itself. The third moment presents an accentuated decline in the post-neonatal mortality in both regions.

As to the neonatal mortality, Figures 2 and 3 indicate very distinct behaviors. In Belo Horizonte, neonatal mortality remained practically stable from 1986 to 1993. It then presented rising rates until 1995 and afterwards there was an accentuated decline. As to the metropolitan region surrounding Belo Horizonte, neonatal mortality initially presented a tendency to decrease, but became irregular for the greater part of the period under study and sometimes presented lower rates than the capital. At the end of the study period, the accentuated decline verified in the capital was not observed in the metropolitan region surrounding it.

## DISCUSSION

One of the major problems in the construction of trustworthy estimates of infant mortality rates is the availability of confidential data concerning death registers and live births. The imprecision of data may distort the rates obtained with obvious setbacks for future inferences. Although both birth and death registers are compulsory in Brazil, they are sub notified.[16]

The sub registration of infant deaths tends to be smaller in the large urban centers, where "clandestine cemeteries" are less likely to be found. It is assumed that this limitation is of little importance, particularly in this region, for sub registration of deaths is considered of small significance.[21] Thus, it is presumed that the number of deaths recorded in the Subsistema de Informações sobre Mortalidade do Ministério da Saúde (SIM-MS) [Subsystem of Information on Mortality of the Ministry of Health] for the MRBH, during the study period, is very close to reality or that there is a small and negligible rate of sub notification.

As to the number of live births, the late registry of births may lead to a bias in the estimates of the rates of infant mortality. There are several methods that attempt to bypass this difficulty, according to different assumptions and methodologies.[13] Probably, at least in the region under consideration, different methodologies would lead to similar results, since the proportion of sub registrations beyond a delay of eight years is negligible. A previous study that evaluated birth statistics in the municipality of Belo Horizonte indicated that the rates of infant mortality, calculated by means of two distinct methods, did not present significant differences.[13] Therefore, it may be admitted that the magnitude of the bias in the correction of sub registration of live births is of little importance, implying in variations of the estimated rates that are not significant. This study presents an approximation of the evolution of the real rates of infant mortality for one of the large metropolitan areas in the Southeastern region of Brazil. In consonance with what occurs throughout most parts of the country, infant mortality is presenting a tendency to decline in the MRBH. The post-neonatal component presented the greatest decline during the study period and its reduction, was, therefore, responsible, in large part, for the decline in infant mortality in the region. A similar phenomenon has been observed in other regions.[18] However, despite the significant decreases in the rates of post-neonatal mortality, it still represents an important public health problem in the capital as well as in the metropolitan region surrounding it. In recent years, the estimated rates are considered elevated in relation to those observed in developed countries. In fact, the rates observed are more elevated than rates of infant mortality, in general, in various countries.[1] Even within Latin America, some countries have rates significantly lower than those observed in this study. In Cuba, post-natal infant mortality was not greater than 6.5 per thousand live births in 1980 and had decreased to 3.9 per thousand live births in 1989.[14] In Chile, post-neonatal mortality decreased from 50.5 per thousand live births, in 1970 to 6.6 per thousand live births in 1992[19] and to 4.3 per thousand live births in 1998.[9]

The elevated participation of deaths in the "diarrhea-pneumonia-malnutrition" cluster is notorious. The economic model has certainly contributed towards the persistence of social inequities and is partially responsible for maintaining the sequence of events that culminates in infant mortality for apparently banal causes. This however, does not nullify the co-responsibility of the health services that, not being capable of intervening in the incidence of morbidity, should assume a commitment to provide early and effective assistance. In principle, diarrheic diseases and pneumonia are pathologies that are easy to handle and that do not require high cost technology. In the majority of cases, complications may be avoided by close surveillance, identifying situations or children that suffer greater risk for a more effective intervention. According to Taucher & Jofré[19] (1997), the decrease in deaths due to diarrheic and respiratory diseases in Chile was due to a set of factors that include early access to health services and high quality medical care.

As to the rates of neonatal mortality, a significant

decline was also observed, particularly in the more recent years of the study period and mainly in the municipality of Belo Horizonte. However, this behavior was irregular, with inclinations varying a great deal throughout the years. This behavior has been observed by other authors that attribute these varied inclinations to the lack of quality of obstetric services.[3] In fact, the evitability of neonatal deaths is more closely associated to the technical conditions of prenatal care and care during birth than to the existence of intensive therapy's sophisticated technology.[10,12] The elevated proportion of deaths due to perinatal conditions constitutes an indicator of alarm. Causes associated to the early interruption of pregnancy or to restrictions in uterine growth are frequently associated to deficiencies in prenatal care. Obstetrics traumas, hypoxia or asphyxia at birth are also warning signals of inadequate care at birth.[10]

On the other hand, it cannot be denied that the structure of causes has presented progress throughout the years included in this study. In the capital, the participation of the cluster of causes "diarrhea-pneumonia-malnutrition" in infant mortality in general decreased from approximately 34% in 1984 to 16.5% in 1998, a decrease, therefore, of the order of 50%. As to the metropolitan area surrounding Belo Horizonte, the reduction was equally significant, approximately 55%. This decline in the post-natal mortality is particularly important in the metropolitan area surrounding Belo Horizonte, because it tends to decrease the distance between the rates in the two areas of the Metropolitan region– Belo Horizonte itself and the metropolitan region surrounding it. A similar phenomenon was observed in a previous study in the metropolitan region of Rio de Janeiro.[11]

Certainly the process of municipalization of health services makes it possible to develop different approaches for different municipalities. A more efficient intervention depends upon the priority given to the quality of assistance and greater equity in access to care. It is not very likely that the metropolitan region surrounding Belo Horizonte is representative of the rest of the State. The proximity to propedeutic and therapeutic resources, the greater demographic density of health professionals, the number of outpatient and hospital establishments has, surely played an important role in the decline of infant mortality in the entire MRBH, which probably does not happen in the rest of the State. This data, however is difficult to measure, for the vital statistics for the majority of districts within the State are very precarious.

The behavior of the rates of infant mortality makes it possible to infer that new developments are necessary. Post-natal and neonatal mortality due to perinatal causes, such as prematurity, hypoxia and obstetrics traumas, represent a reserve in which it is possible to obtain further reductions in mortality during the first year of life in the future. In this sense, the participation of the health services is fundamental. However, the need for a continual and efficacious social policy geared towards the improvement of sanitary conditions, maternal education and access to goods and services in general, including opportune, high quality medical care should not be neglected.

Throughout the historical series discussed in this paper, Brazil passed through important transformations. In relation to public health policies, the implementation of the Brazilian Unified Health System (SUS), in 1988, must be emphasized. This represented a new paradigm for health care in Brazil, in terms of policy, technology and ideology as well. As to child health, immunization programs, programs for the control of diarrheic diseases and oral rehydration therapy, for the surveillance of growth and development, as well as programs for food supplementation were augmented. As to prenatal care and care in childbirth, advances were not as significant. As to care for the sick child, bottlenecks sill exist within the health system. The network of hospital assistance is predominantly private and maintains contracts with the public services. Frequently the care provided is not linked to the public network in general, implying in a rupture with the concept of integral health care, which is of fundamental importance in infant health care.

Thus, despite the significant decreases obtained in infant mortality throughout the 15 years analyzed in this study, particularly with respect to the post-neonatal component, the more recent rates of the MRBH are elevated in comparison to those found in developed countries and should be considered ethically unacceptable, due, particularly, to the large proportion of "evitable" causes. According to some authors, this decreasing tendency in the rates of infant mortality highlights the importance of social interventions, but the persistence of evitable causes, particularly among the more deprived groups, underscores the omission of health services in the resolution of this issue. [8] Therefore, for future progress in diminishing the rates of infant mortality the relevance of socio-economic factors and of quality health services, with professionals trained to provide responsible and integral infant health care, since the prenatal period should be stressed.

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