

## INFANT MORTALITY RATE BY REGIONS OF BRAZIL IN THE YEARS 2009 TO 2019

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**Abstract:** The epidemiological study aimed to describe the infant mortality rate by regions of Brazil in the years 2009 to 2019. For this purpose, data extracted from the SIM (Death Information System) and SINASC (Live Birth Information System) were used to calculate early neonatal, late neonatal and post-neonatal mortality rates and construct infant mortality coefficients (the CMI is calculated based on deaths divided by live births in the corresponding region and year, and the result is multiplied by 1,000). Therefore, the values were compared and discussed, taking into consideration, the regions.

In relation to early neonatal mortality (0 to 6 completed days), the North and Northeast regions presented the highest indicators, however among all Brazilian regions, the Northeast region was the one with the greatest drop between the years 2009 to 2019. In which refers to late neonatal mortality (7 to 27 completed), there was the same event as early neonatal mortality rates, with the highest rates being in the North region and the greatest difference in decline being in the Northeast region. In post-neonatal mortality, the North region also has the highest rates, but the greatest difference in decline was observed in the Central West region.

A large decrease in infant mortality in the period from 2009 to 2019 is notable, however, a great effort is still needed to address the differences between regions and reach lower levels. Furthermore, such differences are related to the reality of each region, such as socioeconomic and environmental conditions, and directly influence health indicators and the effectiveness of health systems, showing the extent of social and health inequalities between populations.

**Keywords:** infant mortality, infant mortality by Brazilian regions, infant mortality coefficients.

## INTRODUCTION

Infant mortality is an indicator widely used to assess the living conditions of a place. This rate is calculated by the number of children who die before reaching one year of age for every thousand live births.

The most common causes of death in this age group is associated with prematurity, birth asphyxia, diarrheal disease, congenital anomalies, neonatal sepsis and malnutrition <sup>1</sup>.

Despite the global decrease in its rates, infant mortality is still considered a serious global public health problem, this reality is present in many developing countries. In Brazil, it is observed that differences by region are manifestations of socioeconomic and environmental disparities. It is important to highlight that the reduction of health inequities, and in particular child survival, is the target of attention from international organizations and the Brazilian government.<sup>2</sup>.

According to França et al, 2017, the majority of these deaths occur in the first month of life and the high participation of perinatal causes, such as prematurity, shows how important these factors linked to pregnancy, childbirth, prenatal care, and postpartum, that is, if pregnant women receive quality healthcare during this period, many deaths can be avoided. Furthermore, there is a lack of breastfeeding for babies up to six months of age with food introduction during this period and a lack of educational training to support breastfeeding in Basic Health Units. <sup>3</sup>.

Research shows a higher number of deaths of male children, IBGE data show that in 2015, in Brazil, the probability of male children not completing their first year of life is 14.9 per thousand live births and for sex female, 12.7 per thousand live births. The causes of this difference are linked to biological factors, which indicate a greater fragility of male babies to some types of disease linked to external causes, such as diarrhea, hemorrhages

and pneumonia. Male fetuses have a greater number of miscarriages, as they are more likely to have genetic changes. Studies indicate that some external causes can increase the infant mortality rate. Causes such as stress during pregnancy increase the likelihood of reducing the male to female ratio, as mothers exposed to higher levels of stress have fewer male children <sup>3</sup>.

In recent years, Brazil has gained prominence on the international scene due to the fact that it has achieved a large reduction in the infant mortality rate. In 2000, the child mortality rate was 29.0 per thousand live births; In 2010, it rose to 17.22 and in 2015 it fell to 13.8 deaths per thousand live births. Even in the face of this decline observed in recent years, the country still has high rates of mortality when compared to developed countries. According to França and Lansky, the Brazilian infant mortality rate is still around 3 to 6 times higher than that of countries like Japan <sup>3</sup>.

Furthermore, there is still great regional heterogeneity in the country. In 2015, the lowest Brazilian infant mortality rate was in Espírito Santo, with 9.2 deaths for every thousand live births; The highest rate was in Amapá, with 23.5 deaths per thousand live births. In relation to regions, the highest infant mortality rates stand out in the North, Northeast and Central-West regions <sup>4</sup>.

However, despite the implementation of social and health policies that positively affected the Brazilian population, since 2009 the country has shown a slow decline in infant mortality. Inequality in access to healthcare appears to have played a major role in reducing infant mortality. Socioeconomic conditions and factors related to health care such as income, education, fertility, housing and the Bolsa Família program. Likewise, recent changes in infant mortality in Brazil are related to these factors. A gap was identified in terms of studies and the possibility of

an association between employment and infant mortality. Measuring infant mortality is an important indicator of health and the effectiveness of health systems, which are also capable of estimating the extent of social and health inequalities between populations. In 1994 and 2003, the Family Health Program and the Bolsa Família Program were created, respectively, and since their implementation, health indicators have seen an increase in life expectancy, maternal and child mortality, and mortality from communicable diseases. <sup>5,6,7</sup>.

## **GOAL**

Describe the infant mortality rate by regions of Brazil in the years 2009-2019.

## **METHOD**

This is an ecological time series study on infant mortality, by regions of Brazil from 2009 to 2019. The data were extracted from SIM (Death Information System) and SINASC (Live Birth Information System).

General infant mortality comprises the sum of deaths occurring in the early neonatal (0-6 days of life), late neonatal (7-27 days) and post-neonatal (28 days and more) periods<sup>8</sup>, where the mortality coefficients were constructed infant (the CMI is based on mortality data on live birth data in the corresponding region and year, and the result is multiplied by 1,000). Regarding stratifications, the mortality coefficient is calculated in the same way: being the data on early neonatal, late neonatal and post-neonatal mortality, on the data on live births in the region and year, in which the result is multiplied by 1,000). In the study, a comparison was made between the deaths of early neonatal, late neonatal and post-neonatal children. The infant mortality coefficient is defined as the number of deaths of children under one year of age, per thousand live births, in a given geographic space, in the year considered.

The data found in SIM and SINASC were exported to Excel® software to create indicators and graphs.

## RESULTS

Throughout the historical series, there was a drop-in mortality as shown in the graphs presented below, based on the analysis of general mortality coefficients and by stratifications: early neonatal (0-6 days), late neonatal (7-27 days) and post-neonatal (28-364 days).

In general, a downward trend in infant mortality was observed in the regions of Brazil, the North region was the one with the worst infant mortality indicators ranging from 17.98 (2009) to 15.12 (2019) per 1,000 births live births, followed by the Northeast region, ranging from 17.03 (2009) to 13.70 (2019) per 1,000 live births. The Southeast region started the historical series with 13.18 (2009) and ended with 11.52 (2019) per 1,000 live births, the South with 11.88 (2009) and 10.24 (2019) per 1,000 live births and the Midwest with 14.30 (2009) and 11.82 (2019) per 1,000 live births. It is worth mentioning that the Northeast region showed the greatest difference in coefficients between 2009 and 2019 (drop 3.33/1,000 NV). (figure 1).

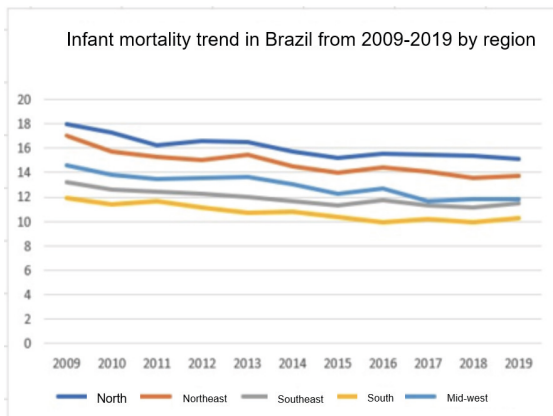
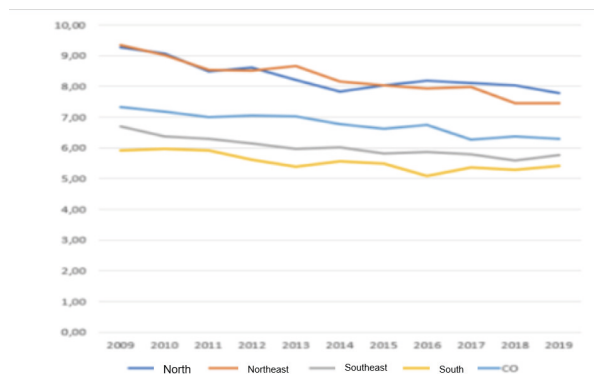


Figure 1. Trend in general infant mortality in Brazilian regions from 2009-2019.

Source: SIM/SINASC

In relation to early neonatal mortality (0 to 6 completed days), the indicators also maintain a downward trend, although among the strata it is the most significant in terms of infant mortality, it is also highest in the North and Northeast regions. Variations were observed throughout the historical series, the North region started the series with 9.27 (2009) and ended with 7.77 (2019) per 1,000 live births, the Northeast with 9.34 (2009) and ended with 7.44 (2019) per 1,000 live births, the Southeast with 6.70 (2009) and ended with 5.77 (2019) per 1,000 live births, the South with 5.92 (2009) and ended with 5.41 (2019) per 1,000 live births and the Center

Oeste with 7.32 (2009) and ended with 6.29 (2019) per 1,000 live births. As with general mortality indicators, the Northeast region showed the greatest difference between the years 2009-2019 (drop of 1.9/1,000 live births) (figure 2).



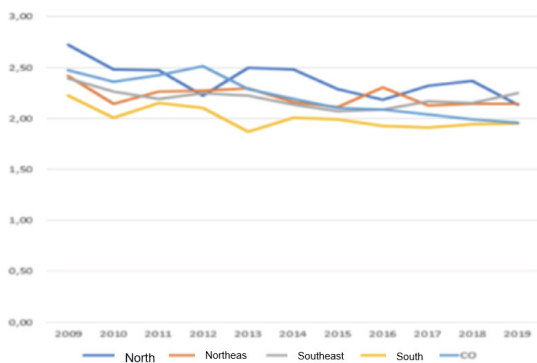
Post-neonatal infant mortality in Brazil by regions, from 2009 to 2019

Figure 2. Trend in early neonatal mortality by regions of Brazil from 2009-2019.

Source: SIM/SINASC

With regard to late neonatal mortality (7 to 27 completed days), the indicators maintain downward trends. North region from 2.72 (2009) to 2.14 (2019) per 1,000 live births, Northeast region from 2.41 (2009) to 2.15 (2019) per 1,000 live births, Southeast region from 2.40 (2009) to 2.25 (2019) per

1,000 live births, the South region from 2.22 (2009) to 1.95 (2019) per 1,000 live births and the Central-West region from 2.48 (2009) to 1.96 (2019) per 1,000 live births. It is worth mentioning that the Central-West region has shown a constant downward trend since 2013 and that the South region had a small worsening of the indicator in 2018 and 2019 when compared to 2017, the same observed in the Northeast region. The biggest difference observed between 2009-2019 occurred in the Northeast region (drop of 0.58/1,000 LB) (figure 3).



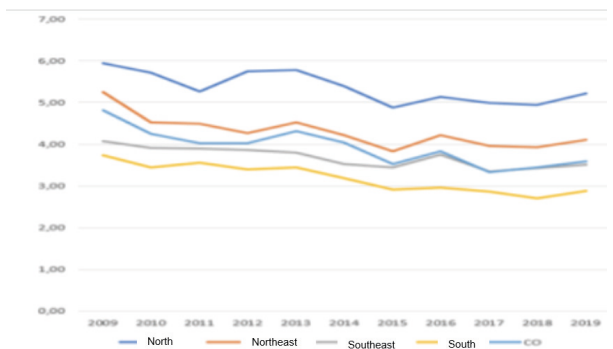
Late neonatal infant mortality in Brazil by regions, from 2009 to 2019

Figure 3. Trend in late neonatal mortality by regions of Brazil from 2009-2019.

Source: SIM/SINASC

Post-neonatal mortality is also related to the other indicators presented with a downward trend, but mortality is still higher in the North region. North region from 5.94 (2009) to 5.22 (2019) per 1,000 live births, Northeast region from 5.25 (2009) to 4.11 (2019) per 1,000 live births, Southeast region from 4.08 (2009) to 3.50 (2019) per 1,000 live births, South region from 3.73 (2009) to 2.87 (2019) per 1,000 live births and Central region

West from 4.81 (2009) to 3.59 (2019) per 1,000 live births. The greatest difference between 2009-2019 was observed in the Central-West region (1.22/1,000 LB) (figure 4).



Post-neonatal infant mortality in Brazil by regions, from 2009 to 2019

Figure 4. Trend in post-neonatal mortality by regions of Brazil from 2009-2019.

Source: SIM/SINASC

## DISCUSSION

Comparing the results of the reports analyzed with data on the infant mortality rate in Brazil by region in the years 2009 to 2019, a drop in infant mortality in the regions over the years is notable. When analyzing the results of global data, a similarity is noticeable, since in Brazil there has also been a drop in infant mortality over the years.

The global death rate has declined by nearly 60% for children under five since 1990, reaching 38 deaths per 1,000 live births in 2019. As a result, millions more children survive into adolescence today compared to 1990. However, the number of child deaths remains unconscionable - 35,000 children died in 2019, mostly from preventable causes, with around 18,000 among early neonates (who face the highest risk of death).

In 2019, the neonatal mortality rate was estimated at 17 deaths per 1000 live births; the probability of death after the first month and before reaching 1 year was estimated at 11 for every 1000 births<sup>9</sup>.

According to the epidemiological bulletin from the Health Surveillance Secretariat, in the years between 2017 and 2019, Brazil's infant mortality rate and the three-year average resulted in 13.3 deaths per thousand live

births. In the North and Northeast regions, the outcome was 16.9 and 15.3 deaths respectively per thousand live births, these regions have the highest average infant mortality rates. The averages for the Southeast and South regions were lower, with 11.7 and 10.1 deaths respectively. Finally, the central-west region remained the same in this period, with 13.0 deaths for every thousand live births<sup>10</sup>.

From 1990 to 2019, in all regions of Brazil, there was a reduction in the infant mortality rate (IMR). There were approximately 38,619 infant deaths across the country in 2019, the result was 91.4% in coverage of infant deaths and 13.3 in IMR per thousand live births, obtaining numbers equal to those in 2015. In the Northeast Region it was where the greatest reductions in this rate occurred. It was analyzed in 2019 and the lowest IMR was observed in the Federal District and the highest was observed

in Amapá, with a rate of 8.5 and 22.9 deaths per thousand live births, respectively<sup>10</sup>.

All regions of Brazil showed an increase in the infant mortality rate in 2016, this increase was probably due to the Zika virus epidemic, leading to a drop-in birth rates and the death of babies with serious malformations.

There has been a considerable reduction in infant mortality in Brazil, however a great effort is still needed to address the differences between regions and reach lower levels<sup>10</sup>.

## CONCLUSION

In this work we were able to conclude that there was a reduction in infant mortality in all regions of Brazil from 2009 to 2019, however the North region continues to have the highest mortality and the more organized regions, such as the Southeast and South, had the lowest rates from the country.

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