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MATERNAL AND FETAL HEALTH IN BRAZIL: INVESTIGATING FETAL MORTALITY BETWEEN 2017 AND 2023

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Abstract: Introduction: Fetal deaths, defined as the death of a fetus after 20 weeks of gestation or weighing at least 500 grams, are an important public health indicator and reflect both maternal health conditions and the performance of health services. This study investigates fetal mortality in Brazil between 2017 and 2023, seeking to identify regional patterns and contributing factors to these disparities. **Methodology:** The data was extracted from the Mortality Information System (SIM) of DATASUS and includes records of fetal deaths in all units of the federation. Descriptive analysis was carried out using Microsoft Excel, and the comparison between the proportions of types of birth between regions was made using the chi-square test. To examine trends in fetal deaths over time, linear regression was applied using R software (version 4.2.2). **Results:** The results showed that the Southeast and Northeast had the highest absolute numbers of fetal deaths, with 74,309 (36.66%) and 66,362 (32.75%), respectively. There was a reduction of approximately 13% in fetal deaths between 2017 and 2023, with a linear regression coefficient of -665.8 ($p = 0.00216$). In addition, 66.8% of fetal deaths occurred by vaginal delivery, while 29.8% were caesarean sections, with statistically significant differences in the proportions of delivery types between regions ($p < 0.0001$). **Conclusion:** The analysis indicates a downward trend in fetal mortality in Brazil, but highlights significant regional disparities, especially in the Southeast and Northeast. The high caesarean section rates in some regions require attention. The findings suggest that public health policies should be implemented to reduce regional inequalities and improve maternal and child health.

INTRODUCTION

Fetal deaths, defined as the death of a fetus after 20 weeks of gestation or weighing at least 500 grams, are an important public health indicator and reflect both maternal health conditions and the performance of health services (1). In Brazil, this phenomenon is particularly important due to the complexity of the health system, which has to cater for a diverse population spread over a vast and unequal territory (2). Fetal mortality in Brazil has been the subject of several studies, which highlight both temporal trends and regional and socio-economic disparities (3).

Fetal mortality in the country can be influenced by several factors, including socioeconomic inequalities and inequalities in access to healthcare (4). In addition, significant regional variations suggest that the risk of a fetal death can be dramatically different depending on geographical location, reflecting disparities in the quality of prenatal care and health infrastructure (5). Previous studies indicate that more economically developed regions, such as the Southeast and South, have better maternal health indicators, while the North and Northeast face greater challenges (6). In 2018, perinatal mortality, which includes fetal mortality, was high in Brazil, with most deaths being potentially preventable with better prenatal care and delivery (7).

Improved documentation of the causes of fetal death can help identify avoidable causes and guide prevention efforts (6). In addition, socioeconomic and regional disparities are evident, with higher fetal mortality rates in areas of greater social vulnerability, as observed in São Paulo, where fetal mortality was 69% higher in areas of high vulnerability (7). Fetal mortality is also more prevalent in adolescents and in women with less schooling (4).

Using fetal mortality data available from DATASUS, this study seeks to evaluate fetal deaths in Brazil between 2017 and 2023, analyzing their occurrence in each unit of the federation. The aim is to identify regional patterns and potential contributing factors to these disparities, providing an empirical basis that can guide public policies aimed at reducing inequalities and improving maternal-fetal health.

METHODOLOGY

DATA EXTRACTION AND DATABASE

The data used in this study was extracted from the Mortality Information System (SIM), available from DATASUS. Data extraction covered the period from 2017 to 2023, considering fetal deaths registered in all Brazilian states. Records were selected that included detailed information on place of occurrence, gestational age, causes of death and demographic characteristics of the mothers.

To guarantee the quality of the data, we carried out a verification and cleaning process, identifying and correcting possible inconsistencies and duplicate records. The final database was structured in a format compatible with statistical analysis, ensuring the inclusion of variables relevant to the study.

DATA ANALYSIS

Descriptive analysis was carried out using Microsoft Excel, with the aim of generating graphs that visualize regional and temporal trends in fetal deaths. The chi-square test of independence was used to compare the proportions of types of birth between different regions. A p-value of less than 0.05 was considered to indicate statistical significance, suggesting that the differences in proportions between regions were statistically significant.

To explore the trend in fetal deaths over time, a linear regression was carried out using R software (version 4.2.2). Linear regression makes it possible to predict the value of a dependent variable based on one or more independent variables, making it easier to analyze the relationship between the year and the number of fetal deaths.

Statistical significance in the regression analyses was assessed by the p-value, considering a significance level of 0.05. This indicates that there is less than a 5% probability that the results are due to chance, increasing confidence that the observed associations reflect real relationships.

RESULTS

REGIONAL DISTRIBUTION OF FETAL DEATHS

Analysis of the regional distribution of fetal deaths in Brazil between 2017 and 2024 reveals significant variations between the country's different regions. The Southeast had the highest absolute number of occurrences, with 74,309 deaths, representing 36.66% of the national total. The Northeast region then recorded 66,362 deaths, corresponding to 32.75% of the total. The North accounted for 24,452 occurrences, equivalent to 12.07% of the total, while the South and Midwest had 21,008 and 16,526 occurrences respectively, representing 10.36% and 8.16% of the fetal deaths recorded in the period. (table 1)

| Region | Occurrences between 2017 and 2024 (n) | % of total (%) |
|--------------|---------------------------------------|----------------|
| Southeast | 74309 | 12.07 |
| North East | 66362 | 32.75 |
| North | 24452 | 36.66 |
| South | 21008 | 10.36 |
| Midwest | 16526 | 8.16 |
| Total | 202657 | |

Table 1. Occurrence of Fetal Deaths by Region (2017-2023)

ANNUAL TRENDS IN FETAL DEATHS BY REGION (2017-2023)

The analysis of annual data on fetal deaths by region from 2017 to 2023 illustrates variations in trends over time, both between years and between regions in Brazil (Table 2).

The Southeast registered a slight initial increase in fetal deaths, with 3,469 occurrences in 2017 and reaching 3,679 in 2021, followed by a decline to 3,311 in 2023.

In the Northeast, there was a peak in deaths in 2018, with 10,381 occurrences, followed by a steady decrease, culminating in 8,335 deaths in 2023.

The Northern region showed higher numbers over the years, starting with 11,418 deaths in 2017 and registering a steady drop to 9,707 in 2023.

The South and Midwest showed generally more stable figures during the period studied. The South began with 3,188 deaths in 2017, reaching its lowest figure in 2023, with 2,837 deaths. The Midwest varied slightly, with 2,336 deaths in 2017 and 2,340 in 2023, showing little overall variation.

In total, fetal deaths fell from 30,620 in 2017 to 26,530 in 2023 throughout Brazil. A reduction of approximately 13% in total deaths during the period analyzed.

ANALYSIS OF BIRTH TYPES (2017-2024)

The analysis of the types of delivery carried out between 2017 and 2024 reveals significant variations in obstetric practices in different regions of Brazil, as well as the predominance of different delivery modalities (Table 3).

In total, 202,657 fetal deaths were recorded, of which 135,346 (66.8%) were by vaginal delivery, 60,376 (29.8%) by caesarean section and 6,935 (3.4%) with the type of delivery unknown. These figures indicate that vaginal birth was the most common type of birth in all regions.

In the Southeast, there were 24,452 fetal deaths, of which 16,471 (67.2%) resulted from vaginal deliveries, while 7,472 (30.6%) were caesarean sections. A small proportion, 509 (2.1%), had the type of delivery ignored.

In the Northeast, of the 66,362 fetal deaths, 45,625 (68.8%) were by vaginal delivery and 18,733 (28.2%) by caesarean section, with 2,004 (3.0%) not reported.

The North region had the highest absolute number of deaths, totaling 74,309. Of these, 49,652 (66.8%) were from vaginal delivery, 21,105 (28.4%) from caesarean section, and 3,552 (4.8%) were classified as unknown.

In the South, 21,008 deaths were recorded, with 13,151 (62.7%) from vaginal delivery and 7,378 (35.1%) from caesarean section, while 479 (2.3%) were unknown.

The Midwest, with 16,526 deaths, had 10,447 (63.2%) by vaginal delivery, 5,688 (34.4%) by caesarean section and 391 (2.4%) unknown.

The results showed a chi-square test value of 1246.8 with 8 degrees of freedom, resulting in a p-value of less than 0.0001. This extremely low p-value indicates that there is a statistically significant difference in the proportions of types of birth between the different regions of the country.

| Region | Vaginal | Cesario | Ignored | Total |
|--------------|---------------|--------------|-------------|---------------|
| South East | 16471 | 7472 | 509 | 24452 |
| North East | 45625 | 18733 | 2004 | 66362 |
| North | 49652 | 21105 | 3552 | 74309 |
| South | 13151 | 7378 | 479 | 21008 |
| Midwest | 10447 | 5688 | 391 | 16526 |
| Total | 135346 | 60376 | 6935 | 202657 |

Table 3. Types of Birth by Region (2017-2024)

LINEAR REGRESSION ANALYSIS

Linear regression analysis was conducted to examine the trend in the number of fetal deaths in Brazil between the years 2017 and 2023. The model revealed a significant negative relationship between the year and the number of fetal deaths (slope coefficient

| Region | 2017 (n) | 2018 (n) | 2019 (n) | 2020 (n) | 2021 (n) | 2022 (n) | 2023 (n) |
|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| South East | 3469 | 3587 | 3523 | 3555 | 3679 | 3328 | 3311 |
| North East | 10209 | 10381 | 9528 | 9634 | 9616 | 8659 | 8335 |
| North | 11418 | 11260 | 10815 | 10583 | 10589 | 9937 | 9707 |
| South | 3188 | 3092 | 3017 | 2879 | 2989 | 3006 | 2837 |
| Midwest | 2336 | 2370 | 2222 | 2342 | 2452 | 2464 | 2340 |
| Total | 30620 | 30690 | 29105 | 28993 | 29325 | 27394 | 26530 |

Table 2. Annual Occurrences of Fatal Deaths by Region (2017-2023)

= -665.8, $p = 0.00216$), indicating an average reduction of approximately 666 deaths per year over the period studied (figure 1).

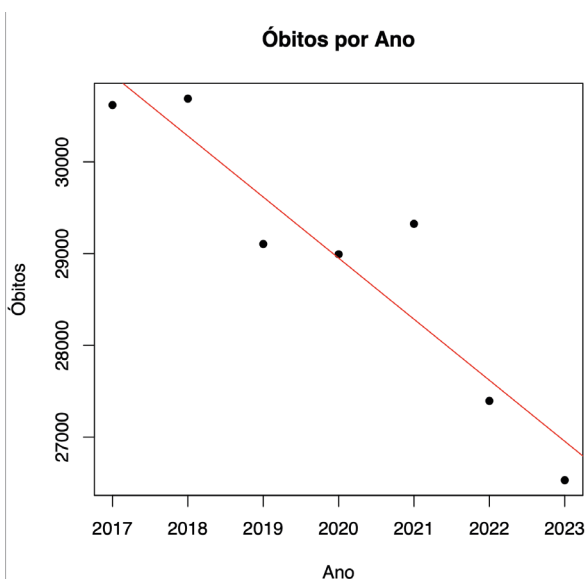


Figure 1: Annual Evolution of Fetal Deaths in Brazil: Linear Regression Modeling

DISCUSSION

Fetal deaths are a critical public health indicator, reflecting not only maternal health conditions, but also the effectiveness of health services available to the population. This study, which analyzed fetal mortality in Brazil between 2017 and 2023, revealed significant variations between the country's regions, in line with previous observations on regional inequalities in health (2). The Southeast, accounting for 36.66% of deaths, and the Northeast, with 32.75%, proved to be the regions with the highest absolute numbers, suggesting that although the Southeast has better health

infrastructure, the Northeast faces persistent challenges that impact fetal mortality (6).

Analysis of the annual data indicates a general downward trend in fetal deaths, with a decrease of approximately 13% from 2017 to 2023. This finding is especially relevant, as it opens up room for discussion about improvements in health policies, access to prenatal care and public health interventions that may have contributed to this drop. The literature suggests that improvements in maternal and child health are related to increased access to adequate health services and education about health practices (4, 5).

Data on the type of delivery revealed that the majority of fetal deaths occurred in vaginal deliveries (66.8%), while caesarean sections accounted for 29.8%. The chi-square test showed statistically significant differences in the proportions of delivery types between regions, indicating that obstetric practices vary according to the regional context. This is worrying, as the high rates of caesarean sections in some regions may be associated with high risks to maternal and perinatal health, as indicated by previous studies that point to the need for vigilance on the reasons for delivery modalities (1).

The linear regression analysis showed a negative coefficient of -665.8, suggesting a significant relationship between the year and the number of fetal deaths, which reinforces the idea that if health policies continue to be improved and access to adequate services is expanded, we can expect a trend towards a continuous reduction in fetal mortality rates (2).

However, it is essential to recognize that there are still significant disparities between regions. Regions such as the North and Northeast continue to present worrying challenges that require immediate attention. Brazil, with its social and economic diversity, needs to implement public policies aimed at health equity that guarantee adequate care, especially for the most vulnerable populations (4).

In addition, data collection must be strengthened to ensure that critical information, such as the type of delivery, is recorded more accurately, allowing future research to analyze trends and practices in maternal health more effectively. Improving the quality and accessibility of data is essential to inform public policies aimed at reducing fetal mortality and improving maternal and child health in Brazil (2).

CONCLUSION

This study investigated fetal mortality in Brazil between 2017 and 2023, revealing a reduction of approximately 13% in total fetal deaths, highlighting a positive trend that can be attributed to improvements in health policies and access to prenatal care. However, regional disparities remain significant, especially in the Southeast and Northeast, which have the highest absolute numbers of deaths.

The analysis of the types of delivery showed a predominance of vaginal deliveries, although the high rates of caesarean sections in some regions require attention. The conclusions of this study highlight the importance of continuous monitoring and the need for public health policies focused on reducing regional inequalities and improving maternal and child health throughout Brazil.

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