

# Maternal Mortality Ratio in Brazil: Impact of the Pandemic in the Incremental, Progressive and Regression Phases

Razão de Mortalidade Materna no Brasil: Impacto da Pandemia nas Fases Incremental, Progressiva e Regressão  
Tasa de Mortalidad Materna En Brasil: Impacto de la Pandemia en las Fases Incremental, Progresiva y Regresión

## RESUMO

**Objetivo:** Analisar o perfil da mortalidade materna no Brasil em três fases: incremental (2018-2019), progressão da pandemia (2020-2021) e regressão (2022-2023). **Método:** Trata-se de estudo ecológico, baseado em dados do Sistema de Informação de Mortalidade e Sistema de Informações sobre Nascidos Vivos. Calcularam-se as razões de mortalidade materna segundo características sociodemográficas e clínicas. **Resultado:** Entre a fase incremental e a pandêmica, a razão de mortalidade materna aumentou 67,11%, sobretudo em mulheres da região Sul (+97,83%), brancas e amarelas (>85%), de 20-34 anos (+73,93%) e com maior escolaridade (+121,3%). Causas obstétricas indiretas, especialmente complicações classificadas como "cuidados médicos e cirúrgicos" (CID-10), predominaram no período. Apesar da redução na regressão, os indicadores mantiveram-se próximos aos níveis iniciais. **Conclusão:** A pandemia representou importante retrocesso no cumprimento dos Objetivos de Desenvolvimento Sustentável, reforçando a necessidade de políticas intersetoriais que reduzam desigualdades estruturais e ampliem o acesso qualificado aos serviços de saúde materna.

**DESCRIPTORIOS:** Mortalidade materna; COVID-19; Desigualdades em Saúde; Saúde da Mulher.

## ABSTRACT

**Objective:** To analyze the maternal mortality profile in Brazil in three phases: incremental (2018-2019), pandemic progression (2020-2021), and regression (2022-2023). **Method:** This is an ecological study based on data from the Mortality Information System and the Live Birth Information System. Maternal mortality ratios were calculated according to sociodemographic and clinical characteristics. **Result:** Between the incremental and pandemic phases, the maternal mortality ratio increased by 67.11%, especially among women in the South region (+97.83%), white and Asian women (>85%), aged 20-34 (+73.93%), and with higher education (+121.3%). Indirect obstetric causes, especially complications classified as "medical and surgical care" (ICD-10), predominated during the period. Despite the reduction in regression, the indicators remained close to initial levels. **Conclusion:** The pandemic represented a significant setback in achieving the Sustainable Development Goals, reinforcing the need for intersectoral policies that reduce structural inequalities and expand qualified access to maternal health services.

**DESCRIPTORS:** Maternal mortality; COVID-19; Health inequalities; Women's health.

## RESUMEN

**Objetivo:** Analizar el perfil de mortalidad materna en Brasil en tres fases: incremental (2018-2019), progresión pandémica (2020-2021) y regresión (2022-2023). **Método:** Estudio ecológico basado en datos del Sistema de Información de Mortalidad y del Sistema de Información de Nacidos Vivos. Se calcularon las razones de mortalidad materna según las características sociodemográficas y clínicas. **Resultado:** Entre las fases incremental y pandémica, la razón de mortalidad materna aumentó un 67,11%, especialmente entre las mujeres de la región Sur (+97,83%), las mujeres blancas y asiáticas (>85%), las de 20 a 34 años (+73,93%) y las de educación superior (+121,3%). Las causas obstétricas indirectas, especialmente las complicaciones clasificadas como "atención médica y quirúrgica" (CIE-10), predominaron durante el período. A pesar de la reducción en la regresión, los indicadores se mantuvieron cerca de los niveles iniciales. **Conclusión:** La pandemia representó un retroceso significativo en el logro de los Objetivos de Desarrollo Sostenible, lo que refuerza la necesidad de políticas intersectoriales que reduzcan las desigualdades estructurales y amplíen el acceso calificado a los servicios de salud materna.

**DESCRIPTORIOS:** Mortalidad materna; COVID-19; Desigualdades en salud; Salud de la mujer.

RECEIVED: 11/12/2025 APPROVED: 11/26/2025

**How to cite this article:** Souza SQC, Belo ML, Passinho RS, Santos Neto ET, Martinelli K. Maternal Mortality Ratio in Brazil: Impact of the Pandemic in the Incremental, Progressive and Regression Phases. *Saúde Coletiva* (Brazilian Edition) [Internet]. 2025 [cited year month day];16(103):18256-18271. Available from: DOI: 10.36489/saudecoletiva.2025v16i103p18256-18271

**Sara Queiroz de Castro Souza**

Medical student at the Federal University of Southern Bahia (UFSB)  
ORCID: <https://orcid.org/0009-0000-5578-6301>

**Manuella Lima Belo**

Medical student at the Federal University of Southern Bahia (UFSB)  
ORCID: <https://orcid.org/0000-0002-8894-8933>

**Renata Soares Passinho**

Professor at the Health Sciences Training Center at the Federal University of Southern Bahia (UFSB)  
ORCID: <https://orcid.org/0000-0003-0605-1610>

**Edson Theodoro Santos Neto**

Professor at the Graduate Program in Public Health at the Federal University of Espírito Santo  
ORCID: <https://orcid.org/0000-0002-7351-7719>

**Katrini Guidolini Martinelli**

Professor at the Center for Training in Health Sciences at the Federal University of Southern Bahia (UFSB)  
ORCID: <https://orcid.org/0000-0003-0894-3241>

**INTRODUCTION**

The World Health Organization (WHO) defines maternal death as any death that occurs during pregnancy, childbirth, or up to 42 days postpartum and is directly related to pregnancy<sup>1</sup>. High maternal mortality ratios (MMR) can have an impact on the health and development of a population, as they are often associated with low levels of education, poor socioeconomic conditions, and inadequate access to health services<sup>2</sup>.

According to the Ministry of Health, in 2022, Brazil had a maternal mortality ratio of 57.7 deaths per 100,000 live births. The country has set a target in the Sustainable Development Goals (SDGs) to reduce maternal mortality to 30 deaths per 100,000 live births by 2030, through actions that ensure universal access to sexual and reproductive health and end all forms of discrimination against women and girls<sup>3</sup>. A time series study that predicted the MMR until 2025 revealed that Brazil is unlikely to achieve this goal due to the COVID-19 pandemic<sup>4</sup>.

Pregnant women and women who

have recently given birth are more vulnerable to SARS-COV-2 infection. Furthermore, infection during pregnancy increases the risk of maternal mortality due to factors such as anatomical and physiological changes that affect the immune, cardiovascular, and respiratory systems<sup>5</sup>. When infected, pregnant women tend to experience more severe forms of the disease, with symptoms ranging from fever to dyspnea requiring mechanical ventilation<sup>6</sup>.

In addition, the pandemic has exacerbated problems related to access to health services, such as prenatal care and delivery assistance, making pregnant women more susceptible to obstetric complications<sup>7</sup>. Furthermore, demographic and socioeconomic variations suggest that certain groups of women were more severely affected in the RMM during the pandemic, including those who normally had access to health services<sup>5</sup>.

Although the impact of the COVID-19 pandemic on maternal mortality has been widely explored, most studies focus on the period when the pandemic was at its most severe.

Few studies address the topic comprehensively and longitudinally, also considering the years before and after the health emergency. This gap hinders understanding of changes in the profile of maternal mortality in different epidemiological, health, and social contexts. Analyses that consider this temporal evolution are essential to identify persistent patterns, circumstantial aggravations, and possible advances or setbacks in public policies. Thus, the objective of this study is to analyze the profile of Brazilian maternal mortality in the following phases: case increment (2018-2019), pandemic progression (2020-2021), and pandemic regression (2022-2023).

**METHODS**

This is an ecological study based on secondary data from the Live Birth Information System (SINASC) and the Mortality Information System (SIM) extracted from the website of the Department of Informatics of the Unified Health System (Datusus) of the Ministry of Health. The study population included all Brazilian women who died

during pregnancy or in the 42 days following term for any cause related to pregnancy, childbirth, or the postpartum period between 2018 and 2023, which was subdivided into three two-year periods characterized as incremental cases (2018-2019), pandemic progression (2020-2021), and pandemic regression (2022-2023). Data collection took place in September 2024.

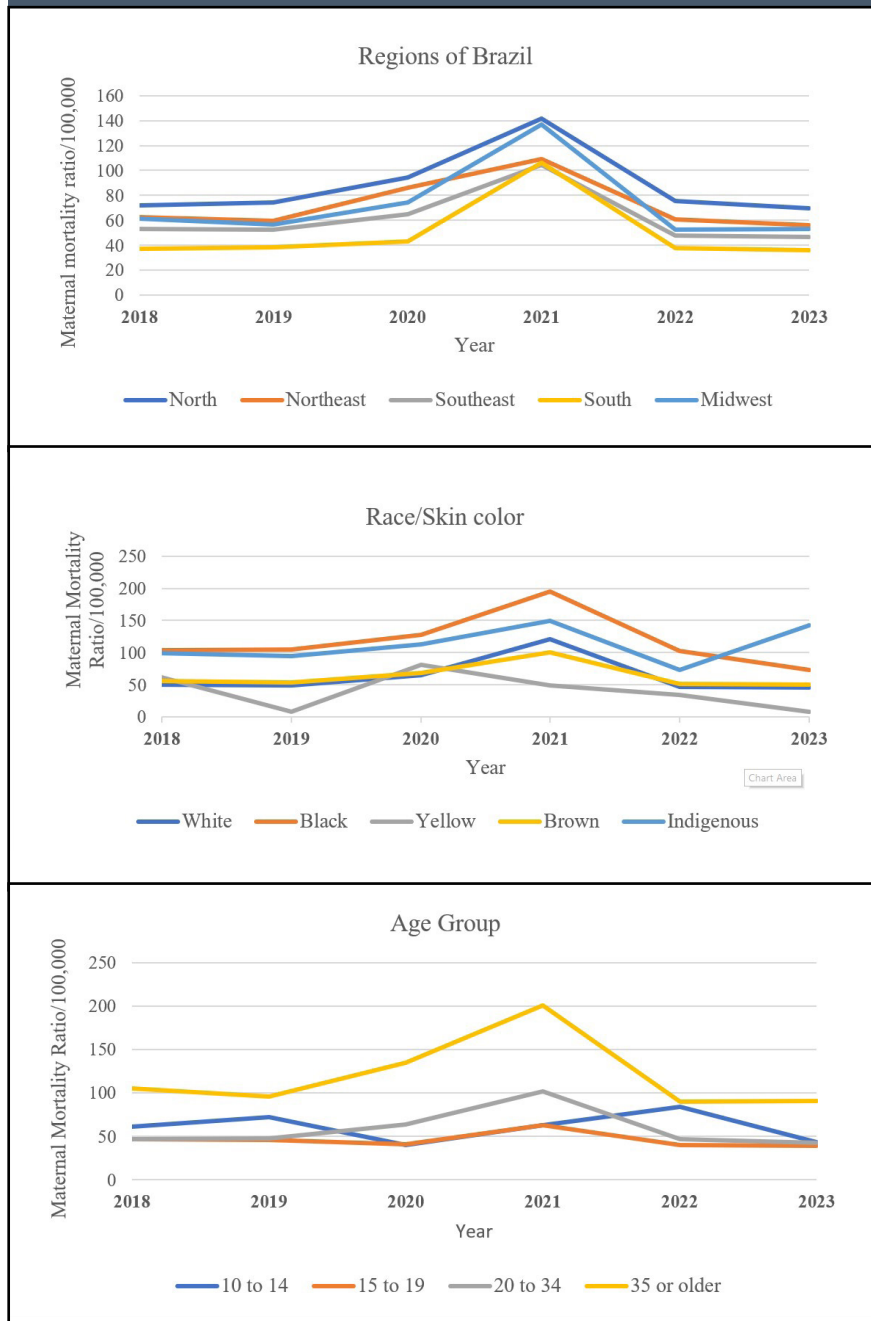
The maternal mortality ratio (MMR) was calculated by dividing the number of maternal deaths by the total number of live births in the same location and year, multiplying the result by 100,000. The same procedure was applied to the variables region (North, Northeast, Southeast, South, Midwest), race/color (white, black, yellow, brown, indigenous), age group (10–14, 15–19, 20–34, ≥35 years) and education (none, 1–7, 8–11, ≥12 years). For the variables of the International Classification of Diseases - 10th edition (ICD-10) group, type of obstetric cause, investigated deaths, and place of occurrence, the absolute and relative frequencies of each category were calculated.

*Microsoft Office Excel (Professional Plus 2021 version)* was used to build the database, create graphs, and calculate the variation in MMR between periods. The variation in MMR for each sociodemographic characteristic was calculated by subtracting the most recent MMR from the oldest and dividing it by the oldest MMR and multiplying it by 100. If the MMR value in the most recent period was lower than in the previous period, the result was subtracted from 100% to determine the percentage reduction.

As only secondary and publicly available data were used, review by the Human Research Ethics Committee was waived, in accordance with Resolutions 466/2012, 510/2016, and 580/2018 of the National Health Council.

## RESULTS

**Figure 1. Maternal mortality ratio per 100,000 inhabitants by region of Brazil, race/skin color, and age group, Brazil 2018-2023.**



There were 10,891 maternal deaths: 3,234 during the incremental period, 4,995 during the progression period, and 2,662 during the regression period of the pandemic. The North region had the highest MMR in all periods; the South had the low-

est. Black and indigenous women had the highest indicators, while Asian women had the lowest MMR. The age group ≥35 years had the highest MMR, reaching 200/100,000 live births in 2021. (Figure 1).

**Table 1. Percentage variation in maternal mortality ratios according to socioeconomic characteristics, Brazil 2018-2023.**

	2018-2019	2020-2021	Percentage change 2018-2019 to 2020-2021	2022-2023	% change 2022-2023 to 2018-2019	% change 2022-2023 to 2020-2021
	MMR	MMR		MMR		
Brazil	55,82	92,38	+67,11	52,21	-6,46	-43,48
Regions of Brazil						
North	73,15	118,33	+61,76	72,41	-1,01	-38,80
Northeast	61,07	97,60	+59,81	58,29	-4,55	-40,27
Southeast	52,79	84,37	+60,09	47,38	-10,24	-43,84
South	37,47	74,13	+97,83	36,80	-1,78	-50,35
Midwest	58,92	105,55	+79,14	52,83	-10,33	-49,94
Race/skin color						
White	48,58	92,27	+89,93	46,47	-4,34	-49,63
Black	104,19	161,46	+54,96	87,19	-16,31	-45,99
Yellow	35,03	65,44	+86,81	21,12	-39,70	-67,72
Brown	54,55	84,33	+54,59	50,70	-7,05	-39,87
Indigenous	96,95	131,86	+36,00	108,8	+12,22	-17,48
Age group (years)						
10-14	66,66	51,37	-22,93	63,77	-4,33	+24,13
15-19	46,35	51,45	+11,00	39,46	-14,86	-23,30
20-34	47,39	82,43	+73,93	44,57	-5,95	-45,92
35-59	100,66	167,74	+66,64	90,31	-10,28	-46,16
Education						
None	266,62	385,00	+44,40	357,25	+33,99	-7,20
1-7 years	105,81	148,50	+40,34	113,13	+6,91	-23,81
8-11 years	39,26	68,04	+73,30	39,68	+1,06	-41,68
12 or more	30,41	67,30	+121,3	31,44	+3,38	-53,28

Comparing the incremental period with the pandemic progression period, the RMM increased by 67.11% in Brazil, as well as in all regions, ranging from 59.81% in the Northeast to 97.83% in the South. The race/skin color with the highest increase was white and yellow, around 90%, however, the RMM remained lower than that of black women in the incremental cases. The 10-14 age group showed a negative variation of 22.93%, although women aged 20 to 34 showed the largest increase (73.93%), the RMM remained lower than that observed among women aged 35 and over, considering the incremental period of cases. Women with 12 or more

years of schooling showed an increase of +121.3%, but the RMM value for women with no schooling during the period of cases was four times that of women with 12 or more years of schooling during the progression of the pandemic. (Table 1).

When comparing the pandemic regression period with the incremental period of cases, there was a 6.46% reduction in the RMM in Brazil, with the largest reduction of 10.33% in the Midwest region and the smallest of 1.01% in the North region. In relation to race/skin color, only the indigenous population showed an increase of 12.23%. Black race/skin color showed a reduc-

tion of 16.31%, obtaining an MMR lower than the incremental period of cases (87.19/100,000 live births). In all age groups, there was a reduction in the MMR, ranging from 14.86% for 15-19 year olds to 4.33% for 10-14 year olds. Women with no schooling showed a 33.99% increase in the MMR. In addition, during the pandemic regression period, this category had an MMR 10 times higher than that of women with 12 or more years of schooling. (Table 1).

When analyzing the percentage variation in the MMR during the pandemic regression period compared to the pandemic progression period, a re-

duction in this indicator was observed in all regions, especially in the South (50.93%) and Midwest (49.94%). Reductions in the MMR were observed for all races/skin colors. However, for

indigenous women, this reduction was modest (17.48%), with the MMR remaining above 100/100,000 live births. The 10-14 age group was the only one that showed an increase in the MMR

during the pandemic regression period (24.13%). Women with 12 or more years of schooling showed a 53.28% reduction in the MMR, while women with no schooling showed a reduction

**Table 2: Maternal mortality rate according to ICD-10 group, Brazil 2018-2023.**

	2018-2019 N	2020-2021 N	2022-2023 N
Human immunodeficiency virus [HIV] disease	30 (0,93)	0 (0,0)	0 (0,0)
Neoplasm of uncertain or unknown behavior	1 (0,03)	1 (0,03)	1 (0,03)
Behavioral syndromes associated with physiological dysfunctions and physical factors	3 (0,09)	0 (0,0)	0 (0,0)
Pregnancy ending in miscarriage	240 (7,42)	237 (4,74)	249 (9,36)
Edema, Proteinuria, and hypertensive disorders in pregnancy, childbirth, and the postpartum period	685 (21,18)	675 (13,51)	559 (21,01)
Other maternal disorders predominantly related to pregnancy	164 (5,07)	150 (3,00)	126 (4,74)
Care provided to the mother for reasons related to the fetus and amniotic cavity and for possible problems related to childbirth	208 (6,43)	193 (3,86)	126 (6,24)
Complications of labor and delivery	464 (14,35)	497 (9,95)	414 (15,56)
Complications predominantly related to the puerperium	459 (14,19)	383 (7,67)	344 (12,93)

\*Comprises categories O94-O99.

According to the ICD-10 group, other obstetric conditions such as medical and surgical complications (NCOP) stood out in all periods, especially during the progression of the pandemic, showing almost double the

percentage of the pre-pandemic and regression periods. The group of edema, proteinuria, and hypertensive disorders in pregnancy, childbirth, and the puerperium had a rate of 21% in the incremental cases and regression, while during the progression of the pandemic, it fell to 13%. The group

of complications in labor and delivery had a prevalence of around 15% in the increase in cases and regression of the pandemic and around 10% during the progression of the pandemic (Table 2).

**Table 3: Description of maternal mortality according to obstetric causes, Brazil 2018-2023.**

	N (%) 2018-2019	N (%) 2020-2021	N (%) 2022-2023
Types of obstetric causes			
Direct	2148 (66,4)	2070 (41,45)	1809 (67,98)
Indirect	968 (29,94)	2782 (55,71)	772 (29,01)
Not specified	117 (3,62)	142 (2,84)	80 (3,01)
Deaths investigated			
Death investigated, with summary form completed	3033 (93,78)	4614 (92,37)	2446 (91,89)
Death investigated, no summary report provided	50 (1,55)	112 (2,24)	35 (1,31)
Death not investigated	151 (4,67)	269 (5,39)	181 (6,80)
Place of occurrence			
Hospital	2909 (89,95)	4614 (92,37)	2408 (90,46)
Other healthcare facility	112 (3,46)	150 (3,00)	101 (3,79)
Home	118 (3,65)	147 (2,94)	98 (3,68)
Public road	36 (1,11)	30 (0,60)	11 (0,41)
Other	58 (1,79)	54 (1,08)	44 (1,65)
Ignored	1 (0,03)	0 (0,00)	0 (0,00)

The direct cause stood out with a prevalence above 65% in the incremental and regression analyses. During the pandemic progression period, the indirect cause obtained a percentage of 55.71%. In all periods, more than 90% of deaths were investigated, and about 90% occurred in the hospital (Table 3).

## DISCUSSION

The COVID-19 pandemic had a major impact on the Brazilian MMR. When comparing the two-year increments of cases, pandemic progression, and pandemic regression, the MMR showed a significant positive variation from the first to the second period, with emphasis on the South region, white race/skin color, age group of 35 years or older, and 12 or more years of schooling, in addition to almost doubling the percentage of other obstetric conditions not classified elsewhere (ICD-10), which includes COVID-19. When comparing the incremental period of cases with the period of regression of the pandemic, the variation was slight and predominantly negative, except for the indigenous race/skin color. In the comparison between the second and third periods, there was a negative and significant variation for all women, except for those aged 10-14 years.

In the context of the incremental phase, from 2000 to 2020, seeking to achieve the Sustainable Development Goals, there was a global trend of reduction in maternal mortality, with a 34% drop worldwide<sup>1</sup>. However, the Covid-19 pandemic hampered access to health services, especially in low-income countries, which contributed to unfavorable maternal outcomes during this period<sup>7</sup>. In a retrospective study conducted in Mexico during the first year of the pandemic, it was observed that the maternal mortality rate increased by 56.8%, with Covid-19 being related to the

outcome in almost 23% of cases<sup>8</sup>. In the United States, before the pandemic, the maternal mortality rate was 20/100,000 live births; in 2020 and 2021, it rose to 23.8 and 32.9, respectively<sup>9</sup>.

“ The pandemic has brought significant challenges to prenatal care and access to health services, especially in regions with historically fragile systems<sup>7</sup>. ”

This scenario may help explain the increase in cases observed, especially in the North region, where structural vulnerability is more pronounced. In addition, the collapse of the health system in this area may have inten-

sified existing social inequalities, including deficiencies in hospital infrastructure, prenatal care, and socioeconomic conditions<sup>10</sup>.

In contrast, the southern region had lower RMMs during the pandemic, although it recorded the largest percentage increase during this period. One of the reasons for this may be attributed to greater access to intensive care, since maternity hospitals with intensive care units (ICUs) are more concentrated in this region<sup>11</sup>. However, a qualitative study conducted with 30 pregnant women in the South of the country, linked to an extension project, revealed that during the pandemic access to services was impaired<sup>12</sup>. Despite the expansion of services during the pandemic, a reduction in these services was observed during the regression phase of cases. According to CNES data, when comparing 2010 with 2023, there was a 17% reduction in obstetric beds<sup>13</sup>.

The Midwest region stood out in reducing the MMR in the post-pandemic period. A study using data from the National Program for Improving Access and Quality of Primary Care revealed that the region stood out in improving the coordination and integration of care in Primary Health Care, including services related to pregnant women<sup>14</sup>. In addition, the state of Mato Grosso do Sul implemented the Bem Nascido (Well Born) project in 2021, with the aim of reducing maternal mortality, and by September 2022, the program had contributed to a 65% reduction<sup>15</sup>.

Ethnic and racial disparities persisted throughout the period analyzed. Although the largest percentage increases during the pandemic occurred among white and Asian women, the MMR among black and indigenous women remained consistently higher, reinforcing the vulnerability of these groups. Black and indigenous women had the highest mortality rates, highlighting the structural and institu-

tional racism present in the Brazilian health system<sup>16</sup>. In addition, the humanitarian crisis in the Yanomami Indigenous Territory, the largest in Brazil, shows that this population group suffered even more from the advance of illegal mining activities, which, in addition to deforesting and polluting rivers, made it even more difficult for indigenous peoples to access health services<sup>17</sup>.

In relation to age, advancing maternal age is directly related to an increase in adverse perinatal outcomes, which explains the higher MMR in women over 35 years of age, due to complications such as pregnancy-specific hypertensive syndromes, particularly preeclampsia, as well as gestational diabetes and premature rupture of membranes<sup>18</sup>. In addition, age itself is an important risk factor for SARS-CoV-2 infection<sup>19</sup>. During the pandemic, the 10-14 age group showed a reduction in the maternal mortality ratio. This group also had a lower rate of hospitalization for COVID-19 and, according to another ecological study based on secondary data, a reduction in the fertility rate<sup>20</sup>.

Education also plays an important role in MMR. Women with 12 or more years of schooling had the lowest MMR rates, reinforcing the positive relationship between higher education and better maternal health outcomes<sup>16</sup>. A systematic review with meta-analysis revealed that the supply and demand for obstetric services decreased globally during the pandemic period. For example, there was a 38.6% reduction in prenatal consultations<sup>21</sup>. This scenario may explain the increase in the maternal mortality ratio, even among women with higher levels of education, throughout the progression of the pandemic.

A study conducted in 2010 in the Legal Amazon and Northeast regions revealed that women with low levels of education received inadequate prena-

tal and childbirth care. For example, only 44% were advised on the place of delivery, and among these, only 8.6% actually gave birth at the recommended location. During COVID-19, illiterate people were the most affected by mortality<sup>23</sup>. These studies showed that low educational attainment is an important social determinant in the context of maternal care and that the pandemic has accentuated inequalities related to this group, which justifies the high MMR when comparing the incremental period of cases with that of the pandemic's regression.

According to ICD-10, the NCOP group covers deaths related to parasitic and infectious diseases and complications associated with pregnancy, childbirth, and the postpartum period. A survey conducted between 2020 and 2021 on maternal mortality associated with Covid-19 in Brazil revealed that pregnant women were at greater risk of death compared to non-pregnant women and men with comorbidities. Therefore, pregnancy was considered a risk factor for complications resulting from infection with the virus. This context may justify the increase in the maternal mortality rate in this population group<sup>6</sup>.

One study projected that isolated strategies would be insufficient to reduce the Maternal Mortality Ratio (MMR) to the levels agreed upon in the SDGs<sup>4</sup>. To this end, intersectoral action is essential, aimed at intervening in social determinants that affect populations at greater risk and impair access to health care, such as facilitating access, training more professionals, recording data on maternal mortality, and respecting women's autonomy and rights<sup>24</sup>. In developing countries, especially in Sub-Saharan Africa, South Asia, and Latin America, the availability of emergency care units has resulted in a reduction in serious complications, just as access to contraceptive methods has reduced the rate of unwanted pregnancies,

which are often associated with adverse outcomes<sup>25</sup>.

This study stands out for conducting a phased analysis of Brazilian MMR and comparing the period prior to the pandemic with the periods of progression and regression of the pandemic, revealing the impact of COVID-19 on the achievement of SDG targets. Another positive point is the fact that SINAN and SIM have high coverage and data adequacy, making the analysis highly reliable. Despite this, it has limitations related to studies with secondary data, such as the impossibility of making individual inferences and variability in data collection between regions.

## CONCLUSION

The MMR increased significantly between the incremental period and the progression of the pandemic, with a partial reduction in the regression phase, but still close to initial levels. The South showed the highest percentage variation, although it reached the lowest absolute value; the North maintained the highest MMR. Black and indigenous women continued to have the highest indicators, reflecting structural inequalities. Higher education was a protective factor, but not sufficient to neutralize the effects of the pandemic. The data highlight the need for intersectoral policies to reduce inequalities and advance the Sustainable Development Goals.

## REFERENCES

- Cresswell J. Trends in Maternal Mortality 2000 to 2020: Estimates by WHO, UNICEF, UNFPA, World Bank Group and UN-DESA/Population Division. 1st ed. Geneva: World Health Organization; 2023. 1 p.
- Do Socorro Candeira Costa M, Dos Santos Figueiredo FW. Relationship between income inequality, socioeconomic development, vulnerability index, and maternal mortality in Brazil, 2017. *BMC Public Health*. dezembro de 2021;21(1):1842.
- Fernandes F. Objetivos de Desenvolvimento Sustentável: onde estamos e recomendações para alcançar metas em saúde sexual e reprodutiva e direitos no Brasil. Brasília, DF: Fundo de População das Nações Unidas; 2024. (Temas Emergentes Em Saúde Sexual E Reprodutiva E Direitos).
- Cañedo MC, Lopes TIB, Rossato L, Nunes IB, Faccin ID, Salomé TM, et al. Impact of COVID-19 pandemic in the Brazilian maternal mortality ratio: A comparative analysis of Neural Networks Autoregression, Holt-Winters exponential smoothing, and Autoregressive Integrated Moving Average models. Alouffi A, organizador. *PLoS ONE*. 31 de janeiro de 2024;19(1):e0296064.
- Souza ASR, Amorim MMR. Maternal mortality by COVID-19 in Brazil. *Rev Bras Saude Mater Infant*. fevereiro de 2021;21(suppl 1):253–6.
- Gonçalves BMM, Franco RPV, Rodrigues AS. Maternal mortality associated with COVID-19 in Brazil in 2020 and 2021: Comparison with non-pregnant women and men. *Yon DK, organizador. PLoS ONE*. 21 de dezembro de 2021;16(12):e0261492.
- Takemoto MLS, Menezes MDO, Andreucci CB, Nakamura-Pereira M, Amorim MMR, Katz L, et al. The tragedy of COVID-19 in Brazil: 124 maternal deaths and counting. *Intl J Gynecology & Obste*. outubro de 2020;151(1):154–6.
- Mendez-Dominguez N, Santos-Zaldívar K, Gomez-Carro S, Datta-Banik S, Carrillo G. Maternal mortality during the COVID-19 pandemic in Mexico: a preliminary analysis during the first year. *BMC Public Health*. dezembro de 2021;21(1):1297.
- Hoyert DL. Maternal Mortality Rates in the United States, 2021. 2023;
- Gonzalez Pazos JV, Castro JDOE, Moysés RPC, Lopes FNB, Ferreira BDO. A evolução da mortalidade materna e o impacto da COVID-19 na Região Norte do Brasil: uma análise de 2012 a 2021. *SaudPesq*. 30 de junho de 2023;16(2):1–18.
- Siqueira TS, De Souza EKG, Martins-Filho PR, Silva JRS, Gurgel RQ, Cuevas LE, et al. Clinical characteristics and risk factors for maternal deaths due to COVID-19 in Brazil: a nationwide population-based cohort study. *Journal of Travel Medicine*. 31 de maio de 2022;29(3):taab199.
- Maria De Lima M, Andrade Leal CD, Costa R, Motta Zampieri MDF, Frello Roque AT, Aparecida Custódio Z. Gestação em tempos de pandemia: percepção de mulheres. *Revista Recien*. 29 de março de 2021;11(33):107–16.
- Brasil. Ministério da Saúde. Departamento de Informática do SUS (DATASUS). Cadastro Nacional de Estabelecimentos de Saúde (CNES). Disponível em: <http://cnes.datasus.gov.br>. Acesso em: 16 jul. 2025.
- Sousa ANA, Shimizu HE. Coordenação na Atenção Básica e integração na Rede de Atenção à Saúde: em que avançamos? *Saúde em Debate*; 2024; 48 (especial 2): e8784.
- Schulz C, de Freitas HG. BEM NASCER MS: UM CAMINHO PARA A REDUÇÃO DA MORTALIDADE MATERNA E INFANTIL NO MATO GROSSO DO SUL. 5(2).
- Leal MDC, Gama SGND, Cunha CBD. Desigualdades raciais, sociodemográficas e na assistência ao pré-natal e ao parto, 1999–2001. *Rev Saúde Pública*. janeiro de 2005;39(1):100–7.
- Basta PC. Garimpo de ouro na Amazônia: a origem da crise sanitária Yanomami. *Cad Saúde Pública*. 2023;39(12):e00111823.
- Lean SC, Derricott H, Jones RL, Heazell AEP. Advanced maternal age and adverse pregnancy outcomes: A systematic review and meta-analysis. *Bhutta ZA, organizador. PLoS ONE*. 17 de outubro de 2017;12(10):e0186287.
- Lima EEC, Gayawan E, Baptista EA, Queiroz BL. Spatial pattern of COVID-19 deaths and infections in small areas of Brazil. *Schriefer A, organizador. PLoS ONE*. 11 de fevereiro de 2021;16(2):e0246808.
- de Lima TA, de Carvalho AA, Jangutta ES, Leonardo JPP. II Semana da Demografia II Semana da Demografia.
- Townsend R, Chmielewska B, Barratt I, Kalafat E, Van Der Meulen J, Gurol-Urganci I, et al. Global changes in maternity care provision during the COVID-19 pandemic: A systematic review and meta-analysis. *eClinicalMedicine*. julho de 2021;37:100947.
- Leal MDC, Theme-Filha MM, Moura ECD, Cecatti JG, Santos LMP. Atenção ao pré-natal e parto em mulheres usuárias do sistema público de saúde residentes na Amazônia Legal e no Nordeste, Brasil 2010. *Rev Bras Saude Mater Infant*. março de 2015;15(1):91–104.
- Szwarcwald CL, Almeida WS, Boccolini CS, Soares Filho AM, Malta DC. The unequal impact of the pandemic at subnational levels and educational attainment-related inequalities in COVID-19 mortality, Brazil, 2020–2021. *Public Health*. junho de 2024;231:39–46.
- Olea-Ramirez LM, Leon-Larios F, Corrales-Gutierrez I. Intervention Strategies to Reduce Maternal Mortality in the Context of the Sustainable Development Goals: A Scoping Review. *Women*. 28 de outubro de 2024;4(4):387–405.
- Salgado LBS, Vaz RA, Silva JED, Santos VSD, Ferreira GM. Intervenções Para Redução Da Mortalidade Materna Em Países Em Desenvolvimento: Uma Revisão Integrativa. *REASE*. 5 de setembro de 2024;10(9):992–1000.