Original Article
doi https://doi.org/10.1590/1983-1447.2024.20230299.en

Impact of the Covid-19 pandemic on the maternal mortality rate in Brazil: trend and spatial distribution

Impacto da pandemia da Covid-19 na razão de mortalidade materna brasileira: tendência e distribuição espacial

Impacto de la pandemia de Covid-19 en la razón de mortalidad materna brasileña: tendencia y distribución espacial

Izabel Cristina da Silva Carvalho[a]
Márcio Dênis Medeiros Mascarenhas[a]
Malvina Thais Pacheco Rodrigues[a]
Jesusmar Ximenes Andrade[a]
Fernando Ferraz do Nascimento[a]
Jardeliny Corrêa da Penha[a]

How to cite this article:
Carvalho ICS, Mascarenhas MDM, Rodrigues MTP, Andrade JX, Nascimento FF, Penha JC. Impact of the Covid-19 pandemic on the maternal mortality rate in Brazil: trend and spatial distribution. Rev Gaúcha Enferm. 2024;45:e20230299. https://doi.org/10.1590/1983-1447.2024.20230299.en

ABSTRACT

Objective: To analyze the impact of the Covid-19 pandemic on the Maternal Mortality Ratio in Brazil from 2018 to 2021.

Method: Ecological time series study, which analyzed the trend and spatial distribution of maternal deaths from 2018 to 2021, with data obtained from the Mortality and Live Birth Information System. The Maternal Mortality Ratio values were subjected to Prais-Winsten linear regression analysis using Stata program, version 14.0. The evolution of the Maternal Mortality Ratio in the regions was presented on maps created using the TabWin software.

Results: A total of 8,229 maternal deaths were recorded in the period. The year 2021 recorded the highest Maternal Mortality Ratio (113.1 maternal deaths per 100,000 live births). Brazil showed a stationary trend, while the North region had a higher Maternal Mortality Ratio across the four years, showing an increasing trend, along with the Northeast, while the Central-West, South and Southeast showed a stationary trend.

Conclusion: Despite the stationary trend in most Brazilian regions, the Maternal Mortality Ratio increased, especially in 2020 and 2021, years of the Covid-19 pandemic, which demonstrates the need for constant monitoring of vulnerabilities among women during the pregnancy-puerperal cycle to prevent maternal deaths.

Descriptors: Maternal Mortality. Covid-19. Spatial Analysis.

RESUMO

Objetivo: Analisar o impacto da pandemia da Covid-19 na Razão de Mortalidade Materna, no Brasil, no período de 2018 a 2021.

Método: Estudo ecológico, de séries temporais, que analisou a tendência e a distribuição espacial dos óbitos maternos, nos anos de 2018 a 2021, obtidos a partir da base de dados do Sistema de Informação de Mortalidade e de Nascidos Vivos. Os valores da Razão de Mortalidade Materna foram submetidos à análise de regressão linear de Prais-Winsten, no programa Stata, versão 14.0. A evolução da Razão de Mortalidade Materna nas regiões foi apresentada em mapas elaborados no programa TabWin.

Resultados: Registraram-se 8.229 óbitos maternos no período. O ano de 2021 obteve a maior Razão de Mortalidade Materna (113,1 mortes maternas por 100.000 nascidos vivos). O Brasil apresentou tendência estacionária, a Região Norte apresentou a maior Razão de Mortalidade Materna nos quatros anos, apresentando tendência crescente, juntamente com Nordeste, enquanto Centro-Oeste, Sul e Sudeste apresentaram tendência estacionária.

Conclusão: Mesmo com tendência estacionária na maioria das regiões brasileiras, a Razão de Mortalidade Materna aumentou, especialmente em 2020 e 2021, anos da pandemia da Covid-19, o que demonstra necessidade de vigilância constante das vulnerabilidades das mulheres no ciclo gravídico-puerperal para evitar mortes maternas.

Descritores: Mortalidade materna. Covid-19. Análise espacial.

RESUMEN

Objetivo: Analizar el impacto de la pandemia de Covid-19 en la Razón de Mortalidad Materna en Brasil de 2018 a 2021.

Método: Estudio de serie temporal ecológica, que analizó la tendencia y distribución espacial de las muertes maternas en los años 2018 a 2021, obtenida de la base de datos del Sistema de Información sobre Mortalidad y Nacidos Vivos. Los valores de la Razón de Mortalidad Materna fueron sometidos al análisis de regresión lineal de Prais-Winsten en el programa Stata, versión 14.0. La evolución de la Razón de Mortalidad Materna en las regiones fue presentada en mapas creados con el programa TabWin.

Resultados: En el período se registraron 8.229 muertes maternas. El año 2021 registró la Tasa de Mortalidad Materna más alta (113,1 muertes maternas por cada 100.000 nacidos vivos). Brasil presentó tendencia estacionaria, la región Norte tuvo mayor Tasa de Mortalidad Materna en los cuatro años, mostrando tendencia creciente, junto con el Nordeste, mientras que el Centro-Oeste, Sur y Sudeste presentaron tendencia estacionaria.

Conclusión: Incluso con una tendencia estacionaria en la mayoría de las regiones brasileñas, la Tasa de Mortalidad Materna aumentó, especialmente en 2020 y 2021, años de la pandemia de Covid-19, lo que demuestra la necesidad de una vigilancia constante de las vulnerabilidades de las mujeres en el ciclo embarazo-puerperal para prevenir muertes maternas.

Descriptores: Mortalidad materna. COVID-19. Análisis espacial.

[a] Universidade Federal do Piauí, Programa de Pós-Graduação em Saúde e Comunidade, Teresina, Piauí, Brasil.

INTRODUCTION

The World Health Organization (WHO) defines Maternal Death (MD) as the death of a woman caused during pregnancy or up to 42 days after its end, regardless of the duration or location of the pregnancy. It also considers any cause associated with or aggravated by pregnancy or by actions taken as a result of this condition, excluding only accidental or incidental causes, represented by violent deaths that occur during the puerperal period[1].

The occurrence of MD in a country is an alarming event, reflecting inadequate healthcare for women and disrespect for sexual and reproductive rights. Therefore, the adoption of public measures for its reduction is necessary, since, worldwide, it can be prevented in 90.0% of cases[2]. As an indicator of this public health problem and, therefore of women's health, the Maternal Mortality Ratio (MMR) is calculated by dividing the number of maternal deaths by the number of live births, multiplied by 100,000[3].

In 2020, the global MMR was 223 deaths per 100,000 live births[4]. In that same year, in Brazil, the MMR was 71.97 deaths per 100,000 live births, and between 2019 and 2021, this country experienced a 77.0% increase in the total number of maternal deaths, revealing the magnitude of the public health problem to be addressed[5].

This increase was largely due to the Covid-19 pandemic. In this regard, an ecological study with pregnant women who gave birth in hospitals through the Unified Health System (*Sistema Único de Saúde* – SUS) showed that, in 2020, there was an increase in maternal mortality compared to the average of the previous 10 years, with a 40.0% increase in low-risk pregnancies. Furthermore, women with low-risk pregnancies who underwent vaginal delivery had a 60.0% (RR = 1.6; 95% CI: 1.39–1.85) higher risk of death in 2020, and those who underwent cesarean section had an 18.0% higher risk of death (RR = 1.18; 95% CI: 1.04–1.34) in 2020, when compared to the average from 2010 to 2019[2].

Still regarding the causes of maternal mortality, it is essential to point out that maternal deaths resulting from direct obstetric causes (such as hemorrhage and hypertension, for example), not considering the period of the Covid-19 pandemic, are the most common[6–8] and that they can be prevented through access to quality health services and care.

Thus, the 2030 Agenda, specifically in Sustainable Development Goal 3 (SDG 3), sets as one of the goals ensuring healthy lives and promoting well-being for all, at all ages, aiming to reduce the global maternal mortality rate to less than 70 deaths per 100,000 live births by 2030. Considering this global goal and the context of this public health problem, Brazil established as a national goal, by 2030, to reduce the MMR to 30 deaths per 100,000 live births[9].

In view of the above, it is important to understand the MMR in the national context, through the analysis of temporal trends and spatial distribution, which will help to identify some risk factors that contribute to maternal morbidity and mortality and, consequently, will support managers and healthcare professionals in developing strategies to promote women's health during the pregnancy-puerperal cycle and prevent complications, thereby avoiding maternal deaths and improve health indicators, such as the MMR.

Thus, the following research question arose: What is the impact of the Covid-19 pandemic on the Maternal Mortality Ratio in Brazil, from 2018 to 2021? Thus, the objective was to analyze the impact of the Covid-19 pandemic on the Maternal Mortality Ratio in Brazil, from 2018 to 2021.

METHOD

This is an ecological, time-series study on the MMR in Brazil, from 2018 to 2021, two years before and two years during the Covid-19 pandemic, which sought to analyze the behavior of the temporal trend and the special distribution of the MMR during this period. The units of analysis were the five Brazilian geographic regions: North, Northeast, Southeast, South and Central-West.

The study analyzed the number of maternal deaths and the MMR from 2018 to 2021, stratified according to the following variables: age group (10 to 14, 15 to 19, 20 to 29, 30 to 39, 40 to 49, 50 to 59 years), education level (none, 1 to 3, 4 to 7, 8 to 11, 12 or more years of schooling), color/race (white, black, yellow, brown, indigenous), marital status (single, married, widowed, legally separated, other) and type of obstetric cause (direct, indirect or unspecified) and geographic region (North, Northeast, Southeast, South and Central-West).

Data on maternal deaths and number of live births were obtained from the Mortality Information System (*Sistema de Informação sobre Mortalidade* – SIM) and the Live Birth Information System (*Sistema de Informações sobre Nascidos Vivos* – SINASC) databases, respectively. Both databases are available on the website of the Department of Informatics of the Unified Health System (*Departamento de Informática do SUS* – DATASUS).

The MMR is the indicator used to evaluate maternal mortality, as well as to verify the characteristics of data, relating them to the period and place of the deaths[10], and it was calculated by dividing the total number of maternal deaths by the number of live births in the same year and place, multiplying the result by 100,000 live births (LB).

Initially, the data were organized in Microsoft Excel to analyze the distribution of absolute and relative frequencies of the number of maternal deaths, as well as to calculate the MMR indicator. The MMR values were then subjected to Prais-Winsten linear regression analysis in Stata, version 14.0.

The Annual Percent Change (APC) was calculated using the Prais-Winsten generalized linear analysis model, which is indicated to correct serial autocorrelation in time series, in which a negative value of the Principal Component Analysis (PCA) indicates a decreasing trend, a positive value indicates an increasing trend and, if there is no significant difference from zero, it indicates a stationary trend ($p<0.05$). The dependent variable (Y) was the MMR, while the independent variables (X) were: the year of death, age group, education level, color/race, marital status and type of obstetric causes[11].

The evolution of the MMR in the five regions of Brazil, from 2018 to 2021, was presented in maps prepared in the TabWin software.

There was no need to submit the project to the Research Ethics Committee, as anonymous and publicly accessible data were used.

RESULTS

From 2018 to 2021,8,229 maternal deaths and a stationary MMR were identified in Brazil. An increasing trend was observed in the North (95%CI=4.85; 52.89, $p<0.05$, APC=26.61) and Northeast (95%CI=3.94; 49.09, $p<0.05$, APC=24.48) regions. The year 2021 was the one with the highest number of deaths (n=3,030) and the highest MMR (113.1 maternal deaths per 100,000 live births) (Table 1).

Also in Table 1, it can be observed that the North Region was the one with the highest MMR in all years studied. The South Region had the lowest MMR values in 2018 (36.8), 2019 (38.0) and 2020 (43.2). In 2021, the Southeast Region presented the lowest MMR (104.4).

Considering the data in Table 1 and to allow a better visualization of the MMR over the years investigated, according to the Brazilian geographic regions, the distribution maps of this indicator are shown (Figure 1), in which it can be observed that the North Region presented, from 2018 to 2021, MMR above the global target proposed in SDG 3[9], followed by the Northeast Region (2020 and 2021). In 2021, all regions were above the global target defined in the SDGs. None of the regions met this target during the four years analyzed.

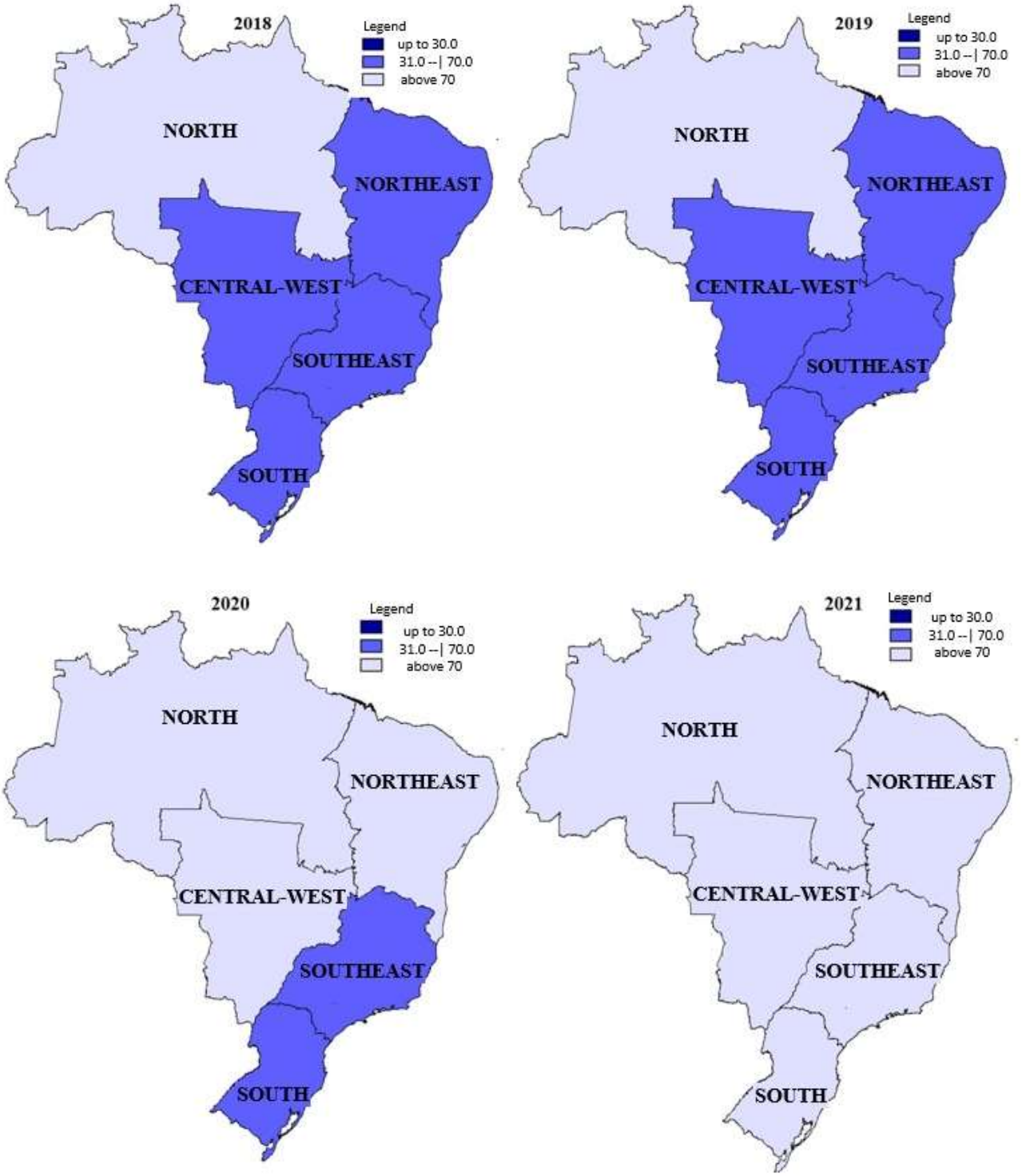
Table 2 shows that the MMR showed an increasing trend in the age groups 30 to 39 years (95%CI=4.35; 75.84, $p<0.05$, APC=6.16) and 40 to 49 years (95%CI=2.33; 51.59, $p<0.05$, APC=24.55); among women with no (95%CI=15.42; 15.43, $p<0.05$, APC=15.42) and 12 or more years of schooling (95%CI=15.26; 89.09, $p<0.05$, APC=47.63); black (CI95%=5.37; 60.69, $p<0.05$, APC=29.25); and who were legally separated

Table 1 – Maternal deaths and maternal mortality ratio by geographic regions in Brazil. Brazil, 2018 a 2021. Teresina, Piauí, Brazil, 2023.

Variables	2018		2019		2020		2021		APC†	95% CI‡	p-value§	Trend
	n	MMR*	n	MMR*	n	MMR*	n	MMR*				
Brazil	1,658	56.3	1,576	55.3	1,965	71.9	3,030	113.1	26.85	(-2.29;64.61)	0.05	Stationary
Regions												
Central-West	151	61.3	136	56.3	171	74.1	314	136.9	30.81	(-10.78;91.81)	0.09	Stationary
North	230	70.1	233	74.5	285	94.7	438	141.9	26.61	(4.85; 52.89)	0.03	Increasing
Northeast	525	62.6	478	59.3	662	85.8	838	109.3	24.48	(3.94; 49.09)	0.03	Increasing
South	146	36.8	147	38.0	162	43.2	385	106.1	35.32	(-10.94;105.62)	0.06	Stationary
Southeast	606	52.8	582	52.7	685	65.0	1,055	104.4	25.14	(-3.25; 61.89)	0.09	Stationary

*MMR: maternal mortality ratio; †APC: annual percent change; ‡95% CI: 95% confidence interval; §p-value: Prais-Winsten linear regression.
Source: Mortality Information System (SIM) and Live Births Information System (SINASC).

Figure 1 – Distribution of maternal mortality ratio by geographic regions. Brazil, 2018-2021. Teresina, Piauí, Brazil, 2023.



Source: Mortality Information System (SIM) and Live Birth Information System (SINASC).

(CI95%=1.11; 104.48, p<0.05, APC=46.79). Furthermore, there was a failure in filling out death certificates, since the MMR also showed an increasing trend among women with unknown education level (CI95%=2.40; 57.75, p<0.05, APC=27.10), color/race (CI95%=15.56; 33.79, p<0.05, APC=24.34) and marital status (CI95%=12.56; 70.03, p<0.05, APC=38.34.

Table 2 – Maternal deaths and maternal mortality ratio by age group, education level, color/race, marital status and type of obstetric cause. Brazil, 2018-1021. Teresina, Piauí, Brazil, 2023.

Variables	2018		2019		2020		2021		95% CI†	p-value‡	APC§	Trend
	n	MMR*	n	MMR*	n	MMR*	n	MMR*				
Age group (years)												
10 to 14	13	0.4	14	0.4	7	0.2	11	8.1	(-1.072; 1.073)	0.00	-1.07	Decreasing
15 to 19	205	6.9	182	6.3	148	5.4	218	41.2	(-8.48; -8.47)	0.00	-8.48	Decreasing
20 to 29	609	20.6	582	20.4	709	2.9	1.103	41.2	(-8.52; 100.95)	0.08	35.58	Stationary
30 to 39	682	23.1	653	22.9	922	33.7	1.441	53.8	(4.35; 75.84)	0.03	6.16	Increasing
40 to 49	149	5.0	144	5.0	178	6.5	252	9.4	(2.33; 51.59)	0.04	24.55	Increasing
55 to 59	0	0	1	0.0	1	0.0	5	0.1	(-97.37;3762.069)	0.99	0.73	Stationary
Education level (years f study)												
None	27	0.9	34	1.1	32	1.1	45	1.6	(15.42; 15.43)	0.00	15.42	Increasing
1 to 3	134	4.5	119	4.1	117	4.2	165	6.1	(-13.54; 37.50)	0.25	9.03	Stationary
4 to 7	390	13.2	357	12.5	384	14.0	475	17.7	(-5.65; 29.45)	0.11	10.51	Stationary
8 to 11	716	24.3	670	23.5	880	32.2	1.456	54.3	(-3.25; 79.58)	0.06	31.81	Stationary
12 years and over	168	5.7	203	7.1	262	9.5	529	19.7	(15.26; 89.09)	0.02	47.63	Increasing
Unknown	223	7.5	193	6.7	290	10.6	360	13.4	(2.40; 57.75)	0.04	27.10	Increasing
Color/race												
White	505	17.1	475	16.6	589	21.5	1.051	39.2	(-6.54; 84.69)	0.07	31.37	Stationary

Table 2 – Cont.

Variables	2018		2019		2020		2021		95% CI†	p-value‡	APC§	Trend
	n	MMR*	n	MMR*	n	MMR*	n	MMR*				
Black	177	6.0	184	6.4	229	8.3	355	13.2	(5.37; 60.69)	0.03	29.25	Increasing
Yellow	8	0.2	1	0.0	10	0.3	6	0.2	(-49.43; 377.63)	0.23	55.41	Stationary
Brown	904	30.6	855	30.0	1.055	38.6	1.520	56.7	(-1.46; 55.36)	0.05	23.73	Stationary
Indigenous	26	0.8	25	0.8	29	1.0	43	1.6	(-3.00; 53.20)	0.06	21.90	Stationary
Unknown	38	1.2	36	1.2	53	1.9	55	2.0	(15.56; 33.79)	0.00	24.34	Increasing
Marital Status												
Single	793	26.9	782	27.4	910	33.3	1.329	49.6	(-0.40; 50.45)	0.05	22.42	Stationary
Married	483	16.4	436	15.3	593	21.7	989	36.9	(-5.10; 85.92)	0.06	32.82	Stationary
Widowed	7	0.2	4	0.1	8	0.2	16	0.5	(-28.60; 199.71)	0.15	46.28	Stationary
Judicially separated	27	0.9	28	0.9	37	1.3	75	2.8	(1.11; 104.48)	0.04	46.79	Increasing
Other	249	8.4	228	8.0	265	9.7	406	15.1	(-7.64; 59.75)	0.09	21.46	Stationary
Unknown	99	3.3	98	3.4	152	5.5	215	8.0	(12.56; 70.03)	0.02	38.34	Increasing
Type of obstetric causes												
Direct	1,114	37.8	1,034	36.2	1.041	38.1	1.029	38,4	(-1.76; 57.59)	0.20	1.39	Stationary
Indirect	489	16.6	479	16.8	843	30.8	1.939	72,4	(4.01; 166.83)	0.04	66.59	Increasing
Unspecified	55	1.8	62	2.1	81	2.9	61	2,2	(21.80;21.80)	0.00	21.80	Increasing

*MMR: Maternal Mortality Ratio; †95%CI: 95% confidence interval; ‡p-value: Prais-Winsten linear regression; §APC: annual percent change.
Source: Mortality Information System (SIM) and Live Birth Information System (SINASC). APC: annual percentage change; 95%CI: 95% confidence interval.

The MMR, even with a stationary trend, was higher during the four years investigated among women with eight and 11 years of schooling, brown women and self-declared as single women (Table 2).

Regarding obstetric causes, the MMR showed an increasing trend among indirect causes (95%CI=4.01; 166.83, p<0.05, APC=66.59) and unspecified causes (95%CI=21.80; 21.80, p<0.05, APC=21.80). The MMR, even with a stationary trend, was higher during the four years investigated for direct cause type (Table 2).

DISCUSSION

Despite the stationary trend of MMR in Brazil, some regions show an increasing trend of this indicator, which represents an important public health problem in the country, since in the majority of cases are preventable deaths. This finding is evident, considering that in the Brazilian reality, there are disparities between the different regions, with high MMR in regions such as the North and Northeast, which have many municipalities with fewer resources and greater difficulties in accessing healthcare services[12,13]. This situation was aggravated by the Covid-19 pandemic, which increased the challenges in addressing this issue. Many women stopped attending routine prenatal consultations, immunizations, imaging and laboratory tests, for fear of infection, which made it difficult to provide qualified care to this population[14].

Even though the public and private health sectors face many challenges in ensuring access and adequate care for all pregnant and postpartum women, the increase in maternal mortality in 2020 and 2021 represented a setback that needs further clarification and action. The Covid-19 pandemic affected many pregnant and postpartum women, with those with greater socioeconomic vulnerability being the most affected. That is, the pandemic worsened the existing social inequalities and injustices in Brazil, as well as the living and health conditions of a population/community[13].

Maternal death was, therefore, in percentage terms, a condition that affected adult women, with low education level, brown skin color and single women. Regarding the obstetric cause, maternal deaths due to direct obstetric causes prevailed in 2018, 2019 and 2020, and in 2021, they were due to indirect obstetric causes, which include Covid-19. Similar findings were identified in other studies, regarding age group[15], education level[10,16,17], color/race[6,16,18,19], marital status[6,10,16,18,19] and classification of the type of obstetric death[17].

The age group with the highest record of maternal deaths identified in this study is related to the fact that, from the age of 35, there is the intermediate type of gestational risk factor, requiring special attention during prenatal care[6]. This risk is due to the susceptibility of women in this age group to the occurrence of some diseases, such as hypertensive or hemorrhagic syndromes[10].

Illiteracy and lower education level are also considered gestational risk factors[6]. In this regard, a study conducted in southern Ethiopia found that the risk of maternal death was 4.4 times higher among mothers with no education than among those with some education (95% CI=1.7–11.0) [17], which may be related to women's limited access to adequate information, as well as insufficient understanding of the information provided by healthcare professionals during prenatal consultations and, consequently, difficulty in adhering to health care, which reflects on their attention to the pregnancy and their own health and the baby's health[10].

Moreover, it is important to highlight that this study also revealed an increasing trend in MMR among women with more years of education, but this is specifically due to the large number of deaths in Brazil due to Covid-19. During the pandemic period, especially at the beginning, national policies to combat and control this problem for pregnant women were incipient. For example, they were not included among the priority groups when the Covid-19 vaccine began to be distributed in the country. After much discussion and intense national repercussion, they were included among the comorbidity groups[11].

Skin color/race should also be one of the aspects investigated during the prenatal consultation, since black skin color, which includes brown (the majority in this study) and black, is one of the criteria for stratifying gestational risk, which classifies these pregnant women as having intermediate risk[17], which is related to socioeconomic status and racial inequality in health[6].

Although race is evidenced as a social construct that encompasses numerous aspects of a person's history and their generations, ethnic-racial studies reflect the broad inequalities in society, such as socioeconomic status and inequality in access to healthcare services and reduced quality of care provided[20].

It is important to highlight that the MMR among black women showed an increasing trend throughout the periods investigated. In the meantime, research conducted in Mato Grosso do Sul revealed that the risk of death for black women (RR=4.3; 95% CI=2,088.71) was approximately four times higher when compared to white women[20]. In addition to the socioeconomic conditions and racial inequality mentioned, black women also have a greater genetic predisposition to

diseases, especially hypertensive syndromes[18], which reveals the need for health care that is welcoming to these women, based on the principle of equity.

When analyzing the sociodemographic profile of women who died during gravid-puerperal cycle, it is clear that it is important to investigate their marital status. An insecure marital situation and lack of family support are therefore also criteria adopted in the stratification of gestational risk (in this case, intermediate)[20]. Therefore, single pregnant women, as well as divorced women, tend to be a vulnerable group[18], since the presence of a partner can be considered a protective factor for women during pregnancy and childbirth[21], when care is shared and self-care is encouraged, as well as emotional, social, affective and financial support[22].

From the above, it is clear that maternal death is closely related to issues involving racial inequality and the social determinants of health of Brazilian women[18]. Therefore, to promote quality prenatal care and reduce maternal deaths, it is essential to have health care that is capable of addressing women in a comprehensive way.

Regarding the type of obstetric causes of death, among the direct causes, the most common are those directly related to the gravid-puerperal cycle and, in most cases, are preventable[21], through quality and comprehensive health care. On the other hand, it is noteworthy, in 2021, there was the highest occurrence of deaths from indirect obstetric causes, among which Covid-19 stands out.

The Covid-19 pandemic has weakened the health systems of developing countries in different regions of the world, due to the lack of qualified health personnel, equipment, infrastructure[23], economic support to face a crisis, among others, which particularly impacted the health of vulnerable groups, such as pregnant women.

Pregnancy presents a risk factor for the development of severe Covid-19 in unvaccinated women[24] and, on the other hand, pregnant women with Covid-19 have a high risk of morbidity and mortality. This is due to the physiological changes present in the gravid-puerperal cycle, especially changes in the immune and respiratory systems[25]. It is important to emphasize that, during the pandemic, prenatal care was highly affected by women's fear of becoming pregnant and seeking assistance, due to the barriers imposed by health care units for women[26]. The focus of care was on individuals with Covid-19 symptoms in Primary Care services. Therefore, it is important that pregnant and postpartum women receive priority attention in the different strategies for healthcare promotion and disease prevention strategies[2].

For Brazil and its regions to reduce the MMR and, therefore, achieve one of the goals of SDG 3, it is necessary to address these internal inequalities, through the implementation of public policies that consider the specificities of the different Brazilian regions and the health needs of women, according to the location in which they live[25]. Therefore, it is essential to carry out different studies by regions of Brazil that allow the analysis of the health situation and the social determinants of health of women during the gravid-puerperal cycle. Such research is fundamental in the development of strategies that allow the implementation of quality and comprehensive health care, which overcomes geographical barriers and vulnerability and ensures the rights of these women, regardless of age, education level, color/race, marital status, among others.

A limitation of the study is the use of secondary data, even though the available information systems within the Unified Health System are reliable, as there was under-reporting in completion of death certificates, since many of the data obtained had the status of ignored, which generated incomplete data analysis.

CONCLUSION

The study highlighted an increase in the MMR, especially between the first two years, 2020 and 2021, of the Covid-19 pandemic, with an increasing trend in the North and Northeast regions and a stationary trend in other regions. The highest MMR was identified in women aged 30 to 39, with eight to 11 years of schooling, self-declared brown skin color and single. In view of this, the need for effective public policies that aim to provide the necessary investments and resources to change this scenario is reinforced, aiming to guarantee a better quality of life for women, through improved access and assistance to services intended for women, thereby reducing the number of maternal deaths in the country, and thus paving the way to achieve the goal set by SDG 3.

REFERENCES

1. Organização Pan-Americana da Saúde (OPAS). Saúde Materna[Internet]. Washington: OPAS; 2023 [cited 2024 Mar 28]. Available from: https://www.paho.org/pt/topicos/saude-materna
2. Michels BD, Marin DFA, Iser BPM. Increment of maternal mortality among admissions for childbirth in low-risk pregnant women in Brazil: effect of COVID-19 Pandemic?. Rev Bras Ginecol Obstet. 2022;44(8):740–5. https://doi.org/10.1055/s-0042-1751059
3. Feitosa-Assis AI, Santana VS. Ocupação e mortalidade materna no Brasil. Rev Saude Publica. 2020;54:64. http://doi.org/10.11606/s1518-8787.2020054001736

4. Oliveira IVG, Maranhão TA, Sousa GJB, Silva TL, Rocha MIF, Frota MMC, et al. Maternal mortality in Northeast Brazil 2009-2019: spatial distribution, trend and associated factors. Epidemiol Serv Saúde. 2023;32(3):e2022973. http://doi.org/10.1590/S2237-96222023000300009.en
5. Fundo de População das Nações Unidas (UNFPA). A razão da mortalidade materna no Brasil aumentou 94% durante a pandemia. Fundo de População da ONU alerta para grave retrocesso [Internet]. 2022[cited 2024 Mar 28]. Available from: https://brazil.unfpa.org/pt-br/news/razao-da-mortalidade-materna-no-brasil-aumentou-94-durante-pandemia-fundo-de-populacao-da-onu
6. Afonso LR, Castro VHS, Menezes CPSR, Custódio LL, Silva MGC, Gomes ILV. Perfil da mortalidade materna no Estado do Ceará. Rev Bras Saúde Matern Infant. 2022;22(1):121-6. https://doi.org/10.1590/1806-93042022000100007
7. Bomela JN. Maternal mortality by socio-demographic characteristics and cause of death in South Africa: 2007–2015. BMC Public Health. 2020;20:157 https://doi.org/10.1186/s12889-020-8179-x
8. Chen L, Feng P, Shaver L, Wang Z. Maternal mortality ratio in China from 1990 to 2019: trends, causes and correlations. BMC Public Health. 2021;21:1536 https://doi.org/10.1186/s12889-021-11557-3
9. Instituto de Pesquisa Econômica Aplicada (IPEA). Objetivos do desenvolvimento sustentável: Saúde e bem estar [Internet]. 2019[cited 2024 Mar 28]. Available from: https://www.ipea.gov.br/ods/ods3.html
10. Figueiredo LCA, Aguiar FB, Cardoso DO, Castro FB, Almeida LF, Cunha AKR, et al. Perfil epidemiológico da mortalidade materna no estado do Espírito Santo durante o período de 2014 a 2018. Rev Eletrôn Acervo Saúde. 2021;13(2):e6296–e6296. https://doi.org/10.25248/REAS.e6296.2021
11. Ministério da Saúde (BR), Secretaria de Vigilância Epidemiológica. Mortalidade proporcional por grupos de causas em mulheres no Brasil em 2010 e 2019. Bol Epidemiol [Internet]. 2021[cited 2024 Mar 28];52(29). Available from: https://www.gov.br/saude/pt-br/centrais-de-conteudo/publicacoes/boletins/epidemiologicos/edicoes/2021/boletim_epidemiologico_svs_29.pdf/view
12. Silva SCM, Monteiro EA, Faustino e Freitas WM, Barros AG, Guimarães CMC, Melo SA. Diagnóstico da situação de morte materna. Rev Bras Promoç Saúde 2019;32:1-11. https://doi.org/10.5020/18061230.2019.9259
13. Pinheiro LMS, Menezes LO, Guerreiro PO, Motta JVS, Oliveira SS, Pinheiro RT. Mortalidade materna no Brasil: análise da associação de recursos financeiros federais de custeio. Rev AMRIGS (Porto Alegre). 2022;66(1):97-105. https://docs.bvsalud.org/biblioref/2023/03/1424839/17_2545_revista-amrigs.pdf
14. Toss AFO, Lima AOF, Pereira MGL, Oliveira AMM, Pinheiro ROS, Santos Neto CV. Óbito materno e fetal em mulheres que não frequentam o pré-natal. Rev Eletrôn Acervo Saúde. 2023;23(6):e12979. https://doi.org/10.25248/reas.e12979.2023
15. Diguisto C, Saucedo M, Kallianidis A, Bloemenkamp K, Bødker B, Buoncristiano M, et al. Maternal mortality in eight European countries with enhanced surveillance systems: descriptive population based study. BMJ 2022;379:e070621. https://doi.org/10.1136/bmj-2022-070621
16. Neiva ABC, Santos JLPP, Macêdo LMD, Ramos VKS, Duarte MB. Mortalidade materna na Bahia: uma análise sociodemográfica. Rev Baiana Saúde Pública. 2021;45(4):53-63. https://doi.org/10.22278/2318-2660.2021.v45.n4.a3476
17. Kea AZ, Lindtjorn B, Gebretsadik A, Hinderaker SG. Variation in maternal mortality in Sidama National Regional State, southern Ethiopia: a population based cross sectional household survey. PLoS ONE. 2023;18(3):e0272110. https://doi.org/10.1371/journal. pone.0272110
18. Vettorazzi J, Valério EG, Zanatta MA, Scheffler MH, SHAM Costa, Ramos JGL. Temporal Evolution of Maternal Mortality: 1980-2019. Rev Bras Ginecol Obstet. 2021;43(9):662–8. https://doi.org/10.1055/s-0041-1735300
19. Ruas CAM, Quadros JFC, Rocha JFD, Rocha FC, Andrade Neto GR, Piris ÁP. Perfil e distribuição espacial da mortalidade materna. Rev Bras Saúde Matern Infant. 2020;20(2):397-409. https://doi.org/10.1590/1806-93042020000200004
20. Coelho VC, Andrade MS, Sena CD, Costa LEL, Bittencourt IS. Caracterização dos óbitos maternos em três regiões de saúde do centro-norte baiano. Cogitare Enferm. 2016;21(1):01-08. http://dx.doi.org/10.5380/ce.v21i1.42475
21. Picoli RP, Gazola LHO, Lemos EV. Mortalidade materna segundo raça/cor, em Mato Grosso do Sul, Brasil, de 2010 a 2015. Rev Bras Saúde Matern Infant. 2017;17(4):739-47. https://doi.org/10.1590/1806-93042017000400007
22. Mascarenhas PM, Silva GRD, Reis TT, Casotti CA, Nery AA. Análise da mortalidade materna. Rev Enferm UFPE. 2017;11(Supl 11):S4653-S62. https://doi.org/10.5205/reuol.11138-99362-1-SM.1111sup201715
23. Alabi QK, Oyedeji AS, Kayode OO, Kajewole-Alabi DI. Impact of COVID-19 pandemic on mother and child health in Sub-Saharan Africa: a review. Pediatric Res Found. 2023. https://doi.org/10.1038/s41390-023-02651
24. González-Vanegas O, Martinez-Perez O. SARS-CoV-2 Infection and preeclampsia: how an infection can help us to know more about an obstetric condition. Viruses. 2023;15:1564. https://doi.org/10.3390/v15071564
25. Ministério da Saúde (BR). Protocolo de Manejo Clínico do Coronavírus (COVID-19) na Atenção Primária à saúde [Internet]. Brasília, DF; 2020[cited 2024 Mar 28]. Available from: https://bvsms.saude.gov.br/bvs/publicacoes/manejo_clinico_covid-19_atencao_especializada.pdf
26. World Health Organization (WHO). Pulse survey on continuity of essential health services during the COVID-19 pandemic [Internet]. 2020 [cited 2024 Mar 28]. Available from: https://www.who.- int/publications/i/item/WHO-2019-nCoV-EHS_continuity-survey-2020.1

Authorship contribution

Conceptualization: Izabel Cristina da Silva Carvalho, Jardeliny Corrêa da Penha.
Data curation: Izabel Cristina da Silva Carvalho, Jesusmar Ximenes Andrade, Fernando Ferraz do Nascimento.
Formal analysis: Izabel Cristina da Silva Carvalho, Jardeliny Corrêa da Penha, Márcio Dênis Medeiros Mascarenhas, Malvina Thais Pacheco Rodrigues.
Methodology: Izabel da Silva Cristina Carvalho, Jardeliny Corrêa da Penha, Márcio Dênis Medeiros Mascarenhas, Malvina Thais Pacheco Rodrigues, Jesusmar Ximenes Andrade, Fernando Ferraz do Nascimento.
Project administration: Jardeliny Corrêa da Penha, Márcio Dênis Medeiros Mascarenhas, Malvina Thais Pacheco Rodrigues.
Software: Izabel Cristina da Silva Carvalho, Jesusmar Ximenes Andrade, Fernando Ferraz do Nascimento.
Supervision: Jardeliny Corrêa da Penha, Márcio Dênis Medeiros Mascarenhas, Malvina Thais Pacheco Rodrigues.
Visualization: Izabel Cristina da Silva Carvalho, Jardeliny Corrêa da Penha, Márcio Dênis Medeiros Mascarenhas, Malvina Thais Pacheco Rodrigues.
Writing-original draft: Izabel Cristina da Silva Carvalho, Jardeliny Corrêa da Penha, Márcio Dênis Medeiros Mascarenhas, Malvina Thais Pacheco Rodrigues.
Writing-review & editing: Izabel Cristina da Silva Carvalho, Jardeliny Corrêa da Penha, Márcio Dênis Medeiros Mascarenhas, Malvina Thais Pacheco Rodrigues.

The authors declare that there is no conflict of interest.

Corresponding author:

Izabel Cristina da Silva Carvalho
Email: bebelcristina12@hotmail.com

Associate editor:
Gisele Knop Aued

Received: 12.20.2023
Approved: 04.26.2024

Editor-in-chief:
João Lucas Campos de Oliveira