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Original Article

Trend in maternal mortality due to postpartum hemorrhage in Brazil: time-series analysis (2000–2023)

Tendência da mortalidade materna por hemorragia pós-parto no Brasil: análise de séries temporais (2000–2023)

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ABSTRACT

Objective: to analyze the trend in maternal mortality due to postpartum hemorrhage. **Methods:** ecological study using secondary data on maternal deaths due to postpartum hemorrhage from the Mortality Information System. We applied an interrupted time series approach across the five Brazilian regions from 2000 to 2023. **Results:** a total of 2,394 maternal deaths due to postpartum hemorrhage were analyzed in Brazil between 2000 and 2023, with the highest ratios among Brown (*parda*) women aged 30–34 years. The overall maternal mortality ratio due to postpartum hemorrhage was 3.46 per 100,000 live births. In 2023, the South recorded the lowest ratio (3.12) and the Central-West had the highest (4.89) per 100,000 live births. **Conclusion:** the maternal mortality ratio due to postpartum hemorrhage in Brazil remains a marker of regional disparities, racial inequities, and gaps in the effectiveness of public policies. **Contributions to practice:** the findings underscore the importance of more comprehensive prenatal care and the implementation of preventive strategies for postpartum hemorrhage to improve maternal and neonatal outcomes.

Descriptors: Maternal Mortality; Epidemiology; Postpartum Hemorrhage; Brazil.

RESUMO

Objetivo: analisar a tendência da mortalidade materna por hemorragia pós-parto. **Métodos:** estudo epidemiológico ecológico, com dados secundários sobre mortalidade materna em decorrência de hemorragia pós-parto disponibilizados pelo Sistema de Informações sobre Mortalidade. Para a análise, utilizou-se a técnica de séries temporais interrompidas das cinco macrorregiões do Brasil, de 2000 a 2023. **Resultados:** foram analisados 2.394 óbitos maternos por hemorragia pós-parto no Brasil, entre 2000 e 2023, com maior incidência em mulheres de cor parda e com idade entre 30 e 34 anos. A taxa de mortalidade materna global por hemorragia foi de 3,46 para cada 100 mil nascidos vivos. Em 2023, a região Sul apresentou a menor taxa (3,12) e a região Centro-Oeste a maior taxa (4,89). **Conclusão:** a razão de mortalidade materna por hemorragia pós-parto no Brasil persiste como marcador de disparidades regionais, desigualdades raciais e falhas na efetividade de políticas públicas. **Contribuições para a prática:** os resultados evidenciam a importância de um acompanhamento pré-natal mais detalhado e implementação de estratégias preventivas da hemorragia pós-parto, para melhorar os desfechos maternos e neonatais.

Descritores: Mortalidade Materna; Epidemiologia; Hemorragia Pós-Parto; Brasil.

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Introduction

Maternal death is considered a serious violation of women's reproductive rights and, consequently, of human rights[1]. In addition to clinical and individual repercussions, it affects families, communities, society, and the economy; therefore, reducing maternal mortality is essential to building a more just society[2-3].

The United Nations Sustainable Development Goals set a maternal mortality ratiotarget of less than 70 per 100,000 live births by 2030. In Brazil, the target was updated to an maternal mortality ratio below 30 per 100,000 live births[3].

In Brazil, most maternal deaths are direct obstetric deaths[4], including hypertensive disorders of pregnancy, puerperal sepsis, and postpartum hemorrhage. The latter is the leading cause of maternal mortality in low- and middle-income countries and ranks second in Brazil[5]. Although the causes are well-defined and known[6-7], postpartum hemorrhage episodes are largely unpredictable[7].

Despite technological advances and recognition of several preventive measures—particularly for postpartum hemorrhage—reducing maternal mortality is a complex, multifactorial endeavor because it involves social, individual, and local health system determinants. The shift from high to low maternal mortality has occurred worldwide in recent decades, albeit slowly. Brazil is in a transitional stage, characterized by high coverage of health services and even an excess of interventions in childbirth care, such as cesarean delivery. However, inequities in the care of pregnant and postpartum women coexist with these advances, and preventable maternal deaths still predominate in the country[8].

Some risk factors, such as a history of postpartum hemorrhage and multiple gestation, can be identified during prenatal care. In this context, early identification of pregnant women at increased risk of postpartum hemorrhage and intensive training for health professionals to recognize these cases are critical[9]. In addition, evidence-based guidance is needed to optimize health outcomes and to support the prevention and treatment of postpartum hemorrhage, thereby improving care during labor and delivery and advancing the Sustainable Development Goals[10].

Extremes of maternal age are associated with higher risks of postpartum hemorrhage, obstetric complications, and maternal death; age is an important proximal determinant of maternal outcomes[5-8]. Racial inequities persist in access to and quality of prenatal and childbirth care, indicating that race/color functions as a social marker of inequality that permeates care practices and shapes differential experiences in maternal care[9].

Despite the implementation of *Rede Cegonha* and subsequent maternal health policies, few studies systematically assess mortality due to postpartum hemorrhage using time-series methods in Brazil, which hinders understanding of this phenomenon's historical progression. Brazil also exhibits regional inequities in access to and quality of obstetric care; identifying region-specific patterns and evaluating the effectiveness of public policies is, therefore, essential, given the heterogeneity of the country's regions[11-13].

Time-series analyses of maternal mortality due to postpartum hemorrhage identify patterns, trends, and changes over time, moving beyond point-in-time snapshots to document its historical progression and indicate decreases or increases in deaths. They also reveal shifts in light of contextual factors, such as the coronavirus disease (COVID-19) pandemic. The absence of robust time series undermines strategic planning and the formulation of public policies to reduce maternal mortality due to postpartum hemorrhage. The lack of evidence demonstrating patterns, trends, and the effects of prior policies constrains the development of more effective, equitable, and regionally contextualized strategies.

This study asked: What was the trend in maternal mortality due to postpartum hemorrhage across Brazil and its regions between 2000 and 2023, and what were the impacts of the implementation of *Rede*

Cegonha (2011) and the COVID-19 pandemic (2020–2023) on this trend? Accordingly, the objective was to analyze the trend in maternal mortality due to postpartum hemorrhage.

Methods

Study design

This ecological study used secondary data on maternal mortality for Brazil and its five regions (North, Northeast, Central-West, South, and Southeast) from 2000 to 2023, restricted to deaths due to postpartum hemorrhage.

Context

Data were obtained from the Mortality Information System (SIM), filtering for direct obstetric causes in the International Classification of Diseases, 10th Revision (ICD-10), Chapter XV "Pregnancy, childbirth and the puerperium" and category O72 "Postpartum hemorrhage." Data were extracted in May 2025.

Data collection

According to the World Health Organization, the maternal mortality ratio is calculated by dividing the number of deaths occurring during pregnancy, childbirth, and the puerperium (up to 42 days postpartum) by the number of live births in a given geographic area and year, expressed per 100,000 live births, regardless of whether the cause is related to or aggravated by pregnancy[14].

Live-birth data were obtained from the Live Births Information System for all 24 years under analysis.

The dependent variable was the maternal mortality ratio due to postpartum hemorrhage, computed as: maternal mortality ratio due to maternal mortality ratio = (number of maternal deaths dues to maternal mortality ratio / number of live births x 100,000).

Maternal deaths were obtained from SIM (modules for deaths among women of reproductive age and for maternal deaths). For the denominator, the number of live births was taken from Live Births Information System by maternal place of residence.

Variables

We also analyzed variables available in the death records, summarizing absolute and relative frequencies of reported deaths by characteristics and categories. Sociodemographic characteristics included maternal age in years and race/color of the mother.

Data analysis

Statistical analysis was performed with Stata 17. For the descriptive analysis, we calculated the maternal mortality ratio due to postpartum hemorrhage for Brazil and for each of the five regions.

We used interrupted time series, estimated with segmented linear regression[15-16]. Interrupted time series assesses the effects of events—such as policy, economic, or sudden natural events—when time-series data are available. We evaluated whether an intervention produced an immediate impact (level change) and/or a progressive impact (slope change) on the series.

A statistically significant level change indicates an immediate (positive or negative) impact, whereas a statistically significant slope change indicates a progressive (positive or negative) impact; either or both may occur. When neither parameter is significant, the intervention (or factor under test) is interpreted as not associated with the series[10-11].

For this study, we set 2011 as the first interruption point, corresponding to the implementation of Rede Cegonha. This Ministry of Health initiative was gradually implemented nationwide to structure Brazil's maternal and child health care network and ensure women's rights to sexual and reproductive health and appropriate care throughout pregnancy, childbirth, and the postpartum period[17-18].

We then defined a second interruption corresponding to the coronavirus disease (COVID-19) pandemic (2020–2023). We fit interrupted time series models for Brazil and for each of the five regions (North, Northeast, Central-West, South, and Southeast). Added to this scenario is the serious process of institutional dismantling of the Unified Health System (SUS), with emphasis on the decharacterization of the Stork Network, characterized by a phase of discontinuity and organizational weakening of the Stork Network[19-20]. The attempt to transition from the Stork Network to the Maternal and Child Health Care Network resulted in the loss of structural guidelines for maternal and neonatal care in the SUS, which reinforced the fragmentation of care and limited equity[19,21].

We also calculated the annual percent change (APC) for each dependent variable. Trends were interpreted as increasing ($p < 0.05$ with a positive regression coefficient), decreasing ($p < 0.05$ with a negative coefficient), or showing no significant trend ($p > 0.05$)[15-16].

Table 1 – Description of maternal deaths due to postpartum hemorrhage by region, maternal age, and race/color. Belo Horizonte, MG, Brazil, 2025

Variables	North	Northeast	Southeast	South	Central-West	Brazil
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Age (years)						
15 to 19	40 (13.4)	88 (11.4)	46 (5.8)	28 (7.9)	17 (9.2)	219 (9.1)
20 to 24	55 (18.5)	143 (18.6)	105 (13.2)	58 (16.5)	29 (15.7)	390 (16.2)
25 to 29	60 (20.2)	146 (18.9)	152 (19.1)	60 (17.0)	34 (18.4)	452 (18.8)
30 to 34	62 (20.8)	154 (20.0)	217 (27.3)	90 (25.6)	50 (27.1)	573 (23.9)
35 to 39	52 (17.5)	158 (20.5)	188 (23.7)	84 (23.9)	40 (21.7)	522 (21.8)
40 to 44	27 (9.0)	71 (9.2)	79 (9.9)	26 (7.4)	14 (7.61)	217 (9.0)
45 to 49	1 (0.3)	9 (1.1)	6 (0.7)	5 (1.4)	0 (0.0)	21 (0.8)
Race/color						
White	44 (17.1)	125 (16.3)	366 (46.2)	282(80.8)	54 (31.4)	871 (37.2)
Black	10 (3.91)	63 (8.2)	73 (9.2)	27 (7.7)	11 (6.4)	184 (7.8)
Brown*	196(76.5)	502 (65.6)	307 (38.8)	31 (8.8)	105 (61.0)	1,141(48.8)
Yellow	0 (0.0)	4 (0.5)	6 (0.7)	2 (0.5)	2 (1.1)	14 (0.6)
Ignored	6 (2.3)	71 (9.2)	39 (4.9)	7 (2.0)	0 (0.0)	126 (5.3)

*Parda

The maternal mortality ratio due to postpartum hemorrhage varied substantially across regions. Nationally, the maternal mortality ratio peaked in 2021 at 4.36 per 100,000 live births, followed by 2015 (4.21) and 2018 and 2020 (both 4.17) (Table 2).

At the regional level, the North recorded the highest maternal mortality ratio in 2021 (6.88), 2020 (6.72), and 2014 (6.64) per 100,000 live births (Table 2). In the Northeast, peaks occurred in 2015 (5.38), 2021 (5.14), and 2017 (4.82) per 100,000 live births (Table 2).

In the South, the maternal mortality ratio due to postpartum hemorrhage peaked in 2015 (4.29 per 100,000 live births), followed by 2018 (3.77) and 2005 (3.69) (Table 2). In the Southeast, the highest ratios were observed in 2002 (6.46), 2022 (5.85), and 2004 (5.06) per 100,000 live births (Table 2).

In the Central-West, the maternal mortality ratio due to postpartum hemorrhage reached its maximum in 2020 (6.99 per 100,000 live births), followed by 2018 (4.91) and 2023 (4.89). There was considerable variability across regions and years. In 2023, the South recorded the lowest maternal mortality ratio, while the Central-West recorded the highest, due to postpartum hemorrhage — 3.12 and 4.89 per 100,000 live births, respectively (Table 2).

Table 2 – Maternal mortality ratio due to postpartum hemorrhage per 100,000 live births, by region and year. Belo Horizonte, MG, Brazil, 2025

Year	North	Northeast	Southeast	South	Central-West	Brazil
2000	1.75	3.76	2.01	4.26	3.05	2.88
2001	3.40	3.25	1.97	3.40	2.23	2.70
2002	4.72	4.70	2.11	6.46	3.56	3.84
2003	4.57	4.15	1.88	2.07	3.13	2.96
2004	2.63	4.68	2.56	5.06	2.20	3.51
2005	2.59	3.62	3.69	4.63	1.31	3.50
2006	2.56	3.31	3.53	5.05	2.28	3.46
2007	3.59	4.15	3.50	4.17	3.75	3.81
2008	2.84	2.62	2.41	3.53	1.82	2.62
2009	2.62	3.63	2.88	3.58	2.29	3.12

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Year	North	Northeast	Southeast	South	Central-West	Brazil
2010	2.32	3.13	2.42	4.36	3.20	2.93
2011	3.89	3.10	2.20	3.73	2.67	2.88
2012	3.30	2.92	2.10	3.17	3.95	2.75
2013	4.55	4.07	2.98	2.34	3.44	3.41
2014	6.64	3.77	2.55	4.07	2.88	3.56
2015	3.48	5.38	4.29	1.98	4.48	4.21
2016	5.95	2.80	3.57	2.82	3.01	3.46
2017	6.16	4.82	3.40	2.02	4.13	3.96
2018	4.45	4.47	3.77	4.06	4.91	4.17
2019	5.49	3.13	3.19	4.68	2.09	3.53
2020	6.72	3.54	3.63	3.21	6.99	4.17
2021	6.88	5.14	3.38	3.04	4.83	4.36
2022	2.45	4.12	3.58	5.85	3.14	3.89
2023	3.92	3.87	3.12	3.93	4.89	3.69

Table 3 presents the time-trend analysis and annual percent change of the maternal mortality ratio due to postpartum hemorrhage in Brazil and across regions from 2000 to 2023, treating Rede Cegonha and the pandemic years (2020–2023) as interruption points. Nationally, the maternal mortality ratio due to postpartum hemorrhage showed no significant trend, with no significant impact of *Rede Cegonha* or the COVID-19 pandemic.

The Southeast was the only region that showed an increasing trend; all other regions showed no significant trend. In the Southeast, the maternal mortality ratio due to postpartum hemorrhage increased significantly in terms of APC both when excluding the pandemic period (5.4%) and when including it (4.4%), with no significant impact of *Rede Cegonha* or the COVID-19 pandemic (Table 3).

Table 3 – Time trend and annual percent change in the maternal mortality ratio due to postpartum hemorrhage in the Mortality Information System; impact of *Rede Cegonha* and COVID-19 (level change) on the time series and post-interruption trend (slope change), by regions and Brazil. Belo Horizonte, MG, Brazil, 2025

Region	APC/ (95% CI)*	Trend	Level change	Slope change	p-value
Excluding the pandemic years and treating *Rede Cegonha* as a level change					
Brazil	0.53 (-1.98;3.11)	Stable	None	Stable	0.666
North	0.07 (-0.68;7.20)	Stable	None	Stable	0.982
Northeast	-2.38 (-5.56;0.91)	Stable	None	Stable	0.148
Southeast	5.43 (0.40;10.72)	Increasing	None	Stable	0.038
South	-0.24 (-5.82;5.67)	Stable	None	Stable	0.931
Central-West	-3.06 (-8.39;2.58)	Stable	None	Stable	0.267
Considering the pandemic years (2020–2023) and treating *Rede Cegonha* as a level change					
Brazil	0.45 (-1.60;2.55)	Stable	None	Stable	0.656
North	3.28 (-4.35;11.51)	Stable	None	Stable	0.395
Northeast	-1.91 (-4.66;0.92)	Stable	None	Stable	0.175
Southeast	4.44 (0.44;8.61)	Increasing	None	Stable	0.032
South	-3.08 (-8.22;2.33)	Stable	None	Stable	0.248
Central-West	-1.76 (-6.28;2.98)	Stable	None	Stable	0.444

*APC: Annual percent change; CI: Confidence interval

Discussion

The analysis of maternal deaths due to postpartum hemorrhage in Brazil from 2000 to 2023 showed a higher concentration among women aged 30–34 years and a predominance among Brown (parda) women. The maternal mortality ratio due to postpartum hemorrhage varied substantially across regions. Time-trend analysis indicated no significant overall trend nationally and no significant impact of *Rede Cegonha* or the COVID-19 pandemic; the Southeast was the exception, showing an increasing trend from 2000 to 2023.

In Brazil, the persistence of deaths due to post-

partum hemorrhage remains a major public health challenge[19]. Analyses of postpartum hemorrhage-related maternal mortality must be framed within the social determinants of health, since unequal access to services, socioeconomic barriers, and greater exposure to risk factors directly shape women's vulnerability.

Evidence indicates that, among women admitted to obstetric intensive care units for postpartum hemorrhage, there was a higher proportion of Brown (parda) women and a majority younger than 19 years[20]. Superimposed on this is structural and institutional racism, reflected in lower-quality care and fewer opportunities to receive obstetric care among Black and Brown women, underscoring historical and persistent inequities.

Another salient issue is the greater vulnerability observed among younger women—evidence that remains underexplored despite being recurrent[21-22]. A study of maternal deaths in Bahia reported that the most frequently affected profile was Brown/Black women aged 30–39 years[23]. Another study of the epidemiological profile of maternal mortality likewise found that most maternal deaths occurred among Brown/Black women[20]. Taken together, these findings consistently reinforce that being a young Black or Brown woman is associated with a higher likelihood of maternal death[8].

When maternal deaths due to postpartum hemorrhage are stratified by age and race/color, despite the implementation of public policies to reduce the maternal mortality ratio[17-18], effects differed by age group: substantial reductions (40–49 years), moderate reductions (30–39 years), and no change among those aged 10–29 years[20-21]. Time-trend analyses of hemorrhage-related maternal mortality ratio showed declines between 1997 and 2009[22]. The absence of specific analyses explaining why this age group faces higher risks reveals a gap and indicates the need for investigations that integrate social, racial, and age-related factors to more comprehensively explain the persistence of preventable deaths in the Brazilian context.

In this study, the years with the highest maternal mortality ratio due to postpartum hemorrhage were 2021, 2015, and 2018. COVID-19's impact on vulnerable populations manifested, among other factors, through inequities in access to health services, limiting access to appropriate care[24]. A global review of the pandemic's effects on maternal and perinatal outcomes indicates that, beyond the direct consequences of infection, access to care declined, helping explain increases in adverse pregnancy outcomes[25]. Maternal mortality increased in maternity hospitals after the onset of COVID-19, underscoring the need to mitigate the disease's long-term impact on maternal health by implementing effective strategies to improve outcomes for mothers and newborns[26].

Interpreting postpartum hemorrhage-related maternal mortality ratio across years and regions requires accounting for the phenomenon's complexity in maternal health, as well as for potential causes, risk factors, and policy effects, given Brazil's longstanding regional inequities that shape the distribution of health infrastructure[27]. Regarding *Rede Cegonha*, results have been heterogeneous nationwide: some regions advanced in service provision and adherence to guidelines, whereas others continue to face structural and managerial barriers that limit the policy's reach and, consequently, its effectiveness in reducing maternal mortality[28].

Among the different regions of Brazil, it is observed that the Southeast region showed an increasing trend in maternal mortality due to postpartum hemorrhage. This result may be related to different factors, such as structural and contextual factors. The development of urban centers and large population concentrations in these locations impact obstetric services, since hospital infrastructure has not kept pace with this development[20-21].

In addition, in Brazil, historically, more vulnerable population groups do not access services or encounter barriers to access, such as black women and women from peripheral areas, which reinforces the obstetric racism experienced in maternity wards in determining adverse maternal outcomes[9,13,18,27]. Fi-

nally, factors related to the organizational component of obstetric services are decisive in the management and morbidity and mortality of postpartum hemorrhage, among which the following stand out: availability of beds, referral flows, and training of childbirth care teams[7,12]. Thus, there is an intersectional issue in the maternal mortality ratio in the Southeast between demographic, socioeconomic, racial, and organizational factors, showing that the view of maternal mortality must go beyond clinical factors[5,8].

To publicly report the causes of these deaths, Brazil relies on the Maternal, Fetal, and Infant Mortality Surveillance System. This system includes Municipal Committees for the Prevention of Maternal, Fetal, and Infant Deaths, which play an important role in identifying and correcting inadequately reported maternal deaths[29]. Grounded in evidence-based care, the World Health Organization prioritizes postpartum hemorrhage management to reduce maternal and neonatal mortality and recommends appropriate interventions aligned with WHO protocols[30].

Awareness efforts to encourage attendance at prenatal care should be strengthened to ensure any history of postpartum hemorrhage is documented during visits and hypertensive disorders of pregnancy are properly managed[9]. However, management efforts remain insufficient to secure consistent gains in access to and quality of prenatal care[27]. Even so, the implementation of *Rede Cegonha*, coupled with expanded primary care coverage, likely facilitated its dissemination across states and municipalities, increasing uptake and contributing to higher-quality care for women during prenatal care, childbirth, and the postpartum period, as well as for infants—changes with the potential to reduce maternal mortality nationwide.

Although not directly assessed in this study, the expansion of Primary Health Care—particularly through the Family Health Strategy—has been pivotal for progress in maternal health indicators by ensuring early prenatal access, risk detection, and appropriate referral[9,13,18]. Recognizing its influence is essential to contextualize the results and to guide future analyses of the relationship between primary care coverage and reductions in maternal mortality.

As the leading preventable cause of maternal death, postpartum hemorrhage requires early recognition and diagnosis, since most deaths occur within 24–48 hours after birth; hence, rapid intervention after diagnosis can reduce mortality. Criteria for recognizing postpartum hemorrhage must be simple and easy to apply in daily clinical practice across care settings with varying complexity. They should include clinical findings that facilitate immediate diagnosis and treatment, as well as early identification of women at risk of progressing to shock[6].

Disparities in the maternal mortality ratio due to postpartum hemorrhage among Brazilian regions were also observed and may be driven by socioeconomic factors. Globally, implementing proven interventions and strategies to achieve better postpartum hemorrhage outcomes remains a widely recognized challenge. Across regions, most showed no significant trend in postpartum hemorrhagerelated maternal mortality ratio, with the Southeast as the exception (increasing trend). Because many implementation barriers are highly contextual, global campaigns may have limited impact; locally adapted solutions are needed[10].

Study limitations

This study has limitations inherent to the use of secondary data from the Mortality Information System on maternal deaths, including potential underreporting and the use of regions as the unit of analysis, which may mask inequities evident at smaller geographic scales. In the context of the COVID-19 pandemic, these limitations likely intensified, particularly in areas with already fragile health services, such as the North and Northeast, which were more affected—illustrating how unforeseen events like the pandemic can exacerbate preexisting problems. Another important limitation is the inability to identify the specific etiology of postpartum hemorrhage leading to mater-

nal death, given the secondary nature of the data.

A strength of the study is Mortality Information System's broad coverage, which enables a comprehensive assessment of maternal mortality trends across Brazilian regions. In addition, extensive use of official health data provides a reliable basis for analyzing time trends and regional inequities and for supporting public policies—especially in the wake of COVID-19 and the structural health inequities that affect maternal mortality. Even so, the findings provide important evidence for understanding the impact of postpartum hemorrhage on maternal mortality in Brazil.

Contributions to practice

The findings underscore the importance of more comprehensive prenatal care and the implementation of preventive strategies for postpartum hemorrhage to improve maternal and neonatal outcomes. In this context, it is essential to adopt evidence-based clinical protocols in maternity hospitals and to provide ongoing training for healthcare teams to ensure early recognition, diagnosis, and appropriate management of postpartum hemorrhage. The work of Maternal Mortality Committees should also be strengthened to identify preventable factors and propose locally tailored interventions.

Conclusion

The maternal mortality ratio due to postpartum hemorrhage in Brazil persists as a marker of regional disparities, racial inequities, and gaps in the effectiveness of public policies. Moreover, its stagnation over recent decades, even after initiatives such as *Rede Cegonha*, highlights the need for more targeted strategies, especially for Black and Brown women.

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Authors' contributions

Conception and design, or analysis and interpretation of data; drafting the manuscript and critical revision for important intellectual content; final approval of the version to be published; and agreement to be accountable for all aspects of the manuscript, ensuring that questions related to accuracy or integrity are appropriately investigated and resolved: Ciaravolo LCF, Oliveira TM, Guida JPS, Moreira APA, Matozinhos FP, Silva TPR.

References

1. Nove A, Friberg IK, Bernis L, McConville F, Moran AC, Najjemba M, et al. Potential impact of midwives in preventing and reducing maternal and neonatal mortality and stillbirths: a Lives Saved Tool modelling study. Lancet Glob Health. 2021;9(1):e24-e32. doi: http://doi.org/10.1016/S2214-109X(20)30397-1
2. Qian J, Wolfson C, Kramer B, Creanga AA. Insights from preventability assessments across 42 state and city maternal mortality reviews in the United States. Am J Obstet Gynecol. 2025;232(4):394.e1-394.e10. doi: https://dx.doi.org/10.1016/j.ajog.2024.08.030
3. World Health Organization. SDG 3: Ensure healthy lives and promote wellbeing for all at all ages [Internet]. 2020 [cited Jan 14, 2025]. Available from: https://www.who.int/sdg/targets/en/
4. Instituto de Pesquisa Econômica Aplicada (IPEA). ODS 3 - Saúde e bem-estar [Internet]. 2019 [cited Jun 11, 2025]. Available from: https://www.ipea.gov.br/ods/ods3.html
5. Cresswell JA, Alexander M, Chong MYC, Link HM, Pejchinovska M, Gazeley U, et al. Global and regional causes of maternal deaths 2009-20: a WHO systematic analysis. Lancet Glob Health. 2025;13(4):e626-e634. doi: https://doi.org/10.1016/S2214-109X(24)00560-6
6. Borovac-Pinheiro A, Priyadarshani P, Burke TF. A review of postpartum hemorrhage in low-income countries and implications for strengthening health systems. Int J Gynaecol Obstet. 2021;154(3):393-9. doi: http://doi.org/10.1002/ijgo.13618

7. Alves ALL, Francisco AA, Osanan GC, Vieira LB. Postpartum hemorrhage: prevention, diagnosis and non-surgical management. Rev Bras Ginecol Obstet. 2020;42(11):776-84. doi: https://dx.doi.org/10.1055/s-0040-1721882

8. Souza JP, Day LT, Rezende-Gomes AC, Zhang J, Mori R, Baguiya A, et al. A global analysis of the determinants of maternal health and transitions in maternal mortality. Lancet Glob Health. 2024;12:e306-e316. doi: http://doi.org/10.1016/S2214-109X(23)00468-0

9. Zenani NE, Tulelo PM, Netshisaulu KG, Sepeng NV, Musie M, Gundo R, et al. A scoping review on the contribution of interprofessional collaborative practices on preventing and managing post-partum haemorrhage in the health care system. BMC Nurs. 2025;24(1):455. doi: https://doi.org/10.1186/s12912-025-02988-z

10. World Health Organization. A roadmap to combat postpartum haemorrhage between 2023 and 2030 [Internet]. 2023 [cited Feb 11, 2025]. Available from: https://iris.who.int/bitstream/handle/10665/373221/9789240081802-eng.pdf?sequence=1

11. Santos MCC, Monteiro MS, Cavalcante PAV, Camargo LL, Correia JBT, Pimentel LJR. Perfil epidemiológico da mortalidade materna por hemorragia pós-parto no Brasil no período de 2018 a 2022. Rev Ibero-Am Hum Ciênc Educ. 2025;11(1):1115-23. doi: http://doi.org/10.51891/rease.v11i1.17819

12. Betti T, Gouveia HG, Gasparin VA, Vieira LB, Strada JKR, Fagherazzi J. Prevalence of risk factors for primary postpartum hemorrhage in a university hospital. Rev Bras Enferm. 2023;76(5):e20220134. doi: https://doi.org/10.1590/0034-7167-2022-0134

13. Siqueira GL, Oliveira-Fontes GR, Silva AG, Gomes RGG, Ferreira FM, Guida JPS, et al. The effect of the Covid-19 pandemic on the maternal mortality rate and the achievement of the Sustainable Development Goal in Brazil. BMC Public Health. 2025;25:2005. doi: https://dx.doi.org/10.1186/s12889-025-23219-9

14. World Health Organization. Maternal mortality ratio (per 100 000 live births) [Internet]. 2025 [cited Feb 11, 2025]. Available from: https://data.who.int/indicators/i/AC597B1

15. Bernal JL, Cummins S, Gasparrini A. Interrupted time series regression for the evaluation of public health interventions: a tutorial. Int J Epidemiol. 2017;46(1):348-55. doi: http://doi.org/10.1093/ije/dyw098

16. Antunes JLF, Cardoso MRA. Uso da análise de séries temporais em estudos epidemiológicos. Epidemiol Serv Saúde. 2015;24(3):565-76. doi: https://doi.org/10.5123/S1679-49742015000300024

17. Ministério da Saúde (BR). Portaria n° 1.459, de 24 de junho de 2011. Institui, no âmbito do Sistema Único de Saúde - SUS - a Rede Cegonha [Internet]. 2011 [cited Feb 27, 2025]. Available from: https://bvsms.saude.gov.br/bvs/saudelegis/gm/2011/prt1459_24_06_2011.html

18. Leal MDC, Esteves-Pereira AP, Vilela MEA, Alves MTSSBE, Neri MA, Queiroz RCS, et al. Reduction of inequities of access to appropriate childbirth care in Rede Cegonha. Ciênc Saúde Colet. 2021;26(3):823-35. doi: https://dx.doi.org/10.1590/1413-81232021263.06642020

19. Motta CT, Moreira MR. Will Brazil comply with the SDG 3.1 of the 2030 Agenda? An analysis of maternal mortality, from 1996 to 2018. Ciênc Saúde Colet. 2021;26(10):4397-409. doi: https://doi.org/10.1590/1413-812320212610.10752021

20. Figueiredo ERL, Miranda CSC, Campos ACV, Gomes FC, Rodrigues CNC, Melo-Neto JS. Influence of sociodemographic and obstetric factors on maternal mortality in Brazil from 2011 to 2021. BMC Womens Health. 2024;24(1):84. doi: https://doi.org/10.1186/s12905-024-02925-3

21. Oliveira IVG, Maranhão TA, Frota MMC, Araújo TKA, Torres SRF, Rocha MIF, et al. Maternal mortality in Brazil: an analysis of temporal trends and spatial clustering. Ciênc Saúde Colet. 2024;29:e05012023. doi: https://dx.doi.org/10.1590/1413-81232024295.05012023

22. Silva MSFF, Amorim MMR, Melo B, Lanza AV, Ramos MET, Carvalho BAD, et al. The profile of patients with postpartum hemorrhage admitted to the obstetric intensive care: a cross-sectional study. Rev Bras Ginecol Obstet. 2024;46:e–rbgo47. doi: https://doi.org/10.61622/rbgo/2024rbgo47

23. Silveira MMP, Santos IR, Silva GC, Moraes MMS. Maternal mortality in a maternity hospital for

high-risk pregnancies in a cityin thestate of Bahia. Rev Eletr Acervo Saúde. 2024;24(7):e17016. doi: https://doi.org/10.25248/REAS.e17016.2024

24. Liu E, Dean CA, Elder KT. Editorial: the impact of COVID-19 on vulnerable populations. Front Public Health. 2023;11:1267723. doi: https://doi.org/10.3389/fpubh.2023.1267723

25. Chmielewska B, Barratt I, Townsend R, Kalafat E, van der Meulen J, Gurol-Urganci I, et al. Effects of the COVID-19 pandemic on maternal and perinatal outcomes: a systematic review and meta-analysis. Lancet Glob Health. 2021;9(6):e759-e772. doi: https://doi.org/10.1016/S2214-109X(21)00079-6

26. Ferreira DP, Bolognani CV, Santana LA, Soares-Fernandes SES, Moraes MSF, Fernandes LAS, et al. Impact of the COVID-19 pandemic on births, vaginal deliveries, cesarian sections, and maternal mortality in a Brazilian metropolitan area: a time-series cohort study. Int J Womens Health. 2023;15:1693-703. doi: https://doi.org/10.2147/IJWH.S429122

27. Melo JPG, Santos BNS, Amorim T, Araújo FG, Matozinhos FP, Felisbino-Mendes MS. Quality of antenatal care and parturition in Brazil: comparison between the 2013 and 2019 National Health Survey. Ciênc Saúde Coletiva. 2025;30(9):e13162024. doi:https://dx.doi.org/10.1590/1413-81232025309.13162024

28. Bittencourt SDA, Vilela MEA, Marques MCO, Santos AM, Silva CKRT, Domingues RMSM, et al. Labor and childbirth care in maternities participating in the "Rede Cegonha/Brazil": an evaluation of the degree of implementation of the activities. Ciênc Saúde Coletiva. 2021;26(3):801-21. doi: https://doi.org/10.1590/1413-81232021263.08102020

29. Carvalho PI, Vidal SA, Figueirôa B Q, Vanderlei LCM, Oliveira CM, Pereira CCB, et al. Maternal mortality committee and death surveillance in Recife in improving information: ex-ante and ex-post evaluation. Rev Bras Saúde Mater Infant. 2023;23:e20220254. doi: https://dx.doi.org/10.1590/1806-9304202300000254-en

30. Vallely LH, Shalit A, Nguyen R, Althabe F, Pingray V, Bonet M, et al. Intrapartum care measures and indicators for monitoring the implementation of WHO recommendations for a positive childbirth experience: a scoping review. BMJ Open. 2023;13(11):e069081. doi: https://dx.doi.org/10.1136/bmjopen-2022-069081