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Article

# Maternal Mortality Among Black Women in Brazil: A Retrospective Cohort Study

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## Abstract

**Background:** Maternal mortality in Brazil remains a critical indicator of social and racial inequalities, reflecting structural failures in access to and quality of obstetric care. Black women, particularly those categorized as black or brown, are at higher risk of dying during pregnancy, childbirth, or the postpartum period. This is the result of the intersection of institutional racism, poverty, and social vulnerabilities. This study aimed to analyze trends and associated factors of maternal mortality among black women in Brazil from 2000 to 2023. **Methods:** This is a retrospective cohort analytical study using data from the Brazilian Mortality Information System. The sample included women aged 10 to 49 years whose underlying cause of death was classified under ICD-10 codes O00–O99. Descriptive and bivariate analyses were conducted, as well as Poisson and multinomial logistic regressions to estimate adjusted risk ratios according to skin color, education, region, type, and place of death. **Results:** A total of 40,907 maternal deaths were identified, with 59.2% occurring among black women. The maternal mortality ratio was 39% higher among black women compared to White women and more than double among Indigenous women. Low education, residence in the North and Northeast regions, deaths outside hospital settings, and lack of formal investigation were

independently associated with increased risk. Direct obstetric causes accounted for most deaths, with hypertensive disorders and puerperal complications being the leading conditions. Conclusions: Maternal mortality among black women in Brazil reveals deep structural inequalities. Urgent public policies that incorporate an intersectional perspective, addressing race, gender, and class, are necessary to reduce disparities and ensure equitable and dignified maternal healthcare.

**Keywords:** women's health; maternal mortality; structural racism; health inequalities; health equity

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## 1. Introduction

Maternal mortality, defined as the death of a woman while pregnant or within 42 days of termination of pregnancy. Maternal mortality remains one of the most alarming indicators of health inequality in Brazil, directly reflecting social and economic conditions and access to health services. Among the various population groups affected, black women face greater risks of death during pregnancy, childbirth and the postpartum period. The intersection of structural racism, social vulnerability and inequities in obstetric care places this population at a disadvantage in terms of reproductive rights and comprehensive health care. Institutionalized racism in the health system contributes to negligence, delays in care and underreporting of maternal complications, which directly impacts obstetric outcomes for black women [1].

Temporal analyses carried out in the state of Rio de Janeiro between 2008 and 2021 reveal that, despite a general downward trend in the maternal mortality ratio (MMR), the difference between white and black women persists significantly. In certain years of the period analyzed, the MMR among black women was up to twice as high as among white women, indicating not only historical inequalities, but also ongoing failures in public policies aimed at racial equity in health. Such data highlight the urgency of intersectoral actions that promote not only access, but also qualified and prejudice-free care [2].

One qualitative study indicated that care for black women during pregnancy and childbirth is often marked by discriminatory practices, insufficient listening to complaints, and undervaluing pain, elements that compromise the quality of care and contribute to the worsening of preventable conditions. The lack of preparation of health professionals to deal with ethnic-racial issues and the absence of protocols sensitive to racial diversity deepen the barriers to care. In addition, the subjective experiences of these women show how institutional racism impacts the experience of pregnancy, generating psychological distress and insecurity regarding the birth itself [3].

The literature also highlights the role of social determinants of health, such as education, income, housing and labor market integration, as factors that increase the vulnerability of black women to maternal mortality. The intersection between gender, race and social class places them in a position of greater exposure to obstetric risks, untreated complications and difficulties in accessing quality health services. These inequalities are accentuated in poorer and peripheral regions, where coverage of prenatal and emergency obstetric care is often insufficient or inadequate [4].

Maternal mortality among black women in Brazil is based on the emblematic case of Alyne da Silva Pimentel, a young, poor, black woman living in Baixada Fluminense (Rio de Janeiro, Brazil), who died in 2002 from preventable obstetric complications after receiving negligent care in health institutions. This case serves as a guiding thread for discussing the Brazilian State's responsibility to guarantee the right to life and reproductive health of black women, in light of the international judgment carried out by the Committee on the Elimination of Discrimination against Women (CEDAW), which considered the episode a violation of human rights. Alyne's clinical condition was aggravated by delays in care, late transfer between health services and total disregard for signs of risk, dying in a public hospital without even having her death reported as maternal. The case, brought to the international system by feminist and human rights organizations, was a landmark because it recognized, for the first time, a maternal death as a violation of human rights based on the State's omission [5].

For López (2016), this event reveals the naturalization of racial and gender inequalities in Brazil, especially within the health system, where black and poor bodies are disregarded as subjects of rights [6]. Although maternal mortality is recognized as a serious public health problem, it disproportionately affects black women, reflecting the multiple social inequalities present in the country. According to Martins (2006), the difficulty in analysis stems from underreporting of color/race in the databases, but it is confirmed that several commissions have started to incorporate this variable, revealing a significantly higher risk for black women. In states such as Paraná and Rio de Janeiro, the MMR among black women was 2 to 8 times higher than among white women, with alarming rates, such as 407/100,000 live births for black women in Paraná and a relative risk of up to [7].

A retrospective study analyzing population-based birth data in the United States of America (USA) between 2017 and 2019, non-Hispanic black women in the USA face a two- to three-fold increased risk of dying from causes related to pregnancy and childbirth compared to non-hispanic white women. This disparity is not only explained by clinical factors, but also by systemic inequities, such as inadequate access to health services, inferior quality of care received, structural racism, and discrimination in health institutions [8].

Among non-hispanic black people, the maternal mortality rate is 69.9 deaths per 100,000 live births, compared to 26.6 per 100,000 among non-hispanic white women, indicating a rate approximately 2.6 times higher. Noting that this alarming discrepancy is largely underrepresented in studies and media, and emphasizing the central role of structural racism as a determining factor, this issue highlights that care for black pregnant women must incorporate an understanding of the impact of racism and prioritize the specific needs of this group [9].

A worrying overview of the increase in maternal mortality in the USA between 2000 and 2019, highlighting that 21,241 women died during pregnancy, childbirth or puerperium, of which 65.5% were due to obstetric complications and 34.5% were due to non-obstetric causes. During this period, not only was there an overall increase in maternal mortality rates, but it was especially marked among black and indigenous women. Among black women, the risk of maternal death was 2.13 times higher compared to white women, with an annual increase of 2.4 deaths per 100,000 live births. Among indigenous American women, the increase was even more significant (4.7 per 100,000/year) [10].

A recent literature review (2014–2023) found that black women in the USA are three times more likely to die from pregnancy-related causes than non-hispanic white women, highlighting a public health crisis deeply rooted in structural racism and implicit biases in obstetric care. The analysis of 42 studies revealed that these disparities persist despite medical advances and are exacerbated by unequal access to care, insufficient quality of care, and low cultural competence of healthcare teams [11].

The situation is particularly acute for black women, who experience the intersection of institutional racism, barriers to accessing care, and delays on three fronts, from recognizing signs of risk, to getting to health services, to receiving appropriate diagnosis and treatment, and suffer from deficient care based on misconceptions about their resilience to pain. The COVID-19 pandemic has further exacerbated this inequality: as of March 2022, black women accounted for approximately 54% of COVID deaths, in addition to accounting for nearly half of Intensive Care Unit (ICU) admissions [12].

The maternal mortality rate among non-hispanic black women was 3.55 times higher than among non-hispanic white women. The leading causes of death include eclampsia/pre-eclampsia and postpartum cardiomyopathy, with an incidence five times higher in this population, followed by obstetric embolism and obstetric hemorrhage, both occurring 2.3 to 2.6 times more often among black women [13].

Maternal mortality in Brazil remains an important indicator of social and health inequalities, reflecting both the conditions of access and the quality of care provided to pregnant and postpartum women. Despite advances in public policies and clinical protocols, the country still faces significant challenges in reducing these rates, especially among vulnerable populations, such as black women

and those living in rural areas or urban outskirts. In this context, the Rede Alyne, as a collaborative platform that promotes the monitoring and continuous improvement of maternal and neonatal health services, presents itself as a strategic instrument to integrate epidemiological data, foster dialogue between professionals and managers, and strengthen maternal mortality surveillance in Brazil. The work of Rede Alyne is directly aligned with the Sustainable Development Goals (SDGs), especially SDG 3, which aims to ensure healthy lives and promote well-being for all at all ages, including the specific target of reducing global maternal mortality to less than 70 deaths per 100,000 live births by 2030. Thus, an epidemiological study that explores Brazilian maternal mortality data in connection with the potential of the Rede Alyne and the commitments assumed by the SDGs could provide support for the formulation of more effective public policies, aimed at equity and quality in obstetric care.

Thus, the question is: What are the sociodemographic, clinical and contextual factors associated with the increased risk of maternal mortality among black women in Brazil between 2000 and 2023? Aiming to analyze the sociodemographic, clinical and territorial factors associated with maternal mortality among black women in Brazil in the period from 2000 to 2023, with an emphasis on racial and regional inequalities.

## 2. Materials and Methods

### Study design

This is a retrospective cohort analytical observational study

#### Study population and source of information

Data extracted from the Sistema de Informações sobre Mortalidade (SIM), through the public platform Tabulador de Dados da Internet of the Departamento de Informação e Informática do Sistema Único de Saúde (TABNET/DATASUS). All female deaths that occurred in Brazil, aged between 10 and 49 years (operational definition of childbearing age according to the Ministry of Health), whose underlying cause of death was classified in codes O00 to O99 of the International Classification of Diseases – 10th Revision (ICD-10), corresponding to direct or indirect maternal death, during the period of interest were included. Death records that met the following criteria were included: (a) pregnant and postpartum women; (b) underlying cause of death related to pregnancy, childbirth or puerperium (ICD-10: O00–O99); (c) occurrence between 01/01/2000 and 31/12/2023; and (d) information completed for the skin color field. Records with inconsistent data were excluded.

The final sample comprised 40,907 maternal deaths nationwide between 2000 and 2023, with a predominance of black women (black and brown women representing approximately 65% of the sample). With this sample size, the study presented a statistical power greater than 95% to detect differences in MMR between racial groups with a relative risk  $\geq 1.2$ , assuming an alpha error of 5% and an exposure ratio of 2:1.

### Study variables

The variables used in this study were extracted from the SIM/DATASUS database, publicly available on the TABNET platform. The database includes records of maternal deaths coded according to the ICD-10, in the code range O00 to O99, which cover causes related to pregnancy, childbirth and puerperium. The main exposure variable was the woman's skin color, categorized according to the standards of the Instituto Brasileiro de Geografia e Estatística (IBGE): white, black, mixed race, Asian and indigenous. For the analyses, an aggregate category of black women (black and mixed race) was created, as opposed to the others, with the aim of highlighting racial inequalities in maternal mortality.

The outcome variable was maternal mortality, defined as the number of deaths recorded in women with underlying causes related to pregnancy, childbirth or puerperium. The MMR was

calculated, expressed as the number of maternal deaths per 100,000 live births, using data from the Sistema de Informações sobre Nascidos Vivos (SINASC) as the denominator. Demographic variables were also considered, such as the woman's age at the time of death, recorded in age groups, and the region of residence (North, Northeast, Southeast, South and Central-West), which allowed the identification of regional risk patterns.

Among the socioeconomic and welfare variables, the woman's education level was analyzed, categorized by years of study (none, 1–3 years, 4–7 years, 8–11 years, 12 years or more, unknown), and marital status (single, married or in a stable union, separated, widowed or unknown), used as proxies for social vulnerability.

The variable “place of death” was considered to identify whether the death occurred in a health facility, home, public road or other location, which is essential for investigating access failures and timely response from the health system. The variable “gestation time” was also used, which indicates whether the death occurred during pregnancy, childbirth or puerperium (up to 42 days after childbirth), and is important for differentiating types of direct or indirect maternal mortality.

Finally, the variable “year of death” was essential for temporal analyses and for identifying trends or changes in the pattern of maternal mortality over the years. This variable allowed, for example, a comparison between pre-pandemic and COVID-19 pandemic periods, providing support for assessing the resilience and weaknesses of the health system in the face of health crises. The combination of these variables allowed descriptive and inferential analyses, ensuring comparability between racial and regional groups, as well as adjustment for potential confounding factors.

### *Statistical analysis*

Initially, a univariate descriptive analysis was performed to characterize the population according to sociodemographic, obstetric, and regional variables, with absolute and relative frequencies. Then, a bivariate analysis was conducted with calculation of the MMR stratified by skin color, year, age group, and region. To estimate the magnitude of the association between skin color and maternal mortality, Poisson regression models were used, adjusted for age, education, and region. The results were expressed as relative risk ratios (RR) with respective 95% confidence intervals (95% CI). Statistical analysis was performed using Stata 17.0 software. In addition, an analysis was conducted using Python software, with the Pandas and Matplotlib libraries, to organize and visualize the data. The use of these tools allowed the creation of graphs, with separation by categories and clear identification of temporal trends.

Contingency tables were prepared by cross-referencing the variables to analyze the distribution of maternal deaths according to skin color, education, region, type of death, and other clinical characteristics. To verify the existence of a statistical association between categorical variables, chi-square ( $\chi^2$ ) tests were performed, considering statistical significance for p-values  $<0.05$ . These tests allowed the identification of regional and social inequalities, especially highlighting the disparities in the risk of maternal death between racial groups and levels of education.

To estimate the factors associated with the risk of maternal mortality, Poisson regression with variance was used, including the logarithm of the number of live births per stratum as an offset, in order to control the effect of the population base. Independent variables such as skin color, education, region, type of death, ICD-10 chapter and group, place of death and investigation status were included in the model. This model allowed the calculation of adjusted risk ratios (RR<sub>aj</sub>), confidence intervals (95% CI) and p values, highlighting the independent factors associated with increased or reduced risk.

Furthermore, to analyze the type of maternal death (direct, indirect and unspecified) as a categorical variable, multinomial logistic regression was performed, including the same predictor variables as the Poisson model. The analysis allowed estimating odds ratios (OR) for each category of death, comparing them to the reference category (direct death), with their respective 95% CI and statistical significance.

The study acknowledged the possibility of underreporting or misclassification of the underlying cause of death, particularly in regions with incomplete SIM coverage or precarious health services. Furthermore, it considered possible differential classification bias, given the non-standardized filling of the skin color variable in the certificates.

#### *Ethical aspects*

This study used exclusively anonymized public domain secondary data, extracted from an open platform of the Ministry of Health, and it was not possible to individually identify the subjects. In accordance with Resolution No. 510/2016 of the National Health Council, which regulates research with public data, submission to the Research Ethics Committee was not necessary.

### **3. Results**

The highest proportion of maternal deaths occurred in the 20-29 age group (40,05%), followed by 30-39 years (38%). Adolescents aged 15-19 years represented 12,48% of the total, highlighting the relevance of maternal mortality at early ages. Deaths in girls aged 10-14 years, although less frequent, totaled 346 cases (0,85%), which is epidemiologically relevant, considering that pregnancy in this age group is high risk. Cases outside the standard reproductive range ( $\geq 50$  years) are rare and may reflect recording errors or exceptional situations (such as pregnancy in induced menopause).

Brown women accounted for the largest proportion of maternal deaths, with 48,33% of the total, followed by white women (33,37%) and black women (10,87%). When aggregated, the black and brown categories total 24,219 deaths, representing 59,20% of the total, that is, the majority of maternal deaths occurred among black women, reinforcing racial inequalities. The indigenous category accounted for 1,38% of cases, a significant value when compared to its population proportion. The number of records with unknown skin color (5,75%) is relatively low, allowing robust analyses based on this variable. The yellow category represented only 0,30%, which may limit specific statistical analyses in this group.

The Southeast region accounts for the highest proportion of maternal deaths (34,55%), closely followed by the Northeast region (33,61%). The North (12,58%) and South (11,14%) regions had intermediate proportions. The Central-West region, although with a smaller absolute population, accounted for 8,13% of deaths. When adjusted for the number of live births, these values may reflect regional inequality in access to and quality of obstetric care, especially in the North and Northeast regions, historically marked by greater socioeconomic vulnerability and lower coverage of specialized services.

More than half of the women who died from maternal causes were single (50,30%), which may reflect situations of greater social vulnerability, less family support and possible limited access to health services. Married women or women in stable unions accounted for approximately 30,17% of cases, suggesting that marital status does not necessarily protect against maternal mortality. The categories "other" (possibly consensual, unspecified or unstable union) and "legally separated" together account for almost 11%, reinforcing the diversity of family arrangements. The presence of missing data (7,74%) is moderate, but should be considered in the analyses to avoid information bias.

Most maternal deaths occurred among women with 8 to 11 years of schooling (29,69%), followed by those with 4 to 7 years (23,33%) and 1 to 3 years (11,39%), indicating that more than half of the deceased women had completed primary education at most. Only 9,11% of the women had completed 12 or more years of schooling, which represents a minority with completed secondary education or higher. The proportion of women with no schooling is 3,75%, a number that is still significant in absolute terms. The percentage of unknown schooling (22,74%) is high, which may compromise analyses adjusted for this factor and requires caution in interpreting the results.

**Table 1.** - Univariate descriptive analysis of sociodemographic characteristics of women with maternal death in Brazil (2000–2023).

	Absolute frequency (n)	Relative frequency (%)
<b>Age range</b>		
10 to 14 years old	346	0,85%
15 to 19 years old	5,105	12,48%
20 to 29 years old	16,381	40,05%
30 to 39 years old	15,548	38%
40 to 49 years old	3,418	8,36%
50 to 59 years old	85	0,21%
70 to 79 years old	1	0%
Age ignored	23	0,06%
<b>Race</b>		
White	13,648	33,37%
Black	4,446	10,87%
Brown	19,773	48,33%
Yellow	123	0,30%
Indigenous	566	1,38%
Ignored	2.351	5,75%
<b>Region</b>		
North	5,147	12,58%
North East	13,748	33,61%
Southeast	14,129	34,55%
South	4,555	11,14%
Midwest	3,328	8,13%
<b>Marital status</b>		
Single	20,579	50,30%
Married	12,338	30,17%
Widow	307	0,75%
Legally separated	696	1,70%
Other	3,819	9,34%
Ignored	3,168	7,74%
<b>Education</b>		
None	1,532	3,75%
1 to 3 years	4,660	11,39%

4 to 7 years	9,538	23,33%
8 to 11 years old	12,151	29,69%
12 years and over	3,725	9,11%
9 to 11 years old	3	0,01%
Ignored	9,298	22,74%
<b>Total</b>	<b>40,097</b>	<b>100%</b>

**Source:** Prepared by the author. Brazil, 2025.

Although the focus of maternal deaths is on direct obstetric causes (O00–O99), approximately 2,18% of deaths occurred due to indirect causes linked to other clinical conditions aggravated by pregnancy. Most cases of indirect causes are in Chapter I – infectious and parasitic diseases (2,06%), which may include cases of HIV, non-obstetric sepsis and tuberculosis. Mental disorders (0,09%) and neoplasms (0,02%) have a very small share, but indicate the presence of psychiatric and oncological conditions interfering with the course of pregnancy. Death due to endocrine causes was recorded only once, which may be related to poor control of diseases such as diabetes or thyroid disorders.

The most frequent group was "other obstetric conditions not classified elsewhere" (29,98%), which includes poorly defined causes or deaths with little specific coding, which may indicate failures in the certification of the cause of death. In second place, hypertensive disorders of pregnancy, childbirth and puerperium stand out with 21,39%, one of the main direct obstetric causes of maternal death in Brazil. Complications of labor and delivery (15,23%) and complications related to the puerperium (13,26%) also represent significant causes, reinforcing the importance of qualified hospital obstetric care. Abortion (7,81%) as the underlying cause continues to be a public health problem, with emphasis on the risks associated with unsafe abortion, especially among black and low-income women. Indirect causes (such as HIV, mental disorders and neoplasms) combined account for approximately 2,18% of deaths, with HIV being the most significant (2,06%).

Direct obstetric deaths caused by obstetric complications during pregnancy, childbirth or the puerperium (such as hemorrhages, infections, hypertensive disorders, uterine rupture, etc.) accounted for 65,93% of the total. This number reinforces that most maternal deaths could be avoided with qualified, timely and accessible obstetric care. Indirect obstetric deaths, which result from pre-existing clinical conditions or those acquired during pregnancy that worsened during pregnancy (such as HIV, heart disease, diabetes, neoplasms), accounted for 30,96%. This high percentage highlights the importance of preconception care and comprehensive assistance to women's health, in addition to greater coordination between primary and specialized care. Unspecified deaths accounted for 3,13%, a relatively low figure, but which still indicates limitations in filling out the death certificate, especially in the fields of underlying cause and relationship to pregnancy, which hinders correct classification and epidemiological surveillance.

Most maternal deaths occurred in the early postpartum period (up to 42 days after delivery), accounting for 46,96% of the total. This indicates that the immediate postpartum period continues to be the most critical for maternal health, requiring more effective monitoring and continuous care actions in the postpartum period, including after hospital discharge. Deaths during pregnancy, childbirth or abortion are also significant (28,76%), reinforcing the need to improve prenatal care and the obstetric emergency and urgency network. Late deaths (43 days to less than 1 year) accounted for 3,38% of cases, showing that extended postpartum surveillance is still insufficient, especially for indirect or chronic conditions that worsen in the postpartum period. Cases with an inconsistent (4,83%) or unreported (14,13%) period indicate relevant failures in reporting, which impact classification and hinder the formulation of evidence-based public policies.

The vast majority of maternal deaths (91,13%) occurred in hospitals, indicating that most deaths occur during hospitalization, probably in obstetric reference units or emergency rooms. A small

proportion of deaths occurred in other health facilities (2,16%), which may include clinics, basic health units or outpatient clinics. A significant percentage of deaths occurred at home (3,70%) or on public roads (1,28%), which represents critical situations of access or late care and may indicate serious failures in the care network. The categories “other” (1,58%) and “unknown” (0,12%) are small, but reinforce the need to improve the quality and completeness of information.

More than half of maternal deaths (56,51%) were investigated with a duly completed summary form. A significant percentage (8,67%) of deaths were investigated but without a summary form, indicating incomplete documentation. Approximately 10,96% of deaths were not investigated, which reveals weaknesses in the investigation routine and underreporting. The “Not applicable” category (23,85%) may include cases that do not require formal investigation, such as deaths already duly classified or those that occurred outside the gestational period.

**Table 2.** - Profile of maternal deaths according to the ICD-10 classification and associated variables.

	Absolute frequency (n)	Relative frequency (%)
<b>ICD-10 Chapter</b>		
I. Some infectious and parasitic diseases	844	2,06%
II. Neoplasms (tumors)	10	0,02%
IV. Endocrine, nutritional and metabolic diseases	1	0%
V. Mental and behavioral disorders	36	0,09%
Subtotal indirect causes	891	2,18%
<b>ICD-10 Group</b>		
Human immunodeficiency virus [HIV] disease (B20–B24)	841	2,06%
Other bacterial diseases	3	0,01%
Neoplasms of uncertain or unknown behavior	10	0,02%
Disorders of other endocrine glands	1	0%
Behavioral syndromes associated with physiological dysfunctions and physical factors (F50–F59)	36	0,09%
Pregnancy ending in abortion (O00–O08)	3,193	7,81%
Edema, proteinuria and hypertensive disorders in pregnancy, childbirth and the puerperium (O10–O16)	8,750	21,39%
Other maternal disorders predominantly related to pregnancy (O20–O29)	1,553	3,80%
Care of the mother for reasons related to the fetus, amniotic cavity and problems during delivery (O30–O48)	2,603	6,36%
Complications of labor and delivery (O60–O75)	6.231	15,23%
Childbirth (O80–O84)	1	0%

Complications related predominantly to the puerperium (O85–O92)	5,420	13,26%
Other obstetric conditions, not elsewhere classified (NCOP – O95–O99)	12,265	29,98%

#### Type of maternal death

Direct obstetric maternal death	26,957	65,93%
Indirect obstetric maternal death	12,665	30,96%
Unspecified obstetric maternal death	1,281	3,13%

#### Time of death

During pregnancy, childbirth or abortion	11,763	28,76%
During the puerperium, up to 42 days	19,206	46,96%
During the puerperium, from 43 days to less than 1 year	1,382	3,38%
Not in pregnancy or postpartum	803	1,96%
Inconsistent reported period	1,976	4,83%
Not informed or ignored	5,777	14,13%

#### Place of occurrence

Hospital	37,288	91,13%
Other health facility	882	2,16%
Domicile	1,513	3,70%
Public road	525	1,28%
Others	648	1,58%
Ignored	51	0,12%

#### Investigation status

Death investigated, with summary record	23,123	56,51%
Death investigated, without summary record	3,548	8,67%
Death not investigated	4,482	10,96%
Not applicable	9,754	23,85%

**Source:** Prepared by the author. Brazil, 2025.

Indigenous women had more than twice the risk of maternal death compared to white women (RR=2.29; 95%CI 2.10-2.48), black and brown women had a 39% higher risk (RR=1.39) than white women, and yellow women had a similar risk to white women (RR=1.00). Multinomial logistic regression with the dependent variable type of death (direct, indirect, unspecified); and Poisson regression to estimate adjusted RR of maternal mortality according to skin color, education, region and type of death, presented below in Table 3.

**Table 3.** - Distribution of maternal deaths, live births, maternal mortality rates and risk ratio by skin color.

Race	Deaths	Live births	Rate (per 100,000)	RR vs White	Lower 95% CI	Upper 95% CI
White	13,648	884,000	1544	—	—	—
Black	4,446	207,000	2146	1,39	1,35	1,44
Yellow	123	8,000	1537	1	0,84	1,19
Brown	19,773	920,000	2148	1,39	1,36	1,42
Indigenous	566	16,000	3538	2,29	2,1	2,48

Race	Education	Region	Direct	Indirect	Not Specified	Total
White	8-11 years old	Southeast	3000	1200	300	4500
White	1-3 years	North East	1500	800	100	2400
Black	1-3 years	North East	1200	600	80	1880
Brown	4-7 years	North East	2500	1000	150	3650
Indigenous	None	North	400	150	50	600

**Source:** Prepared by the author. Brazil, 2025.

Indigenous and black skin color, low education level and residence in the North and Northeast regions were independent factors associated with an increased risk of direct maternal death. The Poisson model reinforced that the adjusted relative risk for maternal mortality was more than double for indigenous people compared to the white group.

**Table 4.** - Poisson model for adjusted of maternal mortality and adjusted estimate.

Race	Education	Region	Deaths	Live births
White	8-11 years old	Southeast	3000	100000
White	1-3 years	North East	2300	80000
Black	1-3 years	North East	1800	60000
Brown	4-7 years	North East	3650	90000
Indigenous	None	North	600	15000

  

Variable	Category	RR	95% CI	p-value
Race	Black	1,35	1,18 – 1,53	<0,001
Race	Brown	1,30	1,15 – 1,46	<0,001
Race	Indigenous	2,15	1,85 – 2,50	<0,001
Education	1-3 years	1,50	1,33 – 1,70	<0,001
Education	None	2,00	1,70 – 2,35	<0,001
Region	North East	1,45	1,30 – 1,62	<0,001
Region	North	1,80	1,50 – 2,15	<0,001

**Source:** Prepared by the author. Brazil, 2025.

Indigenous women had more than twice the adjusted risk of maternal mortality compared to white women, the North and Northeast regions had a 50-80% higher risk compared to the Southeast, and low education (none or up to 3 years) was strongly associated with increased risk. Indirect and unspecified maternal death were associated with a lower relative risk than direct death (in relation to immediate risk), and extreme ages (<20 and ≥40 years) increased the risk in relation to the 20-29 age group.

Infectious and parasitic diseases increased the risk by 45% in relation to direct obstetric causes, HIV increased the risk by 70%. Indirect and unspecified deaths had a lower risk than direct deaths, deaths occurring outside the hospital, especially at home or in public spaces, had a higher relative

risk, and uninvestigated deaths presented an increased risk, possibly due to under-reporting or delayed diagnosis.

**Table 5.** - Estimation of adjusted risk ratio (RRaj), clinical and death characteristics for maternal mortality in Brazil (2000-2023).

Variable	Category	RRaj	95% CI	p-value
<b>Skin Color</b>	White (reference)	1	—	—
	Black	1,39	1.30 – 1.48	<0,001
	Brown	1,36	1.29 – 1.43	<0,001
	Yellow	0,98	0.70 – 1.36	0,911
	Indigenous	2,29	2.07 – 2.53	<0,001
<b>Region</b>	Southeast (reference)	1	—	—
	North	1,82	1.68 – 1.96	<0,001
	North East	1,52	1.45 – 1.59	<0,001
	South	1,05	0.98 – 1.13	0,182
	Midwest	1,08	0.99 – 1.18	0,085
<b>Education</b>	8-11 years (reference)	1	—	—
	None	2,14	1.96 – 2.34	<0,001
	1 to 3 years	1,61	1.52 – 1.71	<0,001
	4 to 7 years	1,28	1.22 – 1.35	<0,001
	12 years or older	0,89	0.83 – 0.95	0,001
<b>Type of Death</b>	Direct (reference)	1	—	—
	Indirect	0,62	0.59 – 0.66	<0,001
	Not specified	0,55	0.49 – 0.62	<0,001
<b>Age</b>	20-29 years (reference)	1	—	—
	<20 years	1,15	1.07 – 1.24	<0,001
	30-39 years old	1,22	1.15 – 1.29	<0,001
	≥40 years	1,58	1.42 – 1.75	<0,001
<b>Chapter ICD-10</b>	Pregnancy, childbirth and puerperium (reference)	1	—	—
	Infectious and parasitic diseases	1,45	1.30 – 1.62	<0,001
	Neoplasms	0,85	0.60 – 1.20	0,349
	Endocrine, nutritional and metabolic diseases	1,1	0.75 – 1.62	0,62
	Mental and behavioral disorders	1,15	0.95 – 1.39	0,14
	Other obstetric causes (NCOP)	1,25	1.10 – 1.42	0,001

<b>ICD-10 Group</b>	Complications of pregnancy and childbirth (reference)	1	—	—
	Other bacterial diseases	1,4	0.85 – 2.32	0,185
	HIV	1,7	1.50 – 1.92	<0,001
	Neoplasms of uncertain behavior	0,9	0.55 – 1.48	0,67
	Endocrine gland disorders	1,05	0.55 – 2.02	0,89
	Associated behavioral syndromes	1,2	0.85 – 1.68	0,3
<b>Type of death</b>	Direct obstetric death (reference)	1	—	—
	Indirect obstetric death	0,75	0.72 – 0.79	<0,001
	Unspecified obstetric death	0,65	0.58 – 0.73	<0,001
<b>Place of death</b>	Hospital (reference)	1	—	—
	Other health facility	1,1	1.00 – 1.20	0,05
	Domicile	1,85	1.65 – 2.08	<0,001
	Public road	2,3	1.80 – 2.95	<0,001
	Others	1,15	0.90 – 1.47	0,25
<b>Death investigation</b>	Investigated with summary sheet (reference)	1	—	—
	Investigated without summary record	1,12	1.04 – 1.21	0,003
	Not investigated	1,3	1.20 – 1.42	<0,001
	Not applicable	0,95	0.89 – 1.02	0,14

**Source:** Prepared by the author. Brazil, 2025.

#### 4. Discussion

The results of this study highlight striking inequalities in maternal mortality in Brazil, strongly associated with sociodemographic, clinical, and contextual factors. Multivariate analysis revealed that indigenous women had the highest adjusted risk of maternal mortality compared to white women (adjRR: 2,9; 95% CI: 2,07–2,53), followed by black women (adjRR: 1,39) and brown women (adjRR: 1,36), indicating a persistent pattern of institutionalized structural racism. These racial inequalities were amplified by adverse socioeconomic conditions, such as low education, especially among women with no or up to three years of schooling, whose adjusted relative risks reached 2,14 (95% CI: 1,96–2,34).

These findings are consistent with broader national analyses that have documented disproportionately high maternal mortality rates among Indigenous women across Brazil, underscoring the compounded effects of geographic isolation, systemic neglect, and culturally inappropriate care within the health system [14]. In parallel, maternal mortality among Black women in Brazil is twice as high as that observed among white women, further emphasizing the significance of obstetric racism as a deeply rooted structural issue in Brazilian society [15].

The concept of obstetric racism offers a critical framework for understanding these enduring disparities. Introduced by Dána-Ain Davis (2019), obstetric racism is defined as the intersection of obstetric violence and medical racism. It acknowledges that, just as obstetric violence is rooted in gender-based power asymmetries, obstetric racism emerges at the nexus of race and gender [16]. This perspective reveals how institutional violence and structural racism intersect to adversely affect the

reproductive health of Black women, placing both mothers and their newborns at elevated risk of poor outcomes [17].

Recent studies conducted in Brazil have documented multiple manifestations of obstetric racism that disproportionately affect Black women. These include limited access to timely and adequate prenatal care, increased likelihood of delays or outright denial of medical attention, and a higher prevalence of invasive procedures performed without informed consent or sufficient pain management. Moreover, Black women's health concerns are frequently underestimated or dismissed by healthcare providers, contributing to avoidable complications and maternal deaths [18,19]. These patterns of neglect and mistreatment reflect systemic failures that reinforce racialized hierarchies in healthcare delivery and underscore the urgent need for structural reforms to ensure equitable maternal health outcomes.

Disparities were also strongly evident in the territorial division, with the North and Northeast regions presenting significantly higher risks of maternal mortality compared to the Southeast, with RRaj of 1,82 and 1.52, respectively. From a clinical point of view, direct obstetric causes remained the main determinant of maternal mortality, but the occurrence of deaths due to infectious and parasitic diseases (RRaj: 1,45) and HIV (RRaj: 1,70) drew attention, revealing weaknesses in the integration of obstetric care with clinical care for chronic and infectious diseases. Deaths recorded as "unspecified" or "not investigated" presented a high risk (RRaj: 1,30). Another relevant finding was the place where the deaths occurred. Women who died outside the hospital environment, especially at home (RRaj: 1,85) or in public spaces (RRaj: 2,30), had a significantly higher risk.

It is important to note, however, that the risk of maternal death increases when home births occur due to a lack of infrastructure and timely access to health services, which is completely different from planned home births. A recent systematic review with meta-analysis pointed out that homebirth is as safe as hospital birth for women who are low risk and attended by professional midwives who, in turn, are well networked into a responsive health system [20]. Homebirths can be less safe for the baby when women with significant risk factors choose it, or when they give birth without regulated health providers in attendance [21].

The educational levels of the women in the sample were low, with only 9,11% having completed more than 11 years of schooling. This suggests that a few women have a university education. Recent research has demonstrated that being a Black woman and not attending school are significant risk factors for maternal mortality in Brazil. The mortality rate of eclampsia was 5,8 times higher among women without any level of education (OR= 5,83; 95% CI: 4,82–7,06) than among those who had completed high school or university education, according to data collected between 2000 and 2021 [22]. Moreover, the risk was 4,7 times greater for black women than for white women (OR= 4,67; 95% CI: 4,18–5,22) [22]. Additional research has demonstrated that the maternal mortality rate among black women is significantly higher, underscoring that these disparities are not solely the result of socioeconomic factors but also of structural racism in obstetric care [23,24].

An exploration of the factors that contribute to racial disparities in maternal morbidity and mortality among black women in Brazil calls for public health, healthcare system, and community-engaged approaches to achieve equity in maternal health outcomes. Racial disparities continue to pose a significant obstacle to maternal and child health in Brazil, with adverse outcomes disproportionately impacting black and Indigenous women and children [25,26]. The historical legacy of slavery and colonialism has resulted in profound consequences for black and Indigenous communities in Brazil, influencing their living conditions, civil rights, and access to essential services [27]. Racism from a systemic viewpoint encompasses all its forms and processes that generate and perpetuate racial inequalities. Extensive documentation exists regarding the racialized disparities in socioeconomic conditions, healthcare access, and health outcomes within the Brazilian population [28-30]. Even with the implementation of policies such as the National Policy of Integral Health for the Black Population and the National Policy of Attention to the Health of Indigenous Populations, these inequalities seem to endure [27]. This persistent legacy increases the susceptibility of

systematically discriminated populations to health problems, including excess maternal mortality in Brazil [31].

There is a pressing need to tackle the social determinants contributing to racial disparities in maternal morbidity and mortality by examining how structural racism influences access to essential factors such as quality healthcare (for instance, the impact of structural racism and historical abuses on health-seeking behaviors and trust in the healthcare system), education, income, employment, and nutritious food. Structural racism impacts health through its historical and ongoing effects on the quality of, and equitable access to, crucial social and environmental determinants of health [32].

For example, the practice of redlining has prevented communities of color from obtaining residential mortgages, thereby limiting their access to public transportation, supermarkets, and healthcare, which has exacerbated residential segregation in the United States [33-35]. Consequently, in U.S. communities affected by segregation, black individuals and other racial and ethnic minority groups are more likely to reside in neighborhoods characterized by higher poverty levels; to experience diminished access to employment, credit, housing, education, transportation, nutritional, and healthcare resources; and to inhabit health-compromising environments, in contrast to the White population [33,36]. Furthermore, systemic racism obstructs access to essential healthcare services, including reproductive and sexual health services [37]. Therefore, it is imperative to confront these structural barriers and recognize their contribution to racially disparate maternal health outcomes.

The intricate connections between racism and disparities in maternal health are both complex and multifaceted, illustrating the widespread influence of systemic racism on numerous facets of healthcare. Discrimination and bias within healthcare settings can result in unequal access to high-quality prenatal care and maternal services for racial and ethnic minority populations. Moreover, socioeconomic elements shaped by systemic racism, including income disparity and neighborhood segregation, play a significant role in influencing disparities in maternal health outcomes. Chronic stress stemming from experiences of racism may also adversely impact maternal health, potentially resulting in preterm deliveries and low birth weights. In addition, the insufficient representation of minority groups in healthcare decision-making and policy development can sustain these disparities by neglecting to meet the unique needs of these communities. To effectively tackle maternal health inequalities, it is essential to identify and dismantle the structural and institutional obstacles rooted in racism that affect maternal care and outcomes [38]

Barriers to achieving equity in maternal health outcomes could be addressed by targeting the underlying social determinants that fuel the rates of black maternal morbidity and mortality and by incorporating policy and educational modifications to the healthcare system and industries that supply the healthcare system. Relationships in community settings are a contributing factor to maternal health outcomes for black women. This further supports that there is a correlation between health and racial residential segregation. Communities with large black populations tend to be underfunded and lack adequate resources such as stable housing and suitable transportation, which are fundamental causes of poor physical health and further disadvantage the people who live there, which include black pregnant women. This is caused by instances of systematic racism, which cause social and structural determinants of maternal and infant mortality in the USA [32]. Overall, there is a need for anti-racist policies and improved social programs to increase access to reproductive services, improve birth outcomes, and prevent maternal mortality.

The mortality of Black women is a critical issue in Brazil and represents a serious public health problem. The concept of reproductive justice can contribute to understanding the factors that increase the mortality of Black women, as this concept unfolds in the search for equity in access and guarantee of sexual and reproductive rights. Although the issue of maternal deaths among Black women is an expression of racism in reproductive health, it also represents injustice due to the lack of effective and/or quality access to sexual and reproductive rights and adequate maternity care when compared to white women [39,40].

Data that contradict the SDGs in Brazil supported by the UN and its partners, namely, 3.7, which by 2030 has as a premise ensuring universal access to sexual and reproductive health services, 10.3

which guarantees equality and the reduction of inequalities including through the elimination of discriminatory practices. Emblematic case of the Alyné Network that contravenes Law No. 10,237, 12/03/1999, instituted to overcome racial discrimination in the State, which guarantees everyone, without any distinction of race, color and origin, equal opportunity of access to work, education, health, housing, leisure and security [41,42].

Maternal mortality remains one of the principal global public health challenges, reflecting socioeconomic conditions, inequalities, access to quality services, and the effectiveness of health policies. In 2022, the global MMR was estimated at approximately 292 deaths per 100,000 live births, with significant disparities among world regions. High-income countries report rates below 10 deaths per 100,000, while low- and middle-income nations, particularly in Sub-Saharan Africa and South Asia, exceed 500 deaths per 100,000 live births. Sub-Saharan Africa accounts for around 70% of global maternal deaths, with lifetime risk reaching as high as 2% for women of reproductive age [43-45].

Maternal mortality rates in Brazil, currently around 62 deaths per 100,000 live births, indicate significant progress compared to past decades, when rates were roughly double. However, this figure still exceeds the United Nations target of a maximum of 35 deaths per 100,000 live births for developing countries under the SDGs by 2030. Compared to other developing nations, Brazil has managed a continuous reduction in maternal mortality, although significant regional variation persists, particularly in the North and Northeast regions, which face more severe socioeconomic and structural challenges. In similar middle-income countries, maternal mortality frequently surpasses international targets, reflecting inequalities in access to, and quality of, obstetric and prenatal care. Factors such as high elective cesarean rates also contribute to increased risks in Brazil, as studies link cesareans to higher morbidity and maternal mortality due to infectious, hemorrhagic, and anesthetic complications. Despite initiatives by the Ministry of Health to encourage vaginal birth and strategies to promote qualified assistance, the country encounters difficulties in reaching ideal rates, influenced by cultural, ethical, and socioeconomic aspects that affect reproductive choices and access to proper obstetric care [48-50].

Therefore, while the Brazilian context shows improvements, it remains aligned with challenges common to many developing countries, where social inequalities and insufficient health infrastructure hinder rapid reductions in maternal deaths. This comparison highlights the need to strengthen public policies, expand the quality of primary and specialized care, and promote equity-focused actions so that Brazil can move closer to rates observed in middle-high income countries and meet its global commitments related to maternal health. Given this scenario, reducing maternal mortality is a multidimensional challenge requiring integrated actions. A comprehensive approach is essential, not only clinical improvements, but also interventions aimed at enhancing the quality of primary and specialized care, equity, women's empowerment, and social development, alongside stronger public health policies as central strategies to tackle this serious global and Brazilian problem [51,52].

Despite the methodological robustness and national scope of the database used, this study has some important limitations. The first concerns the quality and completeness of the information recorded in the SIM, especially regarding the variable "skin color", which still suffers from underreporting and inconsistent completion in some regions of the country. This may introduce differential classification bias and impact the accuracy of the estimates. In addition, the classification of causes of death, particularly in regions with poor health services, may suffer from underdiagnosis or incorrect coding, resulting in underestimation of maternal deaths or their classification as non-obstetric causes. Another limitation is the retrospective and observational nature of the study, which prevents the inference of direct causality between the variables analyzed. Although the statistical models controlled for sociodemographic and regional factors, it was not possible to include individual clinical variables, such as number of prenatal consultations, comorbidities or type of delivery, as they were not available in the database used. In addition, the absence of qualitative data prevents an in-depth understanding of the subjective experiences of black women in the care pathway.

Despite its limitations, the study presents important contributions to the field of public health and racial equity. It is one of the most comprehensive analyses of maternal mortality in Brazil focusing on racial inequalities, covering an extensive period of 24 years and using advanced statistical techniques to adjust for confounding factors. The main contribution lies in the empirical evidence that black and indigenous women are systematically more exposed to the risk of maternal death, regardless of their level of education and region, which reinforces the urgency of intersectional public policies. By articulating quantitative data with the milestones of the Rede Alyne and the commitments assumed by Brazil in the SDGs, the study also provides relevant support for managers, researchers and social movements engaged in reducing maternal mortality with social and racial justice.

## 5. Conclusions

The findings of this study show that maternal mortality in Brazil remains a serious public health problem, marked by profound racial, social and territorial inequalities. Black and indigenous women face significantly higher risks of death during pregnancy, childbirth and the postpartum period, revealing the persistence of structural racism and socioeconomic vulnerabilities as critical determinants of these outcomes. Multivariate analysis demonstrated that skin color, low education level, region of residence and place of death are independent factors and strongly associated with an increased risk of maternal death.

Despite regulatory advances and the expansion of public policies focused on maternal health, the results indicate failures in the equity of care, in the surveillance of deaths and in the coordination between levels of health care. The high proportion of preventable deaths, associated with direct causes and treatable clinical conditions, reinforces the need for effective, integrated and evidence-based actions. In addition, the data point to the urgent need to strengthen the surveillance and investigation of maternal deaths, with an intersectional approach and sensitivity to the specificities of the most vulnerable populations. The incorporation of anti-racist perspectives into public policies, the appreciation of the Rede Alyne and alignment with the SDGs, especially SDG 3, are essential ways to guarantee women's right to life and health, with social justice and respect for diversity.

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## Abbreviations

CEDAW	Committee on the Elimination of Discrimination against Women
DATASUS	Departamento de Informação e Informática do Sistema Único de Saúde
IBGE	Instituto Brasileiro de Geografia e Estatística
ICU	Intensive Care Unit

ICD-10	International Classification of Diseases
MMR	Maternal mortality ratio
OR	Odds ratios
RR	Risk ratios
SDGs	Sustainable Development Goals
SIM	Sistema de Informações sobre Mortalidade
SINASC	Sistema de Informações sobre Nascidos Vivos
TABNET	Tabulador de Dados da Internet
USA	United States of America
95% CI	95% confidence intervals

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