IOSR Journal Of Humanities And Social Science (IOSR-JHSS)
Volume 30, Issue 3, Series 5 (March, 2025) 11-18
e-ISSN: 2279-0837, p-ISSN: 2279-0845.
www.iosrjournals.org

Spatiotemporal Distribution Of Maternal Mortality Among Adolescents In Brazil: Regional Patterns And Causes Of Death

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Abstract:
This study aimed to analyze the spatial and temporal distribution of maternal mortality among adolescents across Brazilian regions and causes of death from 2010 to 2021. A temporal trend study was conducted on the maternal mortality ratio among adolescents (10-19 years old) in Brazil using data from the Mortality Information System (SIM). Trends were estimated using Joinpoint Regression, and choropleth maps were generated via Python software. A comparative analysis of maternal mortality before and during the COVID-19 pandemic was performed using a mean comparison test. During the study period, Brazil recorded 2,679 maternal deaths among adolescents. The maternal mortality ratio showed an increasing trend in the North and Southeast regions, with annual percentage variations of 2.10% (95% CI: 0.24; 3.90) and 2.57% (95% CI: 0.82; 4.36), respectively. Higher maternal mortality ratios were observed among Black and Indigenous women, those without a partner, individuals with inadequate education levels for their age, and deaths occurring during the puerperium. Regarding direct causes of death, groups 2 (hypertension) and 4 (infection) were most prevalent, as classified by the ICD-10 – Maternal Mortality/WHO. A significant difference was identified in the maternal mortality ratio between the pre-pandemic (2018-2019) and pandemic (2020-2021) periods, particularly in the Northeast and Southeast regions, as well as across racial/ethnic groups, marital status, education level, timing of death, and both direct and indirect causes of maternal mortality. Overall, maternal mortality in Brazil exhibited a stable trend from 2010 to 2021 but saw a marked increase during the COVID-19 pandemic across all regions, with values surpassing the targets set by the Sustainable Development Goals (SDGs).

Keywords: *Maternal mortality; Adolescents; Maternal and child health; COVID-19; Time series studies.*

Date of Submission: 07-03-2025 Date of Acceptance: 17-03-2025

I. Introduction

Maternal mortality is a critical health indicator that poses a major challenge to public health and has been the focus of international efforts to reduce its incidence, given the high prevalence of preventable causes of death[1] [2].

In Brazil, although the Maternal Mortality Ratio (MMR) showed a significant decline between 1990 and 2019—from 111.4 deaths per 100,000 live births to 62.1 maternal deaths[3]—the rates remain unacceptably high. They are ten times greater than those reported in developed countries[1] [3]. A nationwide study conducted between 2019 and 2021 observed a significant increase in the absolute number of maternal deaths and 2
MMR across all regions, highlighting the impact of the COVID-19 pandemic on maternal health indicators3.

The persistently high MMR levels in Brazil can be attributed to multiple factors, including poor prenatal and obstetric care, delays in accessing healthcare services, excessive medicalization, illegal abortion, and a high rate of medically unnecessary cesarean sections, particularly among women of higher socioeconomic status[2]. Notably, during the COVID-19 pandemic (2020-2021), negative pregnancy and obstetric outcomes were reported across all age groups due to limited healthcare access, delays in symptom identification, hospitalization, and early medical interventions for infected pregnant women and postpartum mothers5 6.

Among adolescents, complications related to pregnancy and childbirth are among the leading causes of death in the 15- to 19-year-old age group. Those who become pregnant before turning 16 are three to four times more likely to experience adverse gestational and obstetric outcomes than adult women7 .

International agreements, such as the Millennium Development Goals (MDGs) and, more recently, the United Nations' Sustainable Development Goals (SDGs), have guided national initiatives aimed at improving maternal health conditions. These initiatives focus on enhancing childbirth care and prenatal attention, with the goal of reducing maternal mortality to fewer than 30 deaths per 100,000 live births by 20307 8.

Despite adolescents accounting for a substantial proportion of childbirth statistics in Brazil, significant knowledge gaps persist regarding pregnancy-related complications in this age group. Key concerns include maternal morbidities (such as preeclampsia) and an increased risk of preterm birth and maternal or fetal death9. Since these adverse outcomes are more prevalent in low-income populations, further studies are necessary to deepen our understanding of the issue.

In this context, the present study aims to analyze the spatial and temporal distribution of maternal mortality and causes of death among adolescents across Brazilian regions from 2010 to 2021.

II. Methods

This study is an ecological time series analysis based on data from the Mortality Information System (SIM), available from the Department of Informatics of the Brazilian Unified Health System (DATASUS/Ministry of Health). The unit of analysis was the five 3 macro-regions of Brazil (North, Northeast, Southeast, South, and Center-West), where maternal deaths among adolescents were recorded from 2010 to 2021.

Maternal deaths were classified according to Chapter XV of the International Statistical Classification of Diseases and Related Health Problems (ICD-10) – Pregnancy, Childbirth, and the Puerperium, except for Late Maternal Death (O96) and Sequelae of Direct Obstetric Causes (O97). Additional causes classified in other chapters were also included. Adolescence was defined based on the World Health Organization (WHO) criterion, encompassing individuals aged 10 to 19 years.

To calculate the Specific Maternal Mortality Ratio (SMMR) according to maternal age (dependent variable), the numerator consisted of the number of maternal deaths among adolescents by region and period, while the denominator comprised the number of live births among adolescents, obtained from the Live Birth Information System (SINASC), also by region and period.

Given the underreporting and misclassification of deaths, the SMMR values were adjusted using correction factors specific to each region, as recommended by the "Active Search Survey" methodology from the Department of Epidemiological Analysis and Surveillance of Noncommunicable Diseases (DAENT/SVS/MS)10: Brazil (1.08 and 1.05); North (1.20 and 1.10); Northeast (1.15 and 1.07); Southeast (1.03 and 1.02); South (1.04 and 1.02); and Center-West (1.07 and 1.05).

Independent Variables variables were grouped according to adolescent maternal age (10-19 years) into: Sociodemographic factors: Race/skin color (White; Black; Brown; Indigenous). The Yellow race category was excluded due to the low number of maternal deaths (n=2); Marital status (with a partner; without a partner); Educational attainment adjusted for age (adequate; inadequate), based on the expected number of years of schooling for the given age. Death-related factors: Type of obstetric cause (direct; indirect; unspecified); Cause-of-death groups (classified according to ICD-10 codes);Timing of death (during pregnancy, childbirth, or abortion; or within 42 days postpartum).

The cause-of-death groups were categorized according to the **ICD-MM (International Classification of Diseases – Maternal Mortality)**11 as follows: Direct causes: Group 1: Pregnancy ending in abortion (ICD-10: O00-O07); Group 2: Hypertensive disorders during pregnancy, childbirth, or the puerperium (O11-O16); Group 3: Obstetric hemorrhages (O20; O43-O46; O67; O71.0; O71.1; O71.3; O71.4; O71.7; O72; Group 4: Pregnancy-related infections (O23; O41.1; O75.3; O85-O86;4 O91); Group 5: Other obstetric complications (O21.1, O21.2; O22; O24.4; O26.6, O26.9; O41.0, O41.8, O62; O71.2, O71.5, O71.6, O71.8, O71.9; O73; O75.0-O75.2, O75.4-O75.9; O87.1, O87.3, O87.9; O88; O90); Group 6: Unanticipated complications (related to anesthesia) (O29; O74; O89). Indirect causes: Group 7: Non-obstetric complications (O10; O24.0, O24.2, O24.3, O24.9; O98 (including B20-24) and O99). Unspecified causes: Group 8: Unknown causes (O95). Deaths classified under less likely maternal mortality causes (O30-O36; O40; O41.9; O42; O60-O61; O63-O66) were included in Group 5 – Other Obstetric Complications due to their low case numbers (n=24), following the methodology proposed by Mendonça et al. (2022)12.

III. Data Analysis

To assess temporal trends in maternal mortality across Brazil and by independent variables, a segmented regression model (Joinpoint Regression Analysis) was applied. This model identifies inflection points in the time series and estimates the Annual Percentage Change (APC) for each segment. The analysis was conducted using the Joinpoint Regression Program – version 5.0.2 (available at: https://surveillance.cancer.gov/joinpoint/). The

APCs and their respective 95% Confidence Intervals (95% CI) were also estimated for the study period. Trends were classified as increasing, decreasing, or stable based on the regression coefficient's sign (positive or negative) and statistical significance ($p \leq 0.05$).

To analyze the spatial distribution of SMMR, choropleth maps were generated using cartographic data from Brazil's five macro-regions. The study period was divided into three subperiods (2010-2014; 2015-2019; 2020-2021) to evaluate the potential impact of the COVID-19 pandemic (2020-2021) on adolescent maternal mortality. The maps were created using Python software (version 3.9).

For comparisons between the pre-pandemic (2018-2019) and pandemic (2020-2021) periods, a descriptive and exploratory analysis of SMMR was performed. The mean and standard deviation of each study variable were calculated for these two specific periods. Subsequently, a mean comparison test was applied, adopting a 5% significance level.

IV. Results

In Brazil, 21,692 maternal deaths were recorded between 2010 and 2021, of which 2,679 (12.4%) occurred among adolescents (10-19 years old). Across all maternal age 5 groups, the highest crude Specific Maternal Mortality Ratio (SMMR) was observed in the North and Northeast regions, while the South had the lowest rates (Table 1).

During the study period, the corrected SMMR among adolescents ranged from 41.3 maternal deaths per 100,000 live births in 2012 to 64.6 in 2021. The highest SMMR was recorded in the North region, with 63.9 maternal deaths per 100,000 live births (Table 2), which remained high throughout the COVID-19 pandemic. In this region, SMMR followed an increasing trend over the years, rising from approximately 52 maternal deaths per 100,000 live births in 2012 to 79 per 100,000 in 2018 (Table 2).

In the Northeast, SMMR values exceeded the targets established by the United Nations and remained stable throughout the study period. However, a significant increase was observed in 2021 (66.3 deaths per 100,000 live births). Similarly, the Center-West region showed a stable trend but with a considerable increase in maternal mortality during the pandemic period. In the Southeast, the SMMR trend was increasing throughout the study period (Table 2).

Unlike other regions, the South exhibited stable SMMR values (31.6 per 100,000 live births), approaching the United Nations' Sustainable Development Goal (SDG) target of 30 maternal deaths per 100,000 live births. However, despite this stability, an increase in maternal mortality was recorded in 2021, similar to other regions of Brazil during the pandemic (2020-2021) (Table 2).

The spatial distribution analysis revealed that the North and Northeast regions had the highest SMMR values, with worsening results during the pandemic period (2020-2021). The increase was also evident in other regions of the country (Figure 1).

Sociodemographic Characteristics and Maternal Mortality Trends Regarding race/ethnicity, SMMR was highest among Indigenous women (101.2 maternal deaths per 100,000 live births) and Black women (88.2 per 100,000 live births). However, among White adolescents, a statistically significant increasing trend was identified (Table 2). Between 2010 and 2021, adolescents without a partner had a higher SMMR (34.2 per 100,000 live births), while those with a partner exhibited a decreasing trend. A rising trend was also observed among adolescents with adequate education for their age, whereas SMMR remained higher among those with inadequate schooling (27.9 per 100,000 live births) (Table 2).

6 Causes and Timing of Maternal Deaths

Regarding the type and groups of causes of death, maternal mortality due to direct obstetric causes (preventable deaths) was the most frequent (31.4 maternal deaths per 100,000 live births), primarily driven by: Group 2 (Hypertensive disorders): 9.5 deaths per 100,000 live births; Group 4 (Pregnancy-related infections): 6.9 deaths per 100,000 live births. Maternal deaths occurring within 42 days postpartum had the highest SMMR (24.9 deaths per 100,000 live births) and showed an increasing trend (Table 2).

Comparison Between Pre-Pandemic (2018-2019) and Pandemic (2020-2021) Periods

When comparing SMMR averages between the pre-pandemic (2018-2019) and pandemic (2020-2021) periods, statistically significant differences were found for: Regions: Northeast and Southeast; Race/ethnicity: White, Black, and Indigenous adolescentes; Marital status: Adolescents without a partner; Education level: Both adequate and inadequate schooling for age; Timing of death: Postpartum deaths within 42 days; Cause of death: Both direct and indirect causes showed statistically significant increases in mortality during the pandemic (Table 3).

V. Discussion

The analytical techniques and methodological approach used in this study enabled the identification of key maternal mortality indicators, highlighting both similarities and differences across Brazilian regions from

2010 to 2021, especially during the COVID-19 pandemic (2020-2021). These findings underscore the pandemic as a critical factor associated with the increase in maternal mortality among adolescents.

Maternal mortality remains a major public health challenge, prompting international investments to reduce its incidence. This indicator is crucial for assessing the quality of healthcare provided to pregnant women and postpartum mothers, significantly influencing human development indexes[1 2]. The results of this study reveal that 2021, the second year of the COVID-19 pandemic, recorded the highest Specific Maternal Mortality Ratio (SMMR) of the analyzed period (64.6 deaths per 100,000 live births). This suggests significant shortcomings in Brazil's healthcare system in ensuring adequate maternal care for adolescents during the pandemic, despite this age group being considered low risk for COVID-19-related mortality.

Over the study period, despite previous advances in reducing adolescent maternal mortality, Brazil failed to meet the United Nations' Sustainable Development Goal (SDG) target of reducing maternal mortality to ≤30 deaths per 100,000 live births[7 8]. The statistical significance of the increase in adolescent maternal mortality during the pandemic aligns with national studies showing a rise in absolute maternal deaths across all regions and age groups, with the highest MMR recorded in 2021[4]. Similar trends were reported in other Latin American countries, such as Chile, Mexico, and Ecuador, where maternal mortality increased during the pandemic[13 14].

Regional Disparities in Adolescent Maternal Mortality

Regarding the geographic distribution of maternal deaths, the findings indicate that adolescent maternal mortality was highest in socioeconomically disadvantaged regions, particularly in the North and Northeast. These results are consistent with a national study reporting the highest MMR in the North (141.1 deaths per 100,000 live births across all age groups), while the South had the lowest MMR. However, even in the South, maternal mortality increased during the pandemic, mirroring national trends[4].

Studies suggest that many pregnant adolescents face barriers in accessing healthcare services, including insufficient prenatal care, leading to undiagnosed or untreated pregnancy complications[13 14]. Globally, research indicates that adolescents are at substantially higher risk for pregnancy-related complications and mortality than adult women, with maternal mortality being particularly high at the extremes of maternal age[2 4 15].

A large-scale population study in the United States (US) found that maternal mortality risk was three times higher among adolescents under 15 years old compared to women aged 25-29. The highest MMR was recorded among adolescents younger than 15 years (54.5 per 100,000 live births), while those aged 15-19 had a rate of 20.6 per 100,000[15]. These findings highlight the need for targeted maternal and child health policies to reduce adolescent maternal mortality.

Impact of the COVID-19 Pandemic on Adolescent Maternal Mortality

Findings from this study reinforce the negative impact of the COVID-19 pandemic on maternal health across all age groups, including adolescents. The pandemic introduced new challenges, such as reduced access to prenatal care, fear of COVID-19 exposure in healthcare settings, and overwhelmed health services prioritizing COVID-19 patients[5 6].

Additionally, delays in symptom identification and emergency care for pregnant women infected with COVID-19 may have contributed to poor outcomes. The increased demand for hospital beds and medical resources further strained the healthcare system, reducing its ability to provide adequate obstetric care[16].

Racial Disparities in Adolescent Maternal Mortality

When analyzing race/ethnicity, this study found that Black and Indigenous adolescents exhibited the highest maternal mortality rates throughout the decade. These findings reflect not only structural social inequalities but also persistent racial discrimination in Brazil. Research consistently shows that Black and Indigenous women have a higher likelihood of dying during pregnancy, childbirth, or the postpartum period compared to White women[15].

A nationwide study analyzing Ministry of Health data from 2017 to 2022 found that MMR among Black women was twice as high as that of White women (125.81 vs. 64.15 per 100,000 live births), with the disparity persisting throughout the COVID-19 pandemic[17].

Similar patterns have been observed in other countries. In the United States, racial disparities in maternal mortality trends (2000-2019) revealed that Black and Indigenous women had a significantly higher risk of maternal death compared to White women[18].

Research indicates that racial disparities in maternal mortality stem from multiple factors, including: Limited access to quality healthcare due to economic and geographic barriers; Higher prevalence of pre-existing conditions among Black and Indigenous women (e.g., hypertension, diabetes, and anemia), increasing pregnancy-related risks; Racial discrimination within the healthcare system, leading to delayed diagnoses, inadequate treatments, and higher maternal morbidity and mortality[15 16].

Influence of Sociodemographic Factors on Maternal Mortality

Among the sociodemographic variables, this study found that adolescent maternal mortality was significantly higher among those without a partner throughout the study period (2010-2021). These findings align with research highlighting the positive impact of spousal support during pregnancy, which reduces gestational risks and improves maternal health outcomes, particularly among adolescents[7 9].

Regarding education level, the findings revealed that SMMR was higher among adolescents with inadequate schooling for their age. Studies indicate that higher education levels correlate with increased maternal health awareness, leading to earlier detection of pregnancy complications[9].

Preventable Causes of Maternal Mortality

In this study, direct obstetric causes accounted for most maternal deaths, reaffirming findings from national and international research[2 4]. The leading causes of maternal mortality among adolescents were: Hypertensive disorders during pregnancy, childbirth, or the puerperium (Group 2); Pregnancy-related infections (Group 4). Research from other countries suggests that reducing maternal mortality from these causes depends on strengthening prenatal care, labor monitoring, and postpartum medical support[3 16]. Addressing these issues requires:

Improving healthcare provider training to enable early diagnosis and timely intervention for obstetric complications.

Expanding maternal and child health education to empower pregnant adolescents with essential health knowledge.

Ensuring equitable access to high-quality maternal healthcare services, particularly for vulnerable populations.

VI. Final Considerations

Between 2010 and 2021, adolescent maternal mortality in Brazil was highest in socioeconomically disadvantaged regions (North and Northeast), with an increasing trend in the North and Southeast. The pandemic exacerbated maternal mortality across all regions, with the highest SMMR recorded in 2021.

Adolescents who were Indigenous, Black, unmarried, or had inadequate schooling for their age were disproportionately affected. The most common causes of maternal mortality were hypertensive disorders and infections, with postpartum deaths within 42 days showing a significant increasing trend.

This study highlights the urgent need for targeted investments in maternal and child healthcare, particularly for socially and racially marginalized groups. Comprehensive public health policies, expanded prenatal care services, and systematic efforts to address racial disparities are critical to reducing adolescent maternal mortality in Brazil.

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Table 1 – Crude Specific Maternal Mortality Ratio (SMMR) by Maternal Age Group and Brazilian Regions, 2010-2021.

Maternal Age Group	10-19 years			20-29 years			30-39 years			40 years or older		
Region	Maternal Deaths	Live Births	SMMR*	Maternal Deaths	Live Births	SMMR*	Maternal Deaths	Live Births	SMMR*	Maternal Deaths	Live Births	SMMR*
North	538	918.354	**58.6**	1.244	1.941.798	**64,1**	972	816.421	**119,1**	175	71.610	**244,4**
Northeast	980	1.991.201	**49.2**	2.794	4.961.570	**56,3**	2.731	2.624.497	**104,1**	595	240.553	**247,3**
Southeast	761	1.901.256	**40.0**	2.850	6.536.120	**43,6**	3.400	4.658.085	**73,0**	673	442.718	**152,0**
South	206	664.728	**31.0**	770	2.252.177	**34,2**	963	1.567.203	**61,4**	195	144.656	**134,8**
Center-West	194	472.358	**41.1**	740	1.447.481	**51,1**	766	841.115	**91,1**	142	69.357	**204,7**
Total**	2.679	5.947.897	**45.0**	8.398	17.139.146	**49,0**	8.832	10.507.321	**84,1**	1.780	968.894	**183,7**

* SMMR (Specific Maternal Mortality Ratio) per 100,000 live births

** Excluding cases with missing data (n=3)

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

Table 2 – Temporal Trend Analysis of the Adjusted Specific Maternal Mortality Ratio (SMMR) by Sociodemographic and Death-Related Variables, Adolescents (10-19 years old), Brazil, 2010-2021

Variable	Total SMMR	APC	95% CI	p-value*	Trend
Brazil	**46.3**	**1.17**	**-0.25; 2.61**	**0.080**	**Stable**
REGION					
North	63.9	2.10	0.24; 3.90	0.004*	Increasing
Northeast	52.9	-0.89	-2.25; 0.49	0.127	Stable
Southeast	40.4	2.57	0.82; 4.36	0.019*	Increasing
South	31.6	-0.65	-6.03; 4.90	0.589	Stable
Center-West	41.9	2.15	-1.62; 5.93	0.129	Stable
RACE/SKIN COLOR					
White	42.6	3.58	1.08; 6.14	0.009*	Increasing
Black	88.2	-5.38	-10.75; 0.31	0.061	Stable
Brown	43.5	0.81	-0.69; 2.34	0.257	Stable
Indigenous	101.2	1.26	-7.71; 5.65	0.685	Stable
MARITAL STATUS					
With partner	3,1	-8,93	-12,63; -5,07	0,002*	Descending
Without partner	34,2	2,02	-0,034; 4,13	0,108	Stable
ADEQUACY OF SCHOOLING					
Adequate	11,6	15,01	9,0; 21,27	<0,000*	Increasing
Inadequate	27,9	-4,87	-9,42; -0,09	0,046*	Descending
TYPE OF CAUSES OF DEATH					
Direct	31,4	-0,25	-1,63; 1,15	0,720	Stable
Indirect	13,5	3,30	-0,01; 6,72	0,090	Stable
Unspecified	1,5	5,59	-1,60; 13,29	0,116	Stable
GROUPS OF CAUSES OF DEATH					
1 – Pregnancy ending in abortion	3,8	-2,71	-9,23; 4,24	0,209	Stable
2 – Hypertensive causes during pregnancy, childbirth or puerperium	9,5	-0,47	-2,16; 1,11	0,626	Stable
3 – Obstetric hemorrhages	3,7	3,25	-1,65; 8,27	0,090	Stable
4 – Pregnancy-related infections	6,9	-2,10	-7,22; 3,35	0,191	Stable
5 – Other obstetric complications	7,1	0,77	-1,67; 3,12	0,390	Stable
6 – Unanticipated complications (related to anesthesia)	0,5	-0,57	-3,79; 1,94	0,265	Stable
7 – Non-obstetric complications	13,5	3,30	-0,01; 6,72	0,090	Stable
8 - Unknown causes	1,5	5,59	-1,60; 13,29	0,116	Stable
TIME OF DEATH					
During pregnancy, childbirth or abortion	15,5	-1,35	-3,15; 0,49	0,133	Stable
In the puerperium, up to 42 days	24,9	3,63	2,15; 5,13	0,000*	Increasing

* p≤0.05

APC (Annual Percentage Change) – variation of mortality over time; 95% CI (Confidence Interval at 95%);

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

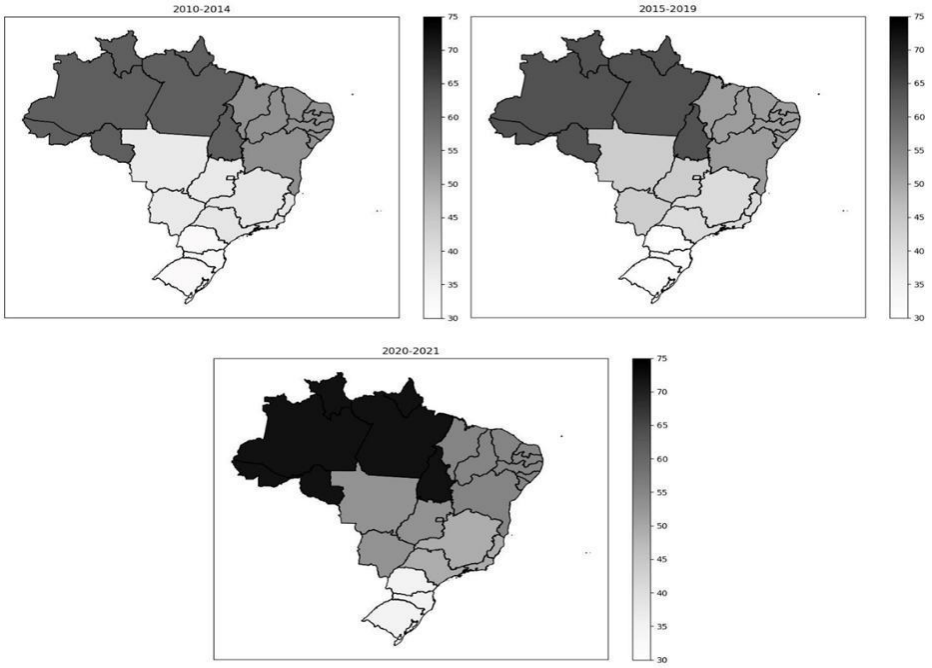
Table 3 – Mean Comparison of the Adjusted Specific Maternal Mortality Ratio (SMMR) by Sociodemographic and Death-Related Variables, Adolescents (10-19 years old), Brazil, 2018-2021

Variable	2018-2019	SD	2020-2021	SD	p-value
	Mean		Mean		
Region					
North	70.9	11.36	72.01	37.78	0.787
Northeast	50.75	1.9	55.34	15.45	<0.000*
Center-West	49.4	5.95	53.26	38.18	0.5624
Southeast	43.92	4.73	49.65	12.32	<0.000*
South	30.81	4.22	35.65	28.54	0.379
Race/Skin Color					
White	44.4	5.99	56.42	18.85	<0.000*
Black	75.45	1.17	96.97	56.11	0.024*
Brown	46.93	0.92	46.28	12.77	0.408
Indigenous	79.74	1.65	111.04	36.9	0.007*
Marital Status					
With a partner	2.26	0.96	2.23	1.63	0.946
Without a partner	37.35	0.43	41.11	11.64	<0.000*
Type of Cause					
Direct	33.61	0.11	29.33	7.56	<0.000*
Indirect	12.75	1.73	21.78	9.07	<0.000*
Timing of Death					
During pregnancy, childbirth, or abortion	16.4	1.34	14.26	20.7	0.223
Within 42 days postpartum	26.92	0.19	33.35	11.2	<0.000*

* $p \leq 0.05$ (statistically significant); SD (Standard Deviation)

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

Figure 1 – Spatial Distribution of the Adjusted Specific Maternal Mortality Ratio (SMMR) (per 100,000 live births), Adolescents (10-19 years old), by Brazilian Regions, 2010-2021



Legend: This choropleth map illustrates the geographic disparities in adolescent maternal mortality across Brazil from 2010 to 2021;

The North and Northeast regions reported the highest mortality rates throughout the period, with worsening indicators during the COVID-19 pandemic (2020-2021); The South region, despite having the lowest SMMR values, also experienced an increase in maternal mortality during the pandemic.

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