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Race inequalities in maternal mortality in the city of Rio de Janeiro, Brazil: 2010–2019

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SUMMARY

OBJECTIVE: To analyze the behavior of maternal mortality according to the race/color variable in the city of Rio de Janeiro, Brazil, between 2010 and 2019.

METHODS: This is a cross-sectional study that used microdata collected in the Sistema de Informações sobre Mortalidade and Sistema de Informações sobre Nascidos Vivos. Data were disaggregated by race/color and age groups of childbearing age. Pearson's χ^2 test was used to compare the ratio in each category of covariates. In order to explore the differences in the maternal mortality ratio of the respective variables, the data were adjusted using Poisson's model. Polynomial regression models were tested to describe the trend.

RESULTS: There were 732 maternal deaths in the city of Rio de Janeiro between 2010 and 2019. The time trend analysis of general maternal mortality showed a significant decline between 2010 and 2018 followed by a new upward trend in 2019. There was a greater maternal mortality ratio for older age groups, especially for women over 40 (prevalence ratio of 18.80, 95%CI 13.54–26.78; p<0.0001) and black ones (prevalence ratio of 2.31, 95%CI 1.90–2.80; p<0.0001).

CONCLUSION: There is evidence that maternal mortality is associated with issues of race, which suggests the racial disparity in obstetric care in the city of Rio de Janeiro.

KEYWORDS: Maternal mortality. Primary healthcare. Healthcare disparities. Racism.

INTRODUCTION

The role of contextual factors and persistent racial inequality in contributing to pregnancy-related mortality among black women has been extensively explored in the literature[1]. Despite advances in the quality and access to maternal and child healthcare with a marked reduction in infant and maternal mortality rates, certain racial and ethnic groups systematically benefit less from these advances[2].

Literature is full of examples of racial disparities in the results concerning obstetric care, mainly regarding the prevalence of premature birth, fetal growth restriction, fetal death, maternal mortality, and inadequate prenatal care[3]. Only a small amount of research focused on race/color influences regarding pregnancy and childbirth experience has been conducted in Brazil. The study "Born in Brazil: National Survey on Childbirth and Birth" is unprecedented in this sense and identified racial disparities in the process of paying attention to pregnancy and childbirth. It showed a gradient from worse to better care among black, brown, and white women[4].

The city of Rio de Janeiro has a persistent and chronically high maternal mortality ratio[5]. When data are categorized by skin color, the result is that black women are at least three times more likely to die during pregnancy than white women[6]. Racial inequalities in prenatal and childbirth care in Rio de Janeiro were first reported in 2005[7]. Since then, there has been an attempt to monitor the occurrence of racial disparities in obstetric care. Therefore, we aimed to analyze the behavior of maternal mortality according to the race variable in the city of Rio de Janeiro between 2010 and 2019.

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METHODS

This was an observational cross-sectional study that used microdata from the city of Rio de Janeiro. Women's deaths during pregnancy or puerperium periods (up to the 42nd day of puerperium) from 2010 to 2019 were considered based on information provided on the death certificate.

The maternal mortality ratio (MMR) was calculated according to the formula:

$$\text{MMR} = \frac{\text{Deaths in pregnant and puerperal women according to race and age group}}{\text{Number of live births according to mother's age and race}} \; x \; 100{,}000$$

The variables, age group and race, were stratified as: the age variable was categorized as 15 to 19 years, 20 to 39 years, and 40 years and older; whereas race was divided into white, brown, and black.

The maternal mortality count was estimated based on the occurrence of deaths for each of the above-mentioned category. Pearson's χ^2 test and its respective p-value were used to compare the ratio in each covariate category.

Data were adjusted using Poisson's model to explore the differences in the maternal mortality ratio of the variable strata. The analyzed variables were included in the model when the bivariate analysis indicated a statistically significant association with the studied outcome. In the modeling for each variable, the gross and adjusted prevalence ratios were calculated according to the best model obtained by the maximum likelihood statistics. Confidence intervals (CIs) were also estimated at a 95% significance level.

Then, the historical series of the maternal mortality ratio for the period were expanded. The total MMR trend was calculated according to age and race categories. The trends were analyzed using the polynomial model, whose dependent variable (Y) is represented by the maternal mortality ratios, and the independent variable (X), by the calendar years. A residual analysis was performed to choose the best model, and the assumption of homoscedasticity and adherence to normal distribution was evaluated. In addition, the dispersion diagram and determination coefficient (R^2) values were analyzed.

In order to assess the possible impact of the coverage expansion of the Brazilian Family Health Strategy in the occurrence of maternal death, which started in 2009, the annual hospitalization rates between 2010 and 2019 were estimated for all causes. Using the year 2010 as a reference, the rate ratios for each year and their respective CIs were calculated.

RESULTS

Between 2010 and 2019, 732 maternal deaths in the city of Rio de Janeiro were reported. Over this period, the maternal mortality ratio varied between 63 and 89 deaths per 100 thousand live births. We analyzed the association between the race and age group variables and MMR through modeling using Poisson's regression. Based on these results, the respective prevalence ratios were calculated (Table 1).

Using the prevalence ratios (PR) and their respective 95% CIs, we observed an increase in the maternal mortality ratio for older age groups, especially for women over 40 (PR=18.80, 95%CI 13.54–26.78), and for race, mainly for black women (PR=2.31, 95%CI 1.90–2.80). No statistical significance in the gross model was observed for the brown category. However, when the model was adjusted between the variables, even this category started to have statistical significance, suggesting an effect of interaction between race and age.

Once it was observed that the age group and race/color variables showed differences between the categories, we carried out a time trend analysis of MMR for all the categories. The results are described in Table 2. None of the trends is significant even for the best fit model, thus an important change in the MMR

Table 1. Gross and adjusted Poisson's regression models for maternal mortality in the city of Rio de Janeiro, between 2010 and 2019.

	Gross model			Adjusted model		
	PR	95%CI	p-value	PR	95%CI	p-value
Age group (years)						
15 to 19	1	[–]	[–]	1	[–]	[–]
20 to 39	2.62	1.92–3.66	<0.001	2.78	2.04–3.90	<0.001
40 and more	18.8	13.54–26.78	<0.001	20.62	14.83–29.43	<0.001
Race						
White	1	[–]	[–]	1	[–]	[–]
Brown	1.11	0.95–1.29	0.078	1.28	1.10–1.51	0.001
Black	2.31	1.90–2.80	<0.001	2.64	2.18–3.20	<0.001

Source: Mortality Information System (SIM-SUS), 2020. PR: prevalence ratio; 95%CI: 95% confidence interval.

trend was observed in the short ten-year period. In addition, for most categories, the pattern presented in the time series showed a decline followed by an increase, suggesting that an initial tendency to reduce the MMR occurred followed by an apparent change in the trend and return to a growth pattern.

Finally, when analyzing the variation year by year, with the rate ratio (RR) for each category, the total rates between 2011 and 2018 showed a significant reduction. However, in 2018, we found a lower MMR than in 2010 (reference year), which was significant, corroborating that there was, in fact, a change in the tendency towards a decline. This pattern was followed in the color and age group analysis (Table 3). A similar association was obtained for the brown and white groups, in which the 2019 ratio was significantly higher than that of the reference year. We found a similar pattern for the age group between 15 and 19, and a similar situation in the white race occurred for the 20 and 39 age group. We observed an apparently significant reduction in the ratio with time evolution for the black race and for the age group of 40 years and older.

DISCUSSION

Health outcomes are largely associated with social determinants, including health and system services, location, employment, education, race, and income. The literature consistently reports that ethnic-racial minorities receive lower quality and intensity of healthcare compared to whites over a wide range of preventive, diagnostic, therapeutic services, and disease organizations[8].

In fact, the fifth goal of the Millennium Goals includes worldwide reduction of maternal mortality by 75%, but Brazil has not reached this goal. Between 1990 and 2015, Brazil reduced MM by 43%, which was below the target of 66%[9]. The MM decrease was one of the worst indicators that Brazil presented when it reported the achievement of the Millennium Development Goals to the United Nations in 2015. It remains a priority for the Sustainable Development Goals on the 2030 agenda[10].

In the last 20 years, it was observed an improvement in almost all maternal health indicators in Brazil, as well as a great expansion of access to health services. There was a big drop in fertility rates, universalization of prenatal and hospital care for childbirth, increased access to contraception and breastfeeding, and decreased hospitalizations for abortion and malnutrition[11]. However, MM persists as a public health challenge. MM can be considered an indicator of social inequality[12]. Incorporated into these persistent disparities are the continuing effects of institutional racism[13].

Over time, maternal mortality was shown to be persistently higher in black women, who are the most socially vulnerable. However, meanwhile, universal coverage of both prenatal and childbirth care was available in addition to the investigation expansion of deaths in women of childbearing age. This finding indicates that the reduction below the expectation may have occurred due to the improvement in the birth record and the maternal condition in the perinatal period rather than due to the healthcare system ineffectiveness[14].

Maternal mortality disparities are well-documented for non-Hispanic blacks, who carry the burden of the highest MMR. Furthermore, MM *per se* may be an indication of racial disparities in pregnancy complications, leading many to explore risk factors and disparities in severe maternal morbidity, which is a more common precursor to MM[15]. The solutions to the inequality issue in MM are specific to each location, considering that there are peculiar issues of social, such as structural racism, and operational, such as access to health services, aspects[16].

Some measures have been adopted in Rio de Janeiro to mitigate the problem. The Cegonha Carioca Program[17] was implemented for the Municipal Health Department of Rio de Janeiro in 2011. Its implementation caused changes in the organization of actions

Table 2. Time trend of maternal mortality according to age and race in the city of Rio de Janeiro, 2010 to 2019.

	Equation	R^2	p-value	Trend	Significance
Race					
White	$y=-0.21x^2+3.10x+53.29$	0.03	0.888	Increase with subsequent decline	NS
Brown	$y=0.67x^2-7.97x+155.99$	0.09	0.742	Decline with subsequent growth	NS
Black	$y=0.44\ x^2-4.93x+88.18$	0.12	0.667	Decline with subsequent growth	NS
Age group (years)					
15 to 19	$y=1.23x^2-13.02x+97.08$	0.15	0.616	Decline with subsequent growth	NS
20 to 39	$y=-0.12x^2+2.2x+64.93$	0.08	0.759	Increase with subsequent decline	NS
40 and more	$y=5.86x^2-88.74x+469.45$	0.48	0.129	Decline with subsequent growth	NS
Total	$y=0.30x^2-3.42x+84.38$	0.09	0.764	Decline with subsequent growth	NS

Source: Mortality Information System (SIM-SUS), 2020. NS: non-significant.

and services provided in prenatal, childbirth, and postpartum care with positive results for the healthcare improvement in women and children, especially those with greater vulnerability, expanding their access to healthcare services in the pregnancy–puerperal cycle[17].

The *Estratégia Rede Cegonha* seeks to ensure access and to improve the quality of care offered to women and newborns in the puerperal pregnancy cycle. The implementation of this model implies the verification of changes and adjustments in the organization of health actions and services. Thus, the role of the Family Health Strategy is central. Silva[18] identified a reduction in direct obstetric causes from the expansion of the Brazilian Family Health Strategy in 2009.

Even so, the most recent analysis of the city of Rio de Janeiro shows that there is no equal access to quality healthcare, and it is important to hold the debate on structural and institutional racism in such location[19]. Hence, the expansion of the Brazilian Family Health Strategy coverage does not seem to have been sufficient to mitigate the problem of adequate access. Therefore, innovations in prenatal and childbirth with the potential to be involved with the social determinants of maternal health are necessary, which is a finding corroborated by Gadson et al.[20].

Therefore, some measures must be adopted to minimize some of the impacts of systemic racism on healthcare services, to ensure high-quality access for all, and to address social needs as part of the care provision[21]. Ultimately, reducing MM requires investments specifically in black maternal healthcare and solutions that involve inequities that undermine health outcomes for black mothers and their children. The elimination of health inequities, therefore, requires a multidisciplinary approach.

CONCLUSIONS

Our study demonstrated the racial disparity in maternal mortality in the city of Rio de Janeiro. To reduce maternal mortality,

Table 3. Rate ratio for temporal association of maternal mortality according to race categories in the city of Rio de Janeiro, 2010–2019.

Year	Race															
	White				Black				Brown				Total			
	MMR	RR	95%CI		MMR	RR	95%CI		MMR	RR	95%CI		MMR	RR	95%CI	
			LL	UL			LL	UL			LL	UL			LL	UL
2010	63.86	1.00	[–]	[–]	172.92	1.00	[–]	[–]	85.76	1.00	[–]	[–]	89.31	1.00	[–]	[–]
2011	40.28	0.63	0.56	0.71	123.51	0.71	0.66	0.77	84.32	0.98	0.92	1.05	69.58	0.78	0.74	0.81
2012	60.47	0.95	0.83	1.06	137.11	0.79	0.74	0.85	65.92	0.77	0.72	0.82	70.46	0.79	0.75	0.82
2013	79.60	1.25	1.10	1.40	106.95	0.62	0.57	0.66	68.96	0.80	0.75	0.86	77.23	0.86	0.83	0.90
2014	61.17	0.96	0.84	1.07	130.02	0.75	0.70	0.81	87.40	1.02	0.95	1.08	80.98	0.91	0.87	0.95
2015	70.00	1.10	0.96	1.23	146.28	0.85	0.79	0.91	71.61	0.84	0.78	0.89	75.55	0.85	0.81	0.88
2016	49.61	0.78	0.68	0.87	146.86	0.85	0.79	0.91	85.24	0.99	0.93	1.06	77.56	0.87	0.83	0.91
2017	81.51	1.28	1.12	1.43	145.42	0.84	0.78	0.90	74.35	0.87	0.81	0.92	82.25	0.92	0.88	0.96
2018	39.17	0.61	0.54	0.69	146.00	0.84	0.78	0.90	64.94	0.76	0.71	0.81	63.31	0.71	0.68	0.74
2019	75.98	1.19	1.05	1.33	124.98	0.72	0.67	0.77	90.24	1.05	0.99	1.12	87.02	0.97	0.93	1.02
2010	100.68	1.00			71.20	1.00			434.31	1.00			89.31	1.00		
2011	55.08	0.55	0.46	0.63	66.52	0.93	0.87	1.00	204.01	0.47	0.38	0.56	69.58	0.78	0.74	0.81
2012	46.27	0.46	0.39	0.53	63.24	0.89	0.83	0.95	379.51	0.87	0.70	1.04	70.46	0.79	0.75	0.82
2013	80.09	0.80	0.67	0.92	74.12	1.04	0.97	1.12	127.59	0.29	0.24	0.35	77.23	0.86	0.83	0.90
2014	81.84	0.81	0.69	0.94	78.67	1.10	1.03	1.18	90.44	0.21	0.17	0.25	80.98	0.91	0.87	0.95
2015	96.81	0.96	0.81	1.11	62.28	0.87	0.81	0.94	311.35	0.72	0.58	0.86	75.55	0.85	0.81	0.88
2016	30.98	0.31	0.26	0.36	85.68	1.20	1.12	1.29	87.29	0.20	0.16	0.24	77.56	0.87	0.83	0.91
2017	55.09	0.55	0.46	0.63	84.80	1.19	1.11	1.28	134.08	0.31	0.25	0.37	82.25	0.92	0.88	0.96
2018	78.80	0.78	0.66	0.90	56.93	0.80	0.74	0.86	127.78	0.29	0.24	0.35	63.31	0.71	0.68	0.74
2019	100.07	0.99	0.84	1.15	80.93	1.14	1.06	1.22	173.87	0.40	0.32	0.48	87.02	0.97	0.93	1.02

Source: Mortality Information System (SIM-SUS), 2020. MMR: maternal mortality ratio; RR: rate ratio; LL: lower level; UL: upper level; 95%CI: 95% confidence interval.

we must view it as a form of neglect and recognize the inequities in order to change the reality of public maternity hospitals. An urgent issue is the establishment of a national commitment to improve the access of the poorest and most segregated populations (mainly black people) to medical services, close to homes and quality. Thus, we recommend more detailed research on the reality of racial disparities in health to better understand the components of these disparities: racism, spatial segregation, poverty.

AUTHORS' CONTRIBUTIONS

LGRA: Conceptualization, Data Curation, Formal Analysis, Investigation; Methodology; Project Administration; Resources; Software; Validation; Visualization; Writing – Original Draft and Writing – Review & Editing. **RMG:** Conceptualization, Data Curation, Formal Analysis, Investigation; Methodology; Project Administration; Resources; Software; Validation; Visualization; Writing – Original Draft and Writing – Review & Editing.

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