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Racial iniquity in mortality from cervical cancer in Brazil: a time trend study from 2002 to 2021

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Abstract *This ecological study examined time series, from 2002 to 20121, of age-adjusted coefficients of cervical cancer mortality, in Brazil, in women aged 20 years or more, by race. The information sources were Brazil's mortality information system (Sistema de Informação sobre Mortalidade - SIM) and the official bureau of statistics (Instituto Brasileiro de Geografia e Estatística - IBGE). Annual changes in age-adjusted mortality rates were calculated using the Prais-Winsten linear regression method. Black women die more and the rate is decreasing less. Racial inequality has increased over the years. In 2002, there were 0.08 more deaths per 100,000 women in the black population than among white women; in 2021, the number was one death. Health policymaking should consider racial differences in the implementation of strategies and goals.*

Key words *Cervical neoplasms, Ethnic origin and health, Racial factors, Mortality, Time series studies*

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Introduction

Cervical cancer ranks third in causes of female mortality worldwide. It occurs more frequently in disadvantaged populations as part of a complex of diseases connected with poverty, race and unfavorable living conditions[1].

Incidence is reduced by early diagnosis of precursor lesions and vaccination against human papillomavirus (HPV)[2]. Cervical cancer is a disease that can be screened for; the high number of related deaths – and its continuing to be a public health problem – is associated with its being diagnosed late, at an advanced stage.

Nearly all cases of cervical cancer are caused by chronic infection with high-risk, oncogenic subtypes of HPV. Accordingly, risk factors are those associated with an increased likelihood of HPV infection, including early sexual initiation, multiple sexual partners or a partner with multiple sexual partners, immunosuppression, a history of sexually transmitted infection, a history of HPV-related vulvar or vaginal dysplasia and lack of access to screening[3].

Although race is another prominent risk factor in the international scientific literature[4], most studies in Brazil have limited themselves to examining aspects relating to poverty and fail to give proper emphasis to racial inequalities in health[5,6].

Introducing race data into national information systems enables indicators to be constructed to reveal racial inequalities, thus making it possible to assess health service performance in social inclusion[7]. However, data for constructing indicators by race are not always available in sufficient quality and quantity. Despite the limitations, calculating and disseminating indicators contributes to the debate and improving information systems to identify racial differences.

In that regard, this study examined time series of mortality from cervical cancer in Brazil from 2002 to 2021 by race.

Methods

This ecological time series study drew on data from Brazil's mortality information system (*Sistema de Informações sobre Mortalidade*, SIM) and population information from the official bureau of statistics (*Instituto Brasileiro de Geografia e Estatística*, IBGE). These data were used to calculate cervical cancer mortality rates in Brazil, from 2002 to 2021, by race (Figure 1).

The study considered all deaths of women aged 20 or over, residing in Brazilian territory, the underlying cause of whose death was cervical cancer.

To counter classification bias (deaths from cervical cancer classified as "part unspecified"), the causes considered were those specified in the 10th revision of the International Statistical Classification of Diseases and Related Health Problems (ICD10) as Malignant neoplasm of cervix uteri (C53), Malignant neoplasm of corpus uteri (C54) and Malignant neoplasm of uterus, part unspecified (C55). Also, deaths classified as C55 (Malignant neoplasm of uterus, part unspecified) were redistributed proportionally by year and age group. This was a four-step procedure: first, deaths classified as Malignant neoplasm of cervix uteri and of corpus uteri were added together; second, deaths from Malignant neoplasm of cervix uteri and of corpus uteri were each calculated as proportions of the total number of Malignant neoplasm of cervix uteri and of corpus uteri); third, deaths from Malignant neoplasm of the uterus, part unspecified, were redistributed as Malignant neoplasm of cervix uteri and of corpus uteri in the proportions calculated in the second step; and fourth, the value obtained in step three was added to the original deaths from Malignant neoplasm of cervix uteri and of corpus uteri, to give the corrected number of deaths[8,9].

The mortality rate by race was calculated by dividing the number of deaths from cervical cancer in women aged 20 or over by the number of women aged 20 or over per 100,000 women. Rates were adjusted for age distribution using the standard global population[10].

For standardization purposes, age groups by race were obtained by linear projection from 2000 and 2010 census data, given that the IBGE does not provide intercensal estimates from which to stratify the population simultaneously by race and age group.

Race for both population and mortality was obtained by self-reporting and classified, by the IBGE definitions, as white, brown, black, yellow, and indigenous[7,11]. Brown women were added to black women in both numerator (deaths) and denominator (population) to give the mortality coefficient for black women. The category "black" (the sum of black and brown women) represents, on the one hand, the population descended from Africans born in the diaspora and, on the other, the process of miscegenation as a dimension of Brazil[11].

The data from 2002 to 2021 were analyzed by estimating annual percentage changes (APCs) in cervical cancer mortality rates, by race, with

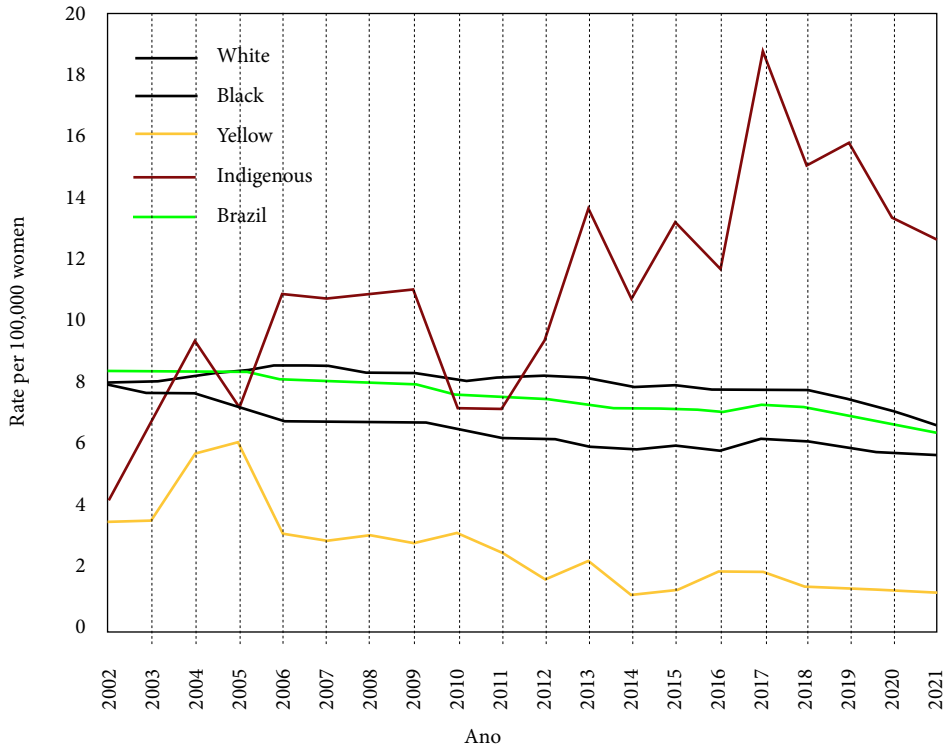

Figure 1. Time series of cervical cancer mortality rates by race/colour, Brazil, 2002 to 2021.

Source: Authors.

their respective 95% confidence intervals, using a linear regression model with Prais-Winsten correction. Rates were considered rising when the APC was positive and falling when negative. In the study model, rate trends were considered non-significant when p>0.05.

This study was approved by the research ethics committee of the School of Medicine of the Universidade de São Paulo on 05 September 2018 (Research Protocol No. 162/18).

Results

From 2002 to 2021, 133,429 deaths from cervical cancer were recorded in Brazil. Of these, 63,102 (47.3%) occurred in white women, 10,741 (8.1%) in black women, 57,584 (43.2%) in brown women, 635 (0.48%) in yellow women, 632 (0.47%) in indigenous women. The black population (brown women plus black women) accounted for 68,325 (51.2%) of these deaths. Mortality among black and white women represented 98.50% of total records in the study period.

In 2002, the mortality rate in black women was 1.0% higher than in white women; in 2021, the difference was 17.8%, i.e., racial inequality had increased. In the population of indigenous women, fluctuating rates have resulted from the small numbers involved and this group's minor participation in the general population. In 2002, mortality among indigenous people was 47.3% lower than among white people. In 2021, mortality among indigenous women was 123.5% higher than among white women (Table 1).

Table 2 shows descriptive statistics for the study object variable in Brazil, from 2002 to 2021, by race. Indigenous race returned the highest average rate (10.99), and white returned the lowest (6.5). The time series with the largest relative variation from the average was for the yellow race (53.90%) and the smallest for the black race (6.13%). Asymmetry coefficients were positive for all time series (except for black race), indi-

cating below-average data concentration for the period (Table 2 and Figure 2).

Table 3 shows the trend in mortality from cervical cancer. For the female population in Brazil, the annual percentage varied negatively by 1.33% (95%CI -1.56 to -1.10), indicating a downward trend. The percentage variations in the white and yellow populations showed even stronger downturns of -1.74% (95%CI -2.24 to -1.23) and -7.17% (95%CI -9.31 to -4.97), respectively.

While mortality decreased significantly among white and yellow women during the study period, the annual percentage variation for black women was more minor (APC of 0.98% CI95% -1.93 to -0.02), indicating values close to stability although decreasing. The trend was upward among indigenous women, with a positive annual percentage variation of 4.74% (95%CI 2.39 to 7.16).

The trends found were thus heterogeneous: mortality rates decreased most in the white and yellow populations, and racial inequality increased concomitantly.

Discussion

As far as is known, this study is the first to examine relationships between race and age-standardized, corrected cervical cancer mortality on a Brazil-country basis.

Table 1. Age-adjusted (per 100,000 women) cervical cancer mortality rate, by race and year, Brazil, 2002 to 2021.

Year	White	Black	Yellow	Indigenous	Total
2002	7.96	8.04	3.50	4.19	8.41
2003	7.66	8.09	3.55	6.59	8.37
2004	7.65	8.27	5.74	9.39	8.44
2005	7.26	8.41	6.10	7.23	8.36
2006	6.78	8.64	3.14	10.89	8.13
2007	6.68	8.58	2.93	10.72	8.03
2008	6.78	8.35	3.12	10.93	7.95
2009	6.78	8.37	2.88	11.08	7.98
2010	6.53	8.05	3.16	7.16	7.63
2011	6.23	8.22	2.53	7.20	7.55
2012	6.25	8.28	1.66	9.41	7.47
2013	5.96	8.15	2.27	13.75	7.30
2014	5.85	7.89	1.13	10.70	7.12
2015	5.99	7.93	1.33	13.27	7.20
2016	5.81	7.78	1.93	11.71	7.05
2017	6.21	7.82	1.90	18.73	7.29
2018	6.13	7.77	1.42	15.03	7.19
2019	5.87	7.46	1.34	15.81	6.94
2020	5.72	7.12	1.31	13.37	6.68
2021	5.64	6.65	1.23	12.61	6.40

Source: Authors.

Table 2. Mean, standard deviation, coefficient of variation, and asymmetry of cervical cancer rates, by race. Brazil, 2002 to 2021.

Race/colour	Mean	Standard deviation	Coeff. Variation (%)	Coeff. Asymmetry
White	6.50	0.71	10.95	0.76
Yellow	2.60	1.40	53.90	1.16
Indigenous	10.99	3.51	31.97	0.15
Black	8.00	0.49	6.13	-1.33
Brazil	7.58	0.61	7.99	-0.09

Source: Authors.

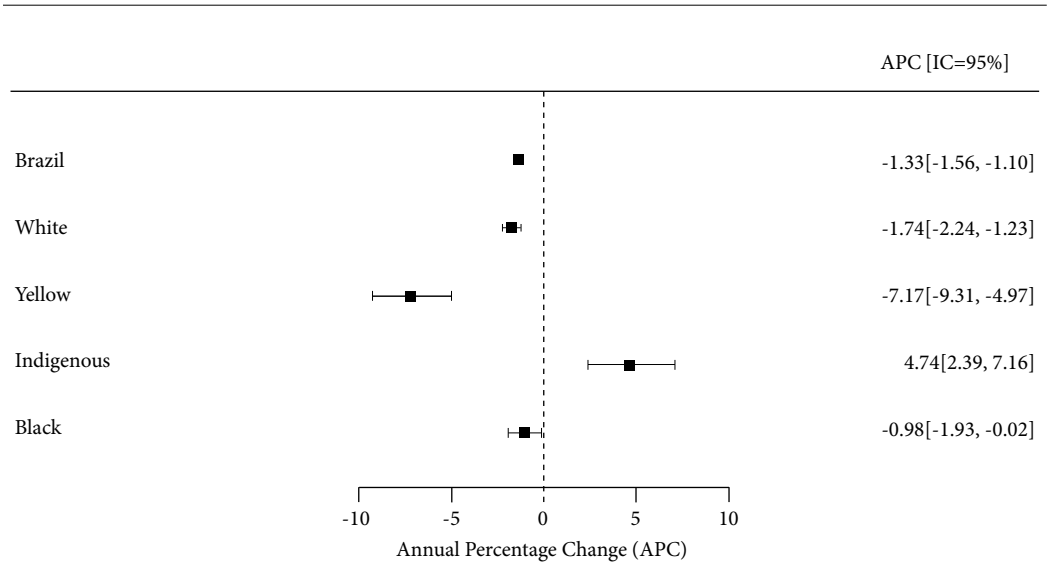

Figure 2. Annual percentage change in cervical cancer mortality by race/colour. Brazil, 2002 to 2022.

Note: The vertical dotted line indicates the critical null hypothesis value of APC. H0: APC=0.

Source: Authors.

Table 3. Annual percentage change and trend in cervical cancer mortality by race/colour. Brazil, 2002 to 2021.

Race/colour	APC*	95%CI	P	Trend
White	-1.74	-2.24 to -1.23	0.0000	Decreasing
Yellow	-7.17	-9.31 to -4.97	0.0000	Decreasing
Indigenous	4.74	2.39 to 7.16	0.0005	Increasing
Black	-0.98	-1.93 to -0.02	0.0454	Decreasing
Brazil	-1.33	-1.56 to -1.10	0.0000	Decreasing

*Annual percentage change.

Source: Authors.

Cervical cancer mortality trends from 2002 to 2021 were found to differ by race in Brazil and to display different temporal patterns. Racial inequality increased in the study period.

Relationship between race and health has been investigated in the United States since the 1980s. In Brazil, although 56.1% of the population is black, the field of black health has been established only since the 2000s, when the 3rd World Conference Against Racism, Xenophobia, and Related Intolerance was held. A special secretariat for the promotion of racial equality policies (*Secretaria Especial de Promoção de Políticas de Igualdade Racial*, SEPPIR) was subsequently set up under the Presidency of the Republic[12].

The category "black" reflects an ethnic and racial identity and is present in denominations that combat racism. It makes it possible to understand the effects of the history, culture, and economic and political contexts that have deeply imprinted the meanings of Brazilian social realities and the effects of racial discrimination.

Some studies trace the panorama of mortality from cervical cancer in specific states or municipalities and highlight social inequality. In 2013, nine out of ten deaths from cervical cancer

occurred in less-developed local regions, where the risk of death before age 75 was three times higher[13]. In the city of Recife between 2000 and 2004, most deaths were among black women from 40 to 59 years old (that is, under 60 years old) without a steady partner, who were housewives, residing in neighborhoods without basic infrastructure and public hospital users[14]. In Rio de Janeiro and São Paulo, mortality from cervical cancer decreased significantly, especially in women born after 1960[13]. Rio Grande do Norte mortality coefficient did not vary considerably between 1996 and 2010. Nonetheless, coefficients increased in areas where socioeconomic conditions were worse[10]. An increasing trend was also observed from 2000 to 2011 in Piauí[15].

While there is little research in Brazil to examine associations between race and cervical cancer, in the USA, there have been many studies whose results are to those in Brazil. However, only one such study has analyzed time series. Between 2000 and 2012, mortality rates for black women aged 65 in the USA were found to follow an increasing trend against a stable trend for white women[16]. As compared with white women, non-Hispanic black women faced an increased risk of cervical cancer mortality, while Hispanic women showed decreased risk[17-19].

The differences in cervical cancer mortality, by race, found here, can be explained by the unequal distribution of social resources. Although this situation results from levels of poverty, it is catalysed by racial inequalities. The central interventions to control cervical cancer are oncotic cytology, timely diagnosis, and treatment; accordingly, the different mortality rates can be explained by difficulties in accessing services. Younger black women in Rio de Janeiro had less access, received less information, and rated worse the care they received[20]. A similar situation was found in two cities in Rio Grande do Sul (Pelotas and São Leopoldo), where racial inequalities in access persisted even after controlling for age and socioeconomic factors[21]. In Brazil, black women had significantly fewer Pap smears and breast exams and more late diagnoses with worse prognoses[22-25]. A similar situation in access to medical procedures has been found in the USA. Even when clinically indicated, black women received less surgery for early-stage disease, less chemotherapy, and less radiotherapy[18,26].

Macrostructural and political factors hinder the black population's access to services. Vulnerability influences decision-making and assertion of rights. Relationships between individuals and how they position themselves in the world are dictated by social, cultural, and historical conditions, which shape the health and disease process and many other conditions. These determinants maintain and reproduce social forms in diverse domains, preventing people from demanding health services[27-29]. Although slavery was abolished in Brazil more than a century ago, its relics and updated forms exist and are expressed in a socially disadvantaged black population. Most economic and health indicators reveal unfair differences by race[30]. The positions occupied by groups and individuals in social space, the way they relate to each other, and nature in the process of producing wealth are at the origin of diseases and their unequal distribution in the population.

The findings of this study should be interpreted in view of the limitations of using secondary data. Although the quality of the Mortality Information System (SIM) has improved, approximately 30% of deaths in the study period were found to have been classified as unspecified uterine cancer. The proportional redistribution described in the Methods section was designed to circumvent this limitation.

Surprisingly, completion of the race field in SIM records proved good quality. Race could be determined in 95.0% of deaths from cervical cancer (ICD C53 and deaths redistributed from ICD C55). This improved over time, with better quality data in recent years: notification rates were 90.7% in 2002 and 97.8% in 2021.

Another factor to be considered when interpreting the results is that, between the 2000 and 2010 Censuses, the percentage of self-declared black and brown respondents increased, while those self-declared white decreased[11]. The effect of this phenomenon on the mortality coefficient for the black population was to increase the denominator and thus reduce the coefficient. For the white population, the opposite occurred: the denominator decreased, increasing the coefficient. It is thus possible that the coefficients given here for black women are underestimated and those for white women, overestimated. Accordingly, racial inequality may be even more pronounced than in our results.

Importantly, the classification of race in the census and SIM data may not be uniform. Although both records self-declared race, the census offers greater accuracy because it is conducted by personnel specifically trained to obtain population information.

This study's importance resides in its originality. It is the first study to examine relationships

between race and age-standardised, corrected cervical cancer mortality on a Brazil-country basis. Furthermore, it underlines the challenge of overcoming inequalities in health service access to create a truly universal and equitable health system. Services need to organize care in such a manner as to grasp and address racial disparities. Interventions in the social determinants of health and related conditioning factors should reflect the endevour to achieve racial equality.

Lastly, the study findings point to the need for a policy and management decision-making structure that give priority to reducing the effects of institutional racism. As regards the policy to combat cervical cancer, black women should receive special attention when strategies are developed for Brazil's national cervical and breast cancer control programme (*Programa Nacional de Controle do Câncer do Colo do* Útero *e de Mama*). Primary health care goals and activities, HPV vaccination coverage, screening, the referral and counter-referral system, and implementation of a service network for timely treatment should consider the specifics and needs of the black population.

Collaborations

OC Luiz, V Nisida, ASP Souza, AM Silva Filho, APN Nunes participated in the study conception and design, information gathering, and data analysis and interpretation. ASP Souza and OC Luiz prepared the preliminary versions of the manuscript, and OC Luiz, ASP Souza, V Nisida, AM Silva Filho, and APN Nunes performed a critical review of the intellectual content and approved the final version. All authors are responsible for all aspects of the work and guarantee its accuracy and integrity.

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