Influence of Race/Skin Color on Delays in Care for Oral Cavity Cancer in Brazil: The Mediating Role of Geography and Clinical Severity

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Influência da Raça/Cor da Pele nos Atrasos Assistenciais ao Câncer de Cavidade Oral no Brasil: O Papel Mediador da Geografia e da Gravidade Clínica

Influencia de la Raza/Color de Piel en los Retrasos en la Atención del Cáncer de Cavidad Oral en el Brasil: El Papel Mediador de la Geografía y la Gravedad Clínica

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ABSTRACT

Introduction: The social, economic, cultural, and ethnic-racial disparities in Brazil may be related to the time it takes for healthcare services to diagnose and treat oral cavity cancer. **Objective:** To analyze the relationship between race/skin color and different time intervals for the diagnosis and treatment of oral cavity cancer in Brazilian health services. **Method:** Observational, hospital-based study with 12,421 cases retrieved from the Brazilian Hospital Cancer Registries. Ethnic-racial classification was based on the combination of color and race categories used by the Brazilian Institute of Geography and Statistics. The Wilcoxon rank-sum test, Poisson regression model, and causal mediation analysis were applied. **Results:** The retrieved records represented 6,523 (53%) white individuals and 5,898 (47%) non-white individuals. The groups showed heterogeneity in sociodemographic, clinical, and therapeutic variables, but were homogeneous regarding the main risk factors for the disease. Significant differences were observed in all key points analyzed (p<0.001). Non-white individuals have a longer health services interval than white individuals (median of 71 vs. 57 days, respectively), with the direct effect of race/skin color being significant (p<0.001) even when mediated by region of residence or clinical stage of the disease. **Conclusion:** Race/skin color has a decisive impact on waiting times in Brazilian healthcare services, where non-white individuals wait, on average, 16.2 days longer than white individuals.

Key words: Mouth Neoplasms; Racial Groups; Diagnosis; Time-to-Treatment; Squamous Cell Carcinoma of the Head and Neck.

RESUMO

Introdução: As disparidades sociais, econômicas, culturais e étnico-raciais do Brasil podem ter relação com o intervalo do serviço de saúde para o diagnóstico e tratamento do câncer de cavidade oral. **Objetivo:** Analisar a relação entre a raça/cor da pele e diferentes intervalos de tempo para o diagnóstico e tratamento do câncer de cavidade oral nos serviços de saúde brasileiros. **Método:** Pesquisa observacional, de base hospitalar, com 12.421 casos recuperados dos Registros Hospitalares de Câncer Brasileiro. A classificação étnico-racial foi baseada na combinação das categorias de cor e raça empregada pelo Instituto Brasileiro de Geografia e Estatística. Foram aplicados o teste de soma de postos de Wilcoxon, modelo de regressão de Poisson e análise de mediação causal. **Resultados:** Os registros recuperados representaram 6.523 (53%) indivíduos brancos e 5.898 (47%) não brancos. Os grupos exibiram heterogeneidade para as variáveis sociodemográficas, clínicas e terapêuticas, sendo homogêneos para os principais fatores de risco da doença. Com diferenças significativas em todos os pontos-chave analisados (p<0,001), os indivíduos não brancos apresentam intervalo do serviço de saúde maior que os brancos (mediana de 71 *vs.* 57 dias, respectivamente), sendo o efeito direto da raça/cor da pele significativo (p<0,001) mesmo quando mediado pela Região de residência ou estadiamento clínico da doença. **Conclusão:** A raça/cor da pele exerce um impacto determinante no tempo de espera nos serviços de saúde brasileiros, onde indivíduos não brancos esperam, em média, 16,2 dias a mais do que brancos.

Palavras-chave: Neoplasias Bucais; Grupos Raciais; Diagnóstico; Tempo para o Tratamento; Carcinoma de Células Escamosas de Cabeça e Pescoço.

RESUMEN

Introducción: Las disparidades sociales, económicas, culturales y étnico-raciales en el Brasil podrían estar relacionadas con el tiempo transcurrido entre el diagnóstico y el tratamiento del cáncer de cavidad oral en los servicios de salud. **Objetivo:** Analizar la relación entre la raza/color de piel y los diferentes intervalos de tiempo para el diagnóstico y el tratamiento del cáncer de cavidad oral en los servicios de salud brasileños. **Método:** Estudio observacional hospitalario, con 12 421 casos recuperados de los Registros Hospitalarios de Cáncer del Brasil. La clasificación étnico-racial se basó en la combinación de categorías de color y raza utilizada por el Instituto Brasileño de Geografía y Estadística. Se aplicaron la prueba de suma de rangos de Wilcoxon, el modelo de regresión de Poisson y el análisis de mediación causal. **Resultados:** Los registros recuperados presentaron a 6523 (53%) personas blancas y 5898 (47%) personas no blancas. Los grupos mostraron heterogeneidad con respecto a las variables sociodemográficas, clínicas y terapéuticas, pero homogeneidad en cuanto a los principales factores de riesgo para la enfermedad. Se observaron diferencias significativas en todos los puntos clave analizados (p<0,001). Las personas no blancas tienen un intervalo del servicio de salud más largo que el de las personas blancas (mediana de 71 frente a 57 días, respectivamente), y el efecto directo de la raza/color de la piel es significativo (p<0,001) incluso cuando está mediado por la región de residencia o el estadio clínico de la enfermedad. **Conclusión:** La raza/color de piel tiene un impacto decisivo en los tiempos de espera en los servicios de salud brasileños, donde los individuos no blancos esperan, en promedio, 16,2 días más que los individuos blancos.

Palabras clave: Neoplasias de la Boca; Grupos Raciales; Diagnóstico; Tiempo de Tratamiento; Carcinoma de Células Escamosas de Cabeza y Cuello.

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INTRODUCTION

With a multifactorial etiology, oral cavity cancer attacks people with no distinction of age, race, ethnicity, or sex[1], and is the result of environmental exposures, genetic susceptibility, and other factors that may lead to risk differences between different groups of people[2]. The progressive increase in cancer incidence and mortality makes this chronic non-communicable disease a relevant public health problem and a challenge to the healthcare system, which directly influences oncological outcomes[3,4].

The healthcare service interval encompasses the time from the individual's admittance into the oncology care service, through the first consultation with the specialist responsible for treatment, until the start of specific treatment for the neoplasm.[5]. Aiming at the timely diagnosis and treatment of individuals with suspected cancer in Brazil, Law N. 13,896/2019[6] establishes a deadline of up to 30 days for diagnostic confirmation, followed by 60 days to start the treatment, according to Law N. 12,732/2012[7]. The longest interval in healthcare services may be related to how the service is organized and include factors, such as geographical distribution, availability of services, access difficulties, quality of human and technological resources[8], and issues related to the individuals, like social determinants, race/ethnicity, and financial restrictions, among others[9,10]. These conditions, either from individuals or the services, are added to the rooting and persistence of structural racism, which is a set of practices — unconscious, conscious, or institutionalized —, producing invisibility, unequal treatment, and less social prestige to certain groups of society[11].

The magnitude and trend of oral cavity cancer mortality rates are influenced by sociodemographic and economic aspects, anatomical location of the tumor, and the availability, efficacy, and quality of services provided to individuals[12-16]. Exposing the inequality in cancer incidence and mortality in different social layers of the population[13,14], Cunha, Prass e Hugo[14] identified a growing pattern in the oral cavity cancer mortality rate for non-white men (20.36%/year) and women (8.24%/year).

Brazil, a country of continental dimensions, presents social, economic, cultural, and racial-ethnic disparities across regions[17]. With a major part of the population self-declared as non-white (56.5%), it becomes relevant to investigate the itineraries of these Brazilians in their pursuit for oncology care. The literature shows that racial-ethnic disparities in different areas are well discussed, but the relation between race/skin color and the time it takes for a healthcare service to treat oral cavity cancer deserves further investigation. Thus, the objective of this study is to analyze the relationship between race/skin color and different time intervals for the diagnosis and treatment of oral cavity cancer in Brazilian health services.

METHOD

Hospital-based observational study with individuals diagnosed with oral cavity cancer in Brazil. Data was obtained from the Hospital-based Cancer Registries Informational Support System (SisRHC), updated by oncology-licensed hospitals in every Brazilian State and the Federal District. The data search was done in June 2023 at the electronic address of the Integrated Module of Hospital-based Cancer Registries (RHC)[18].

The study included all the analytical records identified in SisRHC from 2000-2022, with age groups starting at 19 years old, histopathological confirmation for squamous cell carcinoma (code 8070/3), classified in the categories C00, C02 to C06 (C00 lip, C02 other parts of tongue, unspecified, C03 gum, C04 floor of mouth, C05 palate, and C06 other parts of mouth, unspecified), according to the 2nd edition of the International Classification of Diseases for Oncology[19] (ICD-O) until the year 2004 and according to the ICD-O[20], 3rd edition, from 2005 onwards. The study excluded those who came to the hospital with a diagnosis and/or treatment transferred from other National Health System (SUS) units, presented date of treatment before the diagnosis, were missing key dates in the record, or had a negative difference for the number of days between key dates, in addition to records with no information regarding race/skin color.

The variables considered in this study are related to the sociodemographic characteristics (sex, age, race/skin color, marital status, education, main occupation, and region of residence), risk factors (smoking, alcohol drinking, and family history of cancer), tumor characteristics (primary tumor location and grouped staging), diagnosis and treatment (origin of referral, displacement, first treatment received at the hospital, main reason for not undergoing the first treatment at the hospital, disease status at the end of the first treatment and the key dates in the health service interval — date of admittance in the oncology service provided, date of first consultation, date of first diagnosis, and date of the first treatment at the hospital).

Ethnic-racial classification was based on the combination of color and race categories used by the Brazilian Institute of Geography and Statistics. This variable was divided into whites and non-whites, respectively, for the records identified as whites and the records identified as blacks, browns, yellows, and indigenous. Seeking to work with individuals starting at younger ages, the Brazilian Statute of the Child and Adolescent (ECA)[21] and the SisRHC[22] manual were used to determine the minimum age for

participating in this study. For analysis purposes, ages were categorized into age groups and occupations into larger groups following the aggregated structure of the Brazilian Classification of Occupations[23]. The time interval data was analyzed as a continuous variable, respecting the criteria proposed by the Aarhus Declaration[5], with the health services interval being considered from the time of admittance to the oncology services until the specific treatment for the neoplasm.

The data analysis encompassed a descriptive statistical assessment of the studied population, including absolute and relative frequencies of the categorical variables, according to race/skin color, as well as medians and interquartile intervals of the continuous variable. The significance level adopted was 5% (α=0.05). Statistical tests were conducted, including Pearson's chi-square test[24], which assessed the relationship between categorical variables and race/skin color. Followed by the Wilcoxon rank-sum test[25], which calculated the number of days between the key dates of the health services time interval and compared the medians between the two groups. The choice for the Wilcoxon test was due to the nature of the time interval data distribution (number of days), which presented strong asymmetry (non-normality), making the parametric tests unfit for median comparisons.

In the context of modeling, to estimate the Prevalence Ratio (PR) of a certain number of days within the healthcare service interval, considering one or more predictors, a Poisson regression model was implemented with a negative binomial distribution. The selection of covariables for the main association model — race/skin color and number of days in the health service interval — followed theoretical criteria related to scientific evidence that suggest the action of certain variables as confusion factors[10,26-28].

Additionally, a causal mediation analysis was conducted to investigate the mechanisms by which race/skin color influences waiting times, testing the clinical and geographic mediation hypotheses. Two independent models were structured using the *mediation* statistical package. In the first model, clinical staging (divided into initial and advanced) was assessed as a clinical mediator; in the second, region of residence (grouped in North/Northeast and other regions) was tested as a structural mediator. Both models were adjusted for education, family history, and marital status. For estimating effects, the non-parametric bootstrapping procedure was used with 100 simulations to calculate the Average Causal Mediation Effect (ACME), Average Direct Effect (ADE), and Average Proportion, with 95% confidence intervals (CI) calculated by the percentile method. All the analyses were conducted using the R[29] software, version 4.3.2.

According to Resolution 510/2016[30], there was no need for approval from a Research Ethics Committee, as this study used public domain data available on the Internet, with no identification or direct contact with individuals.

RESULTS

The *IntegradorRHC* registry had, for the 2000-2022 period, 104,521 oral cavity cancer records, with approximately 88% (91,900) of those being squamous cell carcinoma (SCC) and the other diagnosed as other neoplasms of epithelial, mesenchymal, odontogenic, and hematopoietic origin. The eligibility criteria were applied to the SCC records, resulting in 12,421 records analyzed (Supplementary Figure 1).

When analyzing the sociodemographic profile and life habits of individuals diagnosed with oral cavity cancer according to race/skin color, Table 1 shows that most cases in white and non-whites are, respectively, in men (77% and 74%), aged between 40 and 59 years (45% and 46%), with elementary education (67.2% and 62%), smokers (70.6% and 69%), alcohol drinkers (54.2% and 53%), who have no family history of cancer (59% and 62.6%). White individuals tend to have activities in the extractive, construction, textiles, and other industries as their main occupation (31.1%), live in the South region (42.8%), and have a spouse (54%). Non-whites are more likely to engage in agricultural, forestry, and fishery activities (44.2%) as their main occupation, live in the Northeast region (62.2%), and have no spouse (51.7%).

Table 2 shows the clinical, diagnostic, and treatment characteristics of oral cavity lesions, according to race/skin color. White and non-white individuals mostly present, respectively, cancer located on the tongue (30.7% and 36.2%), diagnosed in advanced stage (69.7% e 74%), referred to the SUS oncology service (83% and 83%), needing to travel from their residence to another municipality to undergo treatment (59% and 68.5%), underwent surgery as primary treatment (60.1% and 48.5%), and present full remission at the end of that treatment (39.3% and 24.6%). Most records from both race/skin color groups received treatment (96% and 94%); however, those who did not receive treatment were due to death (3.5%) for non-whites and lack of clinical conditions (1.3%) and death (1.3%) for whites.

The median number of days between the key dates of the health services interval and its comparison between the two race/skin color groups are presented in Table 3. It shows that white individuals wait less to receive care from the oncology specialist after being admitted to the oncology service (median of 0 days), to receive a diagnosis

after the first consultation (median of 9 days), to initiate treatment after diagnostic confirmation (median of 35 days), and to initiate treatment after admission (median of 57 days), when compared to the group of non-whites (medians of 0, 12, 47, and 71 days, respectively). This highlights significant differences between white and non-white race/skin color groups in relation to every key date within the health service interval (p<0.001).

Table 4 shows the association models between race/skin color and the health service interval. In the crude model (Model 1), non-white individuals presented a waiting time 28% longer than white individuals (PR 1.28; 95% CI 1.21-1.36). This association remained robust after successive adjustments per education degree, family history, and marital status in Model 3 (PR 1.24; 95% CI 1.16-1.31; p<0.001). When including the variables region of residence and clinical staging (Model 4), PR was attenuated to 1.02 (95% CI 0.97-1.07), with a global p value still significant (p<0.001).

The causal mediation analysis allowed us to identify the mechanisms by which racial disparity operates in the oncology workflow (Table 5). When assessing the mediation per clinical staging, it was possible to notice that this does not explain the longer waiting time, since advanced cases exert an indirect effect of suppression in the increase of the health service interval (ACME = -0.31; p<0.001). In contrast, in the region of residence mediation, the concentration of non-white population in the North and Northeast regions was observed to exert a significant indirect effect on the increase of waiting time (ACME = 0.70 days; p<0.001). Although geography explains around 4.1% of the total disparity, the direct effect — ADE — revealed that non-white individuals wait, on average, 16.2 days longer than white individuals, regardless of their region of residence.

DISCUSSION

The results found in this study, respecting the Aarhus Declaration's[5] recommendations for studies on cancer diagnosis and treatment, show that there was a relation between race/skin color and the health service interval for diagnosis and treatment of oral cavity squamous cell carcinoma in Brazil.

Even with 56% of the Brazilian population represented by black people[17], the white race/skin color group was more prevalent in this study, corroborating previous studies[31,32] regarding the epidemiological profile of oral cavity cancer. The other sociodemographic characteristics and life habits of the individuals diagnosed with oral cavity cancer are consistent with the literature[32-34] and indicate that even finding significant differences among the groups regarding sex, age, marital status, education, occupation, region of residence, and family history of cancer, the main risk factors for the disease are common among the individuals with oral cavity cancer in Brazil, regardless of race/skin color.

The results from this study reveal clinical and therapeutic inequality between the groups studied, regarding tumor location, staging, need for displacement to receive treatment, first-established treatment, main reason for not undergoing the first treatment, and disease status at the end of the first treatment. Non-white individuals tend to manifest more unfavorable clinical conditions than white individuals, impacting their disease prognoses. Similar results were found by Amorim et al.[35], Baliga et al.[36], and Osazuwa-Peters et al.[37], who observed a worse prognosis for oral cavity cancer among non-white individuals.

Brazil is historically constituted based on racial, social, colonial, patriarchal, and class oppression and discrimination, which makes this country bear an inequality and exploitation matrix, which reflects in the conception, management, and formulation of health policies, in the production of care and health conditions of the different population groups. Rooted in Brazilian society, structural racism and its intersections privilege a certain race, facilitating access to goods, services, and opportunities, to the detriment of others. Thus, like in other American and European countries, in Brazil, this distinction favors the whites and disfavors the black and indigenous, for example[11].

This study found that the primary means of accessing oral cavity cancer diagnosis and treatment in Brazil, regardless of race/skin color, is through SUS. What can be justified by the high diagnosis and treatment costs of this disease, and the fact that SUS is organized as a health care network, responsible for providing free and integral assistance, including oncological care, involving all care levels[38,39]. The gold standard for oral cavity cancer diagnosis is biopsy of the lesion, which can be done in the Dental Specialties Centers (DSC) or in the high complexity services for specialized and integral assistance to patients with cancer[38]. Thomaz et al.[40] found that referrals from DSCs in Brazil for oncology-specialized hospital care have decreased. Considering data from the National Cancer Institute RHC (RHC-INCA), Raymundo et al.[41] observed that the origin of SUS hospital referrals for individuals with oral cavity cancer is associated with socioeconomic factors.

The main treatment for oral cavity cancer in Brazil, regardless of race/skin color, is surgery. Despite sharing general therapeutic modalities (surgery, chemotherapy, radiotherapy), the malignant neoplasms present distinct

Table 1. Sociodemographic profile and life habits of individuals diagnosed with oral cavity cancer according to race/skin color. Brazil, 2000-2022

Variables	White N = 6,523		Non-white N = 5,898*		$p^{\S}$
Sex					**<0.001**
Male	5,041	77%	4,383	74%	
Female	1,482	23%	1,515	26%	
Age					**0.009**
19-39 years old	284	4.4%	210	3.6%	
40-59 years old	2,951	45%	2,685	46%	
60-79 years old	2,807	43%	2,494	42%	
≥80 years old	481	7.4%	509	8.6%	
Marital status					**<0.001**
Has a spouse	3,410	54%	2,805	48.3%	
No spouse	2,914	46%	3,002	51.7%	
Education					**<0.001**
Illiterate	94	17%	1,379	27.6%	
Elementary	3,713	67.2%	3,089	62%	
High school	666	12.1%	444	9%	
Higher education	206	3.7%	68	1.4%	
Grouped occupation					**<0.001**
Agricultural, forestry, fishery	1,099	28%	1,666	44.2%	
Officers	22	0.6%	18	0.5%	
Public sector chiefs	48	1.2%	19	0.5%	
Science and liberal arts professionals	166	4.2%	85	2.2%	
Technicians with high school diploma	84	2.1%	48	1.3%	
Administrative services	90	2.3%	63	1.7%	
Services and sales	949	24.1%	708	18.8%	
Extractive, construction, textile and other industries	1,221	31.1%	942	25%	
Chemical, steel, food industries	39	1.0%	56	1.5%	
Repair and maintenance	212	5.4%	163	4.3%	
Region of residence					**<0.001**
Southeast	2,213	34%	1,406	23.9%	
Northeast	1,208	18.6%	3,659	62.2%	
South	2,771	42.8%	243	4.1%	
Central-West	195	3%	217	3.7%	
North	107	1.6%	359	6.1%	
History of tobacco intake				**0.057**	**0.057**
Yes	3,627	70.6%	3,252	69%	
No	1,504	29.4%	1,466	31%	
History of alcohol intake				**0.078**	**0.078**
Yes	2,641	54.2%	2,316	53%	
No	2,180	45.8%	2,058	47%	
Family history of cancer					**0.003**
Yes	1,443	41%	1,180	37.4%	
No	2,071	59%	1,971	62.6%	

Source: Brazil[18].
Captions: *Yellow = 77 records, Indigenous = 13 records, Brown = 5,082 records, Black = 725 records; §Pearson's Chi-square test.

Table 2. Clinical, diagnostic, and treatment characteristics of oral cavity lesions, according to race/skin color. Brazil, 2000-2022

Variables	White N = 6,523		Non-white N = 5,898		$p^{\S}$
Tumor location					**<0.001**
Tongue	2,000	30.7%	2,135	36.2%	
Lip	1,022	15.6%	499	8.5%	
Gum	215	3.3%	221	3.7%	
Floor of mouth	1,041	16%	915	15.5%	
Palate	1,020	15.6%	1,057	18%	
Other parts of mouth	1,225	18.8%	1,071	18.1%	
Grouped staging					**<0.001**
Advanced staging	2,918	69.7%	3,150	74%	
Initial stage	1,268	30.3%	1,110	26%	
Origin of referral					**0.811**
SUS	4,660	83%	4,509	83%	
Not SUS	953	17%	911	17%	
Displacement					**<0.001**
No	2,662	41%	1,858	31.5%	
Yes	3,861	59%	4,040	68.5%	
First treatment					**<0.001**
Surgery	3,918	60.1%	2,859	48.5%	
Radiotherapy	1,598	24.5%	1,978	33.6%	
Chemotherapy	955	14.7%	993	16.8%	
Others	39	0.6%	54	1%	
None	8	0.1%	8	0.1%	
Reason for not undergoing the first treatment					**<0.001**
Lack of clinical condition	84	1.3%	27	0.4%	
Refusal / Drop out	33	0.5%	45	0.8%	
Treatment performed elsewhere	6	0.1%	10	0.2%	
Death	81	1.3%	204	3.5%	
Other reasons	47	0.8%	65	1.1%	
Underwent treatment	6,060	96%	5,424	94%	
Disease status at the end of the first treatment					**<0.001**
Complete remission	1,944	39.3%	1,094	24.6%	
Partial remission	400	8.1%	267	6%	
Stable disease	922	18.7%	1,047	23.5%	
Disease in progression	849	17.2%	984	22.1%	
Death	826	16.7%	1,057	23.6%	

Source: Brazil[18].
Caption: §Pearson's chi-square test.

Table 3. Median of the number of days between the key dates of the health services interval for oral cavity cancer in Brazil, according to race/skin color groups

Intervals	White N = 6,523*	Non-white N = 5,898*	$p^{\S}$
From admittance to oncology service to first consultation (days)	0 (0-0)	0 (0-1)	**<0.001**
From first consultation do diagnosis (days)	9 (4-25)	12 (5-29)	**<0.001**
From diagnosis to treatment start (days)	35 (0-71)	47 (9-85)	**<0.001**
Health services interval† (days)	57 (27 - 97)	71 (40 - 112)	**<0.001**

Source: Brazil[18].
Captions: *Median (Q1 – Q3); §Wilcoxon's test; †From admittance to oncology service to treatment start.

Table 4. Association between the health service interval and race/skin color in Brazil

Model	PR	95% CI	*global p*
Model 1[a]	1.28	1.21-1.36	**<0.001**
Model 2[b]	1.25	1.17-1.32	**<0.001**
Model 3[c]	1.24	1.16-1.31	**<0.001**
Model 4[d]	1.02	0.97-1.07	**<0.001**

Captions: PR = Prevalence ratio; CI = Confidence interval; [a]Crude model; [b]Education and family history-adjusted model; [c]Education, family history, and marital status-adjusted model; [d]Education, family history, marital status, region of residence, and clinical staging-adjusted model.

Table 5. Causal mediation analysis of the direct and indirect effects of race/skin color on the waiting times for oral cavity cancer treatment, according to clinical and geographical mediators

Mediation model	Direct Effect (ADE)	Indirect Affect (ACME)	Total Effect	Mediated Proportion
Mediator: Staging	7.48*	-0.31*	7.17*	-4.30%
Mediator: Region (N/NE)[a]	16.24*	0.70*	16.94*	4.10%

Captions: ADE (Average Direct Effect): Effect of race regardless of the mediator; ACME (Average Causal Mediation Effect): Effect of race that operates through the mediator; [a]Region of residence (North/Northeast); *p<0.001.

clinical commitment and prognosis, depending on their origin, which reflects on the sensitivity to the treatment and choice of main approach. In cases of squamous cell carcinomas, surgery is the most commonly applied treatment[32,42]. By the end of the first treatment, non-white individuals presented worse outcomes in this research, such as death and disease progression. These findings are similar to those by Osazuwa-Peters et al.[37], who found a 40% higher risk of mortality in non-white individuals, when compared to white individuals (Relative Risk – RR 1.40, 95% CI 1.35–1.46). It is worth reinforcing that, in the present study, the time median between the key dates "diagnosis and treatment start" for non-whites was 47 days, dangerously approaching the legal 60-day deadline[7], while for whites (35 days) there was a larger safety margin.

Lima et al.[10], in a systematic review, reported that the long interval in oral cavity cancer diagnosis has diverse and complex causes, involving different factors connected to the individuals, health professionals, and/or health services, conditions that are also found in other studies[43,44]. It is noteworthy in this study that there is a temporal inequality in the number of days until care for individuals with oral cavity cancer in Brazil, with white individuals more likely to have a faster process of diagnosis and treatment than non-whites. So, in this study's education, family history, and marital status-adjusted model, the median of the number of days in the health service interval varies 24% for race/skin color.

A key finding from this study is the decomposition of the delay mechanisms through causal mediation analysis. It has been shown that the region of residence acts as a structural mediator, indicating that part of the disadvantage faced by non-white patients is explained by their geographic concentration in areas with greater healthcare gaps (North and Northeast). On the other hand, clinical staging presented a suppression effect, suggesting that, although SUS tries to prioritize advanced cases, this clinical haste is insufficient to nullify the impact of structural racism. The expressive ADE found in the study, which reached 16.2 days in the regional model, shows that racial disparity is not merely a sub-product of the disease's severity or geographical location, but a persistent barrier in the care workflow that imposes a systematic temporal onus to the non-white population, regardless of their clinical condition or region of residence.

The early diagnosis and treatment of oral cavity cancer are possible in shorter intervals between the identification of a suspicious lesion, diagnostic confirmation, and the start of treatment. In this sense, although each area has a well-established role in the SUS care network, the integrated multidisciplinary approach is more effective than a succession of isolated interventions in patient management, reducing disease mortality and sequelae from more aggressive treatments, which compromise speech, swallowing, and socializing. For that, in Brazil, Laws N. 12,732/2012[7] and 13,896/2019[6] define the maximum time for cancer diagnosis and start of treatment.

By using only data from individuals who accessed hospitals that provide oncological healthcare services, this study presents a possible selection bias, as well as limitations that involve under-recording, incompleteness of variables, system updates, among others. To bypass these, SisRHC encourages professionals to completely and legibly fill out the medical record and applies critical routines that analyze the validity and inconsistency of information. Therefore, data available from *IntegradorRHC* are reliable[45] to the conduction of different studies that aim to collaborate with epidemiological surveillance, help with administrative planning, and support policies for cancer prevention. It is important to highlight that the non-white population may have access barriers to reach the hospital, causing an iceberg[46] effect, in which the data presented may be subjected to the real existing disparity. Moreover, the Aarhus Declaration determines criteria that consider a healthcare system with a different organization from the Brazilian SUS.

CONCLUSION

The present study shows that, in Brazil, there is a heterogeneity in the health service interval for oral cavity cancer according to race/skin color. White individuals present a more favorable sociodemographic, clinical, and therapeutic profile, while non-whites face more vulnerability conditions, manifested in worse clinical outcomes, greater access barriers, and longer waiting times.

The causal mediation analysis confirmed that race/skin color exerts a determinant impact on the health service interval. This reveals that inequality is not merely a reflex of the clinical severity or geographical location, but a structural racism phenomenon and, perhaps, direct institutional racism, which imposes a waiting time of up to 16.2 days for the non-white population, regardless of the region of residence or the clinical staging of the disease.

Although SUS is organized on universality and integrity principles, data shows that the current oncology pathway fails to ensure racial equity. Therefore, compliance with current legislation regarding maximum time frames for diagnosis and treatment must be accompanied by public policies that specifically address racial and territorial barriers, otherwise disparities in the prognosis and survival of individuals with oral cavity cancer will persist.

CONTRIBUTIONS

Lidiane de Jesus Lisboa, Jean Carlos Zambrano Contreras, and Valéria Souza Freitas have substantially contributed to the study design, data acquisition, analysis, and interpretation, wording, and critical review. They approved the final version for publication.

DECLARATION OF CONFLICT OF INTERESTS

There is no conflict of interest to declare.

DATA AVAILABILITY STATEMENT

The generated data sets analyzed during the current study are available at the following URL: <https://irhc.inca.gov.br/RHCNet/visualizaTabNetExterno.action>

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