

Overview of oral cancer in the state of Paraná, Brazil: an epidemiological analysis of the period 2008-2019**Panorama do câncer bucal no estado do Paraná, Brasil: uma análise epidemiológica do período 2008-2019****Panorama del cáncer oral en el estado de Paraná, Brasil: un análisis epidemiológico del período 2008-2019**

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Objective: to analyze the panorama of oral cancer in adults in the state of Paraná, from 2008 to 2019. **Methods:** descriptive, population-based study in the state of Paraná, Brazil, with analysis of secondary data obtained from the federal databases of the Hospital Information System. The variables investigated were: frequency of hospitalization, geographic distribution, deaths by sex, race/color, age group and hospitalization costs. Data were tabulated in TabWin 4.15 and analyzed in Microsoft Excel®. **Results:** there was an increase in oral neoplasms from 2017, especially in the East and Northwest regions. The frequency of oral cancer in men was 64% higher than in women, with the age of 45 years being the most affected. In men, higher values occurred between 55 and 64 years of age (31.3%), while in women from 65 years of age (37.2%). **Conclusion:** cases of oral cancer are distributed throughout the state, revealing the importance of adopting a global prevention program and application of early diagnosis and treatment methods.

Descriptors: Mouth neoplasms; Head and neck neoplasms; Epidemiology; Risk factor.

Objetivo: analisar o panorama do câncer bucal em adultos do estado do Paraná, de 2008 a 2019. **Método:** estudo descritivo, de base populacional no estado do Paraná, com análise de dados secundários obtidos nas bases federais do Sistema de Informação Hospitalar. As variáveis investigadas foram: frequência de internamento, distribuição geográfica, óbitos por sexo, raça/cor, faixa etária e custos de internamento. Os dados foram tabulados em TabWin 4.15 e analisados em Microsoft Excel®. **Resultados:** houve aumento das neoplasias bucais a partir de 2017, com destaque para as regiões Leste e Noroeste. A frequência de câncer bucal em homens se mostrou 64% superior que em mulheres, com a idade de 45 anos sendo a de maior acometimento. Nos homens, valores superiores ocorreram entre 55 e 64 anos de idade (31,3%), enquanto nas mulheres a partir de 65 anos (37,2%). **Conclusão:** os casos de câncer bucal se distribuem por todo estado, revelando a importância de ser adotado um programa de prevenção global e aplicação de métodos de diagnósticos e tratamento precoces.

Descritores: Neoplasias bucais; Neoplasias de cabeça e pescoço; Epidemiologia; Fator de risco.

Objetivo: analizar el panorama del cáncer oral en adultos en el estado de Paraná, desde 2008 hasta 2019. **Método:** estudio descriptivo de base poblacional en el estado de Paraná, Brasil, con análisis de datos secundarios obtenidos en las bases federales del Sistema de Información Hospitalaria. Las variables investigadas fueron: frecuencia de hospitalización, distribución geográfica, muertes por sexo, raza/color, grupo de edad y costes de hospitalización. Los datos se tabularon en TabWin 4.15 y se analizaron en Microsoft Excel®. **Resultados:** hubo un aumento de las neoplasias orales a partir de 2017, con énfasis en las regiones Este y Noroeste. La frecuencia del cáncer oral en los hombres fue un 64% mayor que en las mujeres, siendo la edad de 45 años la más afectada. En los hombres, los valores más altos se dan entre los 55 y los 64 años (31,3%), mientras que en las mujeres a partir de los 65 años (37,2%). **Conclusión:** los casos de cáncer bucal se distribuyen por todo el estado, revelando la importancia de ser adoptado un programa de prevención global y la aplicación de métodos de diagnóstico y tratamiento precoces.

Descritores: Neoplasias de la boca; Neoplasias de cabeza y cuello; Epidemiología; Factor de riesgo.

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INTRODUCTION

Oral neoplasms are frequent morbidities, and oral cancer (OC), especially squamous cell carcinoma, also called squamous cell carcinoma, is one of the ten most prevalent worldwide, with an increasing trend and high annual morbidity and mortality rate. In 2020, it was estimated that 377,700 new cases of OC occurred worldwide, with 177,800 deaths¹.

The José Alencar Gomes da Silva National Cancer Institute (INCA), in its publication of cancer incidence estimates for Brazil, considers malignant neoplasms of the oral cavity to be those whose primary location affects the mouth, lips, salivary glands and oropharynx². In Brazil, OC is the 12th most frequent tumor, corresponding to 11,200 new cases in men, with greater involvement in the age group from 49 to 50 years, and 3,500 new cases in women in the period 2018-2019³.

The estimate, according to INCA, is that for each year of the triennium 2020-2022, there will be 15,190 new cases of cancer of the lips and oral cavity; of these, there will be 11,180 cases in men and 4,010 in women. These values correspond to an estimated risk of 10.69 new cases per 100,000 men, ranking 5th among the most prevalent neoplasms. For women, it corresponds to 3.71 for every 100 thousand of them, being the 13th most frequent among all cancers⁴. Such statistics are corroborated by national findings, in which men contributed in 81% of deaths, with an average mortality rate of 4.5 deaths per 100,000 inhabitants, while for women the figure was 0.9 per 100,000 inhabitants⁵.

In Brazil, the geographic distribution of OC cases and mortality is variable⁶. In the South region, OC is the 6th most prevalent among men (13.36/100 thousand inhabitants) and the 14th among women (4.08/100 thousand inhabitants)⁴. The Report on the care and epidemiological scenario of cancer of the lip and oral cavity in Brazil, published in 2020, revealed that the South is the 2nd region with the second highest mortality rate in the country due to the disease⁶.

The development of OC has a multifactorial origin, and among the intrinsic risk factors involved are inherited or acquired genetic mutations, problems in the immune system and nutritional factors⁷. These, in turn, are exacerbated or influenced by extrinsic factors related to life habits, such as tobacco consumption, excessive consumption of alcoholic beverages, Human Papillomavirus (HPV), unprotected exposure to ultraviolet rays and inadequate or insufficient oral hygiene^{8,9}.

Therefore, the variation in geographic and regional incidences, as well as the onset and progression of the clinical stages of the disease, may be related to cultural, demographic and

social factors¹⁰. Regarding anatomical structures, the most affected are lips, tongue edge, floor of mouth, buccal mucosa, retromolar trigone and hard palate^{11,12}.

The most effective diagnostic method for identifying OC is biopsy with subsequent histopathological analysis, a strategy recommended by the Brazilian Ministry of Health, combined with other complementary diagnostic investigation tests¹³.

The importance of self-examination is added, as well as periodic follow-up with the dentist, for clinical evaluation of the entire oral cavity, with a view to preventing the development of diseases, as well as detecting possible early malignant neoplasms, avoiding late diagnosis and mutilating treatment¹³. Thus, this study aims to analyze the panorama of oral cancer in adults in the state of Paraná, from 2008 to 2019.

METHOD

This is a descriptive, population-based study in the state of Paraná, with analysis of secondary data obtained from the federal databases of the Hospital Information System (SIH - <http://sihd.datasus.gov.br>) and public domain files of Reduced Hospital Admission Authorizations (AIH). The selection and download of data were considered:

- Mode: Auxiliary files for tabulation

* Tabwin definition files

- Mode: Data

* File Type: RD – Reduced AIH

* Year: 2008 to 2019

* Month: January to December

* State: PR

Chapter 2 of the International Classification of Diseases (ICD-10) was used, with selection of records with hospitalization diagnoses C00-0 to C10-9. As incidence by municipality of Paraná, in the information in the field “Municipality of residence”. The variables analyzed were: deaths by sex, race/color, age group, frequency of hospitalization for OC, geographic distribution of oral neoplasms and hospitalization costs.

The tabulations and geographic distribution of the data were performed with the software TabWin 4.15[®]. The reduced files (RD) were selected according to the criteria for tabulation: *Line*: Municipality of Residence Paraná, *Column*: Year of processing, *Increment*: Frequency, *Suppresses Zeroed Lines*: true, *Suppresses Zeroed Columns*: true, *Active Selections*, *Federative Unit of Residence*: Paraná, and the *ICD10 Diagnosis chapter 02*: C00.0, C00.1, C00.2, C00.3, C00.4, C00.5, C00.6, C00.8, C00.9, C01, C02 .1, C02.0, C02.1, C02.2, C02.3, C02.4, C02.8,

C03.0, C03.1, C03.9, C04.0, C04.1, C04.8, C04.9, C05.0, C05.1, C05.2, C05.8, C05.9, C06.0, C06.1, C06.2, C06.8, C06.9, C07, C08.0, C08.9, C09.0, C09.1, C09.8, C09.9, C10.0, C10.1, C10.2, C10.3, C10.4, C10.8, C10.9.

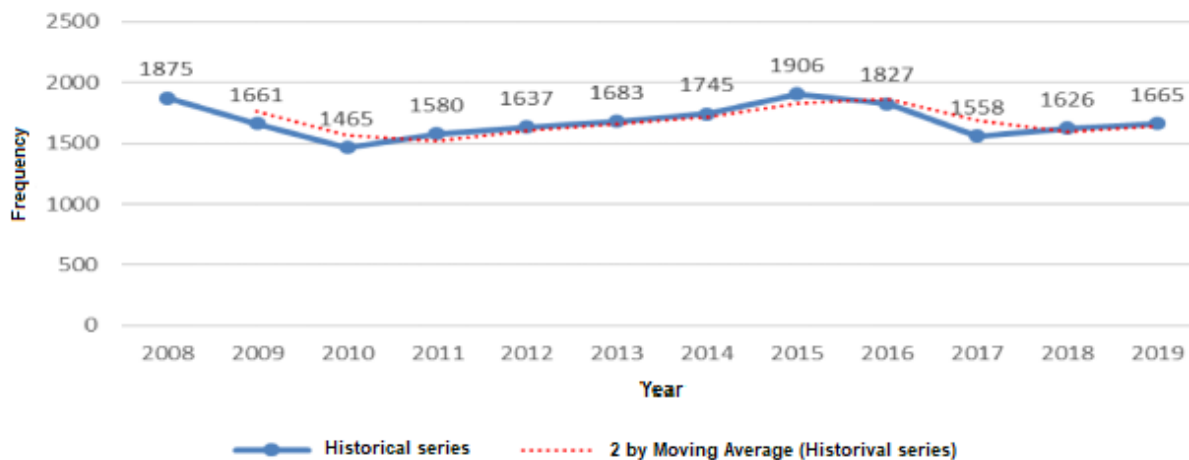
The data from the tabulations were transferred to Microsoft Excel®, to be organized and thus to carry out the descriptive statistical analysis, with representations in tables and graphs. For the geographic distribution in the map of the state of Paraná, the tool “type of chart-map” of the software Tabwin 4.15® was used.

The development of the study did not require approval by the Research Ethics Committee, since the data used are in the public domain.

RESULTS

According to the SIH, in the period under analysis, 20,228 hospitalizations for OC were recorded in the state of Paraná. Although there was a 15% reduction in the frequency of cases between 2008 and 2019, as of 2017 there were no significant changes, and, when considering the moving average every two years, the epidemiological picture remained stable (Figure 1).

Figure 1. Hospitalizations for oral cancer in Paraná, Brazil, between 2008-2019.



Source: SIH (2008-2019).

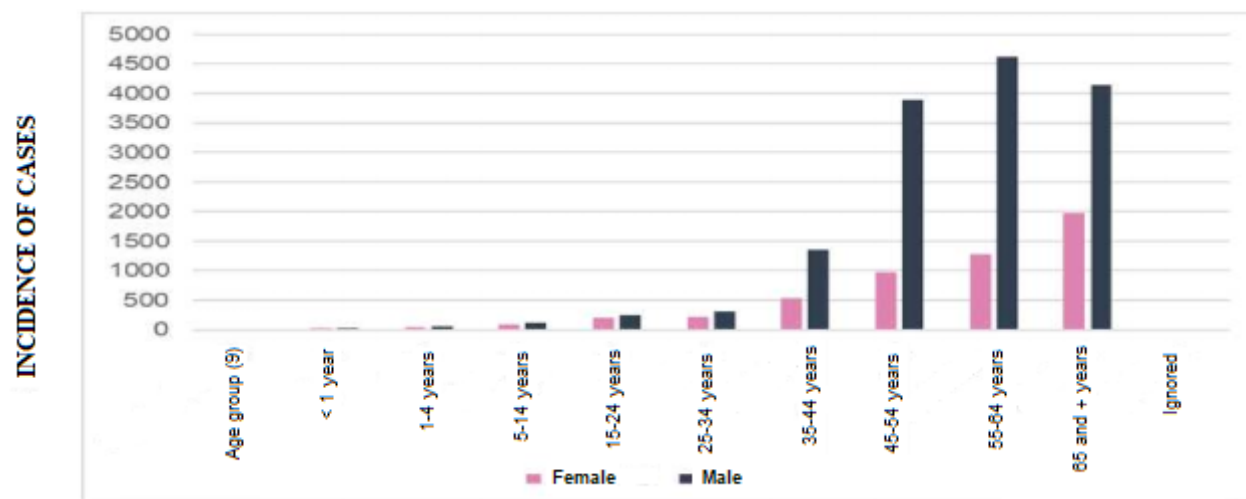
As for the locations of specific malignant neoplasms, the highest prevalence occurred in: oropharynx (17%), lip (11.9%) and floor of mouth (11.3%). When stratified by race/color, in people who identified as asian, the highest incidence after the oropharynx (26.3%) was the parotid gland (17.1%). Among indigenous people, higher values were found on the lips (20%) (Table 1).

Table 1. Oral cavity neoplasms according to race/color (Paraná, 2008-2019).

ICD-10 Diagnosis (category)	White No (%)	Black No (%)	Mixed No (%)	Asian No (%)	Indigenous No (%)	No information No (%)	Total No (%)
C00 Malig Neopl of lip	1821 (12.4)	12 (2.4)	134 (6.3)	4 (5.3)	2 (20.0)	428 (15.2)	2401 (11.9)
C01 Malig Neopl of base of tongue	1600 (10.9)	45 (9.1)	237 (11.2)	4 (5.3)	1 (10.0)	387 (13.7)	2274 (11.2)
C02 Malig Neopl of other unspecified parts of tongue	2073 (14.1)	101 (20.3)	350 (16.5)	6 (7.9)	1 (10.0)	412 (14.6)	2943 (14.5)
C03 Malig Neopl of gum	186 (1.3)	5 (1.0)	29 (1.4)	1 (1.3)	0 (0.0)	25 (0.9)	246 (1.2)
C04 Malig Neopl of floor of mouth	1764 (12.0)	55 (11.1)	242 (11.4)	6 (7.9)	1 (10.0)	225 (8.0)	2293 (11.3)
C05 Malig Neopl of palate	621 (4.2)	21 (4.2)	94 (4.4)	0 (0.0)	0 (0.0)	134 (4.8)	870 (4.3)
C06 Malig Neopl of other and unspecified parts of mouth	2052 (14.0)	68 (13.7)	270 (12.7)	14 (18.4)	3 (30.0)	586 (20.8)	2993 (14.8)
C07 Malig Neopl of parotid gland	1247 (8.5)	33 (6.6)	135 (6.4)	13 (17.1)	0 (0.0)	163 (5.8)	1591 (7.9)
C08 Malig Neopl of other and unspecified major salivary glands	507 (3.4)	16 (3.2)	80 (3.8)	6 (7.9)	1 (10.0)	119 (4.2)	729 (3.6)
C09 Malig Neopl of tonsil	325 (2.2)	9 (1.8)	73 (3.4)	2 (2.6)	0 (0.0)	31 (1.1)	440 (2.2)
C10 Malig Neopl of oropharynx	2505 (17.5)	132 (26.6)	481 (22.6)	20 (26.3)	1 (10.0)	309 (11.0)	3448 (17.0)
Total	14701 (100.0)	497 (100.0)	2125 (100.0)	76 (100.0)	10 (100.0)	2819 (100.0)	20228 (100.0)

Source: Department of Health Informatics (DATASUS; <http://datasus.saude.gov.br/>)

In relation to age group, people aged 45 and over are more affected by the disease, with 79.6% in women and 85.7% in men. Also, in women, the highest value (37.2%) occurred from 65 years of age and among men it was 31.3% for the age group of 55 to 64 years (Figure 2).

Figure 2. Oral cavity neoplasms, according to sex and age group (Paraná, Brazil, 2008-2019).

Source: Department of Health Informatics (DATASUS; <http://datasus.saude.gov.br/>).

Among the specific causes of death from OC, the main one among men was malignant neoplasm of the oropharynx (25%) and among women, malignant neoplasm of the base of the tongue (18%) (Table 2). Regarding nonspecificity (ICD C02, C06 and C08), the percentage of deaths was 11%, 32% and 2% for women and 15%, 18% and 1% for men, with lethality rates of, respectively, 8%, 16% and 3% for women, and 10%, 4% and 5% for men. It was observed that, for men, the frequency and lethality of oral cavity neoplasms is higher than for women (Table 2).

More than 23% of all cases of hospitalization due to morbidity occurred in white people, 2.4% in mixed raced people and 0.6% in black people. Among indigenous people, the number of records of hospitalization due to oral cavity neoplasia was lower when compared to the other race/color categories. Also, for black and mixed raced people, the highest prevalence of hospitalizations occurred in the age group from 45 to 54 years (Table 2).

Table 2. Hospitalizations for neoplasm of the oral cavity according to race/color (Paraná, 2008-2019).

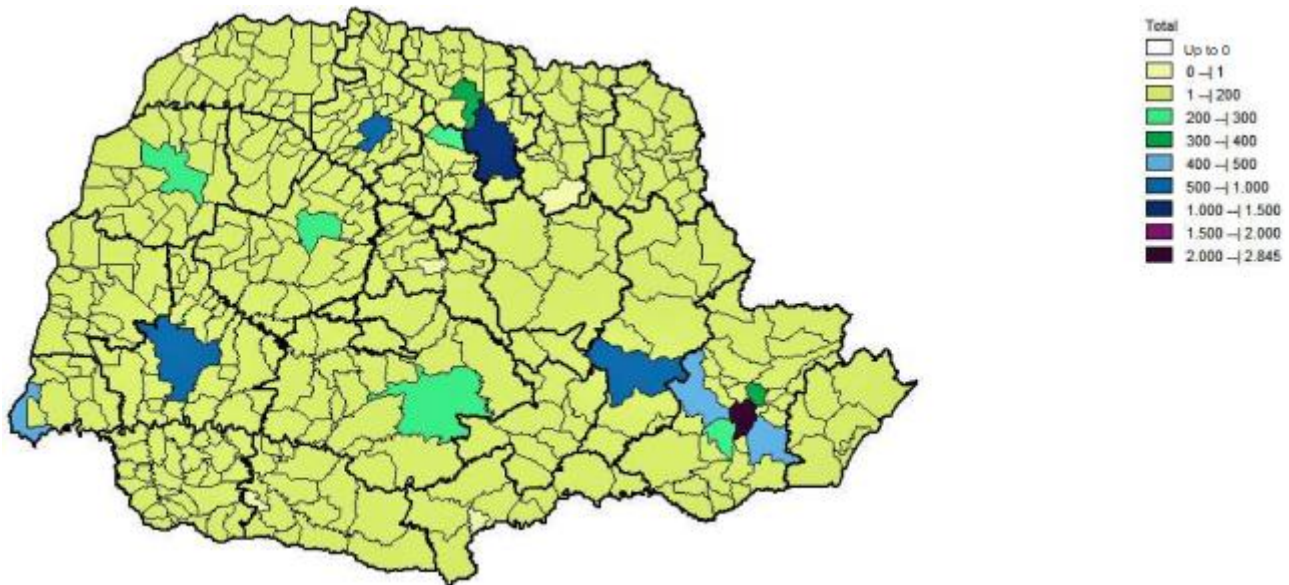
ICD-10 Diagnosis (category)	Female			Male		
	% of deaths	Lethality rate	Total of deaths	% of deaths	Lethality rate	Total of deaths
C00 Malig Neopl of lip	5	3	820	4	4	1581
C01 Malig Neopl of base of tongue	18	18	473	16	14	1801
C02 Malig Neopl of other unspecified parts of tongue	11	8	708	15	10	2235
C03 Malig Neopl of gum	2	9	86	1	8	160
C04 Malig Neopl of floor of mouth	7	9	409	10	8	1884
C05 Malig Neopl of palate	4	8	230	5	13	640
C06 Malig Neopl of other and unspecified parts of mouth	32	16	995	18	14	1998
C07 Malig Neopl of parotid gland	5	3	707	3	5	884
C08 Malig Neopl of other and unspecified major salivary glands	2	3	341	1	5	388
C09 Malig Neopl of tonsil	1	3	90	2	11	350
C10 Malig Neopl of oropharynx	14	14	511	25	13	2937
Total	100	9	5370	100	11	14858

Source: Department of Health Informatics (DATASUS; <http://datasus.saude.gov.br/>)

In the geographic distribution of people who were hospitalized for treatment of oral cavity neoplasms (codes C00 to C10), the origin was especially from the East and Northwest regions of the state, with emphasis on five municipalities: Curitiba, Londrina, Maringá, Cascavel and Ponta Grossa (Figure 3).

As for the costs for hospitalizations by OC, the average amount paid by state management was R\$1,444,447.46 and by full municipal management in Paraná was R\$2,444,717.97, totaling a total average value between 2008 and 2019, of BRL 3,889,165.43 per year.

Figure 3. Geographic distribution of oral cavity neoplasms (Paraná, Brazil, 2008-2019).



Source: Department of Health Informatics – DATASUS (<http://datasus.saude.gov.br/>).

DISCUSSION

Head and neck cancers are currently the 7th most diagnosed cancer in the world¹. The data presented here pointed to a greater involvement and lethality among Brazilian men and other investigations corroborate these findings^{6,14}. However, results point to an inversion, with a tendency to increase these rates for women, which can be attributed to a series of behavioral changes that lead to an increase in cases, such as the consumption of alcohol and tobacco¹⁵.

In an epidemiological survey that included the four macro-regions of Brazil, it was identified that the mortality rate among men in the southern region of the country by OC and oropharyngeal was the 2nd highest compared to other regions, about 7.10/100,000 inhabitants¹⁶. In another, from 1983 to 2017, of the 142,634 deaths from mouth and oropharynx cancer, 54% were oropharyngeal⁵. In the present study, the region most affected, when analyzing the data as a whole, was the same.

By the self-reported race/color demographic variable in the state of Paraná, it was found that white people was the most affected by OC, which may reflect the higher concentration of white individuals in the region, given the European colonization¹⁷. Also as a cultural heritage, part of the population of Paraná lives from agriculture, which makes exposure to sunlight an

important risk factor for the development of potentially malignant (or malignable) lesions, as seen in other studies^{18,19}.

Actinic cheilitis and squamous cell carcinoma of the lip are examples of these lesions. Actinic cheilitis is related to the lack of melanin and is an inflammation of the lips, with the presence of whitish spots that evolve, when untreated, to dryness and lip peeling. If excessive exposure to the sun persists, without proper protection, it can progress to labial atrophy with the presence of crusts, erosions and possible ulcerations. About 10% of actinic cheilitis will undergo malignant transformation²⁰. In addition, the habit of consumption of *chimarrão* adopted by part of this population is added as a risk factor for the development of cancer of the mouth and esophagus. The use of water at a high temperature can cause lesions in the mucosal cells²¹.

For people of self-declared Asian descent, a higher proportion of occurrence was found in the parotid gland region, and this fact is identified in another study, with populations of this race²².

Regarding age group, there was a higher incidence of cases in people over 45 years old. This fact can be explained by cellular aging, where physiological changes occur, with a decrease in the cell's regenerative capacity. This process is exacerbated when there is prolonged exposure of cells to carcinogenic factors, making them more susceptible to the development of tumors²³. However, about 20% and 15% of cases occurred in women and men, respectively, in patients under 45 years of age. Currently, there is evidence of an increasing trend in the number of cases in young people¹⁵.

When the race/color and age variables were considered, there was a more frequent prevalence of hospitalization among black and mixed raced individuals aged between 45 and 54 years, when compared to the other categories. Another study¹⁵ also recorded a growth pattern of 20.36%/year for mixed raced people.

When dealing with indigenous people, a higher prevalence of OC was found in the region of the lips. Most likely, this fact is due to increased exposure to the sun and tobacco use. However, a study shows that indigenous populations around the world have higher rates of cervical carcinoma and high-risk HPV infections when compared to non-indigenous populations²⁴. Research is important to investigate whether there is a higher prevalence of oral squamous cell carcinomas induced by HPV in this population. Anyway, the findings support health care for the indigenous population, especially in relation to prevention, notably in the labial region.

In the state of Paraná, there are municipalities in the East and Northwest regions that have higher population density and, thus, reported more hospitalizations due to OC. This

situation is frequent in the Brazilian scenario, due to the historical unequal distribution of health services in geographic areas²⁵.

A study analyzing the effect of socioeconomic variables and the influence of the availability of public oral health services on the frequency of hospitalization cases and on mortality from OC in Brazil identified that a larger population size was associated with a greater number of deaths from the disease²⁶. Regarding the spatial analysis of deaths from OC in the country, another investigation pointed out that the use of health services maintained a direct relationship with the outcome under analysis (deaths from OC)²⁷.

Racial inequities are markedly important in Brazil, for which there is less favoring black and mixed raced individuals in terms of access and use of health services²⁸. Deficient dental care makes this population more vulnerable to the development of chronic degenerative diseases²⁹, including OC.

As for costs, there was a high amount spent by both municipal and state management between 2008 and 2019, with a total average value of R\$ 3,889,165.43 per year. This amount could be better applied to health promotion and disease prevention actions, in primary care, with investments in the early diagnosis of malignant neoplasms, through intra and extraoral examinations (biopsy) and training of professionals. Professionals must have a broader view of health, taking into account the social determinants in which individuals, families and communities are inserted, acting in a systematic and comprehensive manner, consistent with the reality of municipal health systems, developing and evaluating actions to raise awareness of oral health according to local needs³⁰.

There are several factors that imply epidemiological aspects and the development of OC, such as: genetics, lifestyle, environmental and health conditions, which associated or not, can potentiate the expression of the disease in different population groups. Therefore, the challenge lies in minimizing the problems, which involves actions that seek to detect risk factors and thus, strategies for coping aimed at preventing susceptibility, as well as early diagnosis and treatment, are outlined.

CONCLUSION

Oral cancer was identified in all regions of the state of Paraná, with greater frequency in regions with higher population density. In the analyzed period, there was little variation in incidence values, especially from 2017 onwards. Men, white individuals and older people stand out as the most affected.

Based on the findings, the importance of a global prevention program and the application of methods for evaluating and monitoring the quality of active search strategies, access to means of diagnosis and early treatment in order to analyze the impact and the precision capacity of public policies that reduce inequities and improve the unfavorable epidemiological scenario that even leads to high budgetary costs.

The limitation of this study was the impossibility of identifying users who were hospitalized more than once during the study period, which may have an impact on reducing mortality and lethality rates. Still, the variables education and occupation were not considered in the analysis due to the absence or lack of more specific information, which is left as a suggestion in the understanding of these variables for future studies.

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Giuliana Martina Bordin collaborated in the study design and design, data collection and analysis, writing and revision. **Viviane Serra Melanda, Claudia Sirlene Oliveira** and **Daniel Elias da Cruz Perez** participated in data collection and analysis and writing. **Bonald Cavalcante de Figueiredo** collaborated in the design, collection and analysis of data and writing. **Marilisa Carneiro Leão Gabardo** contributed to data collection and analysis, writing and revision.

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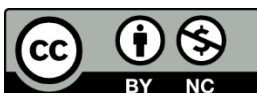
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