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Oral health indicators and job market insertion: a descriptive study with data from the National Health Survey, Brazil, 2019

Indicadores de saúde bucal e inserção no mercado de trabalho: estudo descritivo com dados da Pesquisa Nacional de Saúde, Brasil, 2019

Abstract

Objective: to describe three oral health indicators—the proportions of tooth loss, dental visits, and toothbrushing frequency—according to job market insertion in 2019. *Methods*: a descriptive study with data from the 2019 Brazilian National Health Survey (PNS). We included individuals aged from 18 years or older, irrespective of employment status. We calculated the oral health indicators, as well as their respective 95% confidence intervals (95%CI). *Results*: the sample was composed by 54,343 workers, 29,889 (53.9%) being male. The proportion of 13 or more teeth loss was higher in the informal employment sector [10.5% (95%CI: 9.8;11.2)]. The proportion of people that did not consult a dentist in the previous 12 months was higher in the informal sector [51.9% (95%CI: 50.8;53.0)] and among unemployed [52.4% (95%CI: 49.6;55.2)]. Lower toothbrushing frequency was observed in the informal workers' group [5.2% (95%CI: 4.7;5.6)] and among male workers [7.5% (95%CI: 6.8;8.2)]. *Conclusion*: worse oral health indicators were found among informal and unemployed workers, in addition to gender inequalities.

Keywords: epidemiology, descriptive; dental health surveys; oral health; employment; occupational health.

Resumo

Objetivo: descrever três indicadores de saúde bucal – as proporções de perda dentária, de consulta ao dentista e de frequência de escovação dentária – segundo o tipo de inserção na força de trabalho, no ano de 2019. Métodos: estudo descritivo realizado com dados da Pesquisa Nacional de Saúde de 2019. Foram incluídos indivíduos empregados ou desempregados, com 18 anos ou mais. Foram calculados os indicadores de saúde bucal, assim como seus respectivos intervalos de confiança de 95% ($IC_{95\%}$). Resultados: a amostra foi composta por 54.343 trabalhadores, sendo 29.889 (53,9%) do sexo masculino. A proporção de perda de 13 ou mais dentes foi maior no setor informal [10,5% ($IC_{95\%}$: 9,8;11,2)]. A proporção de pessoas que não consultaram um dentista nos últimos 12 meses foi maior no setor informal [51,9% ($IC_{95\%}$: 50,8;53,0)] e entre os desempregados [52,4% ($IC_{95\%}$: 49,6;55,2)]. Menor frequência de escovação dentária foi observada no grupo com vínculo informal de emprego [5,2% ($IC_{95\%}$: 4,7;5,6)] e entre indivíduos do sexo masculino [7,5% ($IC_{95\%}$: 6,8;8,2)]. Conclusão: piores indicadores foram encontrados entre os trabalhadores do setor informal ou desempregados e foram observadas desigualdades entre os sexos.

Palavras-chave: *epidemiologia descritiva; inquéritos de saúde bucal; saúde bucal; emprego; saúde do trabalhador.*

Introduction

Diseases and conditions affecting oral health impact nearly half of the world's population[1], yet they are shockingly neglected[2]. The most common ones include dental caries, periodontal diseases, tooth loss, and oral cavity cancer[3]. These chronic conditions are unevenly distributed among populations and territories[3-6]. The publication of results from national and local health surveys confirms this reality in Brazil and sheds light on the social determinants of the observed inequalities[6,7].

Income and education have been the most explored explanatory variables in studies on the social determinants of oral health. It is believed that individuals with more years of education have a better understanding of the relevance of oral hygiene habits, such as regularly replacing their toothbrush or using dental floss. With higher levels of education, these individuals are more receptive to guidance on reducing the consumption of sugary foods and quitting smoking, for instance[8]. Additionally, higher income provides individuals with resources to acquire oral hygiene materials and seek dental services [9]. In Brazil, the relationship between income and education with periodontal disease[8,10], edentulism, and dental prosthetics[11] has been examined. However, these studies have not addressed occupation, which is a classic variable in sociology that investigates the socioeconomic status of populations[12]. Nevertheless, the literature has mentioned the limitation of income as a measure of social position[13].

According to the traditional Erikson-Goldthorpe-Portocarero (EGP) scheme, occupational position, that is, the function and type of job market insertion, influences access to resources and rewards[12,14]. In research on the social determinants of health, the variable of occupation has been approached as both the source of income and as a reflection of schooling[15].

Employment is a determinant of health because it is the primary link for accessing and organizing life in society[16]. Formal, permanent, and full-time employment have shown a protective effect on various indicators of oral health in a cohort study of older adult individuals studied in Chile[17]. In addition to employment, the nature of work is another dimension of an individual's job market insertion, and its characteristics have been associated with healthy lifestyles among workers in Brazil[18].

Since the classic study in the 1990s titled "Brazilian dentistry: technically laudable, scientifically questionable, socially chaotic"[19], there has been a documented improvement in oral health indicators in the country[20]. Seven years after the implementation of the Brazilian National Oral Health Policy, known as "Smiling Brazil" (*Brasil Sorridente*) positive changes in the population's epidemiological profile were observed. For example, there was a 50% reduction in the number of adolescents and adults reporting tooth loss, and an increase in the number of people with access to fluoridated water[21]. However, challenges persist. In 2013, 11% of Brazilians aged 18 or older reported complete tooth loss, with a higher proportion among women (13%)[6]. In 2017, based on international comparisons[1], Brazil was among the countries with a high burden of oral diseases and was among the top ten countries ranked in terms of treatment needs respective to such studied diseases.

Oral disorders affecting mouth structures, gums, and teeth can cause discomfort, pain, and impairments to quality of life[22]. Oral diseases, such as periodontal disease, can influence facial expression, communication skills, and facial aesthetics, which are socially valued aspects with implications for employability[23].

State intervention aimed at reformulating labor relations has gained strength in recent decades in Brazil and worldwide, leading to an increase in the number of workers engaged in informal jobs, which often exposes them to worse working conditions[24]. Unemployed individuals lack the resources to afford health services and the political rights to access these services as citizens[16]. Workers employed in the informal sector are exposed to risks such as mental stress, exhaustion, illness, accidents, and even death[25].

In this context, this study aims to describe three oral health indicators—the proportions of tooth loss, dental visits, and toothbrushing frequency—according to the type of job market insertion in 2019.

Methods

Study design and data source

This descriptive study was conducted with data from the second edition of the Brazilian National Health Survey (PNS), conducted in 2019. The PNS is a nationwide home-based health survey conducted by the Ministry of Health in partnership with the Brazilian Institute of Geography and Statistics (IBGE), whose first edition was conducted in 2013.

The sampling plan of the PNS was conducted via a three-stage cluster sampling design, with stratification of primary sampling units (Primary Healthcare Centers), represented by census tracts or groups of census tracts. In the first

stage, the selection of Primary Healthcare Centers (PHC) was performed by simple random sampling. In the second stage, a fixed number of permanent private households was randomly selected within each selected PHC from the previous stage. In the third stage, within each sampled household, one resident was selected with equiprobability—from a list of eligible residents drawn up at the time of the interview—to participate in the individual interview[26]. This and other information about the PNS can be accessed by means of survey database platform (https://www.pns.icict.fiocruz.br/bases-de-dados/).

Participants

For this research, we considered eligible people aged 18 years or older, included in the economically active population (EAP), that is, employed and unemployed. Employers were considered ineligible.

Construction of oral health indicators

Next, the three oral health indicators analyzed and the respective questions used for their construction:

1. Proportion of individuals aged 18 or older who have lost 13 or more teeth:

   U23a. "*Thinking back on your upper permanent teeth, have you lost any?*";

   U24a. "*Thinking back on your lower permanent teeth, have you lost any?*";

2. Proportion of individuals aged 18 or older who have not seen a dentist in the last 12 months:

   J13a. "*When did you last see a dentist?*";

3. Proportion of individuals aged 18 or older who brush their teeth less than twice a day:

   U1a. "*How often do you use a toothbrush for oral hygiene?*".

For the tooth loss indicator, a cutoff point of losing 13 or more teeth was adopted, which is the number at which the dentition is considered non-functional[5].

Variables

The variable "type of insertion in the workforce" was classified into three categories: formal employment, informal employment, and unemployment. The following filter questions were used for the classification of employed and unemployed individuals:

E11. "*How many jobs did you have during the week of July 21st to July 27th, 2019 (reference week)?*";

E22. "*During the period from June 28th to July 27th, 2019 (a 30-day reference period), did you take any steps to find work, whether it be a job or starting your own business?*";

E26. "*If you had found a job, could you have started working during the week of July 21st to July 27th, 2019 (reference week)?*"; and

E23a. "*During the period from June 28th to July 27th, 2019 (a 30-day reference period), what was the main step you took to find work?*".

Those who answered question E11 were considered employed. The unemployed individuals were those who responded positively to questions E22 and E26 and reported taking effective measures to find a job in question E23a.

The employed respondents were subclassified according to the type of employment relationship: formal or informal. In the group of formal employees, the following were included: (1) Domestic worker with a worker's social security card; (2) Military personnel; (3) Private sector employee with a worker's social security card; and (4) Statutory public sector employee or employee with a worker's social security card. In the group of informal employees, the following were included: (1) Domestic worker without worker's social security card; (2) Private sector employee without a worker's social security card; (3) Non-statutory public sector employee without a worker's social security card; (4) Self-employed worker; and (5) Unpaid worker who assists a household member or relative.

The covariates included in the study were: sex (female, male); age in years (18-34, 35-44, 45-59, and ≥ 60); self-reported race/skin-color (White, non-White); and education level (≥ high school, ≤ completed elementary school, and no formal education). The "non-White" race/skin-color category included: Black, Yellow, Mixed-race, and Indigenous.

The *per capita* household income in minimum wages (MW) was analyzed in three categories: (> 3 MW, ≥ 1 and ≤ 3 MW, < 1 MW). It was calculated based on the variable VDF003 (*per capita* household income). The calculation was performed by dividing the obtained value of *per capita* household income by the value of the minimum wage in 2019 (R$ 998.00).

There were no losses due to lack of answers to the questions from which the variables were derived.

Data analysis

The analyses were performed using the statistical program Stata version 16.0. Considering the complex sampling design of the survey, the analyses were conducted considering the strata, the PHCs, and the sample weights obtained via survey module (svy). Descriptive analyses were performed, and proportions along with their respective 95% confidence intervals (*95%CI*) were estimated and reported in the "Results" section as [*proportion (95%CI)*]. The comparison between genders was analyzed by the chi-square test, considering a significance level of 5%.

Ethical considerations

The PNS was approved by the National Research Ethics Commission (Conep) in August 2019, under opinion number 3529376, and in compliance with Resolution number 466/2012 of the Brazilian National Health Council, ensuring the participants' voluntary participation, anonymity, and the possibility to withdraw from the study at any time.

Results

A total of 54,343 economically active individuals participated in the study, consisting of 29,889 (53.9%) male and 24,454 (46.1%) female, after excluding the ineligible (n = 1,869). There were no losses in the answers to the questions used to formulate the oral health indicators.

Table 1 shows the characteristics of the sample.

Table 1 Characterization of the study sample (n = 54,343) according to gender, National Health Survey (PNS), 2019, Brazil

Variables	*Total sample (%)**	*Men (%)**	*Women (%)**	*p-value*
Type of insertion in the job market workforce				
Formal employment	43.4	44.7	41.9	**< 0.001**
Informal employment	48.4	49.0	47.6	
Unemployment	8.2	6.3	10.5	
Age (years)				
18-34	38.4	38.6	38.2	**0.002**
35-44	25.5	24.4	26.8	
45-59	28.1	28.3	27.8	
≥ 60	8.1	8.7	7.2	
Race/skin-color				
White	42.3	40.9	44.0	**< 0.001**
Non-White	57.7	59.1	56.0	
Schooling				
≥ High School	59.1	53.1	66.1	**< 0.001**
≤ Elementary school	15.0	16.9	12.9	
Illiterate/no formal education	25.9	30.0	21.0	
Household income *per capita* (MW)**				
> 3	11.5	11.3	11.7	0.630
≥ 1 and ≤ 3	41.4	41.4	41.5	
< 1	47.1	47.3	46.8	

p-value: χ^2 test for comparison between genders.
*considering the sample weight; **Minimum wage (MW) value in 2019: R$ 998.00.

Informal employment was the most frequent, both for men (49.0%) and women (47.6%). Regarding formal employment, 44.7% of men and 41.9% of women had a worker's social security card. As for unemployment, 6.3% of men and 10.5% of women were in this situation. There was a predominance of individuals in the age group of 18 to 34 years old (38.4%), who identified themselves as non-White (57.7%), with a level of education equal to or above high school, and reported a *per capita* income lower than one MW (47.1%).

The proportion of individuals with the loss of 13 or more teeth was 6.9%, being higher in female workers (7.8%) compared to male (6.0%) (**Table 2**). Overall, the proportion of loss of 13 or more teeth was higher in the informal sector [10.5% (9.8; 11.2)]. In this group, the indicator presented higher values among female [12.6% (11.4; 13.8)] aged 60 years or older [38.7% (35.9; 41.5)], with White skin-color [11.0% (9.7; 12.3)], no formal education [21.1% (19.5; 22.6)], and with a *per capita* household income between one and three MWs [12.6% (11.4; 13.7)] (**Table 1**).

Table 2 Proportion of individuals with the loss of 13 or more teeth, according to the type of insertion in the job market workforce and sociodemographic characteristics, National Health Survey (PNS), 2019, Brazil

Variables	*Formal*		*Informal*		*Unemployment*		*Total*	
	n	*%(95%CI)*	*n*	*%(95%CI)*	*n*	*%(95%CI)*	*n*	*%(95%CI)*
Total	961	3.5 (3.1;3.9)	3,505	10.5 (9.8;11.2)	172	3.1(2.3;4.0)	4,638	6.9(6.5;7.3)
Sex								
Male	501	3.4(3.0;3.7)	1,789	8.7(8.0;9.4)	73	3.5(2.2;4.8)	2,363	6.0(5.6;6.4)
Female	460	3.7(3.0;4.3)	1,716	12.6(11.4;13.8)	99	2.9(1.7;4.0)	2,275	7.8(7.1;8.5)
Age (years)								
18-34	23	0.3(0.1;0.5)	42	0.4(0.2;0.5)	7	0.3(0.0;0.5)	72	0.3(0.2;0.5)
35-44	71	0.9(0.6;1.3)	245	3.1(2.4;3.8)	18	1.2(0.4;2.1)	334	1.9(1.6;2.3)
45-59	552	7.4(6.3;8.4)	1,603	15.9(14.2;17.5)	103	14.2(9.6;18.9)	2,258	12.2(11.1;13.3)
≥ 60	315	26.1(21.7;30.5)	1,615	38.7(35.9;41.5)	44	18.4(11.0;25.7)	1,974	35.14(32.8;37.5)
Race/skin-color								
White	371	3.5(2.9;4.0)	1,239	11.0(9.7;12.3)	53	3.8(1.9;5.7)	1,663	7.0(6.2;7.7)
Non-White	590	3.6(3.1;4.2)	2,266	10.1(9.4;10.9)	119	2.8(1.9;3.6)	2,975	6.9(6.4;7.3)
Schooling								
≥ High School	364	1.7(1.4;1.9)	499	3.4(2.9;3.9)	39	1.5(0.5;2.5)	902	2.3(2.1;2.6)
≤ Elementary school	130	3.8(2.8;4.8)	404	8.0(6.7;9.3)	25	3.4(1.1;5.7)	559	6.0(5.1;6.9)
Illiterate/no formal education	467	12.3(10.4;14.2)	2,602	21.1(19.5;22.6)	108	7.1(5.0;9.1)	3,177	17.8(16.7;19.0)
***Per capita* household income (MW)**								
> 3	103	2.2(1.5;2.9)	224	5.9(4.4;7.4)	1	0.0(0.0;0.0)	328	3.7(3.0;4.5)
≥ 1 and ≤ 3	559	4.2(3.5;4.8)	1,546	12.6(11.4;13.7)	24	2.4(1.1;3.7)	2,129	7.8(7.2;8.4)
< 1	299	3.2(2.6;3.8)	1,735	9.9(8.9;10.9)	147	3.4(2.4;4.5.8)	2,181	6.8(6.2;7.5)

95%CI: 95% confidence interval; MW: minimum wages .

The proportion of workers who did not visit a dentist in the last 12 months was 46.9%, being higher among men (56.0%) compared to women (39.8%) (**Table 3**). Not visiting a dentist in the last 12 months was predominant among the informal sector [51.9% (50.8; 53.0)] and among the unemployed [52.4% (49.6; 55.2)]. The proportion was higher among male workers in the informal sector [57.6% (56.2; 58.9)] and unemployed male [61.7% (57.5; 65.9)].

Increases in the percentages of the three indicators were observed with increasing age. Regarding self-reported race/skin-color, the worst indicators are concentrated in the group of non-White individuals, except for tooth loss.

The proportion of low toothbrushing frequency was 3.7%, higher in male workers (5.5%) than in female (1.6%) (**Table 4**). In the group with informal employment, this proportion was 5.2% (95%CI 4.7; 5.6)], higher among men [7.5% (6.8; 8.2)], non-White individuals [5.5% (5.0; 6.0)], individuals with no formal education [9.5% (8.6; 10.4)], and those with income below one MW [6.5% (5.8; 7.2)].

Table 3 Proportion of workers who did not visit a dentist in the last 12 months, according to type of insertion in the job market workforce and sociodemographic characteristics, National Health Survey (PNS), 2019, Brazil

Variables	*Formal*		*Informal*		*Unemployment*		*Total*	
	n	*%(95%CI)*	*n*	*%(95%CI)*	*n*	*%(95%CI)*	*n*	*%(95%CI)*
Total	8,827	40.4(39.2;41.5)	16,304	51.9(50.8;53.0)	1,963	52.4(49.6;55.2)	27,094	46.9(46.1;47.7)
Sex								
Male	5,505	46.8(45.2;48.4)	10,389	57.6(56.2;58.9)	948	61.7(57.5;65.9)	16,842	53.0(52.0;54.0)
Female	3,322	32.4(30.8;34.0)	5,915	45.1(43.6;46.6)	1,015	45.8(42.2;49.4)	10,252	39.8(38.7;41.0)
Age (years)								
18-34	2,974	40.0(37.9;42.1)	4,265	48.0(46.2;49.9)	1,001	49.5(45.7;53.3)	8,240	44.6(43.2046.0)
35-44	2,578	39.7(37.7;41.8)	3,822	47.8(45.8;49.9)	434	51.4(46.0;56.8)	6,834	44.1(42.8;45.5)
45-59	2,635	40.5(38.4;42.5)	5,472	55.2(53.1;57.2)	422	62.2(56.2;68.2)	8,529	49.3(47.8;50.8)
≥ 60	640	47.6(43.0;52.2)	2,745	62.0(59.4;64.6)	106	67.9(56.9;79.0)	3,491	58.7(56.4;61.0)
Race/skin-color								
White	3,115	37.0(35.2;38.8)	4,798	45.0(43.1;46.8)	528	51.7(46.6;56.7)	8,441	41.6(40.3;43.0)
Non-White	712	43.3(41.7;44.8)	11,506	56.5(55.3;57.8)	1,435	52.7(49.3;56.2)	18,653	50.8(49.9;51.8)
Schooling								
≥ High School	5,446	35.6(34.2;37.0)	187	40.1(38.6;41.6)	997	48.1(44.4;51.6)	11,630	38.4(37.4;39.4)
≤ Elementary school	1,277	49.3(45.7;52.9)	2,628	52.9(50.3;55.4)	356	55.0(48.8;61.2)	4,261	51.8(49.9;53.7)
Illiterate/no formal education	2,104	55.8(53.1;58.4)	489	66.9(65.4;68.4)	610	61.1(55.4;66.9)	11,203	63.6(62.4;64.9)
***Per capita* household income (MW)**								
> 3	999	24.7(22.3;27.1)	926	29.0(26.3;31.8)	38	34.6(18.8;50.5)	1,963	26.8(25.0;28.5)
≥ 1 and ≤ 3	4,126	38.6(37.0;40.2)	361	48.0(46.2;49.0)	270	50.0(42.9;57.1)	9,757	43.2(42.0;44.4)
< 1	702	49.3(47.3;51.3)	10,017	59.1(57.7;60.4)	1,655	53.6(50.5;56.8)	15,374	55.1(54.1;56.2)

95%CI: 95% confidence interval; MW: minimum wages .

Table 4 Proportion of workers who reported brushing their teeth less than twice a day, according to type of insertion in the job market workforce and sociodemographic characteristics, National Health Survey (PNS), 2019, Brazil

Variables	*Formal*		*Informal*		*Unemployment*		*Total*	
	n	*%(95%CI)*	*n*	*%(95%CI)*	*n*	*%(95%CI)*	*n*	*%(95%CI)*
Total	450	2.1(1.8;2.5)	1,836	5.2(4.7;5.6)	147	4.0(2.9;5.0)	2,433	3.7(3.4;4.0)
Sex								
Male	380	3.2(2.6;3.8)	1,459	7.5(6.8;8.2)	92	6.8(4.6;9.0)	1,931	5.5(5.0;6.0)
Female	70	1.0(0.0;1.0)	377	2.4(1.9;2.8)	55	2.0(1.2;2.8)	502	1.6(1.4;1.9)
Age (years)								
18-34	144	2.0(1.3;2.6)	326	3.5(2.8;4.1)	60	3.9(2.4;5.3)	530	2.8(2.4;3.3)
35-44	120	1.9(1.3;2.4)	347	4.7(3.8;5.5)	32	3.7(1.8;5.5)	499	3.2(2.8;3.7)
45-59	130	2.3(1.5;3.0)	693	6.2(5.4;7.0)	43	4.8(2.1;7.4)	866	4.5(4.0;5.0)
≥ 60	56	3.7(2.2;5.3)	470	8.3(7.1;9.4)	12	4.6(0.7;8.6)	538	7.1(6.2;8.0)
Race/skin-color								
White	154	2.0(1.4;2.5)	551	4.7(4.0;5.3)	36	2.7(1.5;3.9)	741	3.3(2.9;3.7)
Non-White	296	2.2(1.7;2.7)	1,285	5.5(5.0;6.0)	111	4.7(3.3;6.0)	1,692	4.1(3.7;4.4)
Schooling								
≥ High School	188	1.4(1.1;1.7)	270	2.1(1.7;2.6)	47	2.3(1.3;3.2)	505	1.8(1.5;2.0)
≤ Elementary school	91	4.3(2.5;6.2)	240	4.5(3.5;5.6)	28	3.8(1.7;5.9)	359	4.4(3.5;5.3)
Illiterate/no formal education	171	3.6(2.7;4.4)	1,326	9.5(8.6;10.4)	72	8.5(5.3;11.7)	1,569	8.0(7.2;8.6)
***Per capita* household income (MW)**								
> 3	43	1.3(0.6;2.1)	97	2.6(1.6;3.6)	*	*	140	1.8(1.2;2.4)
≥ 1 and ≤ 3	183	1.5(1.1;1.9)	565	4.1(3.5;4.6)	13	1.8(0.4;3.2)	761	2.6(2.3;3.0)
< 1	224	3.2(2.4;4.0)	1,174	6.5(5.8;7.2)	134	4.7(3.4;5.9)	1,532	5.1(4.7;5.7)

95%CI: 95% confidence interval; MW: minimum wages.

Discussion

The distribution of oral health indicators among economically active adults in 2019 revealed differences according to the type of insertion in the workforce. A worse situation was observed for all three studied indicators among workers in the informal sector and the unemployed population. Additionally, sex differences were observed. These original results contribute to filling the knowledge gap regarding oral health conditions and practices among economically active adults, according to the type of insertion in the workforce.

The study was based on data from a representative sample of the Brazilian population. In the studied sample, there was an evidenced predominance in the labor force of male, young, non-White, with formal education[27], and with *per capita* household income lower than one MW per month. From 1980 to 2018, the number of unemployed people in Brazil increased by tenfold[28]. In the second half of 2021, the unemployment rate in the country was 14.1%[29]. Parallel to the rise in national unemployment, there was the deregulation of employment[24]. The most significant growth in paid employment occurred in the informal sector, with its relative share in the economically active population (EAP) increasing from 14% in 1980 to nearly 20% in 2018. On the other hand, there was a decrease in the relative weight of formal employment[28].

Regarding the sex differences in the distribution of oral health indicators, female workers had more tooth loss than male, but they are the ones who reported more protective attitudes and behaviors towards oral health, such as a higher frequency of toothbrushing and visits to dental services. How to explain this apparent paradox? Tooth loss has been associated with access to higher dental attendance, it is the previously called tooth death spiral[1]. So, since women visit the dentist more frequently, it is not unexpected to see a higher self-reported prevalence of tooth loss among them.

The racial disparities found are not surprising. The worst oral health conditions most often affect non-White individuals[30,31]. In Brazil, the proportion of dental visits motivated by pain or tooth extraction was higher among individuals of Black and Mixed-race skin color[32]. Socioeconomic conditions that determine health status are added to general living conditions. However, these living conditions are unfavorable for the Black and Mixed-race population, making it hard to adopt necessary oral hygiene measures: 17.9% of the Black and Mixed-race population, compared to 11.5% of the White population, do not have access to piped water supply. Additionally, 42.8% of the Black and Mixed-race population, compared to 26.5% of the White population, reside in areas without proper sanitation systems[33].

The worst results observed in the informal employment group were expected. Labor relations and informal employment conditions, such as temporary contracts, have been considered detrimental to oral health, including tooth loss[34] and its underlying factors, such as untreated tooth decay[35]. In the informal sector, a higher perception of insecurity is likely present, which, in turn, is a stressful factor. It is well known that occupational stress is considered a mediator of health outcomes since it is associated with the search for unhealthy "buffers" to cope with anxiety-inducing situations, such as the consumption of alcohol and tobacco[25]. Physiological changes caused by stress, in addition, would explain the reduction in salivary flow, which promotes the progression of periodontal diseases and their consequences[34,35]. Moreover, in the informal job market, the income of workers and health insurance access is generally lower compared to the formal job market. This reality is particularly concerning, given the structural deficiencies in public dental services coverage in Brazil[8] and worldwide[3].

It was observed, as expected, that dental visits were less frequent in the informal and unemployed groups. The interpretation of these data calls for a two-way reflection. First and foremost, as previously mentioned, access to these services is costly due to the provision deficiency present in the public healthcare system[1], which is impactful for the unemployed workforce[36]. For informal sector workers, access to health insurance is less likely, in addition to prolonged work hours and more frequent irregular schedules[16], which limits time and availability to adhere to oral health care and seek healthcare services[36,37].

However, this study presents some limitations that should be considered when interpreting its results. The possibility of information bias cannot be ruled out, as social acceptance can influence participants' responses when questioned about healthy behaviors. For example, it is common for people to report brushing their teeth three times a day, even if they do not actually do so, simply because they recognize that it is the socially desirable or socially acceptable response. In this case, our results were underestimated.

It was not possible to analyze access to oral health services solely based on the indicator "dental visit in the last 12 months" because perception of treatment need can also influence the utilization of health services[38]. Therefore, other indicators should be included in future investigations.

Furthermore, the description of crude and relative frequencies is recommended to shed light on underexplored situations, such as adult oral health in economically active individuals with an emphasis on the job type. In addition, without analytical studies, it is not possible to determine whether the results are associable to the effects of unemployment time. For instance, considering the worse situation of unemployed women and gender discrimination in the job market, would the unemployed women in our sample be unemployed for a longer period compared to unemployed men? It is known that the unemployment crisis in recent years has affected women more than men[39]. These results instruct future study designs since the duration of unemployment was not considered among the variables of our study.

Although the validity of self-reported tooth loss information may be questioned, its validity has already been demonstrated when compared with clinical measurements[40].

Despite this set of limits, the main strength of this study lies in the use of a representative sample of Brazilian adults. Furthermore, the PNS has filled gaps in the field of occupational health since, in addition to modules on health status, lifestyle, access to healthcare services, etc., the results provide information on employment status and working conditions. The sample design of the PNS ensures representativeness for Brazil in a way that allows for a reliable characterization of the health conditions of adults in the workforce[41]. The 2019 version of the PNS added questions about the social security status of employed individuals. The answer to these questions benefited the characterization of the type of job market insertion.

At the beginning of the 21st century, there was a significant increase in worldwide research and publications on the oral health status of populations and on the importance of policies in this field. The situation of workers in Brazil brings relevant elements to continue reflecting on and criticizing

systemic inequalities in the distribution of the evaluated indicators. The integration of disease prevention actions, behavioral changes to reduce risk factors, policies to protect formal employment, and efforts to decrease unemployment would be an advantageous strategy to improve Brazil's ranking in oral health indicators. This strategy would be strengthened if added to concerns regarding gender inequality in the job market.

Conclusion

The assessment of the distribution of oral health indicators among the Brazilian workforce has revealed worse outcomes among informal workers and unemployed. Gender inequalities were observed, with higher proportion of tooth loss in female workers and lower proportions of toothbrushing frequency and visits to the dentist in men. Workplaces are suitable environments to develop preventive actions and health monitoring. These results are relevant for informing sectoral policies aimed at protecting employment and for discussions on universal access to a secure employment and oral health care. Furthermore, these results can support the improvement of oral health policies, such as expanding the availability of dental visits within the Unified Health System (Sistema Único de Saúde - SUS), including extended hours to accommodate the workers' needs.

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Authors' contribution

Assunção AA outlined the study; Alves NS and Abreu MNS conducted the data collection, analysis, and interpretation; Assunção AA and Alves NS drafted the article and conducted critical revisions. All authors approved the final version and assume full responsibility for the study conducted and the content published.

Data availability declaration

The authors declare that the anonymized dataset supporting the results of this study is publicly available in the "Microdados IBGE" repository at the following address: https://www.pns.icict.fiocruz.br/bases-de-dados/.

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