







Income inequalities in oral health and access to dental services in the Brazilian population: National Health Survey, 2013

Desigualdades de renda na saúde bucal e no acesso aos serviços odontológicos na população brasileira: Pesquisa Nacional de Saúde, 2013

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ABSTRACT: *Introduction:* Despite the improvement in oral health conditions observed in the Brazilian population, there are still high social inequalities that must be monitored. *Objective:* To evaluate income inequality in oral hygiene practices, oral health status and the use of dental services in the adult and senior Brazilian population. *Methods:* Data from the National Health Survey conducted in 2013 (*Pesquisa Nacional de Saúde – PNS 2013*) were used for the population aged 18 years old or older. *Results:* Inequalities were found among the income strata in most of the oral health indicators evaluated. The greatest inequalities were observed in the use of dental floss, in hygiene practices (PR = 2.85 in adults and PR = 2.45 in seniors), and in total tooth loss (PR = 6.74 in adults and PR = 2.24 in seniors) and difficulty in chewing (PR = 4.49 in adults and PR = 2.67 in seniors) among oral condition indicators. The magnitude of inequalities was high in both groups in most oral condition indicators. Income was a factor that persisted in limiting access to dental services, and even the lower income segments had high percentages that paid for dental consultations. *Conclusion:* Based on data from the first PNS, the findings of this study enabled the identification of oral health and dental care aspects more compromised by income differentials, thus, contributing to the planning of dental care in Brazil and to stimulate the monitoring of these disparities with data from future surveys.

Keywords: Oral health. Dental care. Social inequality. Income. Health surveys.

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Conflict of interests: nothing to declare – **Financial support:** Health Surveillance Secretariat. Ministry of Health.

RESUMO: *Introdução:* Apesar da melhora das condições de saúde bucal constatada na população brasileira, persistem elevadas desigualdades sociais que precisam ser monitoradas. *Objetivo:* Avaliar a desigualdade de renda nas práticas de higiene bucal, nas condições bucais e no uso de serviços odontológicos na população brasileira de adultos e idosos. *Métodos:* Foram utilizados dados da Pesquisa Nacional de Saúde realizada em 2013 (PNS 2013) referentes à população de 18 anos ou mais. *Resultados:* Detectaram-se desigualdades entre os estratos de renda na maioria dos indicadores de saúde bucal avaliados. As desigualdades de maior magnitude foram verificadas no uso de fio dental, nas práticas de higiene (RP = 2,85 nos adultos e RP = 2,45 nos idosos), e na perda de todos os dentes (RP = 6,74 nos adultos e RP = 2,24 nos idosos) e dificuldade de mastigar (RP = 4,49 nos adultos e RP = 2,67 nos idosos) entre os indicadores de condições bucais. Na maioria dos indicadores de condições bucais a magnitude das desigualdades foi elevada em ambos os grupos. A renda mostrou-se um fator que persiste limitando o acesso aos serviços odontológicos e, mesmo os segmentos de menor renda apresentaram elevados percentuais que pagam por consulta odontológica. *Conclusão:* Por meio dos dados da primeira PNS, os achados do estudo permitiram identificar aspectos de saúde e de atenção bucais mais comprometidos pelos diferenciais de renda, podendo, nesse sentido, contribuir para o planejamento da assistência odontológica no país e para estimular o monitoramento destas disparidades com dados das próximas pesquisas.

Palavras-chave: Saúde bucal. Serviços odontológicos. Desigualdade social. Renda. Inquéritos epidemiológicos.

INTRODUCTION

Oral health conditions reflect experiences accumulated throughout life and are the result of a complex interaction between biological and social factors¹. The cumulative exposure to untreated oral diseases such as dental caries and periodontal diseases — in adults and seniors — is the main cause of dental loss^{2,3}. The total loss of teeth, called edentulism, is the most serious consequence of this process, resulting from severe periodontal disease⁴, and affecting the quality of life of those affected by it⁵.

The Global Burden of Disease (GBD) study found that oral health problems have not improved in over 25 years worldwide, remaining at high rates and reaching 48% prevalence in 2015⁶. Edentulism was the leading cause of disability-adjusted life year (DALY) due to oral problems affecting 7.6 million people, and a 115 per 100 thousand people DALY rate⁶.

In Brazil, a comparative analysis between the years in which the Brazilian National Oral Health Survey (*Pesquisa Nacional de Saúde Bucal — SB-Brasil*) (1986, 2003, and 2010) was conducted, revealed an improvement in the oral health conditions of the adult population (35–44 years of age), with reduced DMFT (sum of decayed, missing and filled teeth), and increased OH-D (filled and healthy teeth) indexes⁷. Between 1986 and 2003, the contribution of the “lost” component of the DMFT index remained virtually the same among adults, from 66 to 65.7%, though declining to 43.7% in 2010^{8,9}. Dental loss also remained stable among seniors — around 90% in 2003 and 2010⁹.

Although dental caries and periodontal disease are the most common causes of dental extraction, it is important to note that these conditions vary between different age and

socioeconomic groups¹⁰. Marked social inequalities are commonly found in oral conditions^{11,12} in different age groups⁹. Scenarios of greater socioeconomic inequality present greater inequality in oral health indicators⁶.

Among the socioeconomic conditions, despite low income limiting access to hygiene products¹³, to dental services¹⁴ and to knowledge about correct oral hygiene habits, leading to a higher prevalence and severity of dental caries¹⁵, few Brazilian studies have evaluated inequalities in oral health and the use of dental services between the different income strata at national level^{9,16-20}. Only two of these studies^{18,20} used the income variable to analyze social inequalities in the access to and use of dental services. In the others, income was used among other factors to verify association with oral conditions and use of dental services. These studies, based on SB-Brasil, National Household Sample Survey (*Pesquisa Nacional por Amostra de Domicílios* — PNAD) and National Health Survey (*Pesquisa Nacional de Saúde* — PNS), have analyzed social inequalities — specially on tooth loss⁹, prostheses use among seniors¹⁶, self-reported oral health^{19,21}, and dental services use^{18,20} — and found different magnitudes of socioeconomic inequalities depending on the age group and the outcomes related to oral health. Furthermore, these studies have not evaluated income inequalities simultaneously on different dimensions of oral health.

Intense inequalities in oral health conditions, which can be evaluated by clinical examination and self-report, can result in oral hygiene practices, poor diet quality and other factors that influence the risk of dental caries and periodontal disease, as well as availability and access to dental services. The first set of factors depends on life conditions, the individual's and their family's socioeconomic position, and the level of education and knowledge on appropriate care practices. Although dependent on socioeconomic position, the access to dental services could have such dependency strongly reduced if public policies and services offered a broad and universal care.

Due to the multiplicity of factors involved in oral health, the analysis of social inequalities covering a set of indicators is crucial, from hygiene practices and oral health to access to dental services. This is relevant to identify income inequalities that most intensely affect the aspects of oral health, and as public services could act with a view to reduce inequalities in specific ways.

Considering the significant prevalence of oral health problems, the importance of income in the oral health profile of a country and the understanding that adults and seniors have differences related to various aspects of health, the objective of this study was to evaluate income inequality in oral hygiene care and conditions, and access to dental services in Brazil for adults and seniors.

METHODS

DATA SOURCE, SAMPLE AND COLLECTION MEDIA

In this study, data from the Brazilian National Health Survey, conducted in 2013 (PNS 2013) were analyzed, regarding the Brazilian population aged 18 years old or older. PNS 2013 was a nation-wide household health survey that collected data from a probabilistic sample

in three stages: in the first stage, the census tracts constituted the primary sampling units (PSU); in the second stage, the households were drawn; and in the third, an 18-year-old or older resident of each selected household was randomly selected. The draw at each stage was done by simple random sampling.

Interviews were previously scheduled and information was recorded on handheld computers (Personal Digital Assistance — PDA), using three questionnaires: one referring to the characteristics of the residence; another about the residents of the household; and the individual questionnaire, answered by the selected resident to participate in the survey. The individual questionnaire contained questions on the perception of general and oral health, chronic diseases and lifestyles (diet, physical activity, alcohol use and smoking), among others.

In total, 64,348 houses were visited and 60,202 people aged 18 years old or older were interviewed, with a 20.8% total loss.

The PNS was approved by the Research Ethics Committee (CONEP), under process number 328.159.

STUDY VARIABLES

The main independent variable used to analyze social inequalities in this study was the household income *per capita* — considering Brazilian minimum wage (MW) — categorized into five strata (< 0.25 MW, 0.25 to < 0.5 MW; 0.5 to 1 MW, 1 to < 3 MW, 3 or more MW). Dependent variables were as follows, categorized in ‘yes’ and ‘no’:

- Oral hygiene care: frequency of dental brushing ≥ 2 times a day; use of toothbrush and toothpaste; use of toothbrush, toothpaste and dental floss; changing the toothbrush for a new one every three months;
- Self-reported oral conditions: very good and good oral health self-assessment; some degree of difficulty to chew due to problems in teeth or dentures; self-reported loss of functional dentition (13 or more teeth); loss of all teeth (edentulism); and among individuals that had at least one lost teeth, the use of dental prostheses;
- Use of dental services: dental consultation in the last year; the reason for such consultation: cleaning, revision, maintenance or prevention, dental treatment, placement or maintenance of a prostheses or denture, extraction, orthodontic appliance or other reasons (including: toothache, gum problem, oral wound treatment, dental implant, radiography, dental treatment budget, and others); consultation covered by insurance plan; payment for consultation; consultation in public health system; good and very good evaluation of the service received.

DATA ANALYSIS

The data were analyzed using the STATA Software, version 15.0, which has an analysis module for population surveys (svy).

Prevalence and 95% confidence intervals (95%CI) were estimated and associations were tested using Rao-Scott's correction, considering a 5% significance level. Simple and multiple Poisson's regression models were developed to obtain estimates of crude prevalence ratios, being adjusted by age and gender, with 95%CI. Analyses were performed stratifying by age group (adults and seniors).

ETHICAL ASPECTS

The PNS project was approved by the Brazilian National Research Ethics Committee on June 26, 2013, under No. 328.159. All interviewees who agreed to participate in the survey signed an Informed Consent Form.

RESULTS

The analyzed sample consisted of 49,025 adults aged 18 to 59 years, with 37 years as the mean age, and 11,177 seniors (60 years old or older), with 69.8 years as the mean age. The median household income *per capita*, in MW, was 1.64 among adults and 2.17 among seniors. Income is associated with all the demographic and socioeconomic indicators analyzed, except for gender in the seniors' group. We observed prevalence reduction among black and brown people and among people living in the North and Northeast regions with increased income (data not shown).

Table 1 shows the prevalence of oral health indicators. Among adults, prevalence was higher than 90.0% for dental brushing two times or more per day and for toothbrush and toothpaste use. Toothbrush, toothpaste and dental floss were used by 58.5% of the population. The prevalence for use of oral health services for review, maintenance and prevention was 53.8%. Most of the population paid for consultations, and 91.5% evaluated the health service received as good and very good. Regarding seniors, prevalence was higher than 70% for dental hygiene in two times or more per day, for the use of toothbrush and toothpaste, for the use of dental prostheses, and 94.7% evaluated the health services as good and very good. The lowest prevalence was obtained for the consultation of oral health services due to extraction (11.5%), for other reasons (8.3%), and for consultation with insurance plan (12.5%).

Among oral hygiene care (Table 2), there was an increase in the frequency of brushing — two or more times a day —, in the use of toothbrush, toothpaste and dental floss together, and in the replacement of the old toothbrush for a new one every three months, considering the increase in income. The greatest inequality was observed in the use of dental floss, given that its prevalence was 2.85 and 2.45 times higher in the higher income segment, respectively, in adults and seniors.

Table 3 presents indicators of oral conditions, according to household income *per capita*, considering the category of 3 or more MW as reference. The prevalence of self-reported

poor oral health, difficulty in chewing, loss of functional dentition and edentulism showed progressive increase as income declines, whereas the prevalence of prostheses tended to have an inverse association. Higher income inequalities were observed in adults for total teeth loss (PR = 6.74), difficulty in chewing (PR = 4.49), and loss of functional dentition (PR = 4.84); in older adults these prevalence ratios reached, respectively, 2.24, 2.67, and 2.04. Considering the 95%CI, prevalence ratios are significantly higher in adults when compared to seniors in edentulism, loss of functional dentition and poor self-evaluated oral health.

Going to a dental consultation in the year before the interview was reported by 47.7% of adults and 29.4% of seniors (Table 1). The aspects related to access and use of dental services are presented in Table 3. The prevalence of dental consultations significantly increases in adults

Table 1. Prevalence and confidence interval (95%CI) of oral health indicators. National Health Survey (*Pesquisa Nacional de Saúde — PNS*), 2013.

	Adult		Seniors	
	%	95%CI	%	95%CI
Tooth brushing \geq 2 times a day	93.0	92.5 – 93.4	80.8	79.4 – 82.2
Toothbrush and toothpaste use	99.6	99.5 – 99.7	97.8	97.3 – 98.2
Toothbrush, toothpaste and dental floss use	58.5	57.5 – 59.5	32.0	30.1 – 34.0
Change of the toothbrush every three months	49.4	48.4 – 50.4	40.1	38.3 – 41.9
Poor self-reported oral health	31.4	30.7 – 32.2	62.3	60.6 – 63.9
Difficulty to chew	8.2	7.8 – 8.7	20.4	19.1 – 21.7
Loss of functional dentition (\geq 13 teeth)	13.2	12.7 – 13.8	67.4	65.8 – 69.0
Edentulism	4.3	3.9 – 4.6	41.5	39.8 – 43.2
Use of dental prostheses	38.4	37.4 – 39.4	72.2	70.6 – 73.7
Dental consultation in the last year	47.7	46.9 – 48.6	29.4	27.8 – 31.1
Reason for consultation				
Revision, maintenance or prevention	53.8	52.5 – 55.1	48.7	45.4 – 52.0
Dental treatment	20.4	19.3 – 21.5	17.9	15.7 – 20.3
Extraction	9.6	8.9 – 10.2	11.5	9.4 – 13.9
Orthodontic appliance	5.3	4.7 – 5.9	--	--
Other reasons	11.0	10.2 – 11.8	8.3	7.0 – 9.9
Consultation with insurance plan	18.2	17.1 – 19.3	12.5	10.4 – 15.0
Payment for consultation	57.2	56.0 – 58.4	62.4	59.2 – 65.6
Consultation in public systems	23.1	21.9 – 24.2	21.6	18.9 – 24.5
Good and very good evaluation of the service received	91.5	90.7 – 92.2	94.7	93.3 – 95.8

Table 2. Prevalence and prevalence ratio of oral hygiene habits in Brazilian adults and seniors, according to household income *per capita*. National Health Survey (*Pesquisa Nacional de Saúde — PNS*), 2013.

Variable	Income (MW) %					Adjusted PR (95%CI) ^a			
	< 0.25 (1)	0.25 to < 0.5 (2)	0.5 to < 1 (3)	1 to < 3 (4)	≥ 3 (5)	(2)/(1)	(3)/(1)	(4)/(1)	(5)/(1)
Adults – aged 18 to 59 years									
Tooth brushing ≥ 2 times a day	86.6	89.6	92.3	94.6	97.3	1.03 (1.01 – 1.06)	1.07 (1.05 – 1.09)	1.10 (1.08 – 1.13)	1.14 (1.11 – 1.16)
Toothbrush and toothpaste use	99.3	99.4	99.5	99.7	99.8	1.00 (1.00 – 1.01)	1.01 (1.00 – 1.01)	1.01 (1.00 – 1.01)	1.01 (1.00 – 1.01)
Toothbrush, toothpaste and dental floss use	31.4	40.6	53.5	66.1	84.5	1.30 (1.19 – 1.41)	1.74 (1.61 – 1.88)	2.19 (2.03 – 2.37)	2.85 (2.63 – 3.09)
Change of the toothbrush for a new one every three months	46.5	47.2	48.1	49.2	57.9	1.01 (0.94 – 1.09)	1.04 (0.97 – 1.11)	1.07 (1.00 – 1.15)	1.26 (1.17 – 1.37)
Seniors – aged 60 years or more									
Tooth brushing ≥ 2 times a day	81.0	69.0	73.8	81.4	93.0	0.86 (0.76 – 1.97)	0.92 (0.83 – 1.02)	1.02 (0.93 – 1.12)	1.15 (1.05 – 1.26)
Toothbrush and toothpaste use	95.7	95.9	97.0	97.9	99.7	1.00 (0.95 – 1.06)	1.01 (0.96 – 1.07)	1.02 (0.98 – 1.08)	1.04 (0.99 – 1.09)
Toothbrush, toothpaste and dental floss use	28.4	13.8	18.9	28.8	68.2	0.50 (0.31 – 0.80)	0.69 (0.48 – 1.00)	1.08 (0.77 – 1.51)	2.45 (1.76 – 3.41)
Change of the toothbrush for a new one every three months	41.2	36.8	35.7	37.6	55.3	0.90 (0.66 – 1.23)	0.88 (0.66 – 1.16)	0.94 (0.72 – 1.23)	1.35 (1.03 – 1.78)

^aPrevalence ratio adjusted by gender and age; 95%CI: confidence interval of 95%; PR: prevalence ratio; MW: minimum wage.

Table 3. Prevalence and prevalence ratio of oral health status in Brazilian adults and seniors, according to household income per capita. National Health Survey (*Pesquisa Nacional de Saúde — PNS*), 2013.

Variable	Income (MW) %					Adjusted PR (95%CI) ^a			
	≥ 3 (1)	1 to < 3 (2)	0.5 to < 1 (3)	0.25 to < 0.5 (4)	< 0.25 (5)	(2)/(1)	(3)/(1)	(4)/(1)	(5)/(1)
Adults – aged 18 to 59 years									
Poor self-reported oral health	14.4	26.6	35.7	42.3	46.3	1.89 (1.68 – 2.12)	2.60 (2.31 – 2.92)	3.14 (2.80 – 2.53)	3.44 (3.04 – 3.89)
Difficulty to chew	3.7	6.5	9.0	12.0	14.2	1.89 (1.48 – 2.41)	2.71 (2.12 – 3.47)	3.81 (2.97 – 4.88)	4.49 (3.46 – 5.82)
Loss of functional dentition (≥ 13 teeth)	5.3	12.9	14.8	15.9	16.8	2.85 (2.36 – 3.44)	3.60 (2.99 – 4.34)	4.66 (3.85 – 5.65)	4.84 (3.95 – 5.92)
Edentulism	1.4	4.1	5.1	4.7	5.6	3.60 (2.59 – 5.00)	4.96 (3.54 – 6.95)	5.78 (4.07 – 8.20)	6.74 (4.71 – 9.65)
Use of dental prostheses	45.1	42.6	36.9	32.4	28.9	1.06 (0.98 – 1.13)	1.00 (0.92 – 1.08)	0.99 (0.90 – 1.08)	0.88 (0.78 – 0.98)
Seniors – aged 60 years or more									
Poor self-reported oral health	20.3	37.8	45.6	50.1	35.0	1.86 (1.57 – 2.20)	2.25 (1.88 – 2.69)	2.46 (2.01 – 3.02)	1.72 (1.24 – 2.38)
Difficulty to chew	8.0	19.9	26.2	32.3	21.2	2.42 (1.84 – 3.18)	3.21 (2.39 – 4.32)	3.97 (2.86 – 5.52)	2.67 (1.54 – 4.63)
Loss of functional dentition (≥ 13 teeth)	36.6	70.5	77.8	73.4	73.9	1.87 (1.66 – 2.11)	2.06 (1.82 – 2.33)	1.96 (1.72 – 2.25)	2.04 (1.76 – 2.36)
Edentulism	19.5	43.8	49.6	44.5	43.1	2.11 (1.76 – 2.53)	2.39 (1.99 – 2.88)	2.18 (1.77 – 2.69)	2.24 (1.70 – 2.94)
Use of dental prostheses	76.8	75.6	67.3	53.4	66.2	0.99 (0.94 – 1.04)	0.87 (0.82 – 0.93)	0.70 (0.62 – 0.79)	0.87 (0.74 – 1.02)

^aPrevalence ratio adjusted by gender and age; MW: minimum wage; 95%CI: confidence interval of 95%; PR: prevalence ratio.

as income increases, as well as consultations for cleaning and revision and for use and control of orthodontic appliances. The opposite occurs with the attendances for teeth extractions and other reasons, which decrease as income increases. Regarding seniors, only those with family income of 3 or more MW *per capita* had higher prevalence of dental consultations, consultations for cleaning, and revision or maintenance, when compared to the poorest stratum. Going to the dentist for extraction was less frequent in the two higher income strata of seniors.

The prevalence of adults who paid for the consultations or who had oral health insurance increased as income increased, which was not observed in seniors (Table 4). The prevalence of adults who had consultations in the public health system decreased intensively and progressively as income increased, whereas in the senior population, a significant reduction was only verified in the upper income segment. Moreover, the segments of seniors with < 0.25 to < 1 MW income presented higher prevalence of consultations in the public health system than those with lower income. In adults, satisfaction with the care received increases with income, which does not occur among seniors.

DISCUSSION

The analyses of this study pointed to relevant and differentiated income inequalities in hygiene practices, oral conditions and access to and use of dental services in Brazilian adults and seniors.

HYGIENE PRACTICES

The frequency of brushing two or more times a day increases as household income *per capita* increases among adults. Only in the extreme upper income it was possible to observe a higher prevalence of brushing two or more times in the day in the senior population. Infrequent brushing is associated with severe forms of periodontal diseases, which may result in future tooth loss²².

In this study it was observed that the use of toothbrush and toothpaste has a high prevalence in all income strata, both in adults and seniors. However, there is a growing inequality among adults, with higher prevalence of dental floss use as income increases. In older adults, only the stratum with higher income differs significantly from the others.

The mean monthly cost of oral hygiene is high, according to studies conducted in cities in the Northeast²³ and South regions of Brazil¹³, which may indicate a barrier for access to oral hygiene products. Such high cost may also explain the prevalence below 50% of toothbrush change every three months — according to the recommendation — in the income strata living with less than three minimum wages between the adult and senior populations. A study using data from the Family Budget Survey (*Pesquisa Orçamentos Familiares 2008-2009*) showed that the annual *per capita* household expenditure on oral hygiene products was R\$10.27 and that this value is higher as income increases¹⁴.

Table 4. Prevalence and prevalence ratio of aspects related to access and use of services in Brazilian adults and seniors, according to household income *per capita*. National Health Survey (*Pesquisa Nacional de Saúde — PNS*), 2013.

Variable	Income (MW) %					Adjusted PR (95%CI) ^a			
	< 0.25 (1)	0.25 a < 0.5 (2)	0.5 a < 1 (3)	1 a < 3 (4)	≥ 3 (5)	(2)/(1)	(3)/(1)	(4)/(1)	(5)/(1)
Adults – aged 18 to 59 years									
Dental consultation in the last year	33.1	35.4	41.2	53.1	70.1	1.07 (0.98 – 1.17)	1.27 (1.17 – 1.38)	1.67 (1.54 – 1.81)	2.24 (2.06 – 2.43)
Reason for consultation:									
Revision, maintenance or prevention	39.6	43.6	48.6	56.2	65.9	1.10 (0.97 – 1.27)	1.24 (1.10 – 1.39)	1.44 (1.29 – 1.62)	1.73 (1.54 – 1.94)
Dental treatment	16.3	19.8	22.9	21.0	16.8	1.21 (0.96 – 1.54)	1.38 (1.13 – 1.70)	1.24 (1.02 – 1.52)	0.96 (0.76 – 1.20)
Extraction	27.5	20.1	11.8	6.3	2.8	0.73 (0.62 – 0.87)	0.42 (0.35 – 0.50)	0.22 (0.18 – 0.26)	0.09 (0.06 – 0.13)
Orthodontic appliance	2.4	3.0	5.9	6.0	4.8	1.31 (0.56 – 3.06)	2.75 (1.23 – 6.15)	3.09 (1.41 – 6.77)	3.17 (1.41 – 7.13)
Other reasons	14.3	13.5	10.9	10.5	9.6	0.95 (0.71 – 1.27)	0.74 (0.57 – 0.95)	0.69 (0.54 – 0.89)	0.59 (0.43 – 0.81)
Consultation with insurance plan	5.9	8.0	14.0	21.1	27.0	1.37 (0.82 – 2.29)	2.38 (1.49 – 3.80)	3.55 (2.35 – 5.66)	4.49 (2.81 – 7.19)
Payment for consultation	32.5	39.6	53.1	62.7	67.5	1.22 (1.05 – 1.41)	1.64 (1.43 – 1.87)	1.93 (1.69 – 2.20)	2.09 (1.82 – 2.38)
Consultation in public systems	59.9	49.7	30.6	15.6	3.8	0.83 (0.75 – 0.91)	0.51 (0.46 – 0.56)	0.26 (0.23 – 0.29)	0.06 (0.04 – 0.09)
Good and very good evaluation of the service received	83.1	85.1	89.3	93.5	96.4	1.02 (0.98 – 1.07)	1.07 (1.03 – 1.12)	1.13 (1.08 – 1.17)	1.16 (1.12 – 1.21)

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Table 4. Continuation.

Variable	Income (MW) %					Adjusted PR (95%CI) ^a			
	< 0.25 (1)	0.25 a < 0.5 (2)	0.5 a < 1 (3)	1 a < 3 (4)	≥ 3 (5)	(2)/(1)	(3)/(1)	(4)/(1)	(5)/(1)
Seniors – aged 60 years or more									
Dental consultation in the last year	24.7	13.9	16.6	28.4	60.2	0.58 (0.35 – 0.96)	0.70 (0.47 – 1.04)	1.21 (0.84 – 1.74)	2.47 (1.72 – 3.53)
Reason for consultation:									
Revision, maintenance or prevention	29.7	42.1	33.9	45.2	62.9	1.48 (0.73 – 3.04)	1.18 (0.64 – 2.09)	1.58 (0.87 – 2.85)	2.15 (1.20 – 3.85)
Dental treatment	21.9	8.9	18.4	18.2	17.7	0.43 (0.11 – 1.64)	0.87 (0.33 – 2.27)	0.87 (0.35 – 2.17)	0.82 (0.32 – 2.07)
Extraction	30.6	23.7	19.3	12.2	4.4	0.75 (0.24 – 2.29)	0.60 (0.23 – 1.55)	0.39 (0.15 – 0.98)	0.14 (0.05 – 0.42)
Orthodontic appliance	8.7	21.3	19.4	16.3	6.1	2.11 (0.65 – 6.85)	2.12 (0.78 – 5.79)	1.75 (0.66 – 4.62)	0.71 (0.26 – 1.92)
Other reasons	9.1	4.0	9.0	8.0	8.9	0.42 (0.12 – 1.52)	0.99 (0.37 – 2.67)	0.87 (0.34 – 2.21)	0.98 (0.38 – 2.52)
Appointment with insurance plan	14.9	4.5	5.5	12.1	16.9	0.33 (0.08 – 1.34)	0.39 (0.15 – 1.04)	0.86 (0.43 – 1.73)	1.17 (0.56 – 2.42)
Payment for appointment	55.9	36.9	52.8	57.9	77.1	0.65 (0.32 – 1.30)	0.94 (0.61 – 1.44)	1.02 (0.67 – 1.55)	1.37 (0.91 – 2.08)
Consultation in public systems	19.0	45.6	41.4	26.6	2.4	2.52 (1.28 – 4.97)	2.25 (1.26 – 4.00)	1.45 (0.82 – 2.57)	0.13 (0.06 – 0.31)
Good and very good evaluation of the service received	93.0	87.3	91.1	93.7	98.9	0.94 (0.83 – 1.07)	0.98 (0.90 – 1.06)	1.00 (0.94 – 1.08)	0.95 (0.04 – 1.98)

^aPrevalence ratio adjusted by gender and age; 95%CI: confidence interval of 95%; PR: prevalence ratio; MW: minimum wage.

ORAL CONDITIONS

Regarding oral conditions, this study revealed a disadvantage in the lower income segments of adults and seniors. In adults, it was possible to verify higher associations between household income *per capita* and all indicators of oral conditions, which increase as income decreases, whereas in the senior population this gradient is not as evident, reaching lower prevalence ratios.

Oral health self-assessment is a subjective indicator of oral conditions widely used in the literature, and its association with income is commonly found in Brazilian^{24,25} and international studies^{26,27}. However, social inequality gradients are not always found as markedly as they are in this study. The prevalence ratios found in this study are above 1.89, reaching 3.44 in the lowest income category, in relation to the highest one — among adults — found in a study conducted in Florianópolis²⁴, in which prevalence ratio does not exceed 1.6.

The increasing prevalence of difficulty in chewing (or feeding), according to the reduction of income in adults and seniors observed in this study was also verified for the Brazilian population in 2003^{17,28}. This is an indicator of loss of masticatory capacity resulting from oral disorders such as tooth loss, which directly influences the ingestion of fibrous foods and the quality of the diet²⁹.

The association between income and dental loss is well known in the literature¹². Thus, as in this study, findings from the 2010 SB-Brasil survey showed differences between the income segments regarding functional loss in adults (35–44 years of age) and edentulism in seniors (65–74 years of age), with increasing magnitudes as income decreased. The magnitudes of association in adults were greater in this study (PR = 6.7) than in SB-Brasil (PR = 4.74), contrary to what happened regarding the older adult population. For them, we found a 2.24 PR, whereas in SB-Brasil PR was 5.67⁹.

Dental losses are not always replaced by prostheses due to the difficulty in the access to specialized services, low supply and high costs. Among the individuals who lost at least one tooth, this study showed lower prevalence of prostheses use in the segment of lower household income *per capita* in adults, and in the intermediate income segments in older adults. A study using SB-Brasil 2010 data did not find differences among the income segments regarding the use of prostheses in older adults¹⁶.

USE OF DENTAL SERVICES

Although there has been a reduction in social inequalities, measured by the income quintile ratio, in the use of dental services between 1998 and 2008¹⁸, inequalities still persist, and are high when comparing the strata of higher and lower household income *per capita*, as shown by this study. In adults, the prevalence of dental attendances increased proportionally to the income, reaching PR = 2.24 in the highest income stratum.

The low prevalence of dental consultations in all strata of the senior population, except among those with higher income, is underscored. In addition to income, factors such as edentulism, low supply of public dental services and living in rural areas are associated with the lower access of seniors to these services³⁰. The results of this study corroborate the findings of a systematic review that pointed to income inequalities in the access to dental services in European countries, in the USA, Australia, Mexico and Brazil³¹.

Among the reasons for dental consultation, except for extraction, the prevalence of other indicators of reason for consultation were higher in the higher income strata, finding that the richest are more favored in the access to both prevention and various treatments. Those with lower income are more exposed to extraction procedures, which may result in functional dental loss and edentulism — found in greater proportion in this segment. Historically, mutilating practices are part of dental care provided to adults and seniors, whereas preventive and conservation practices are directed toward children³².

Social inequality in access to dental services, both among adults and seniors, suggests a failure to ensure universal and equitable access according to the principles of the Brazilian public unified health system (*Sistema Único de Saúde* — SUS), and reinforced in the *Brasil Sorridente* policy (National Oral Health Policy), launched in 2003³³, placing segments of lower income in disadvantage positions. This hypothesis can be considered since a high percentage of the lower income population — more than 1/3 of the adults and more than 50% of seniors — had to pay the dentist or use the insurance plan, as verified in this study. Going to the dentist using SUS declines sharply as income increases for adults, whereas for seniors this access is higher in the intermediate income strata. Only 19% of lower income seniors went to the dentist using SUS, reflecting this segment's restricted access to public services. The use of public services in greater proportion as income declines was verified in other Brazilian population-based studies^{20,34,35}. Even in developed countries, social inequalities in access to dental services are still persistent³⁶.

The oral health of adults and seniors deserves special attention since dental services historically do not prioritize these groups when acting on the prevention and promotion of health. The restricted access found in this study, especially in the lower income population and among older adults of all income strata, and the submission to care models focused on therapy, generate higher edentulism rates, as well as caries and periodontal diseases in these population segments^{32,37}.

Due to the diversity of cutoff points of the income variable used in the reviewed studies, there was a limitation in the direct comparison of the prevalence ratios. Thus, it was possible to identify and compare the findings only in relation to the degree of magnitude and the direction of the associations.

CONCLUSION

This study was able to detect marked income inequalities in several oral health indicators, but the magnitude of the inequalities varied according to the analyzed indicator. The major

disparities were observed on total tooth loss, functional dental loss and difficulty of chewing among the oral health condition indicators. Considering oral hygiene indicators, higher economic disparity was observed in the use of dental floss, and another important inequality was found for dental consultation in the last year.

Income is crucial in oral health since it is a limiting factor for access to hygiene resources, which are essential for the maintenance of a good oral condition. Moreover, income has an impact on access to services, since, despite the expansion of the dental care offer in SUS after the insertion of oral health teams in Primary Care and Dental Specialties Centers, it was found that even the lower income population is paying to go to the dentist. Results show an urgent need for reassessment of public policies aimed at oral health and greater attention directed at the most vulnerable segments, investing not only in preventive measures but also in restorative and rehabilitative treatments that are necessary for this population, which has sequelae resulting from past exposures.

ACKNOWLEDGEMENTS

The authors thank the Brazilian Ministry of Health for financing the project under agreement No. 817122/2015 and the Brazilian National Council for Scientific and Technological Development (CNPq), as per productivity scholarship by M. B. A. Barros and D. C. Malta.

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Received on: 07/03/2019

Final version presented on: 08/08/2019

Accepted on: 08/19/2019

Author's contributions: All the authors collaborated in the article design, literature survey, writing and article revision.

