

# Oral health profile among community-dwelling elderly and its association with self-rated oral health

## *Perfil de saúde bucal de idosos não institucionalizados e sua associação com autoavaliação da saúde bucal*

Fabiola Bof de Andrade<sup>I</sup>, Doralice Severo da Cruz Teixeira<sup>II</sup>, Paulo Frazão<sup>III</sup>, Yeda Aparecida Oliveira Duarte<sup>III</sup>, Maria Lúcia Lebrão<sup>IV\*</sup>, José Leopoldo Ferreira Antunes<sup>IV</sup>

**ABSTRACT:** *Introduction:* The use of dental prosthesis and the tooth loss in elderly people are associated with significant impact on the overall health and quality of life. Continuous assessment of oral health profile in this population is important for planning the actions and policies of the area. *Objectives:* The aims of this study were to assess the prevalence of tooth loss and use of dental prosthesis among the elderly people in different periods, to evaluate the association between functional dentition (20 teeth or more) and socioeconomic factors, and to evaluate the impact of tooth loss and use of dental prosthesis on self-rated oral health. *Methods:* The sample consisted of people aged 60 years and older who participated in the Health, Well-Being, and Aging Study (SABE). Data from the years 2000, 2006, and 2010 were used to assess the prevalence of tooth loss and use of dental prosthesis. Analysis of the factors associated with the functional dentition and self-rated oral health was based on the data collected in 2010. Comparison of oral health profile over the 3 years was done through descriptive analysis and comparison of confidence intervals. Multiple logistic regression models were used to assess the factors associated with functional dentition and self-rated oral health. *Results:* The prevalence of tooth loss and use of dental prosthesis remained constant over the three periods analyzed. Functional dentition was significantly associated with education, sex, and race/gender. Individuals in need of dental prosthesis and with periodontal pocket were more likely to report poor oral health. *Conclusion:* There was no reduction in the prevalence of tooth loss and in the use of dental prosthesis over 10 years. Functional dentition is associated with socioeconomic inequalities. Self-rated oral health is associated with the need of dental prosthesis.

**Keywords:** Tooth loss. Oral health. Aging. Epidemiology. Health inequalities. Health surveys.

<sup>I</sup>René Rachou Research Institute, Oswaldo Cruz Foundation – Belo Horizonte (MG), Brazil.

<sup>II</sup>Departament of Public Health, Public Health School, Universidade de São Paulo – São Paulo (SP), Brazil.

<sup>III</sup>Nursing School, Universidade de São Paulo – São Paulo (SP), Brazil.

<sup>IV</sup>Departament of Epidemiology, Public Health School, Universidade de São Paulo – São Paulo (SP), Brazil.

\*in memoriam.

**Correspondence to:** Fabiola Bof de Andrade. Avenida Augusto de Lima, 1.715, Barro Preto, CEP: 30190-002, Belo Horizonte, MG, Brasil. E-mail: fabiola.andrade@cpqrr.fiocruz.br

**Conflict of interests:** nothing to declare – **Financial support:** *Fundação de Amparo à Pesquisa do Estado de São Paulo*, 1999/05125-7, 2005/54947-2 e 2010/00883-1.

**RESUMO: Introdução:** O uso de prótese e a perda dentária em idosos estão associados a impactos significativos na saúde geral e na qualidade de vida. A avaliação contínua do perfil de saúde bucal dessa população é importante para o planejamento das ações e políticas da área. **Objetivo:** Foram objetivos deste trabalho avaliar a prevalência de perda dentária e uso de próteses entre idosos em diferentes períodos, verificar as características sociodemográficas associadas à dentição funcional (mais de 20 dentes) e avaliar o impacto do uso de prótese e da perda dentária na autoavaliação da saúde bucal. **Métodos:** A amostra foi composta por pessoas de 60 anos ou mais, participantes do Estudo Saúde, Bem-Estar e Envelhecimento (SABE). A avaliação da prevalência de perda dental e uso de próteses foi feita a partir da comparação dos dados coletados nos anos de 2000, 2006 e 2010. As análises dos fatores associados à dentição funcional e autoavaliação de saúde bucal foram realizadas com base nos dados coletados no ano de 2010. A comparação do perfil de saúde bucal ao longo dos três períodos foi feita por meio de análises descritivas e comparação de intervalos de confiança. Realizou-se análise de regressão logística múltipla para avaliar os fatores associados à dentição funcional e à autoavaliação da saúde bucal. **Resultados:** A prevalência de perda dental e uso de próteses se manteve constante ao longo dos três anos analisados. A dentição funcional foi significativamente associada à escolaridade, sexo e cor/gênero. Idosos com necessidade de próteses e bolsa periodontal apresentaram mais chances de autoavaliação ruim. **Conclusão:** Não houve redução da prevalência de perda dentária e uso de próteses ao longo de dez anos na população estudada. A dentição funcional está associada a desigualdades sociodemográficas. A autoavaliação de saúde bucal está associada à necessidade de próteses.

**Palavras-chave:** Perda de dente. Saúde bucal. Envelhecimento. Epidemiologia. Desigualdades em saúde. Inquéritos epidemiológicos.

## INTRODUCTION

Prevention and control of diseases and disorders related to oral health are important for maintaining the overall health and quality of life. Use of dentures and tooth loss among the elderly have been linked to overall health<sup>1</sup> and quality of life<sup>1,2</sup>. Sequelae related to oral diseases are among the 50 most common observed in the study on Global Burden of Disease, and edentulism ranks 36th, reaching about 2% of the world population<sup>3</sup>. This condition was ranked 79th among the causes of Disability-Adjusted Life Years (DALY)<sup>4</sup>, despite a reduction seen between 1990 and 2010. Among all oral conditions, this was the leading cause of DALY among people aged 60 years or more<sup>5</sup>.

Evidence shows that there is a reduction in the occurrence of tooth loss among the elderly<sup>6</sup> and therefore, in the use of dental prostheses worldwide. However, the number of tooth lost remains one of the main impairments when it comes to these individuals' oral health<sup>7,8</sup>. Only 11.5% of the Brazilian's elderly population has functional dentition<sup>9</sup>, characterized by the presence of 21 or more teeth<sup>10</sup>. In the last National Oral Health Survey, mean DMFT (decayed, missing, and filled teeth) index was 27 between Brazilians aged 65–74 years, and the component “missing” accounts for approximately 92% of the index<sup>8</sup>. Furthermore, comparison between the last two surveys showed no

reduction in the percentage of missing teeth<sup>8-11</sup>. The high percentage in the use of dental prostheses by the elderly reflects the magnitude of tooth loss and edentulism in later ages<sup>8</sup>. However, despite the high dental impairment, studies show that self-perception of oral health by most individuals is good in this age group, so the role of use and need of prostheses must be elucidated<sup>12-14</sup>.

Continuous assessment of the oral health profile of the elderly is necessary for planning appropriate intervention and for assessing the ultimate effect of oral health policies in the population<sup>15</sup>. However, oral health surveys in Brazil have brought information only about people aged 65–74 years, thus leaving a gap when it comes to oral health profile among the population below 65 years and above 74 years of age.

This study was conducted with the following objectives: to assess the prevalence of tooth loss and use of dental prosthesis in a representative sample of noninstitutionalized elderly from São Paulo, Brazil, at different times in 5 year intervals; to evaluate the socioeconomic and demographic characteristics associated with functional dentition; and to evaluate the impact of the use of dental prosthesis and tooth loss on self-rated oral health.

## METHODS

We conducted a cross-sectional study based on the data from the Health, Well-Being, and Aging Study (*Saúde, Bem-Estar e Envelhecimento* – SABE). SABE was initiated in Brazil in 2000 and included a representative sample of people aged 60 years and older living in the urban area of São Paulo. In 2006 and 2010, the second and third waves of the study were conducted, and new cohorts with people aged 60 to 64 were years initiated to maintain the representativeness of this age group in the sample. Participants answered a structured questionnaire and were clinically assessed by dentists trained in a standard methodology<sup>16</sup>. Detailed information of the study is available in other publications<sup>17,18</sup>.

### USE OF PROSTHESIS AND TOOTH LOSS

Analysis of oral health status was based on the data collected in 2000, 2006, and 2010. In 2000, only self-report on the number of missing teeth and the use of dentures were evaluated. Self-reported use of dentures was evaluated by the question “Do you use bridge, dentures, or false teeth?” with two possible answers (yes and no). Self-report of tooth loss was assessed by the question “Do you have missing teeth?” with four options: 0–15 (no/a few [up to 4] yes/many [more than 4 and less than half]), and 16 or more (yes, most of them [half or more]).

Self-reported measures in 2000 were compared with tooth loss and the use of prosthesis clinically evaluated in 2006 and 2010. The use of dentures was evaluated for the maxilla and mandible according to the following categories: no, fixed/removable prosthesis, dentures, fixed/removable prosthesis/dentures), which were recategorized simply as yes and no. Number of missing teeth was grouped using the same categories as in the self-report. In 2006 and 2010, the number of missing teeth (edentulous, 1 to 10, 11 to 20, 21 or more) and the time elapsed since the last dental visit were compared.

## OUTCOMES

Evaluation of the factors associated with functional dentition (presence of 21 or more teeth)<sup>10</sup> and self-rated oral health was carried out with the data from 2010.

Self-rated oral health was evaluated by the question “How do you rate your oral health?” with five response options (very good, good, regular, poor and very poor), recategorized in good (very good/good) and poor (regular/poor/very poor.)<sup>14</sup>

## INDEPENDENT VARIABLES

Besides the use of prostheses, the following variables were used to investigate factors associated with self-assessment of oral health in 2010: clinical measures of oral health (number of teeth [0–20 teeth, 21 teeth or more]<sup>10</sup>, need for dental prostheses [yes, no], periodontal pocket  $\geq 4$  mm [yes, no], periodontal attachment loss  $\geq 4$  mm [yes, no], need for dental treatment [yes, no], presence of caries (crown or root) [yes, no]); use of dental services (time since last dental appointment [ $\leq 2$  years (< 1 year/ 1 to 2 years), and 3 years or more (3 years or more/never)]; reason for the last dental appointment (urgency, treatment, maintenance); general health (number of self-reported diseases [0–1 disease, 2+ diseases] (including: high blood pressure, diabetes, chronic lung disease, heart disease, osteoarticular disease and stroke); depression<sup>19,20</sup> [yes, no], self-rated health [good, poor]); sociodemographic (age [60–69, 70–79, 80+ years old], gender [male, female], education [0–3 years, 4–7 years, 8 years or more], marital relationship [yes, no], self-report of sufficient income for basic expenses [yes, no], skin color [black, brown/mulatto, black, other]).

The independent variables used for the evaluation of factors associated with functional dentition were: sociodemographic (age [60–69, 70–79, 80+ years old], gender [male, female], education [0–3 years, 4–7 years, 8+ years], marital relationship [yes, no], self-report of sufficient income for basic expenses [yes, no] skin color [black, brown/mulatto, black, other]); use of dental services (time since last dental appointment [ $\leq 2$  years (< 1 year/ 1 to 2 years), 3 years or more (3 years or more/never)]; and general health (number of self-reported diseases [0–1 disease, 2+ diseases], smoking [yes, no]).

## STATISTICAL ANALYSIS

Oral health status, with regard to tooth loss and use of prostheses in the years 2000, 2006, and 2010, was evaluated by descriptive analysis using frequency measurements and by the comparison of 95% confidence intervals between periods.

The evaluation of the factors associated with self-reported oral health and tooth loss in 2010 was made by multiple logistic regression models. Variables were included in the model in the following order: sociodemographic variables and oral health measures. The analysis was performed in Stata 13.0, using the “survey” command, which allows considering the complex structure of the sample such as the assignment of sample weights. New sample weights were calculated for each wave, thus allowing the maintenance of samples’ representativeness.

## ETHICAL CONSIDERATIONS

The project SABE was approved by the Ethics Committee of the School of Public Health of Universidade de São Paulo (USP). All selected participants received detailed information about the research objectives, the anonymity guarantee, the forms of data disclosure and the benefits of this study. At the time of interview, researchers and participants signed an informed consent form.

## RESULTS

In 2000, 2006, and 2010, the data from 2,143, 1,394, and 1,242 elderly were analyzed, respectively. Because of the incomplete data found for some variables, evaluation of factors associated with tooth loss was conducted in 1,078 cases and analysis related to self-assessment of oral health was made in 1,082 cases.

### TOOTH LOSS AND USE OF PROSTHESIS (COMPARISON BETWEEN 2000, 2006, AND 2010)

Most of the elderly had 16 or more missing teeth and used dental prostheses. The comparison between years showed a reduction in the percentage of missing teeth and use of prosthesis, but these were not significant from year to year (Table 1).

Tooth loss and use of prosthesis according to different age groups are shown in Table 2. Comparison between age groups in all the three years demonstrated that despite a reduction in the percentage of missing teeth and the use of dentures in each group, there was an overlap of confidence intervals over years, leading to a nonsignificant reduction. However, analyses of each year showed that the tooth loss significantly increased with age. Regarding

the use of prostheses, there was no significant difference between groups in 2000; but in 2006 and 2010, it was shown to be more common with increasing age.

## FUNCTIONAL DENTITION IN 2010

Table 3 shows the characteristics of the population in 2010 and the multiple logistic regression models for factors associated with functional dentition. It was found that 18.6% (95%CI 15.3 – 22.5)

Table 1. Distribution of oral health status of the elderly in 2000, 2006, and 2010.

Factors	2000*	2006	2010
Tooth loss (teeth)			
0 – 15	21.2 (18.0 – 24.7)	21.4 (18.0 – 25.3)	26.7 (22.9 – 30.9)
16 or more	78.8 (75.3 – 82.0)	78.6 (74.7 – 82.0)	73.3 (69.1 – 77.1)
Use of prosthesis			
No	19.3 (17.0 – 21.9)	20.7 (17.7 – 24.0)	24.6 (21.7 – 27.7)
Yes	80.7 (78.1 – 83.0)	79.3 (76.0 – 82.3)	75.4 (72.3 – 78.3)
Use of prosthesis			
No	**	20.7 (17.7 – 24.0)	24.6 (21.7 – 27.7)
Fixed/removable prosthesis		16.9 (14.1 – 20.1)	19.0 (15.7 – 22.7)
Dentures		52.3 (49.0 – 55.7)	46.1 (41.7 – 50.7)
Fixed/removable prosthesis and dentures		10.1 (8.3 – 12.3)	10.3 (8.5 – 12.4)
Number of teeth			
Edentulous	**	44.5 (40.6 – 48.5)	38.2 (34.0 – 42.6)
1 – 10		25.4 (22.8 – 28.1)	24.8 (22.1 – 27.8)
11 – 20		16.6 (14.4 – 19.1)	19.6 (17.0 – 22.5)
21 or more		13.5 (10.8 – 16.7)	17.3 (14.2 – 21.0)
Last dental appointment (year)			
< 1	**	30.5 (27.4 – 33.7)	35.0 (31.4 – 38.9)
1 – 2		20.1 (18.1 – 22.3)	21.1 (18.7 – 23.7)
3 or more		48.0 (44.7 – 51.4)	42.8 (39.1 – 46.5)
Never		1.4 (0.8 – 2.6)	1.1 (0.6 – 1.9)

\*Self-report; \*\*Data not available in 2000.

Source: Health, Well-Being, and Aging Study (SABE), São Paulo.

Table 2. Distribution of oral health conditions of the elderly according to age groups (2000, 2006, and 2010).

Factors	Age	2000			2006			2010		
		60-64 years	65-74 years	75 years or more	60-64 years	65-74 years	75 years or more	60-64 years	65-74 years	75 years or more
Tooth loss (teeth)										
0 - 15		32.1 (26.3 - 38.5)	19.7 (16.5 - 23.4)	8.3 (6.3 - 10.7)†	32.0 (25.9 - 38.7)	20.7 (16.2 - 26.1)	9.8 (7.1 - 13.3)†	39.0 (31.4 - 47.1)	27.1 (22.6 - 32.1)	12.2 (9.0 - 16.3)†
16 or more		67.9 (61.5 - 73.7)	80.3 (76.6 - 83.5)	91.7 (89.3 - 93.7)	68.0 (61.3 - 74.1)	79.3 (73.9 - 83.8)	90.2 (86.7 - 92.9)	61.0 (52.9 - 68.6)	72.9 (67.9 - 77.4)	87.8 (83.7 - 91.0)
Use of prosthesis										
No		21.6 (16.9 - 27.3)	17.5 (14.5 - 20.9)	19.7 (16.0 - 24.0)	30.8 (25.7 - 36.4)	16.2 (12.3 - 21.2)	16.7 (13.5 - 20.4)†	29.2 (23.8 - 35.3)	25.4 (20.8 - 30.7)	18.0 (14.8 - 21.8)*
Yes		78.4 (72.7 - 83.1)	82.5 (79.1 - 85.5)	80.3 (76.0 - 84.0)	69.2 (63.6 - 74.3)	83.8 (78.8 - 87.7)	83.3 (79.6 - 86.5)	70.8 (64.7 - 76.2)	74.6 (69.3 - 79.2)	82.0 (78.2 - 85.2)
Use of prosthesis										
No					30.8 (25.7 - 36.4)	16.2 (12.3 - 21.2)	16.7 (13.5 - 20.4)†	29.2 (23.8 - 35.3)	25.4 (20.8 - 30.7)	18.0 (14.8 - 21.8)†
Fixed/removable prosthesis					17.6 (12.6 - 23.9)	18.5 (14.5 - 23.2)	12.9 (9.4 - 17.5)	24.7 (18.6 - 32.2)	19.7 (15.1 - 25.2)	11.3 (8.0 - 15.8)
Dentures					44.2 (38.9 - 49.8)	53.1 (47.7 - 58.4)	61.0 (56.0 - 65.7)	36.6 (28.5 - 45.6)	43.6 (38.4 - 48.9)	60.8 (55.1 - 66.3)
Fixed/removable prosthesis and dentures					7.4 (4.8 - 11.2)	12.2 (9.1 - 16.1)	9.4 (7.2 - 12.3)	9.4 (6.6 - 13.3)	11.3 (8.4 - 15.0)	9.9 (6.9 - 13.9)
Number of teeth										
Edentulous					30.2 (24.5 - 36.6)	44.6 (39.4 - 49.9)	62.3 (57.0 - 67.2)†	23.6 (17.5 - 31.1)	36.3 (30.1 - 42.9)	57.9 (52.5 - 63.2)†
1 - 10					28.7 (23.8 - 34.3)	25.3 (21.5 - 29.5)	21.3 (18.2 - 24.8)	25.8 (22.2 - 29.9)	25.8 (20.6 - 31.9)	22.2 (18.2 - 26.8)
11 - 20					18.7 (15.6 - 22.3)	18.3 (14.8 - 22.4)	10.9 (8.6 - 13.8)	24.2 (18.6 - 30.8)	21.1 (17.3 - 25.4)	12.1 (9.0 - 16.1)
21 or more					22.3 (17.4 - 28.2)	11.8 (8.3 - 16.6)	5.5 (3.6 - 8.4)	26.3 (19.7 - 34.2)	16.8 (12.9 - 21.7)	7.7 (5.2 - 11.4)

†p < 0.001; †p < 0.0001; \*p < 0.05; \*\*Data not available in 2000.

Source: Health, Well-Being, and Aging Study (SABE), São Paulo.

of the elderly had functional dentition. Most seniors were female, white, and had reported sufficient income for basic expenses.

The chance of having functional dentition was higher among the male and among the well-educated. People aged 75 years or older had less chances of presenting functional dentition compared with those aged 60 to 64 years. People who declared themselves as “black” and “mulatto/brown” were 65 and 45% less likely to have functional dentition.

## SELF-RATED ORAL HEALTH IN 2010

Regarding self-rated oral health, in the bivariate analysis, it was significantly associated with one sociodemographic variable (sufficient income), three general health variables (number of diseases, depression, and self-rated general health), and all oral health variables, with the exception of functional dentition.

The final logistic regression model showed that people aged 80 years or more and with marital relationship had significantly less chance of self-rated poor oral health. The chance of poor self-rated was higher among seniors with two or more diseases, in need of prostheses, presenting periodontal pocket, and who had visited their dentists 3 years ago or more (Table 4).

## DISCUSSION

The main result of this study is the maintenance of the prevalence of tooth loss and use of dental prosthesis over 10 years among the noninstitutionalized elderly of São Paulo. In addition, the prevalence of seniors with functional dentition is low, but higher than the rate observed for the whole Brazilian population<sup>9</sup> and lower than the rates found in developed countries<sup>21,22</sup>. Need for dental prosthesis and the presence of periodontal pockets are significantly associated with poor self-rated oral health.

Different categorizations for tooth loss in different studies make it difficult to compare them. However, unlike in some developed countries<sup>23-25</sup>, the stability of prevalence rates among the elderly in Brazil’s largest city reproduces the findings of the population in the first decade of the 21st century<sup>26</sup>.

This rate stability could be attributed to the short time of observation, since a large proportion of the elderly participants belong to generations who were not exposed, when young, to the socioeconomic changes and to the prevention and treatment policies that have occurred throughout the country in the past decades. These events have produced significant effect among Brazilian adults<sup>27</sup>. The relevance of the cohort effect in improving oral health status has been highlighted in the literature<sup>26-28</sup>. According to Slade et al.<sup>28</sup>, the major determinant of the drop in



Table 3. Distribution of study variables and multiple logistic regression model for the presence of functional dentition.

	Sample	Functional dentition	
	% (95%CI)	Gross OR (95%CI)	Adjusted OR (95%CI)
<b>Gender</b>			
Female	59.9 (56.8 – 63.0)	1	1
Male	40.1 (37.0 – 43.2)	2.05 (1.34 – 3.12)**	1.89 (1.19 – 3.02)**
<b>Age (years)</b>			
60 – 64	34.0 (25.9 – 43.1)	1	1
65 – 74	42.0 (34.8 – 49.6)	0.56 (0.33 – 0.94)**	0.68 (0.42 – 1.10)
75 or more	24.0 (18.7 – 30.2)	0.27 (0.15 – 0.48)***	0.34 (0.19 – 0.60)***
<b>Schooling (years)</b>			
0 – 3	32.9 (28.3 – 37.9)	1	1
4 – 7	39.1 (35.6 – 42.7)	1.28 (0.76 – 2.13)	0.93 (0.53 – 1.64)
8 years or more	28.0 (22.8 – 33.8)	6.70 (4.28 – 10.51)***	3.86 (2.60 – 5.73)***
<b>Marital relationship</b>			
No	43.5 (39.5 – 47.6)	1	1
Yes	56.5 (52.4 – 60.5)	1.84 (1.28 – 2.64)**	1.33 (0.89 – 1.98)
<b>Sufficient income</b>			
No	42.7 (38.6 – 46.9)	1	1
Yes	57.3 (53.1 – 61.4)	1.54 (1.07 – 2.20)*	0.97 (0.67 – 1.40)
<b>Skin color</b>			
White	58.6 (54.1 – 62.9)	1	1
Brown/mulatto	29.6 (25.1 – 34.5)	0.50 (0.33 – 0.77)**	0.55 (0.33 – 0.91)*
Black	6.3 (4.7 – 8.4)	0.25 (0.10 – 0.66)**	0.35 (0.13 – 0.95)*
Other	5.5 (3.9 – 7.8)	1.14 (0.51 – 2.52)	0.92 (0.42 – 2.02)
<b>Number of diseases</b>			
0 – 1	49.4 (46.0 – 52.8)	1	1
2 or more	50.6 (47.2 – 54.0)	0.58 (0.41 – 0.83)**	0.68 (0.48 – 0.96)*
<b>Smoking</b>			
No	87.6 (84.8 – 89.9)	1	1
Yes	12.4 (10.1 – 15.2)	0.59 (0.35 – 0.99)*	0.44 (0.25 – 0.75)**
<b>Last dental appointment (years)</b>			
≤ 2	57.6 (53.7 – 61.4)	1	1
3 or more	42.4 (38.6 – 46.3)	0.30 (0.18 – 0.49)***	0.45 (0.27 – 0.74)**

n = 1,078, representing 1,122,194 elderly people; model p-value < 0.0001; \*p < 0.05; \*\*p < 0.001; \*\*\*p < 0.0001; 95%CI: 95% confidence interval.

Source: Health, Well-Being, and Aging Study (SABE), São Paulo, 2010

Table 4. Final logistic regression model for poor self-rated oral health among elderly in São Paulo, 2010.

	Crude OR (95%CI)	Adjusted OR (95%CI)
<b>Gender</b>		
Male	1.16 (0.84 – 1.60)	1.23 (0.85 – 1.79)
<b>Age (reference 60 – 69 years)</b>		
70 – 79	0.82 (0.57 – 1.17)	0.89 (0.59 – 1.33)
80 or more	0.62 (0.44 – 0.89)*	0.60 (0.39 – 0.91)*
<b>Sufficient income</b>		
Yes	0.62 (0.46 – 0.84)**	0.79 (0.56 – 1.10)
<b>Marital relationship</b>		
Yes	0.77 (0.58 – 1.03)	0.67 (0.48 – 0.94)*
<b>Depression</b>		
Yes	1.91 (1.32 – 2.76)**	1.50 (0.97 – 2.30)
<b>Health self-assessment</b>		
Good		
Poor	1.71 (1.30 – 2.26)***	1.50 (1.09 – 2.08)*
<b>Number of diseases (reference 0–1 disease)</b>		
2 diseases or more	1.50 (1.13 – 1.99)**	1.38 (0.99 – 1.92)
<b>Need for prosthesis</b>		
Yes	2.52 (1.99 – 3.21)***	1.82 (1.36 – 2.44)***
<b>Need for treatment</b>		
Yes	2.25 (1.68 – 3.02)***	1.43 (1.00 – 2.04)
<b>Periodontal pocket &gt; 4 mm</b>		
Yes	2.42 (1.85 – 3.17)***	2.46 (1.77 – 3.44)***
<b>Functional dentition (reference 0 – 20 teeth)</b>		
21 or more	0.89 (0.58–1.36)	0.71 (0.45–1.12)
<b>Last dental appointment (reference ≤ 2 years)</b>		
3 years or more	1.46 (1.04–2.06)*	1.52 (1.04–2.22)*

n = 1,082, representing 1,125,713 people; model p-value < 0.0001.  
 \*p < 0.05; \*\*p < 0.001; \*\*\*p < 0.0001; 95%CI: 95% confidence interval.  
 Source: Health, Well-Being, and Aging Study (SABE), São Paulo.

the prevalence of tooth loss in the United States was the passage of generations born before the 1940s, whose incidence (5–6% per decade of age) exceeded the rates of later cohorts (1–3% per decade of age). In Brazil, the reduction of edentulism as an effect of the introduction of new cohorts is planned for the decade 2050<sup>26</sup>.

The cohort effect cannot be confirmed by means of the analysis performed in this study; however, this effect may be suggested from the comparison of tooth loss among cohorts of 60 to 64 years (in relation to the elderly of the same age in different years of study), which shows an approximate absolute reduction of seven percentage points in the prevalence of tooth loss in the youngest generation (evaluated in 2010) as compared with the other cohorts. The comparison of cohort of 60 to 64 years in 2006 and 2010 shows that edentulism had an absolute reduction of 6.6 points and an increase of 4.0 points in the prevalence of functional dentition. Regarding dentures, as noted by other authors<sup>23</sup>, the effects of tooth loss reduction are reflected as a decline in the use of dentures and increase in the use of fixed or removable dentures.

With regard to factors associated with functional dentition, after adjusting for overall health variables and use of dental services, the presence of functional dentition was still significantly associated with socioeconomic and demographic variables, which confirms the inequalities observed in other studies<sup>21,24,25,29</sup>. Regardless of the variables used, number of missing teeth, edentulism or functional dentition, the chance of this outcome has been significantly higher among less educated individuals<sup>21,26,29</sup>, where one can say that there is a social gradient in tooth loss<sup>24</sup>.

As for the association with the skin color and gender, results are conflicting. In the Brazilian population aged 65–74 years, skin color and gender have lost significance in association with tooth loss when adjusted for socioeconomic variables<sup>26</sup>. Kida et al.<sup>30</sup> found that Tanzanian women were significantly more likely to present tooth loss than men. Wu et al.<sup>25</sup> found that black Americans had less chances of losing teeth, but a larger number of missing teeth. In the same study, no association between gender and edentulism could be established, but women had less tooth lost over time.

Tooth loss reflects not only the history of oral diseases of individuals, but also the behavior and attitude of the patients and dentists, supply of and access to dental care, and the philosophy of dental care<sup>24</sup>. Some researchers have considered edentulism as a social phenomenon. Among the aspects highlighted, the way each social formation accepts and encourages tooth extraction as an inevitable event, as well as the guidelines for dental services organization are important determinants<sup>31,32</sup>. Thus, edentulism acquired at early ages is related to cultural issues and to limited access to care, equally affecting population groups when it comes to skin color and gender. Functional dentition would be more sensible to socioeconomic differences between population groups which end up conditioning the use of health services. Regarding gender, most tooth loss cases among women may be attributed to the hypothesis that they use more dental services and are therefore more prone to overtreatment<sup>26,30</sup>.

In addition to sociodemographic conditions, functional dentition was associated with smoking and the use of dental services. Not smoking and having made recent use of dental services may reflect greater health care, which would explain the best result of oral health among seniors who were nonsmokers and those whose last dental appointment had been 2 years or earlier. Other studies<sup>21,33-35</sup> have reported association between smoking and tooth loss, being the destruction of dental-supporting tissues caused by tobacco consumption pointed out as one of the ways by which smoking would be associated with tooth loss<sup>34</sup>.

Regarding self-reported oral health, after adjusting for sociodemographic, general health and oral health variables, older people in need of prosthesis and presenting periodontal pockets were more likely to self-report poor oral health, which shows the importance of public dental services ensuring dental care and provision of dental prosthesis for this population. As noted by other authors, no association was found between this outcome and the functional dentition<sup>12,13,36</sup> and the use of prostheses<sup>12,13</sup>. These findings indicate that good oral health evaluation may be achieved in the presence of functional dentition or use of dental prostheses, as the need for prosthesis related to poor self-assessment represents the absence of such conditions.

Among the strengths of this study, it is worth highlighting the use of data from a representative sample of noninstitutionalized elderly residents in the largest city in South America, where the proportion of seniors, altogether, is quite significant. Among the limitations, one can mention the use of self-reported dental conditions in the first year of the study, which may have generated some bias in estimates. However, several studies have demonstrated the validity of self-reported number of teeth<sup>37-39</sup> and use of prostheses<sup>37,40</sup> in epidemiological studies. Another limitation was the impossibility of establishing causal relationships between outcomes and covariates, given the cross-sectional design of the study.

## CONCLUSION

Based on the foregoing, the three surveys showed that the prevalence of both tooth loss and use of prosthesis was high and remained constant. As per the study held in 2010, we can confirm the existence of social inequalities with respect to functional dentition. Moreover, the need for prosthesis and the presence of periodontal pockets were associated with self-rated oral health. These results reinforce the importance of oral health services planning throughout life, being continuously evaluated, with the perspective of changing, for next generations, this unfavorable profile of oral health found in the elderly population of this study.

## REFERENCES

- Petersen PE. The World Oral Health Report 2003: continuous improvement of oral health in the 21<sup>st</sup> century – the approach of the WHO Global Oral Health Programme. *Community Dent Oral Epidemiol* 2003; 31(suppl.1): 3-23.
- de Andrade FB, Lebrão ML, Santos JL, Teixeira DS, Duarte YA. Relationship between oral health-related quality of life, oral health, socioeconomic, and general health factors in elderly Brazilians. *J Am Geriatr Soc* 2012; 60(9): 1755-60.
- Vos T, Flaxman AD, Naghavi M, Lozano R, Michaud C, Ezzati M, et al. Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet* 2012; 380(9859): 2163-96.
- Institute for Health Metrics and Evaluation (IHME). GBD Arrow Diagram. Seattle, WA: IHME, University of Washington; 2013. Disponível em: <http://vizhub.healthdata.org/irank/arrow.php>. (Acessado em 16 de setembro de 2014).
- Marcenes W, Kassebaum NJ, Bernabé E, Flaxman A, Naghavi M, Lopez A, et al. Global burden of oral conditions in 1990-2010: a systematic analysis. *J Dent Res* 2013; 92(7): 592-7.
- Petersen PE, Yamamoto T. Improving the oral health of older people: the approach of the WHO Global Oral Health Programme. *Community Dent Oral Epidemiol* 2005; 33(2): 81-92.
- Petersen PE, Kandelman D, Arpin S, Ogawa H. Global oral health of older people--call for public health action. *Community Dent Health* 2010; 27(4 suppl. 2): 257-67.
- Ministério da Saúde. Projeto SBBrazil 2010: Pesquisa Nacional de Saúde Bucal – resultados principais. Brasília; 2011.
- Ferreira CO, Antunes JL, de Andrade FB. Fatores associados à utilização dos serviços odontológicos por idosos brasileiros. *Rev Saúde Pública* 2013; 47(suppl. 3): 90-97.
- Hobdell M, Petersen PE, Clarkson J, Johnson N. Global goals for oral health 2020. *Int Dent J* 2003; 53(5): 285-8.
- Ministério da Saúde. Condições de Saúde Bucal da População Brasileira 2002-2003: resultados principais. Brasília; 2005.
- Andrade FB, Lebrão ML, Santos JL, Duarte YA, Teixeira DS. Factors related to poor self-perceived oral health among community-dwelling elderly individuals in São Paulo, Brazil. *Cad Saúde Pública* 2012; 28(10): 1965-75.
- Matos DL, Lima-Costa MF. Auto-avaliação da saúde bucal entre adultos e idosos residentes na Região Sudeste: resultados do Projeto SB-Brasil, 2003. *Cad Saúde Pública* 2006; 22(8): 1699-707.
- Patussi MP, Peres KG, Boing AF, Peres MA, da Costa JS. Self-rated oral health and associated factors in Brazilian elders. *Com Dent Oral Epidemiol* 2010; 38(4): 348-59.
- World Health Organization. Oral health surveys: basic methods. 5. ed. Geneva: World Health Organization; 2013.
- World Health Organization. Oral health surveys: basic methods. 4. ed. Geneva: WHO; 1997.
- Lebrão ML, Laurenti R. Saúde, bem-estar e envelhecimento: o estudo SABE no Município de São Paulo. *Rev Bras Epidemiol* 2005; 8(2): 127-41.
- de Andrade FB, Lebrão ML, Santos JL, Duarte YA. Relationship between oral health and frailty in community-dwelling elderly individuals in Brazil. *J Am Geriatr Soc* 2013; 61(5): 809-14.
- Yesavage JA, Brink TL, Rose TL, Lum O, Huang V, Adey M, et al. Development and validation of a geriatric depression screening scale: a preliminary report. *J Psychiatr Res* 1982-1983; 17(1): 37-49.
- Almeida OP, Almeida SA. Short versions of the geriatric depression scale: a study of their validity for the diagnosis of a major depressive episode according to ICD-10 and DSM-IV. *Int J Geriatr Psychiatry* 1999; 14(10): 858-65.
- Ando A, Ohsawa M, Yaegashi Y, Sakata K, Tanno K, Onoda T, et al. Factors related to tooth loss among community-dwelling middle-aged and elderly Japanese men. *J Epidemiol* 2013; 23(4): 301-6.
- Thorstensson H, Johansson B. Why do some people lose teeth across their lifespan whereas others retain a functional dentition into very old age? *Gerodontology* 2010; 27(1): 19-25.
- Zitzmann NU, Staehelin K, Walls AW, Menghini G, Weiger R, Zemp Stutz E. Changes in oral health over a 10-yr period in Switzerland. *Eur J Oral Sci* 2008; 116(1): 52-9.
- Bernabé E, Sheiham A. Tooth loss in the United Kingdom--trends in social inequalities: an age-period-and-cohort analysis. *PLoS One* 2014; 9(8): e104808.
- Wu B, Hybels C, Liang J, Landerman L, Plassman B. Social stratification and tooth loss among middle-aged and older Americans from 1988 to 2004. *Community Dent Oral Epidemiol* 2014; 42(6): 495-502.

26. Peres MA, Barbato PR, Reis SC, Freitas CH, Antunes JL. Tooth loss in Brazil: analysis of the 2010 Brazilian Oral Health Survey. *Rev Saúde Pública* 2013; 47(suppl. 3): 78-89.
27. Nascimento S, Frazão P, Bousquat A, Antunes JLF. Condições dentárias entre adultos brasileiros de 1986 a 2010. *Rev Saúde Pública* 2013; 47(suppl. 3): 69-77.
28. Slade GD, Akinkugbe AA, Sanders AE. Projections of U.S. Edentulism prevalence following 5 decades of decline. *J Dent Res* 2014; 93(10): 959-65.
29. Liu Y, Li Z, Walker MP. Social disparities in dentition status among American adults. *Int Dent J* 2014; 64(1): 52-7.
30. Kida IA, Astrøm AN, Strand GV, Masalu JR. Clinical and socio-behavioral correlates of tooth loss: a study of older adults in Tanzania. *BMC Oral Health* 2006; 6: 5.
31. Sussex PV, Thomson WM, Fitzgerald RP. Understanding the 'epidemic' of complete tooth loss among older New Zealanders. *Gerodontology* 2010; 27(2): 85-95.
32. Narvai PC, Frazão P. Saúde bucal no Brasil: muito além do céu da boca. Rio de Janeiro: Fiocruz; 2008.
33. Dietrich T, Maserejian NN, Joshipura KJ, Krall EA, Garcia RI. Tobacco use and incidence of tooth loss among US male health professionals. *J Dent Res* 2007; 86(4): 373-7.
34. Hanioka T, Ojima M, Tanaka K, Matsuo K, Sato F, Tanaka H. Causal assessment of smoking and tooth loss: a systematic review of observational studies. *BMC Public Health* 2011; 11: 221.
35. Morse DE, Avlund K, Christensen LB, Fiehn NE, Molbo D, Holmstrup P, et al. Smoking and drinking as risk indicators for tooth loss in middle-aged Danes. *J Aging Health* 2014; 26(1): 54-71.
36. Martins AB, dos Santos CM, Hilgert JB, de Marchi RJ, Hugo FN, Pereira Padilha DM. Resilience and self-perceived oral health: a hierarchical approach. *J Am Geriatr Soc* 2011; 59(4): 725-31.
37. Axelsson G, Helgadóttir S. Comparison of oral health data from self-administered questionnaire and clinical examination. *Community Dent Oral Epidemiol* 1995; 23(6): 365-8.
38. Pitiphat W, Garcia RI, Douglass CW, Joshipura KJ. Validation of self-reported oral health measures. *J Public Health Dent* 2002; 62(2): 122-8.
39. Gilbert GH, Duncan RP, Kulley AM. Validity of self-reported tooth counts during a telephone screening interview. *J Public Health Dent* 1997; 57(3): 176-80.
40. Palmqvist S, Söderfeldt B, Arnbjerg D. Self-assessment of dental conditions: validity of a questionnaire. *Community Dent Oral Epidemiol* 1991; 19(5): 249-51.

Received on: 11/10/2014

Accepted on: 03/23/2015

