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Self-perceived oral health among Brazilian elderly individuals

ABSTRACT

OBJECTIVE: To identify factors associated with self-perceived oral health among Brazilian elderly individuals.

METHODS: Data from the *Projeto SB Brasil* (Brazilian Oral Health Project), conducted in 2002-2003, were used. A probabilistic sample of 5,349 elderly individuals, aged between 65 and 74 years, was analyzed, interviewed and subsequently grouped into dentate and edentate individuals. The dependent variable was self-perceived oral health condition, while independent variables were as follows: place of residence, individual characteristics, health-related behavior, objective health conditions and subjective health conditions. Descriptive and hierarchical multiple linear regression analyses were performed.

RESULTS: In both groups, self-perceived oral health was considered positive, despite the poor oral health conditions found among the elderly. In the final model, place of residence and individual characteristics contributed little to explain the variability of self-perception. The use of dental services was associated with the outcome in dentate individuals, while objective and subjective conditions were associated in both groups. Among dentate and edentate individuals, R^2 for the external environment was 0.00; with the inclusion of individual characteristics, 0.05 and 0.02, respectively; with the inclusion of health-related behavior, 0.06 and 0.03, respectively; with the inclusion of objective health conditions, 0.11 and 0.04 respectively; and with the inclusion of subjective health conditions, 0.50 and 0.43, respectively. It was possible to explain 50% of the variability of self-perception in dentate individuals, and 43% in edentate ones.

CONCLUSIONS: The main factors associated with self-perceived oral health in both groups were excellent self-perceived appearance, followed by positive self-perceived mastication. The third associated factor was reporting no need for dental treatment in dentate individuals, and self-perceived speech in edentate ones.

DESCRIPTORS: Aged. Self Assessment (Psychology). Tooth Loss. Oral Health. Health Knowledge, Attitudes, Practice.

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INTRODUCTION

Self-perceived health is the interpretation of the health status and experiences in the context of daily life. It is based on information and knowledge about health and disease, which change according to social and cultural norms and experiences.[8] The evaluation of self-perceived oral health and oral health condition are essential, because behavior is regulated by the perception of this condition

and the importance it is given. Self-perceived health favors the indirect participation of the community in making political and social decisions, contributing to an approach aimed at quality of life. In Dentistry, routine evaluation of self-perceived oral health is important to encourage adherence to healthy types of behavior.[3] Among the elderly, the main reason for not seeking dental services is the lack of perception of need.[23] Self-perceived oral health has a multidimensional aspect.[2,3,6,10,15,17,20,21,23] As one of the main components of quality of life, oral health consists in an individual's subjective experience of their functional, social and psychological well-being.[14] Self-perceived oral health provides more information about how a certain disease affects an individual's life, rather than the objective measurements of this disease.[7] In Brazil, public dental care for the elderly needs to be improved and the identification of their self-perception of oral health could be the first step towards the development of programs that include educational actions aimed at self-care, in addition to preventive and rehabilitating actions.[23]

The present study aimed to identify factors associated with self-perceived oral health in elderly Brazilians.

METHODS

Data from the Epidemiological Survey of the Oral Health Conditions of the Brazilian Population (Projeto SB Brasil), conducted by the Brazilian Health Ministry in 2002 and 2003,[a] according to what is recommended by the World Health Organization (WHO), in 1997.[24] Probabilistic, cluster sampling was used, with a random selection of individuals. Interviews and tests were conducted in homes or schools. More information about the methodology is available in the final report of this research project.[a] A total of 5,349 elderly individuals, aged between 65 and 74 years, were examined and interviewed in their homes.

An adaptation[15] of the theoretical model proposed by Gift et al[6] in 1998 was used. Analyses were made in two groups: dentate elderly individuals, who had at least one remaining tooth, and edentate elderly individuals, who had not teeth left. The dependent variable studied – self-perceived oral health condition – was obtained through the following question: "How would you rate your oral health?" (very poor, poor, fair, good, excellent). The independent variables were divided into five subgroups: external environment (place of residence), individual characteristics (age in years, sex, self-reported ethnicity; predisposition: years of education, access to information about how to prevent oral problems; availability of resources: *per capita* household income in reais), health-related behavior (use

of dental services), objective health conditions (presence of soft tissue change, number of permanent teeth present, number of decayed permanent teeth present, number of filled permanent teeth, periodontal condition and need for prosthesis), subjective health conditions (self-perceived: gum and toothache in the last six months; appearance of teeth and gums; mastication; speech, in terms of teeth and gums; relationship, according to oral health and need for dental care). Among the objective conditions, only the presence of soft tissue changes and need for prosthesis were considered in the analyses of both groups, while the remaining aspects were considered in dentate individuals exclusively.

A descriptive analysis was performed in both groups to identify the presence of statistically significant associations between self-perceived oral health and variables of interest. The contributions of independent variables to the variance of the dependent variable were estimated with multiple linear regression, used in the majority of studies on this theme.[1,2,6,17,21,23] This type of regression is indicated to estimate associations between quantitative variables. In the present study, the dependent variable was considered quantitative and discrete, although being ordinal and categorical. The "macro-region", "place of residence", "sex", "ethnicity", "information about how to prevent oral problems", "soft tissue change", "periodontal condition", "self-perceived need for dental care" variables are nominal and categorical and were turned into artificial, indicator or dummy variables.[18] The "age", "level of education", "income" and "numbers of individuals per room, permanent teeth, decayed teeth and filled teeth" variables are quantitative and were categorized in the descriptive analysis exclusively. The "use of dental services", "need for prosthesis" and "self-perceived pain, appearance, mastication, speech and relationship" variables were considered quantitative and discrete, although being ordinal categorical like the dependent variable.

In the multiple linear regression, the following assumptions are recommended: linearity of the phenomenon measured; constant variance of error terms (homocedasticity); independence of error terms (null covariance) or independence of residual random variables; normality of distribution of error terms;[9] non-verification of multicollinearity.[5]

Linearity is assessed by the graphic residue analysis,[4] dispersion diagram or correlation coefficient. The diagnosis of homocedasticity is made from the graphic residue analysis or Levene's test.[9] Verification of null covariance is performed using the Durbin-Watson test or the graphic residue analysis.[5] The validity of the normality assumption of error terms distribution is confirmed with the graphic of normal probability

for residues and the Kolmogorov-Smirnov test of adherence to normality, corrected with Lilliefors or Shapiro-Wilks.[18] Explanatory variables must be linearly independent[5] and, in case multicollinearity is observed, the necessary corrective actions should be determined.[9] The most common measures to assess the collinearity of two or more variables are as follows: value of tolerance and its inverse, variance inflation factor (VIF=1/ tolerance). A reference value which is frequently used is 0.10, corresponding to a VIF higher than 10.[9,18]

Multiple hierarchical analyses were conducted in both groups to determine the relative contributions of each variable proposed in the theoretical model.[15] The magnitudes of association between the dependent variable and factors of interest, in each group of variables, were estimated using R^2, with a 0.05 significance level. The respective estimated parameters and standard-errors were obtained using multiple linear regression. The SPSS 11.0 software was used. The design effect correction to analyze data coming from complex samples was not made, once the data needed for such correction were not available. This adjustment was necessary because the Projeto SB Brasil included a complex cluster sample and estimates that do not consider the cluster sampling organization tend towards overestimation and loss of accuracy of estimates.[19]

The Projeto SB Brasil was approved by the Comissão Nacional de Ética em Pesquisa (National Research Ethics Committee – official opinion 581/2000).

RESULTS

A greater number of elderly Brazilians were edentate (54.8%). Among dentate individuals, the majority perceived their own oral health as good (Table 1). The mean age of dentates was 68.4 years (SD=3.10); mean level of education, 3.22 years (SD=3.53); and mean *per capita* income, R$ 238.07 or US$ 79.35 (SD=R$ 433.19 or US$ 144.39). The mean number of permanent teeth present in dentate and edentate elderly individuals was 5.5 (SD=7.9); that of decayed teeth, 1.23 (SD=2.91); and that of filled teeth, 0.73 (SD=2.4). The mean number of permanent teeth present in dentates was 12.14 (SD=7.6); that of decayed teeth, 2.73 (SD=3.83); and that of filled teeth, 1.61 (SD=3.4).

The majority of edentates perceived their oral health as good (Table 2). Mean age was 69.06 years (SD=3.19); mean level of education, 2.35 years (SD=2.75); and mean *per capita* income, R$ 186.24 or US$ 62.08 (SD=R$ 216.38 or US$ 72.12).

There was linearity in both groups and a violation of homocedasticity. Based on the analysis of null covariance, there was a violation in the graphic residue analysis, although not through the Durbin-Watson

test (DW=1.9; p≤0.05). A violation of the hypothesis of normality of error terms distribution was found in the normal probability graph (Q-Q Plot) and Kolmogorov-Smirnov tests, corrected with Lilliefors or Shapiro-Wilks, (p=0.000). Results of multicollinearity tests showed that such assumption was not violated (tolerance>0.10 and VIF<10).

In the multiple linear regression analysis, the R^2 for model 1, external environment, was found to be 0.00 between dentates and edentates; for model 2 (external environment and individual characteristics), 0.05 and 0.02, respectively; for model 3 (external environment, individual characteristics and health-related behavior), 0.06 and 0.03; for model 4 (external environment, individual characteristics, health-related behavior and objective health conditions), 0.11 and 0.04; for model 5 (external environment, individual characteristics, health-related behavior, objective health conditions and subjective health conditions), 0.50 and 0.43 (Tables 3 and 4).

DISCUSSION

Self-perceived appearance was the factor most strongly associated with self-perceived oral health and no previous studies that had investigated such association were found, thus revealing the need for future studies on this theme. It is suggested that the identification of factors associated with self-perceived appearance could more accurately clarify self-perceived oral health among elderly Brazilians.

As well as other studies, the majority of elderly individuals perceived their oral health as positive,[1,3,6,10,11,17,21,22,23] even with unsatisfactory objective oral health conditions. Literature data are consistent in this sense,[6,21,23] suggesting that objective conditions are poor predictors of such self-perception.[17,21] The weak association between objective conditions and self-perceived oral health in both groups had been previously observed, probably because diseases detected by professional tests can be asymptomatic and unknown to patients,[21,23] who only consider themselves to be ill when suffering from acute manifestations of oral diseases.[21] Another explanation for such weak associations would be the assumption that objective indicators measure diseases, whereas subjective ones assess health and human experiences.[13]

The hierarchical approach of multiple linear regression enabled the assessment of the importance of each group of variables in dentate and edentate individuals' self-perceived oral health. R^2 varied slightly when the three first models that hierarchically included variables related to the external environment; individual and behavioral characteristics were assessed; these variables explained approximately 6% of the variability in

Table 1. Description of dentate elderly individuals, according to self-perceived oral health, external environment, individual characteristics, health-related behavior, objective health conditions and subjective health conditions. Brazil, 2002-2003.

Variable	n	%
Self-perceived oral health		
Very poor	250	5.0
Poor	620	12.4
Fair	1,465	29.2
Good	2,452	48.9
Excellent	227	4.5
External environment		
Place of residence		
Rural area	290	12.0
Urban area	2,128	88.0
Individual characteristics		
Demographic		
Age (years)		
65-68	1,391	57.5
69-74	1,027	42.5
Sex		
Male	1,209	50.0
Female	1,209	50.0
Ethnicity		
White	1,131	46.9
Non-white	1,280	53.1
Predisposition		
Level of education (years)		
0	757	31.3
1-4	1,025	42.4
5 or more	636	26.3
Information about how to prevent oral problems		
No	1,393	57.8
Yes	1,017	42.2
Availability of resources		
Per capita income (R$)[a]		
0,00–99,00	817	34.2
100,00–200,00	849	35.5
201.00 or more	726	30.4
Number of individuals per room		
0,08–0,38	659	27.6
0,39–0,64	761	31.9
0,65–11	966	40.5
Behavior		
Use of dental services (years)		
Has never used	194	8.1
Three or more years before	1,231	51.2
Between one and two	372	15.5
Less than one	608	25.3
Objective conditions		
Soft tissue changes		
Yes	346	14.4
No	2,054	85.6

To be continued

Table 1 continuation

Variable	n	%
Number of permanent teeth		
1-9	1,137	47.0
10 or more	1,281	53.0
Number of decayed permanent teeth		
0	857	35.4
1-2	705	29.2
3 or more	856	85.4
Number of filled permanent teeth		
0	1,648	68.2
1-3	190	7.8
4 or more	580	24.0
Periodontal condition		
Ill	868	50.1
Healthy	863	40.9
Need for prosthesis		
In both jaws	1,131	46.9
In one jaw	854	35.4
No need	425	17.6
Subjective conditions		
Self-perceived pain		
High	167	6.9
Moderate	157	6.5
Low	429	17.8
None	1,656	68.7
Self-perceived appearance		
Very poor	156	6.9
Poor	465	20.5
Fair	785	34.7
Good	808	35.7
Excellent	51	2.3
Self-perceived mastication		
Very poor	174	7.5
Poor	474	20.4
Fair	609	26.2
Good	987	42.5
Excellent	81	3.5
Self-perceived speech		
Very poor	82	3.6
Poor	277	12.2
Fair	528	23.2
Good	1,271	55.8
Excellent	118	5.2
Self-perceived relationship		
Greatly affects	159	7.5
Somewhat affects	189	8.9
Slightly affects	363	17.0
Does not affect	1,422	66.7
Self-perceived need for dental care		
Yes	1,805	74.9
No	604	25.1

[a] R$ 1.00 was equivalent to US$ 3.00 at the time of this study

Table 2. Description of edentate elderly individuals, according to self-perceived oral health, external environment, individual characteristics, health-related behavior, objective health conditions and subjective health conditions. Brazil, 2002-2003.

Variable	n	%
Self-perceived oral health		
Very poor	85	3.1
Poor	224	8.2
Fair	688	25.2
Good	1,583	58.0
Excellent	147	5.4
External environment		
Place of residence		
Rural area	391	13.3
Urban area	2,538	86.7
Individual characteristics		
Age (years)		
65-68	1,414	48.2
69-74	1,517	51.8
Sex		
Male	865	29.5
Female	2,066	70.5
Ethnicity		
White	1,444	49.4
Non-white	1,447	50.6
Predisposition		
Level of education (years)		
0	1,117	38.7
1- 4	1,338	46.3
5 or more	432	15.0
Information about how to prevent oral problems		
No	1,851	63.3
Yes	1,071	36.7
Availability of resources		
Per capita income (R$)[a]		
0.00 - 99.00	872	29.9
100.00 - 200.00	1,214	41.7
201.00 or more	826	28.4
Number of individuals per room		
0.08 - 0.38	810	28.0
0.39 - 0.64	972	33.6
0.65 - 11	1,113	38.4
Behavior		
Use of dental services (years)		
Has never used	116	4.0
Three or more years before	2,263	77.7
Between one and two	248	8.5
Less than one	287	9.8

To be continued

Table 2 continuation

Variable	n	%
Objective conditions		
Soft tissue changes		
Yes	517	17.8
No	2,391	82.2
Need for prosthesis		
In both jaws	536	18.3
In one jaw	531	18.2
No need	1,857	63.5
Subjective conditions		
Self-perceived pain		
High	76	2.6
Moderate	92	3.1
Low	275	9.4
None	2,478	84.8
Self-perceived appearance		
Very poor	112	4.4
Poor	265	10.3
Fair	646	25.1
Good	1,445	56.1
Excellent	106	4.1
Self-perceived mastication		
Very poor	198	7.1
Poor	444	15.9
Fair	647	23.1
Good	1,390	49.7
Excellent	120	4.3
Self-perceived speech		
Very poor	94	3.5
Poor	284	10.4
Fair	601	22.1
Good	1,589	58.4
Excellent	153	5.6
Self-perceived relationship		
Greatly affects	135	5.4
Somewhat affects	141	5.6
Slightly affects	309	12.4
Does not affect	1,912	76.6
Self-deceived need for dental care		
Yes	1,123	38.5
No	1,794	61.5

[a] R$ 1.00 was equivalent to US$ 3.00 at the time of this study

dentates and 3% of the variability of self-perceived oral health in edentates. The inclusion of objective conditions into the model contributed little to the understanding of self-perceived variability, although the R^2 practically doubled in dentates, explaining 11% of

variability and, in addition to rising from 3% to 4% in edentates. This suggests that objective conditions had a greater impact on the self-perception of elderly individuals with at least one remaining tooth than in edentate ones. Subjective conditions were the main factors that explain the variability of self-perceived oral health. In both groups, the inclusion of such variables into the model explained 50% of variability of self-perceived oral health in dentates and 43% in edentates.

Studies suggest that negative self-perceived oral health increases with age.[6,21] In contrast, in the present study and other ones, age is not associated with self-perception.[2,17,23] There was no association between sex and self-perception, as in the majority of studies,[2,6,23] although more frequent positive self-perception in women than in men has been reported.[21] Ethnicity was not associated with self-perception in both groups, thus contrasting with studies that show that white individuals perceived their own health in a more positive way than non-white ones.[2,17] Level of education and access to information about how to prevent oral problems were not associated with the outcome. Studies show that, the greater an individual's level of education[2,6,17] and access to information about how to prevent oral problems, the more frequent the positive self-perceived oral health.[2,6] Income was initially associated in both groups, although such association was not found in the final model. The literature is controversial in terms of income. Among elderly Brazilians, this association was not probably observed due to the homogeneity of the population, most of whom had a low income. The variables related to individual characteristics did not contribute to the understanding of variability of self-perceived oral health in elderly Brazilians.

Use of dental services was associated with self-perceived oral health in dentates. Another study showed that individuals who had used such services for less than one year before perceived their oral health as positive.[2]

Objective conditions have limited relevance in self-perceived oral health.[21] A higher number of permanent teeth present is associated with positive self-perceived oral health.[1,2,6,16,17,21] However, there was an inverse association in the present study, so that the lower the number of teeth present, the more frequent the positive self-perceived oral health. Despite the apparent incoherence of results, elderly individuals seem to rate their oral health more positively when they are free from decayed teeth and probably from diseases, rather than when few teeth are maintained in precarious conditions, in insufficient number and without access to prostheses to guarantee efficient and comfortable mastication.[15] Another study found that the higher number of decayed teeth present in the mouth of individuals was associated with negative self-perceived oral health.[1,6,21] Yet another

study observed that a higher number of filled teeth was associated with positive self-perceived oral health.[21] Results in the literature are controversial about periodontal disease. Loss of periodontal attachment[6] and the presence of periodontal pockets[21,23] were associated with negative self-perceived oral health.[6] The association between periodontal condition and self-perceived oral health was neither found in the present study nor in another study.[1]

Associations between self-perceived global oral health and specific self-rated functional or psychological limitations were observed in another study.[12] The association between absence of sensitivity to pain and positive self-perceived oral health found in the present study, in both groups, was reported in another study.[2] Positive self-perceived appearance was associated with positive self-perceived oral health.[1,17] Other studies indicated the importance of self-perception of the need for dental care in the variability of self-perceived oral health.[1,6,10,16] The frequency of positive self-perceived oral health was higher among those who reported not needing treatment in both groups of study.

Results explained 50% of the variability of self-perceived oral health in dentates and 43% in edentates and also showed the effectiveness of the proposed model. This model surpassed the explanation of such variability in other studies performed in the United States: 14% in workers of an insurance company aged 18 years or more;[21] 43% in the search performed in Medicare users aged less than 65 years, in 1988;[1] 37% in Medicare users aged 65 years or more in Los Angeles, California;[17] 38% in residents of Baltimore; 32% in users of health services for indigenous people; 39% in residents of San Antonio;[2] and 35% in elderly individuals aged 65 years or more.[6] Not all variables associated with self-perception, described in the literature and observed in the proposed model, were analyzed in the Projeto SB Brasil, preventing better understanding of the variability of self-perceived oral health. More in-depth studies will enable the factors that influence it to be better understood. The process that associates self-perception and the variables analyzed is dynamic, as shown in the proposed model. The Projeto SB Brasil was a cross-sectional study, thus not enabling a temporal relationship among the observed associations to be established.

In both groups, two assumptions were violated: homocedasticity and normality of error terms. In practical terms, the violation of the assumption of homocedasticity causes predictions to be better on some levels than on others, so that such violation frequently renders statistical tests more conservative or sensitive. The most common violation is the assumption of normality of error terms,[9] which means that the differences between the estimated model and the data observed

Table 3. Multiple linear regression analysis of self-perceived oral health in dentate elderly individuals. Brazil, 2002-2003.

Variable	Model 1 External environment		Model 2 External environment Individual characteristics		Model 3 External environment Individual characteristics Behavior		Model 4 External environment Individual characteristics Behavior Objective conditions		Model 5 External environment Individual characteristics Behavior Objective conditions Subjective conditions	
	Estimated parameter (EP)	p-value	Estimated parameter (EP)	p-value	Estimated parameter (EP)	p-value	Estimated parameter (EP)	p-value	Estimated parameter (EP)	p-value
Intercept	3.19 (0.06)	**0.00**	2.85 (0.47)	**0.00**	2.45 (0.49)	**0.00**	2.12 (0.58)	**0.00**	0.43 (0.41)	0.30
Place of residence	-0.06 (0.06)	0.32	-0.13 (0.06)	**0.03**	-0.14 (0.06)	0.01	-0.18 (0.07)	**0.00**	-0.05 (0.06)	0.34
Age			0.00 (0.00)	0.56	0.01 (0.01)	0.36	0.01 (0.01)	0.23	-0.00 (0.00)	0.77
Sex			0.00 (0.04)	0.98	-0.01 (0.04)	0.89	-0.09 (0.05)	0.06	-0.07 (0.04)	0.11
Ethnicity			0.24 (0.04)	**0.00**	0.22 (0.04)	**0.00**	0.11 (0.05)	**0.04**	0.06 (0.05)	0.21
Level of education			0.00 (0.00)	0.49	0.00 (0.00)	0.71	0.00 (0.00)	0.94	0.00 (0.01)	0.76
Information about how to prevent oral health problems			0.17 (0.04)	**0.00**	0.11 (0.04)	**0.01**	0.08 (0.05)	0.13	0.04 (0.04)	0.32
Per capita income			0.00 (0.00)	**0.00**	0.00 (0.00)	**0.01**	0.00 (0.00)	0.78	0.00 (0.00)	0.82
Number of individuals per room			-0.15(0.04)	**0.00**	-0.14 (0.04)	**0.00**	-0.09 (0.05)	0.07	0.02 (0.03)	0.58
Use of dental services					0.11 (0.03)	**0.00**	0.05 (0.03)	0.13	0.06 (0.02)	**0.00**
Soft tissue changes							0.23 (0.09)	**0.01**	0.12 (0.06)	**0.04**
Number of permanent teeth							0.00 (0.00)	0.38	-0.01 (0.00)	**0.00**
Number of decayed permanent teeth							-0.04 (0.01)	**0.00**	0.00 (0.01)	0.64
Number of filled permanent teeth							0.01 (0.00)	0.04	0.01 (0.00)	**0.01**
Periodontal condition							0.06 (0.05)	0.24	-0.03 (0.04)	0.37
Need for prosthesis							0.15 (0.04)	**0.00**	-0.01 (0.03)	0.74
Self-perceived gum or toothache in the last six months									0.09 (0.03)	**0.00**
Self-perceived appearance									0.44 (0.03)	**0.00**
Self-perceived mastication									0.23 (0.03)	**0.00**
Self-perceived speech									0.05 (0.03)	0.14
Self-perceived relationship									0.04 (0.03)	0.16
Self-perceived need for dental care									0.21 (0.04)	**0.00**
R² model	0.00		0.05		0.06		0.11		0.50	

P-values in bold are statistically significant

Table 4. Multiple linear regression analysis of self-perceived oral health in edentate elderly individuals. Brazil, 2002-2003.

Variable	Model 1 External environment		Model 2 External environment Individual characteristics		Model 3 External environment Individual characteristics Behavior		Model 4 External environment Individual characteristics Behavior Objective conditions		Model 5 External environment Individual characteristics Behavior Objective conditions Subjective conditions	
	Estimated parameter (EP)	p-value	Estimated parameter (EP)	p-value	Estimated parameter (EP)	p-value	Estimated parameter (EP)	p-value	Estimated parameter (EP)	p-value
Intercept	3.53 (0.06)	**0.00**	3.95 (0.37)	**0.00**	4.08 (0.40)	**0.00**	3.61 (0.42)	**0.00**	0.89 (0.37)	0.02
Place of residence	0.02 (0.07)	0.73	0.01 (0.06)	0.89	0.02 (0.06)	0.81	-0.01 (0.06)	0.77	0.04 (0.04)	0.26
Age			-0.00 (0.00)	0.41	-0.00 (0.00)	0.32	-0.00 (0.00)	0.56	-0.00 (0.00)	0.80
Sex			0.05 (0.03)	0.14	0.05 (0.03)	0.15	0.04 (0.03)	0.30	0.04 (0.03)	0.10
Ethnicity			0.04 (0.04)	0.37	0.04 (0.04)	0.25	0.02 (0.04)	0.67	-0.04 (0.03)	0.26
Level of education			0.00 (0.00)	0.50	0.00 (0.00)	0.46	0.00 (0.00)	0.52	0.00 (0.00)	0.44
Information about how to prevent oral health problems			0.03 (0.05)	0.59	0.05 (0.05)	0.31	0.04 (0.05)	0.39	0.02 (0.03)	0.47
Per capita income			0.00 (0.00)	**0.02**	0.00 (0.00)	**0.02**	0.00 (0.00)	**0.02**	0.00 (0.00)	0.12
Number of individuals per room			-0.20 (0.03)	**0.00**	-0.20 (0.05)	**0.00**	-0.17 (0.05)	**0.00**	-0.07 (0.04)	0.08
Use of dental services					-0.08 (0.05)	0.08	-0.10 (0.05)	**0.04**	-0.03 (0.03)	0.30
Soft tissue changes							0.12 (0.05)	**0.01**	0.07 (0.04)	0.07
Need for prosthesis							0.12 (0.03)	**0.00**	-0.04 (0.02)	0.11
Self-perceived gum or toothache in the last six months									0.11 (0.03)	**0.00**
Self-perceived appearance									0.35 (0.03)	**0.00**
Self-perceived mastication									0.16 (0.02)	**0.00**
Self-perceived speech									0.13 (0.03)	**0.00**
Self-perceived relationship									0.03 (0.02)	0.16
Self-perceived need for dental care									0.11 (0.04)	**0.01**
R^2 model	0.00		0.02		0.03		0.04		0.43	

P-values in bold are statistically significant.

are not frequently zero or close to zero anymore, i.e. that the differences above zero do not only occur occasionally.

The assumption of null covariance was considered not to have been violated, once the graphic analysis is considered subjective[5] and such violation was not confirmed by the Durbin Watson test. In the multiple linear regression analyses where the assumption of multicollinearity is violated, there is a reduction in the accuracy of regression coefficients estimators.[5] In the present study, this assumption was not violated. Despite the limitations resulting from the violation of two out of the five recommended assumptions, the choice made was to compare the results with studies in which the analyses of all recommended assumptions were not described.[1,2,6,17,21,23]

In terms of the variability of self-perceived oral heath, self-perception was considered positive, although poor oral conditions in the elderly were found. The use of the linear regression model to analyze self-perceived oral health is common, though questionable, once it is not a quantitative variable. Self-perceived appearance rated as excellent, followed by positive self-perceived mastication and reporting no need for dental care, were the factors that most contributed to explain the variability of self-perceived oral health in both groups. Objective health conditions helped to explain this, especially in dentates. The higher the number of permanent teeth present, the more negative the self-perceived oral health; moreover, the higher the number of filled permanent teeth, the more positive this self-perception. Factors associated with the external environment, individual characteristics and behavior contributed little to the understanding of variability of self-perception in both groups. The use of dental services influenced the oral health self-perception in dentates. Better understanding of such associations is necessary to guarantee quality of life for elderly individuals.

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REFERENCES

1. Atchison KA, Mathias RE, Dolan TA, Lubben JE, De Jong F, Mayer-Oakes SA. Comparison of oral health ratings by dentists and dentate elders. *J Public Health Dent.* 1993;53(4):223-30. DOI:10.1111/j.1752-7325.1993.tb02708.x

2. Atchison KA, Gift HC. Perceived oral health in a diverse sample. *Adv Dent Res*. 1997;11(2):272-80. DOI:10.1177/08959374970110021001

3. Benyamini Y, Leventhal H, Leventahal EA. Self rated oral health as an independent predictor of self rated general healrh, self esteem and life satisfaction. *Soc Sci Med.* 2004;59(5):1109-16. DOI:10.1111/j.1752-7325.1993.tb02708.x

4. Botelho C, Correia AL, Silva AMC, Macedo AG, Silva COS. Fatores ambientais e hospitalizações em crianças menores de cinco anos com infecção respiratória aguda. *Cad Saude Publica.* 2003;19(6):1771-80. DOI:10.1590/S0102-311X2003000600021

5. Charnet R, Freire CAL, Charnet EMR, Bonvino H. Análise de modelos de regressão linear. Campinas: Editora da Unicamp; 1999.

6. Gift HC, Atchison KA, Drury TF. Perceptions of the natural dentition in the context of multiple variables. *J Dent Res.* 1998;77(7):1529-38. DOI:10.1177/00220345980770070801

7. Gilbert GH, Foerster U, Duncan RP. Satisfaction with chewing ability in a diverse sample of dentate adults. *J Oral Rehabil.* 1998;25(1):15-27. DOI:10.1046/j.1365-2842.1998.00207.x

8. Gilbert L. Social factors and self-assessed oral health in South Africa. *Community Dent Oral Epidemiol.* 1994;22(1):47-51. DOI:10.1111/j.1600-0528.1994.tb01568.x

9. Hair JF, Anderson RE, Tathm RL, Black WC. Análise multivariada de dados. Porto Alegre: Boockman; 2005.

10. Heft MW, Gilbert GH, Shelton BJ, Duncan RP. Relationship of dental status, sociodemographic status, and oral symptoms to perceived need for dental care. *Community Dent Oral Epidemiol.* 2003;31(5):351-60. DOI:10.1034/j.1600-0528.2003.00014.x

11. Kressin NR, Atchison KA, Miller D. Comparing the impact of oral disease in two populations of older adults: Application of the geriatric oral health assessment index. *J Public Health Dent.* 1997;57(4):224-32. DOI:10.1111/j.1752-7325.1997.tb02979.x

12. Locker D, Miller Y. Subjectively reported oral health status in a adult population. *Community Dent Oral Epidemiol*. 1994;22(6):425-30. DOI:10.1111/j.1600-0528.1994.tb00791.x

13. Locker D, Slade G. Association between clinical and subjective indicators of oral health status in an older adult population. *Gerodontology.* 1994;11(2):108-14. DOI:10.1111/j.1741-2358.1994.tb00116.x

14. Locker D. Clinical correlates of change in self perceived oral health in older adults. *Community Dental Oral Epidemiol.* 1997;25(3):199-203. DOI:10.1111/j.1600-0528.1997.tb00926.x

15. Martins AMEBL, Barreto SM, Pordeus IA. Auto-avaliação de saúde bucal em idosos: análise com base em modelo multidimensional. *Cad Saude Publica.* 2009;25(2):421-35. DOI:10.1590/S0102-311X2009000200021

16. 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 Saude Publica.* 2006;22(8):1699-707. DOI:10.1590/S0102-311X2009000200021

17. Matthias RE, Atchison KA, Lubben JE, De Jong F, Schweitzer SO. Factors affecting self-ratings of oral health. *J Public Health Dentistry.* 1995;55(4):197-204. DOI:10.1111/j.1752-7325.1995.tb02370.x

18. Pestana MH, Gageiro JN. Análise de dados para ciências sociais. Lisboa: Silabo; 2003.

19. Queiroz RCS, Portela MC, Vasconcellos MTL. Pesquisa sobre as Condições de Saúde Bucal da População Brasileira (SB Brasil 2003): seus dados não produzem estimativas populacionais, mas há possibilidade de correção. *Cad Saude Publica.* 2009;25(1):47-58. DOI:10.1590/S0102-311X2009000100005

20. Reis SCGB, Marcelo VC. Saúde bucal na velhice: percepção dos idosos, Goiânia, 2005. *Cienc Saude Coletiva.* 2006;11(1):191-9. DOI:10.1590/S1413-81232006000100028

21. Reisine ST, Bailit HL. Clinical oral health status and adult perceptions of oral health. *Soc Sci Med Med Psychol Med Sociol.* 1980;14A(6):597-605. DOI:10.1016/0160-7979(80)90063-6

22. Reisine ST. Dental disease in a work loss. *J Dent Res*. 1984;63(9):1158-61.

23. Silva SRC, Fernandes RAC. Autopercepção das condições de saúde bucal por idosos. *Rev Saude Publica.* 2001;35(4):349-55.

24. World Health Organization. Oral heath surveys: basic methods. Geneva; 1997.