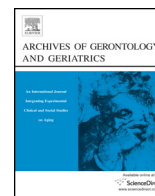


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Socio-demographic factors and oral health conditions in the elderly: A population-based study



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ABSTRACT

The aim of the present study was to analyze the relationship between oral health conditions and socio-demographic factors in an elderly population from Macaíba/RN (Brazil). A questionnaire was used to characterize the socio-demographic profiles and a clinical examination was performed to assess oral health conditions such as tooth decay, gum disease, use of dental prosthesis, need for dental prosthesis and soft tissue injuries. The technique of random sampling by conglomerates was used, taken from randomly selected census drafts, with a total sample of 441 individuals. The prevalence of edentulism, bleeding and dental calculus was 50.8%, 27.2% and 32%, respectively, excluding all sextants in 59% of the elderly. Data analysis was conducted using the chi-squared test with the level of significance set at 5%. Prior to association tests, the dependant variables were submitted to principal component analysis. Four factors were extracted to represent the oral health conditions of elderly individuals. A statistically significant association was found between the following variables: gender and the presence of a caregiver with gum disease; age, residence area, presence of a caregiver and household density with need for dental prosthesis; and household density with soft tissue injuries. Therefore, precarious oral health conditions were found among the elderly and associations were found between these conditions and the socio-demographic factors, particularly gender, age and residence area. The results obtained demonstrated the need for improved oral health conditions in the elderly. The study of these conditions, allied to socio-demographic factors, is important in terms of both dental care and public policy planning related to these individuals.

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1. Introduction

Questions related to the aging process have become a topic of discussion and research worldwide. Unlike what has occurred in developed countries, the growth of the elderly population of Brazil has happened very quickly, bringing problems for this age group and for society in general (Brasil, 2010).

Currently, more than 20 million Brazilians are over 60 years of age, which could represent 15% of the country's population by the year 2020. According to estimates from the *Instituto Brasileiro de Geografia e Estatística* (IBGE), this population is growing and data indicates an elderly population 15 times greater by 2025. In the future, Brazil could have the sixth largest elderly population in the world (Viana, Lorenzo, Oliveira, & Resende, 2008).

An aging population is one of the greatest challenges facing contemporary public health, particularly in developing countries, where this phenomenon takes place in the midst of poverty and great social inequality. Therefore, greater awareness is required about the impact of the aging process and the problems faced by the elderly population (Sanchez, 2000).

Health services should be adapted in order to satisfy this emerging demand for care for the elderly. Comprehensive health care for these individuals should be ensured by the *Sistema Único de Saúde* (SUS). Furthermore, before organic illnesses, the elderly individual exhibits signs of risk and as such, it is the duty of the health professional to identify the signs in order that early preventative action can take place, thereby improving the quality of life of the individual and contributing to a more efficient public health service (Brasil, 2006).

Cesar et al. (2008) demonstrated that the socioeconomic/demographic conditions of these individuals significantly affect access to health services. The authors reported that a lower income led to less use of health services among the elderly and in turn, less

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favorable health conditions and physical function. In terms of dental care, income, education, the type of preferred treatment and the perception of the need for the treatment are associated with reduced access to health services (Bastos, Nomura, & Peres, 2005; Martins, Barreto, & Pordeus, 2008).

Oral health conditions among the elderly, as well as access to health services, are strongly determined by social, economic and living conditions. In terms of the principal oral pathologies such as tooth decay and gum disease, social determinants are fundamentally significant in their process of causality.

Previous epidemiological studies of oral health in the elderly have only been based on a portion of these individuals such as the non-institutionalized, which includes service users and members of old-age societies and communities, and thus have led to unsatisfactory oral health data (Carneiro, Silva, Souza, & Wada, 2005). Therefore, a more comprehensive approach is needed, based on aggregation in studies of elderly populations in their various conditions of daily living. An example of this would be studies in which the allocation technique follows a probabilistic basis.

With this in mind, the aim of the present study was to propose analysis of the relationship between oral health conditions and socioeconomic/demographic characteristics of a representative sample of elderly individuals in a medium-sized municipality in the northeast of Brazil. This knowledge may represent an important step in understanding the factors that affect the oral health of the elderly, thereby providing vital information to those who are planning strategies of comprehensive health care for these individuals.

2. Materials and methods

2.1. Ethical considerations

The present study received approval from the Human Research Ethics Committee of the *Universidade Federal do Rio Grande do Norte* under protocol number 118/09.

2.2. Sampling plan

2.2.1. Calculation of sample size

The size of the sample was calculated taking into account the prevalence of edentulism among individuals aged between 65 and 74 years, according to SB Brazil 2003 (60.8%) (Brasil, 2004). The estimated size of the elderly population of Macaíba-RN was 5801 individuals. The margin of error was set at 10%, whereas the confidence level was 95%, the design effect was 1.5 and the rate of non-response was 20%. A total of 428 individuals were calculated. However, 466 individuals were identified as eligible for the study. In total, 441 male and female elderly individuals (over 60 years) were enrolled.

2.2.2. Sampling

A technique of random sampling by conglomerates was applied during the process of individual assignment, with two stages of random selections. In the first stage, 32 census sectors were drawn, two of which were supplementary, and the remainder of which made up the study area of the examiners. This draw was done electronically, using Microsoft Excel[®] 2007, in spreadsheets that were developed by the technical team of the SB Brazil 2010 project (National Oral Health Survey 2009/2010).

The second stage of the draw corresponded to the household draw which was carried out in situ, at the time of data collection. A sampling fraction was calculated using the prevalence of edentulism in individuals between 65 and 74 years as a parameter, according to SB Brazil 2003 (60.8%) (Brasil, 2004). The estimated size of the elderly population of Macaíba-RN was 5801 individuals.

The margin of error was set at 10%, whereas the confidence level was 95%, the design effect was 1.5 and the rate of non-response was 20%. An approximate value of seven was obtained, which meant that from each seven households, one was eligible for enrollment in the sample element.

2.3. Data collection instrument

The data were obtained using a structured socio-demographic questionnaire and an intra-oral epidemiological examination of the oral health of the elderly participants. The examination assessed the level of tooth decay using the decayed, missing, filled teeth index (DMFT), the condition of the gums using the community periodontal index (CPI) and the periodontal attachment loss index (PAL), as well as assessing the use of and need for dentures and the presence of soft tissue abnormalities. Previously sterilized World Health Organization (WHO) periodontal probes and dental mirrors were used in the oral examination.

In order to ensure the reliability of the data, four examiners were specifically trained and calibrated for the present study. The calibration procedure was performed by partially following the instructions in the Calibration of Examiners manual from the SB Brazil 2010 project, which was theoretically based on the proposals described in the WHO publication "Calibration of Examiners for Oral Health Surveys" in 1993 (Brasil, 2009). This procedure was conducted with the voluntary participation of 19 male and female elderly individuals, aged 60 years or more, according to the inclusion criteria for the sample of the present study.

The data obtained were inserted into Microsoft Excel 2007 spreadsheets, designed by the technical team from the SB Brazil 2010 project, in order to calculate the inter-examiner agreement values and the Kappa coefficient. The agreement of each examiner was calculated in relation to the standard examiner. The Kappa coefficient ranged from 0.39 to 1.00 and, thus, displayed a satisfactory reproducibility of the data, considering that acceptable Kappa coefficient values begin at 0.60.

2.4. Statistical analysis of the data

The data collected were organized in a database and analyzed using STATA 10.0 software. The descriptive analysis of the variables was performed first, concerning the socio-demographic and oral health conditions of the sample. The latter represented the dependent variables of the present study and were converted into quantitative variables and then submitted to principal component analysis. Four factors associated with different dimensions of oral health conditions were extracted from this analysis. These factors became the dependent variables and their association with the independent variables was tested using the chi-squared test and Fisher's exact test, with the level of significance set at 5%.

The statistical analysis of the data was finished with simultaneous logistic regression. The models included all of the independent variables, for which the *p* value was below 0.2 in the association with each dependent variable factor. After adjustments in the regression model, significant associations were obtained between the independent variables for the different dimensions investigated and the factorial variables representing the oral health conditions of the individuals.

3. Results

3.1. Characterization of the sample

The data presented refers to 441 of the 466 elderly individuals that were eligible for the present study. All of the individuals were

Table 1

Distribution of the variables of demographic characterization and socio-economic conditions of a sample of 441 elderly individuals, with mean values, standard deviation (SD) and absolute/relative frequencies.

Variables			Mean ± SD
Age (years)			71.7 ± 8.76
Education (completed years of study)			2.17 ± 2.74
Family income (minimum salaries) ^a			2.00 ± 1.19
Household density ^b			0.65 ± 0.37
Monthly medical expenses			32.47 ± 72.83
Variables	Categories	n	%
Gender	Male	140	31.7
	Female	301	68.3
Marital status	Single	21	4.8
	Married	253	57.4
	Widowed	143	32.4
	Separated/divorced	24	5.4
Residence	Capital city	60	13.6
	Interior of state	381	86.4
Residence area	Urban	228	51.7
	Rural	213	48.3
Receives a pension	Yes	340	77.1
	No	101	22.9
Living companions	Alone	29	6.6
	Spouse	69	15.6
	Spouse and other family members	188	42.6
Caregiver	Other family	155	35.1
	Yes	60	13.6
	No	381	86.4
Lives in own home	Yes	368	83.4
	No	73	16.6
Receives government benefits	Yes	44	10.0
	No	397	90.0
Type of government benefit received	Scholarship	6	13.6
	Family benefit	31	70.5
	Other	7	15.9
How medication is acquired	Purchases all	68	21.5
	Purchases some and receives others	66	20.8
	Receives all	183	57.7

^a Family income represents the amount received of minimum salaries per month, considering all the family members of the individual. In Brazil, one minimum salary in 2010 is equivalent to R\$ 510.00 (US\$ 253.73).

^b Household density is the ratio between the number of residents and the number of rooms in a house.

over 60 years of age and from the municipality of Macaíba-RN (Brazil). Therefore, there was a sample loss of 5.36% in terms of the quantity of eligible individuals. However, this loss was null in terms of the calculated sample, since the final sample resulted in a greater number of individuals than the previous sample size calculation. Table 1 displays the demographic characterization and socio-economic conditions of the participants.

There was an expressive predominance of females in the present study. The age of the participants ranged from 60 to 99 years. Slightly more than 19% of the elderly individuals were 80 years of age or older. Education levels did not exceed two full years of study. In terms of marital status, there was a predominance of stable companions, whether officially married or not. There were also a significant number of widowed individuals. This led to the greater prevalence of individuals living with their companion and other family members, or other family members only. The majority of the participants did not have a caregiver or did not report a need for daily care. The vast majority stated that they had spent most of their lives in the interior of the state and in urban areas.

With regard to the variables associated with socio-economic conditions, the majority received a pension of one minimum salary, in a low-income family environment which was based on two minimum salaries. A large number of the participants lived in their own homes and were not involved in government assistance programs. Those who did require assistance mainly received family benefits. In terms of the quantity of people in the household, a mean figure slightly above 0.6 people/room was confirmed. The most common method for acquiring medicine was from health centers of the municipality without payment.

The oral health characterization of the elderly was performed using the data obtained from the intra-oral epidemiological examination. In total, 224 (50.8%) of the participants were edentulous with a complete absence of teeth. Functional edentulism (at least 20 dental elements) was found in 92.7% of the participants. Root decay, which is a significant problem among the elderly, was found in 28.1% of the participants.

The DMFT index is of fundamental importance in the characterization of oral health conditions. The mean DMFT value in the present study was 28.16, with a prevalence of the missing component (94.1%). Based on the details of this index, a widespread distribution of tooth loss was observed among the participants, as well as a greater permanence of the lower central sextant.

The condition of the participant's gums was assessed based on gingival bleeding, dental calculus and periodontal pocket which were present in the 66.3%, 77.9% and 19.3% of the dentate participants, respectively.

In total, 46.7% of the elderly individuals used an upper prosthesis, whereas only 27.8% used some form of lower prosthesis. The need for upper prosthesis was confirmed in 80% of the participants, whereas the need for lower prosthesis was found in 86.4% of the participants.

3.2. Association between the oral health conditions and the socio-demographic factors

Prior to the tests of association between the dependent and independent variables investigated, the principal component

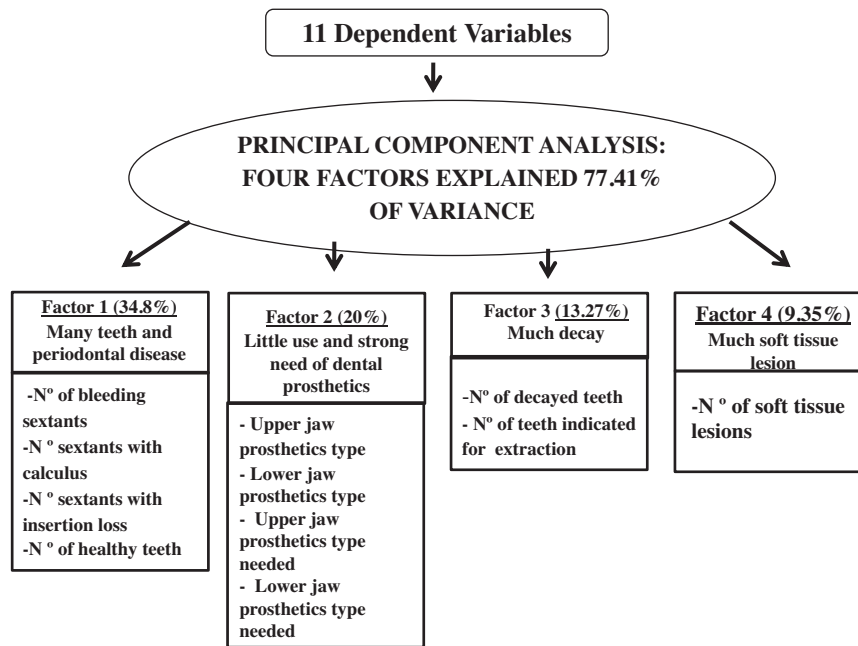


Fig. 1. Results of the principal component analysis (PCA).

analysis (PCA) was performed in order to synthesize the observed relationships between a set of interrelated variables allowing, through data reduction, obtaining factors (“principal components”) that summarize these variables. In addition, the PCA performed here had an exploratory purpose, since we did not have any model previously tested. Thus, for convenience, we label the principal components as “factors”, although the PCA is not technically characterized as common factor analysis.

In the present study, the PCA included the variables associated with oral health conditions. Based on their correlations, these were reduced to four common factors representing different dimensions of oral health conditions and then associated with the variables related to socio-demographic conditions.

In order to analyze the correct applicability of the PCA in this study, we proceed at the analysis of some measures as the KMO measure of sampling adequacy, which presented a satisfactory value (0.712) by the proximity of one. Another measure was the Bartlett’s Test of Sphericity, which presented p -value < 0.001, confirming the correct applicability of the PCA.

For the extraction of the factors we used the PCA with varimax rotation, due to the objective of the data reduction with obtaining of the smallest number of factors that explain the highest possible variance of the original data. The variables were grouped within each factor according to the highest factor loadings in absolute value, presented by each variable. The number of four factors was

selected because, together, they explained 77.41% of the total variance of the variables included in the analysis model. Furthermore, we used the Kaiser’s criterion, whose factors selected have eigenvalues greater than one. Table 2 shows the eigenvalues for each factor, before and after rotation. It is noted that the first four factors had eigenvalues greater than one, then, this was the number of factors extracted from the PCA.

So, in summary, the four factors represented the dependent variables of the study. The inspection of the correlation matrix of these four factors showed that they were not correlated with each other, in view of the method varimax of orthogonal rotation. Fig. 1 shows the results of the PCA with the percentage of the variance explained by each factor, as well as the group of variables in each component.

Table 3 displays the data related to associations between the socio-economic/demographic variables and factor 1, which was called “many teeth and a lot of gum disease”. Bivariate analysis confirmed a statistically significant association between factor 1 and the variables gender, age, present marital status, residence, residence area, presence of a caregiver and form of acquiring medicine. The variables gender and presence of a caregiver remained significant when adjusted for the other variables.

Table 4 displays the results of the associations between the independent variables and factor 2, called “little use and great need of dental prosthesis”. Bivariate analysis revealed a significant

Table 2
Results of the principal component analysis. Eigenvalues of the factors before and after rotation. The first four major factors were extracted.

Factor	Initial			After rotation		
	Eigenvalues	Total variance (%)	Accumulated variance (%)	Eigenvalues	Total variance (%)	Accumulated variance (%)
1	3828	34,796	34,796	3411	31,009	31,009
2	2198	19,986	54,782	2016	18,329	49,338
3	1460	13,271	68,053	1959	17,811	67,149
4	1029	9359	77,411	1129	10,262	77,411
5	717	6514	83,926			
6	495	4503	88,429			
7	360	3275	91,704			
8	301	2738	94,442			
9	278	2526	96,968			
10	262	2378	99,346			
11	072	,654	100,000			

Table 3

Absolute values, percentages, statistical significance and crude and adjusted odds ratio with their respective confidence intervals (CI) for the association between factor 1 of oral health conditions and the demographic and socio-economic variables.

Variables	Categories	Factor 1 Many teeth and a lot of gum disease		p	OR	CI (95%)	p _{aj}	OR _{aj}	CI (95%)
		Yes, n (%)	No, n (%)						
Gender	Male	86 (61.4)	54 (38.6)	<0.001	2.36	1.57–3.57	<0.001	2.481	1.590–3.872
	Female	121 (40.2)	180 (59.8)						
Age	≤70 years	118 (50.9)	114 (49.1)	0.082	1.39	0.95–2.03	0.220	1.289	0.859–1.933
	>70 years	89 (42.6)	120 (57.4)						
Education	≤1 year	110 (46.8)	125 (53.2)	0.953	0.98	0.68–1.43	–	–	–
	>1 year	97 (47.1)	109 (52.9)						
Current marital status	No partner	79 (42.0)	109 (58.0)	0.074	0.70	0.48–1.03	0.983	0.995	0.653–1.517
	Partner	128 (50.6)	125 (49.4)						
Resi	Interior	173 (45.4)	208 (54.6)	0.104	0.63	0.36–1.10	0.499	0.814	0.440–1.478
	Capital	34 (56.7)	26 (43.3)						
Residence area	Rural	91 (42.7)	122 (57.3)	0.086	0.72	0.49–1.04	0.153	0.741	0.490–1.118
	Urban	116 (50.9)	112 (49.1)						
Monthly family income	≤2 MS	161 (45.9)	190 (54.1)	0.374	0.81	0.51–1.28	–	–	–
	>2 MS	46 (51.1)	44 (48.9)						
Receives a pension	No	53 (52.5)	48 (47.5)	0.204	1.33	0.85–2.08	–	–	–
	Yes	154 (45.3)	186 (54.7)						
Living companions	No	13 (44.8)	16 (55.2)	0.814	0.91	0.42–1.94	–	–	–
	Yes	194 (47.1)	218 (52.9)						
Caregiver	No	189 (49.6)	192 (50.4)	0.005	2.29	1.27–4.13	0.015	2.169	1.163–4.048
	Yes	18 (30.0)	42 (70.0)						
Household density	>0.6 ipl/room	89 (47.1)	100 (52.9)	0.956	1.01	0.69–1.47	–	–	–
	≤0.6 ipl/room	118 (46.8)	134 (53.2)						
Lives in own home	No	36 (49.3)	37 (50.7)	0.656	1.12	0.67–1.85	–	–	–
	Yes	171 (46.5)	197 (53.5)						
Receives government benefits	No	184 (46.3)	213 (53.7)	0.455	0.78	0.42–1.47	–	–	–
	Yes	23 (52.3)	21 (47.7)						
Type of government benefit	Family benefit	16 (51.6)	15 (48.4)	0.892	0.91	0.25–3.34	–	–	–
	Other	7 (53.8)	6 (46.2)						
Monthly medical expenses	>R\$ 32.50	37 (49.3)	38 (50.7)	0.546	1.17	0.69–1.97	–	–	–
	≤R\$32.50	107 (45.3)	129 (54.7)						
Acquisition of medication	Bought some	63 (47.0)	71 (53.0)	0.770	1.06	0.68–1.67	–	–	–
	Received all	83 (45.4)	100 (54.6)						

The Hosmer and Lemeshow test (p): 0.859.

association between factor 2 and gender, age, education, residence area, receipt of a pension, presence of a caregiver and household density. However, after the model was adjusted for the variables gender, age, education, residence, residence area, receipt of a pension, presence of a caregiver and household density, the only significant associations were between factor 2 and age, residence area, presence of a caregiver and household density.

Table 5 displays the data referring to associations between factor 3, called “a lot of decay” and the socio-economic/demographic variables. Bivariate analysis revealed a statistically significant association between factor 3 and the variables residence, residence area and monthly medication expenses. No significant associations remained after the model was adjusted for the variables.

Table 6 displays the associations between factor 4, called “a lot of soft tissue damage” and the variables of demographic characteristics and socio-economic conditions. Statistically significant associations were found between factor 4 and the age of the individual and household density. Only the latter was still significant after the model was adjusted for the variables age, education, receipt of a pension, presence of a caregiver, household density and owning their own home.

4. Discussion

The results of the present study revealed the precarious condition of the oral health conditions of the elderly participants. This was evident in the DMFT index, which indicated a total of 28.1 decayed, lost or filled teeth. There

was an expressive predominance of the lost component (94.3% of the index). The literature confirms the severity of decay and its consequences among the elderly, with mean DMFT values ranging from 25 to 31, and up to 84% of this index representing the lost component (Campostrini, Ferreira, & Rocha, 2007; Colussi & Freitas, 2002; Moreira, Nico, Tomita, & Ruiz, 2005).

In the present study, 59% of the individuals were excluded from the periodontal assessment as they did not exhibit acceptable sextants for the examination. Among those assessed, only 2.9% exhibited at least one sextant with a healthy gingival condition. These results were lower than those found by Campostrini et al. (2007) (60.8% of the individuals excluded from the assessment and 7.9% with no periodontal problems).

Edentulism corresponds to complete tooth loss and is caused by the cumulative effects of a precarious history of dental care supplied to the population, which is limited to serial extractions and emergency services (Colussi & Freitas, 2002). In the present study, this condition was found in 50.8% of the participants, compared to 48.4% found by Moreira et al. (2005) and 67.2% found by Evren, Uludamar, Iseri, and Ozkan (2011).

The need for prosthesis refers to the absence of dentures when they are necessary as well as an assessment of the need to substitute the prosthesis that is in place. An expressive percentage of the participants required total prosthetic rehabilitation in the upper and lower arches (41%).

Socio-demographic conditions were shown to have an effect on oral health conditions. The demographic variables with the greatest affect were gender, age, and residence area. Among the

Table 4
Absolute values, percentages, statistical significance and crude and adjusted odds ratio with their respective confidence intervals (CI) for the association between factor 2 of oral health conditions and the demographic and socio-economic variables.

Variables	Categories	Factor 2 Little use and great need of prosthesis		p	OR	CI (95%)	p _{aj}	OR _{aj}	CI (95%)
		Yes, n (%)	No, n (%)						
Gender	Male	81 (57.9)	59 (42.1)	0.031	1.55	1.03–2.33	0.130	1.403	0.905–2.177
	Female	141 (46.8)	160 (53.2)						
Age	≤70 years	96 (41.4)	136 (58.6)	<0.001	0.46	0.31–0.68	0.006	0.556	0.365–0.848
	>70 years	126 (60.3)	83 (39.7)						
Education	≤1 year	131 (55.7)	104 (44.3)	0.015	1.59	1.09–2.32	0.597	1.119	0.737–1.700
	>1 year	91 (44.2)	115 (55.8)						
Current marital status	No partner	99 (52.7)	89 (47.3)	0.401	1.17	0.80–1.71	–	–	–
	Partner	123 (48.6)	130 (51.4)						
Residence	Interior	197 (51.7)	184 (48.3)	0.148	1.49	0.86–2.60	0.917	1.033	0.562–1.899
	Capital	25 (41.7)	35 (58.3)						
Residence area	Rural	127 (59.6)	86 (40.4)	<0.001	2.06	1.41–3.02	0.003	1.892	1.234–2.899
	Urban	95 (41.7)	133 (58.3)						
Monthly family income	≤2 MS	180 (51.3)	171 (48.7)	0.435	1.20	0.75–1.91	–	–	–
	>2 MS	42 (46.7)	48 (53.3)						
Receives a pension	No	42 (41.6)	59 (58.4)	0.045	0.63	0.40–0.99	0.851	0.953	0.570–1.569
	Yes	180 (52.9)	160 (47.1)						
Living companions	No	12 (41.4)	17 (58.6)	0.318	0.67	0.31–1.45	–	–	–
	Yes	210 (51.0)	202 (49.0)						
Caregiver	No	180 (47.2)	201 (52.8)	0.001	0.38	0.21–0.69	0.011	0.447	0.240–0.832
	Yes	42 (70.0)	18 (30.0)						
Household density	>0.6 ppl/room	108 (57.1)	81 (42.9)	0.013	1.61	1.10–2.36	0.025	1.581	1.059–2.361
	≤0.6 ppl/room	114 (45.2)	138 (54.8)						
Lives in own home	No	36 (49.3)	37 (50.7)	0.848	0.95	0.57–1.57	–	–	–
	Yes	186 (50.5)	182 (49.5)						
Receives government benefit	No	204 (51.4)	193 (48.6)	0.187	1.52	0.81–2.87	–	–	–
	Yes	18 (40.9)	26 (59.1)						
Type of government benefit	Family benefit	12 (38.7)	19 (61.3)	0.355	0.54	0.14–2.00	–	–	–
	Other	7 (53.8)	6 (46.2)						
Monthly medical expenses	>R\$ 32.50	32 (42.7)	43 (57.3)	0.136	0.67	0.39–1.13	–	–	–
	≤R\$ 32.50	124 (52.5)	112 (47.5)						
Acquisition of medication	Bought some	60 (44.8)	74 (55.2)	0.123	0.70	0.45–1.10	–	–	–
	Received all	98 (53.6)	85 (46.4)						

The Hosmer and Lemeshow test (p): 0.375

social variables, the greatest associations were found for the presence of a caretaker and household density.

Family income is considered to be one of the principal determinants of tooth preservation. Better economic conditions enable increased access to dental services and a choice of more conservative treatments (Nalçacı, Erdemir, & Baran, 2007). In spite of this fact, there was no statistically significant association between family income and oral health conditions in the present study. This result could be explained by the homogeneity of the population chosen, who survive on little more than US\$ 5.00 a day based on the mean family income data (two minimum salaries) and the mean of four people per residence.

Data from the IBGE related to living conditions of the Brazilian population in 2008 (IBGE, 2008) indicated that the contribution of the elderly, in 52% of Brazilian households, represented more than half of the total income of the household. This figure climbed to 73% in rural areas of the northeast of Brazil. This fact has also been described as an important determinant for the elderly to live alone, since that would require resources (Camargos, Perpétuo, & Machado, 2005). In the present study, 6.6% of the elderly participants lived alone, which is lower than the national average for the year 2007 (Cesar et al., 2008). Slightly more than 77% of the participants lived with family members. This is an extremely important dimension for the elderly, since inter-generational living plays a fundamental role in their well-being. The family home is a natural and privileged place for the establishment of relationships, the enhancement and promotion of individuals, seeking and finding support and supplying the needs of individuals (Herédia, Casara, & Cortelletti, 2007).

Very few studies in Brazil focusing on the oral health of the elderly have used a probabilistic sampling technique or a sample representing a determined population. There is also a lack of studies containing data for residents of rural areas. It is believed that this technique provides the most realistic results and as such, further studies are required in order to establish the oral health conditions associated with the aging process and to compare the data from different regions of the country.

After weighting the sample according to the number of individuals investigated by sector in order to obtain adequate data for the sampling technique used in the present study, it was confirmed that the sample data (calculated for each sector in isolation) did not differ from the population data. This demonstrates a satisfactory representativeness of the results.

The first oral health indicator, called “many teeth and a lot of gum disease” was associated with gender. There was a greater prevalence of male individuals in this category. This association displays the lack of oral hygiene, which is common among elderly males in comparison to females who generally worry more about their health. Matos, Giatti, and Lima-Costa (2004) analyzed the association between socio-demographic factors and the use of dental services among elderly Brazilians and identified this lack of oral hygiene among males. The authors associated this gender with the variable of never having visited a dentist.

The first indicator was also associated with the presence of a caregiver. The quantity of teeth and the prevalence of gum disease are higher in individuals who do not have a caregiver, whether they are a hired professional or a family member. This association may be explained by poor oral hygiene among the elderly, who have

Table 5

Absolute values, percentages, statistical significance and crude and adjusted odds ratios with their respective confidence intervals (CI) for the association between factor 3 of oral health conditions and the demographic and socio-economic variables.

Variables	Categories	Factor 3 A lot of decay		p	OR	CI (95%)	p _{aj}	OR _{aj}	CI (95%)
		Yes, n (%)	No, n (%)						
Gender	Male	68 (48.6)	72 (51.4)	0.055	1.44	0.99–2.22	0.072	1.461	0.967–2.208
	Female	117 (38.9)	184 (61.1)						
Age	≤70 years	99 (42.7)	133 (57.3)	0.746	1.06	0.72–1.55	–	–	–
	>70 years	86 (41.1)	123 (58.9)						
Education	≤1 year	101 (43.0)	134 (57.0)	0.640	1.09	0.74–1.60	–	–	–
	>1 year	84 (40.8)	122 (59.2)						
Current marital status	No partner	75 (39.9)	113 (60.1)	0.451	0.86	0.58–1.26	–	–	–
	Partner	110 (43.5)	143 (56.5)						
Residence	Interior	152 (39.9)	229 (60.1)	0.028	0.54	0.31–0.94	0.147	0.649	0.361–1.165
	Capital	33 (55.0)	27 (45.0)						
Residence area	Rural	79 (37.1)	134 (62.9)	0.046	0.67	0.46–0.99	0.183	0.756	0.500–1.141
	Urban	106 (46.5)	122 (53.5)						
Monthly family income	≤2 SM	145 (41.3)	206 (58.7)	0.591	0.88	0.55–1.40	–	–	–
	>2 SM	40 (44.4)	50 (55.6)						
Receives a pension	No	43 (42.6)	58 (57.4)	0.885	1.03	0.66–1.62	–	–	–
	Yes	142 (41.8)	198 (58.2)						
Living companions	No	13 (44.8)	16 (55.2)	0.745	1.13	0.53–2.41	–	–	–
	Yes	172 (41.7)	240 (58.3)						
Caregiver	No	165 (43.3)	216 (56.7)	0.146	1.52	0.86–2.71	0.131	1.576	0.873–2.844
	Yes	20 (33.3)	40 (66.7)						
Household density	>0.6 ppl/room	86 (45.5)	103 (54.5)	0.190	1.29	0.88–1.89	0.203	1.290	0.871–1.910
	≤0.6 ppl/room	99 (39.3)	153 (60.7)						
Lives in own home	No	38 (52.1)	35 (47.9)	0.055	1.63	0.98–2.70	0.063	1.636	0.973–2.751
	Yes	147 (39.9)	221 (60.1)						
Receives government benefits	No	162 (40.8)	235 (59.2)	0.144	0.62	0.33–1.17	–	–	–
	Yes	23 (52.3)	21 (47.7)						
Type of government benefits	Family benefits	14 (45.2)	17 (54.8)	0.322	0.51	0.13–1.93	–	–	–
	Other	8 (61.5)	5 (38.5)						
Monthly medical expenses	>R\$ 32.50	36 (48.0)	39 (52.0)	0.046	1.70	1.00–2.87	–	–	–
	≤R\$ 32.50	83 (35.2)	153 (64.8)						
Acquisition of medications	Bought some	60 (44.8)	74 (55.2)	0.077	1.50	0.95–2.37	–	–	–
	Received all	64 (35.0)	119 (65.0)						

The Hosmer and Lemeshow test (*p*): 0.939.

difficulty performing the mechanical cleaning tasks related to the oral cavity, and who sometimes forget to do so. These problems do not arise when there is an individual responsible for the care of the elderly individual.

The second oral health indicator referred to little use and great need for dental prosthetics. This indicator was associated with age, indicating greater use and less need of dentures among elderly individuals less than 70 years of age. It is suggested that younger elderly individuals worry more about prosthetic rehabilitation in order to maintain the functions that are lost when teeth are absent. On the other hand, older individuals tend to worry more about other more disabling health problems, which have a greater affect on their overall fragility. This process has become known as “secondarization of oral health” (Piuvezam & Lima, 2011).

Roncalli (2006) reported that the presence of teeth may simply represent one more problem for elderly individuals and their loss, once substituted by artificial teeth, is not a major concern. Furthermore, dental loss is an evolutionary stage of an elderly individual's oral condition, in view of the type of dental treatment they have received. Thus, edentulism is considered a normal and inevitable condition among the elderly. In the literature, this has become known as the “naturalization of tooth loss” (Günday, Sener, & Yamaner, 2009; Hiramatsu, Tomita, & Franco, 2007).

The residence area was also associated with the second indicator, revealing a greater need and less use of dental prosthesis among individuals who live in rural areas. This association is influenced by access to dental services and particularly to specialized dental prosthetic services which, although available in Brazil through the *Sistema Único de Saúde* since the National Oral

Health Policy of 2006, are concentrated in urban centers which often hinders access for those who live in rural areas.

The presence of a caregiver was also associated with the second oral health indicator, indicating greater use and fewer requirements among individuals who did not have this support. The use of dentures possibly represents another detainer aspect for care requirements that could be required of the caregiver, including manipulation skills and daily hygiene. Saliba, Moimaz, Marques, and Prado (2007) reported that the oral health of the elderly affects the type of care they receive and that caregivers should be motivated to devote the time required to the patient's oral health.

In the majority of cases, individuals associated the need for a caregiver with the presence of a chronic disabling condition, which was recorded in 13.6% of the elderly participants. This finding is significantly lower than that reported by Del Duca, Thume, and Hallal (2011) (49.5%) in a study conducted in the urban area of Pelotas in the state of Rio Grande do Sul (Brazil). The type of caregiver was not approached in the present study but, similar to the study conducted in Pelotas, in the majority of cases, the caregiver was a family member who was not hired for this purpose.

An association was also found between the second oral health indicator, defined as little use and great need for dentures, and the variable household density, which is related to the ratio between the number of residents and the number of rooms in a household. The majority of individuals who used dentures less and required them lived in residences with a household density rate higher than 0.6 individuals per room. This variable demonstrated the socio-economic condition, since aside from being a cultural, welfare or humanitarian choice, high household density may simply be an arrangement of survival (Coelho Filho and Ramos, 1999).

Table 6

Absolute values, percentages, statistical significance and crude and adjusted odds ratio with their respective confidence intervals (CI) for the association between factor 4 of oral health conditions and the demographic and socio-economic variables.

Variables	Categories	Factor 4		p	OR	CI (95%)	p _{aj}	OR _{aj}	CI (95%)
		A lot of soft tissue damage							
		Yes, n (%)	No, n (%)						
Gender	Male	61 (43.6)	79 (56.4)	0.440	0.85	0.57–1.27	–	–	–
	Female	143 (47.5)	158 (52.5)						
Age	≤70 years	121 (52.2)	111 (47.8)	0.009	1.65	1.13–2.41	0.052	1.509	0.996–2286
	>70 years	83 (39.7)	126 (60.3)						
Education	≤1 year	102 (43.4)	133 (56.6)	0.199	0.78	0.53–1.13	0.565	0.891	0.601–1321
	>1 year	102 (49.5)	104 (50.5)						
Current marital status	No partner	82 (43.6)	106 (56.4)	0.338	0.83	0.56–1.21	–	–	–
	Partner	122 (48.2)	131 (51.8)						
Residence	Interior	179 (47.0)	202 (53.0)	0.443	1.24	0.71–2.15	–	–	–
	Capital	25 (41.7)	35 (58.3)						
Residence area	Rural	98 (46.0)	115 (54.0)	0.919	0.98	0.67–1.42	–	–	–
	Urban	106 (46.5)	122 (53.5)						
Monthly family income	≤2 MS	164 (46.7)	187 (53.3)	0.699	1.09	0.68–1.74	–	–	–
	>2 MS	40 (44.4)	50 (55.6)						
Receives a pension	No	53 (52.5)	48 (47.5)	0.154	1.38	0.88–2.15	0.481	1.185	0.739–1902
	Yes	151 (44.4)	189 (55.6)						
Living companions	No	12 (41.4)	17 (58.6)	0.586	0.80	0.37–1.73	–	–	–
	Yes	192 (46.6)	220 (53.4)						
Caregiver	No	181 (47.5)	200 (52.5)	0.185	1.45	0.83–2.54	0.402	1.283	0.716–2301
	Yes	23 (38.3)	37 (61.7)						
Household density	>0.6 ppl/room	76 (40.2)	113 (59.8)	0.027	0.65	0.44–0.95	0.022	0.636	0.432–0.937
	≤0.6 ppl/room	128 (50.8)	124 (49.2)						
Lives in own home	No	39 (53.4)	34 (46.6)	0.179	1.41	0.85–2.33	0.183	1.421	0.848–2382
	Yes	165 (44.8)	203 (55.2)						
Receives government benefits	No	184 (46.3)	213 (53.7)	0.910	1.03	0.55–1.93	–	–	–
	Yes	20 (45.5)	24 (54.5)						
Type of government benefits	Family benefits	15 (48.4)	16 (51.6)	0.335	2.10	0.53–8.32	–	–	–
	Other	4 (30.8)	9 (69.2)						
Monthly medical expenses	>R\$ 32.50	33 (44.0)	42 (56.0)	0.693	0.90	0.53–1.51	–	–	–
	≤R\$ 32.50	110 (46.6)	126 (53.4)						
Acquisition of medications	Bought some	59 (44.0)	75 (56.0)	0.601	0.88	0.56–1.38	–	–	–
	Received all	86 (47.0)	97 (53.0)						

The Hosmer and Lemeshow test (*p*): 0.990.

This variable was also associated with the indicator related to soft tissue abnormalities. The majority of individuals who lived in residences with less than 0.6 people per room exhibited less prevalence of injuries. This association could be explained by the fact that the elderly individual in a crowded household probably spends less time on their oral healthcare, particularly when children, who also require more attention, share the residence (Andrade, Caldas Júnior, Kitoko, & Zandonade, 2011; Coelho Filho and Ramos, 1999). Less dental care, combined with the diet of an elderly individual, may lead to more fragility and susceptibility to fungal injuries, which are commonly found in elderly individuals who use dentures.

Studies of the oral health conditions of the elderly, allied to the search for an association with socio-demographic conditions, represent an important step in understanding the factors that affect the oral health of the elderly as well as in public health policy planning. Therefore, public policies that promote oral health in the elderly are necessary to help these individuals enjoy a high quality of life. Furthermore, policies guided by prosthetic rehabilitation, aimed at changing the lack of attention currently given to oral health in elderly individuals, are of vital importance.

5. Conclusions

The results highlight the precariousness of the oral health conditions among the elderly. There was a high proportion of edentulous individuals and when teeth were present, the prevalence of gum disease was high. These results reflect a historical lack of dental care and consequently, an accumulation of non-treated oral problems. It was confirmed that social factors

such as the presence of a caregiver and household density, as well as demographic factors (particularly gender, age and residence area) affect oral health conditions.

Conflict of interest statement

None declared.

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