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Periodontal disease and associated factors in the adult and elderly population from Jundiaí City, Brazil

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Aim: This study assessed the prevalence of periodontal disease in the adult and elderly populations from Jundiaí City, and its association with individual social inequalities in a conceptual framework approach. **Methods:** The survey was conducted with a sample of 342 adults and 145 elderly, and periodontal disease was assessed based on the Community Periodontal Index (CPI) and Clinical Attachment Loss (CAL). A questionnaire addressing socio-demographic and behavioral variables, smoking and diabetes was included. Bivariate and multivariate analyses, using binary regression analyses, were carried out in a hierarchical approach with conceptual framework to reveal association among periodontal disease and social-demographic, smoking and diabetes variables. **Results:** One adult and fifty-six elderly who had lost all teeth were excluded from the sample. Mild periodontal disease (CAL ≤3 mm) was the condition more prevalent in the adult (74%) and elderly populations (60.6%). Adjusted analysis revealed that low educational level (OR 2.65, 95% CI 1.19-5.88), irregular use of tooth floss (OR 1.9, 95% CI 1.06-3.40), and smoking (OR 2.14, 95% CI 1.04-4.42) were independently associated with moderate/severe periodontal disease (CAL and Probing Depth ≥4 mm) in the adult group. For the elderly group, low educational levels (OR 0.16, 95% CI 0.04-0.58), use of public dental service (OR 5.32, 95% CI 1.23-23.03), and diabetes condition (OR 3.78, 95% CI 1.20-11.91) were significantly associated with periodontal disease. **Conclusion:** In conclusion, the data showed that education level, smoking habits, diabetes, use of dental floss and type of dental service are factors associated to moderate/severe periodontal disease among Brazilians from Jundiaí City.

Keywords: Periodontal Disease. Epidemiology. Oral Hygiene. Smoking. Diabetes Mellitus.

Introduction

Periodontal diseases are one of the most important oral health conditions contributing to the global burden of chronic diseases[1]. Along with severe dental caries, periodontal diseases are a major cause of tooth loss, particularly among the elderly, which directly affects the quality of life of people in terms of reduced functional capacity, self-esteem and social relationships, representing a public health problem[1].

There are different clinical manifestations of periodontal diseases, in which gingivitis is the most prevalent form, found in large proportions in all populations[2]. Regarding chronic periodontitis, in which breakdown of supporting tissues of teeth occurs, epidemiological surveys have shown that this condition varies significantly between ages and countries[2]. According to World Oral Health Report (WHO), severe periodontitis affects between 5-15% of most adult populations (35-44 years) worldwide[3]. Data from the 2009-2010 *National Health and Nutrition Examination Survey* (NHANES)[4] showed that the prevalence of periodontitis in the adult population was 36.6% while in the elderly it was 70.1% [4]. In England, the prevalence of periodontitis was 42% between individuals of 35-44 years, and 70% in individuals of 55-64 years[5].

In Brazil, a representative study conducted in Porto Alegre, involving only adults (>30 years), showed a clinical attachment loss ≥ 5 mm in 79% of adults and ≥ 7mm in 52% of the population[6]. Further, data from the last Brazilian Oral Health Survey showed that 15.3% of the adult population had "moderate to severe" periodontal disease and that 5.8% had a "severe" form of disease[7]. Compared with the 2003 epidemiological survey, it was observed a 6.3% increase in the prevalence of "moderate to severe" periodontal disease[8]. This increasing of the prevalence of periodontal disease may be a consequence of improvements in life expectancy and the growth of Brazilian population, which may result in an increased number of people with a higher number of natural teeth[9].

The etiology of the inflammatory periodontal disease is associated with the accumulation of supra- and sub-gingival microflora of dental biofilms, mainly due to poor oral hygiene[10]. In addition, tobacco smoking and diabetes mellitus have been recognized as true risk factors for the development of this inflammatory process[11]. Further, some studies have also suggested that socioeconomic inequalities play a significant role in the occurrence of periodontal diseases[10,12,13].

In this context, the aim of the present study was to assess the prevalence of periodontal disease in the adult and elderly population from Jundiaí City and its association with individual social inequalities in a conceptual framework approach.

Material and Methods

Study design and location

This cross-sectional study was conducted in the city of Jundiaí, São Paulo State, Brazil, with a household probability sample. In 2014, the population of Jundiaí consisted

of 397.965 residents. A group of adult and elderly subjects, 35 to 44 and 65 to 74 years old were respectively, 56.569 and 20.431 inhabitants[14]. The present study is part of a major study for "Oral health conditions of the population from Jundiaí".

Ethical considerations

The study was approved by the Research Ethics Committee of the Campinas State University – UNICAMP (#077/2013). Individuals who agreed to participate signed the informed consent form. At the end of the examination, the participants were provided with a report about their oral status and diagnosed diseases. Patients with diagnosed periodontal diseases were advised to seek oral health consultation and treatment. The study was conducted in between the month of April to September 2014.

Sample

For the purpose of this study, adults aged 35 to 44 years old, and elderly aged 65 to 74 years old residing in Jundiaí were eligible to participate. The sample size was calculated in order to obtain a representative sample of the adult population of this municipality. The prevalence of periodontal disease adjusted for the Jundiaí population size for adults and elderly individuals, of 70.2% and 90.9% respectively, was the basis of the calculation[7]. A confidence interval of 95%, an accuracy of 10% and a design effect of 2 were adopted. A 30% increase was added to this total in order to compensate the possible loss, thereby resulting in an estimate of 204 adults 35–44 years old and 27 elders 65–74 years old, to be representative for periodontal disease. However, sample size considered caries disease in order to obtain oral health conditions data for the major study. The sample size adopted for the study was 300 adults and 71 elderly. To select the houses, considering the possibility of refusals, we added 30% of this sample size, which comprised 428 houses for adults and 101 for elderly. The total was divided by the 30 census tracts selected for the study (Figure 1).

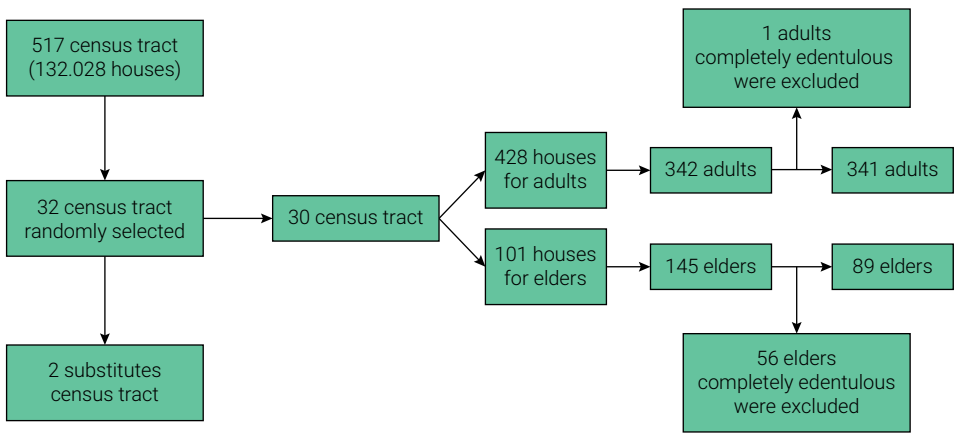

Figure 1. Flowchart of study sample.

Sample selection was carried out in two stages. In the first stage, the unit of selection was the census tract and from 517 census tracts, 30 were randomly selected (plus 2 in case substitutions were needed). The second stage consisted of the selection of households, and a 30% increase in the probabilistic sample size to select the houses was used to compensate for non-responses. This resulted in a total of 342 houses, divided by the 30 census tracts selected for the study, resulting in a fraction of 11.4 houses per census tract. Based on the average population size of each census tract, 11 houses per tract for adults and 3 for elderly were randomly selected and then one adult or elderly, per house was also randomly selected.

Interview and clinical examination

A team of five dentists, two dental assistants, and twenty local community health agent conducted the fieldwork. Dentists using a written questionnaire, which included 66 questions about demographics, socioeconomics, behavioral, dental services and diabetes mellitus data, interviewed participants. All clinical examinations were performed with individuals seated on a regular chair, in a well-illuminated part of the house, using an intraoral mirror and a ball point probe.

Periodontal diseases were assessed based on the Community Periodontal Index (CPI) as proposed at Oral Health Surveys by World Health Organization in 2013[15]. In Addition, clinical attachment loss (CAL) was performed in all sextants using the following categories: (0) up to 3mm, (1) 4-5mm, (2) 6-8mm, (3) 9-11mm, (4) 12mm or more and (X) excluded sextant. A sextant should be examined only if there are two or more teeth present which are not indicated to extraction.

All examiners and interviews were trained and calibrated by a researcher with experience in this type of epidemiological study. The calibration process consisted of two processes: firstly, a theoretical phase where diagnostic criteria were discussed and secondly, a practical phase, in which 20 individuals were examined twice, in order to calculate intra and inter-examiner reliability indexes. Further, the calibration process was performed during the fieldwork to ensure the inter-examiner reliability. The intra- and inter-examiner reproducibility was calculated using Kappa test. For periodontal conditions, the values vary from 0.63 to 0.91 (mean value = 0.87). The intra-examiner values vary from 0.63 to 0.87.

Data analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 19.0 software program. Descriptive weighted analyses were performed to obtain the frequency, mean, median, and standard deviation (SD) of variables which were the clinical conditions examined. The independent variables studied were selected according to a validated conceptual framework adapted from Batista MJ et al.[16] (2014) (Figure 2). After a descriptive analysis, the variables selected were categorized and/or dichotomized for statistical analysis.

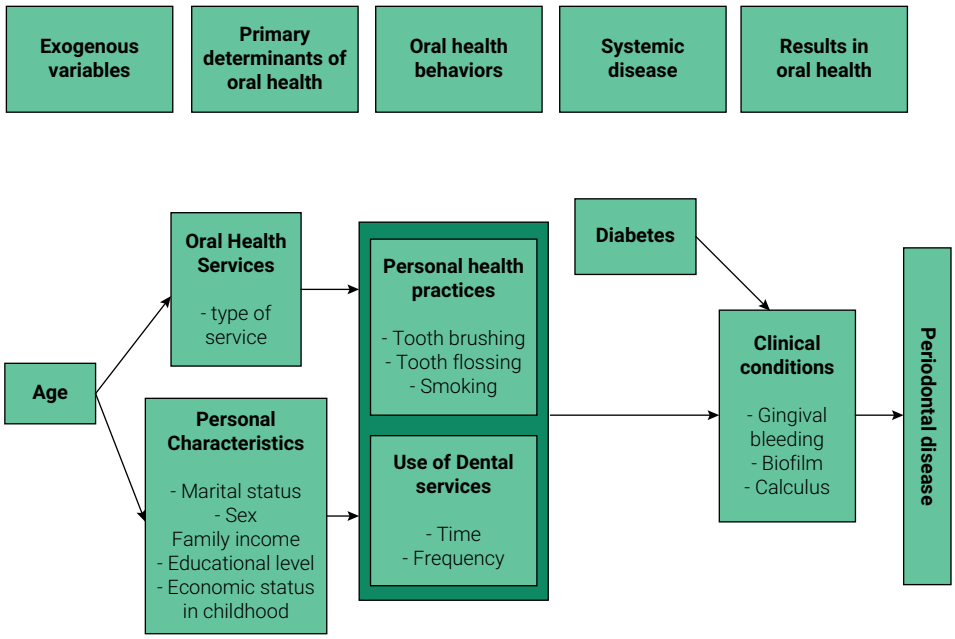

Figure 2. Conceptual framework for oral health-related qualify of life adapted from Batista MJ et al., 2014.

The outcome of this study was mild and moderate-severe periodontal disease. It was considered mild periodontal disease for individuals who presented at least one sextant with bleeding, calculus and clinical attachment loss up to 3mm. For periodontal disease moderate to severe, it was considered individuals who presented clinical attachment loss and periodontal pocket ≥ 4 mm. Individuals who presented the six sextants without any sign of periodontal disease (CPI=0) was excluded from the sample of affected individuals.

Bivariate and multivariate analyses were performed for adults and elderly separately, using binary regression analysis in a hierarchical approach according to the conceptual model in figure 2 [16]. First, a preliminary analysis was performed using univariate model, and all variables showing associations with $p<0.25$ were included in a multivariable model. At first level, age was the exogenous variable, analysed as a discrete variable. For this study, at second level, the primary determinants of health were: oral health service (public, private and insurance), sex (male and female), marital status (dichotomized in those who lived with a partner and not), family income ($405 or less, $405 to $810 or more than $810), educational level (less than 8 years, 8 to 12 and more than 12 years), and economic status in childhood (rich/ middle class or poor/very poor).

At third level, oral health behaviors were tooth brushing (one/two or three or more times/ day), tooth flossing (yes or no), smoking (yes or no). The use of dental services was characterized by the frequency of use (once a year, less than once a year and urgency), the type of service (public, dental insurance or private) and the time since last visit (3 or more years, 1 to 2 years and less than one year ago. At fourth level, systemic disease was assessed as having or not diabetes mellitus. At fifth level, clinical conditions such as, gingival bleeding, biofilm, and calculus were considered. The outcome variable was the presence of periodontal disease.

Results

A total of 342 individuals aged 35 to 44 years and 145 aged 65 to 74 years were examined. One adult and 56 elderly completely edentulous were excluded from the analyses. Then, the study sample included 341 adults and 89 elderly. Mild periodontal disease was the condition more prevalent between adult (74%) and elderly (60.6%) population. When the prevalence of moderate to severe disease was assessed, this condition was higher among elderly (39.3%) compared to adult (25.8%) individuals.

The distribution of periodontal conditions by independent variables are displayed in Tables 1 and 2. The prevalence of moderate to severe disease was higher in adult self-declared as white (65.9%) and in non-whites elderly individuals (80.0%). Mild periodontal disease was more frequently in adults and elderly who lived in houses with four or fewer individuals. In addition, elderly individual who lived a poor or very poor childhood had the highest prevalence of moderate to severe periodontal disease (Table 1).

Both mild and moderate/severe periodontal diseases were more prevalent in individuals who had used dental services at less than one year and who reported

Table 1. Distribution of periodontal conditions according to demographic and socioeconomic factors in adult and elderly populations from Jundiaí City.

Variables		Adults (35-44 years)		Elderly (65-74 years)	
		Early periodontal disease	Moderate/ Severe periodontal disease	Early periodontal disease	Moderate/ Severe periodontal disease
		n (%)	n (%)	n (%)	n (%)
Sex	Male	75 (29.6)	36 (40.9)	23 (42.6)	22 (62.9)
	Female	178 (70.4)	52 (59.1)	31 (57.4)	13 (37.1)
Race	Non white	70 (27.8)	30 (34.1)	37 (68.5)	28 (80.0)
	White	182 (72.2)	58 (65.9)	17 (31.5)	7 (20.0)
Marital status	Married/ Living common law	172 (69.4)	61 (69.3)	39 (72.2)	24 (68.6)
	Not living common law	76 (30.6)	27 (30.7)	14 (25.9)	11 (31.4)
Household income	< R$1620.00 ($405.00)	45 (18.3)	20 (23.0)	8 (15.4)	6 (17.1)
	R$1620 to R$3240 ($405 to $810)	67 (27.2)	30 (34.5)	23 (44.2)	9 (25.7)
	> R$3240 ($810)	134 (54.5)	37 (42.5)	21 (40.4)	20 (57.1)
Individuals per household	4 or less individuals	194 (77.6)	60 (69.0)	47 (88.7)	31 (88.6)
	More than 4 individuals	56 (22.4)	27 (31.0)	6 (11.3)	4 (11.4)
Education	Less than 8 years	68 (26.4)	25 (34.7)	32 (59.3)	16 (44.4)
	8 to 12 years	94 (36.0)	35 (48.6)	10 (18.5)	7 (19.4)
	More than 12 years	88 (34.1)	10 (13.9)	9 (16.7)	13 (36.1)
Economic status in childhood	Poor or very poor	114 (45.6)	51 (58.6)	26 (48.1)	21 (60.0)
	Rich or middle class	136 (54.4)	36 (41.4)	28 (51.9)	14 (40.0)
Current situation compared to childhood	Better	176 (70.1)	65 (73.9)	41 (75.9)	32 (91.4)
	Same or worse	75 (29.9)	23 (26.1)	13 (24.1)	3 (8.6)

Table 2. Distribution of periodontal conditions according to dental service, behavioral and diabetes factors in adult and elderly populations from Jundiaí City.

Variables		Adults (35-44 years)		Elderly (65-74 years)	
		Early periodontal disease	Moderate/ Severe periodontal disease	Early periodontal disease	Moderate/ Severe periodontal disease
		n (%)	n (%)	n (%)	n (%)
Time since last visit	3 or more years	43 (17.3)	17 (19.3)	19 (35.2)	7 (20.0)
	1 to 2 years	68 (27.4)	27 (30.7)	15 (27.8)	5 (14.3)
	Less than one year	137 (55.2)	44 (50.0)	20 (37.0)	23 (65.7)
Type of service	Public	33 (13.3)	13 (14.8)	5 (9.3)	8 (22.9)
	Dental insurance/ Others	50 (20.1)	15 (17.0)	9 (16.7)	3 (8.6)
	Private	166 (66.7)	60 (68.2)	40 (74.1)	24 (68.6)
Service rating	Great/ Good	222 (89.9)	72 (82.8)	50 (92.6)	31 (88.6)
	Regular/ Bad	25 (10.1)	15 (17.2)	4 (7.4)	4 (11.4)
Knows what Periodontal Disease is?	No	153 (60.5)	58 (65.9)	37 (68.5)	18 (51.4)
	Yes	98 (38.7)	29 (33.0)	17 (31.5)	17 (48.6)
Has received periodontal treatment?	No	108 (42.7)	34 (38.6)	26 (48.1)	10 (28.6)
	Yes	142 (56.1)	54 (61.4)	27 (50.0)	25 (71.4)
How many times do you brush your teeth?	One or two times/ day	66 (25.6)	24 (33.3)	22 (41.5)	14 (38.9)
	3 or more times/ day	192 (74.4)	48 (66.7)	31 (58.5)	22 (61.5)
Use of dental floss	No	83 (32.8)	47 (53.4)	30 (55.6)	19 (54.3)
	Yes	168 (66.4)	41 (46.6)	23 (42.6)	16 (45.7)
Have you ever received information about preventing dental problems?	No	44 (17.4)	18 (20.5)	15 (27.8)	8 (22.9)
	Yes	206 (81.4)	70 (79.5)	38 (70.4)	27 (77.1)
Smoker	Yes	27 (10.7)	19 (21.6)	1 (1.9)	3 (8.6)
	No	224 (88.5)	69 (78.4)	53 (98.1)	32 (91.4)
Former-smoker	No	205 (81.0)	75 (85.2)	41 (75.9)	17 (48.6)
	Yes	46 (18.2)	12 (13.6)	13 (24.1)	18 (51.4)
Diabetes	No	162 (64.0)	58 (65.9)	9 (16.7)	3 (8.6)
	Yes	89 (35.2)	29 (33.0)	44 (81.5)	32 (91.4)

brushing their teeth three or more times a day. The prevalence of moderate to severe periodontal disease was higher among non-smokers adult and elderly individuals who reported to have already received periodontal treatment and who did not use dental floss. Diabetes mellitus was a systemic disease present in 33.0% of adult and 91.4% of the elderly population with moderate to severe periodontal disease (Table 2).

The results of multivariate analysis of periodontal diseases are displayed in Tables 3 and 4. In the adult group, education level, smoking, and use of dental floss were significantly associated with periodontal disease (Table 3). Further analysis showed

Table 3. Multivariate analyses of factors associated with moderate to severe periodontal disease in adults from Jundiaí City .

Variables		Adults (35-44 years)							
		Early periodontal disease	Moderate to severe periodontal disease	OR	95% CI	p	OR adjusted	95% CI	p
		n (%)	n (%)						
Sex	Male	75 (29.6)	36 (40.9)	0.67	0.39-1,14	0,41	-	-	-
	Female	178 (70.4)	52 (59.1)						
Race	Non white	70 (27.8)	30 (34.1)	1.07	0.60-1.89	0.821	-	-	-
	White	182 (72.2)	58 (65.9)						
Marital status	Living common law	172 (69.4)	61 (69.3)	0.77	0.44-1.35	0.363	-	-	-
	Not living common law	76 (30.6)	27 (30.7)						
Household income	< R$1620.00 ($405.00)	45 (18.3)	20 (23.0)	1.49	0.81-2.74	0.198	-	-	-
	R$1620 to R$3240 ($405 to $810)	67 (27.2)	30 (34.5)	1.68	0.85-3.32	0.138			
	> R$3240 ($810)	134 (54.5)	37 (42.5)						
Individuals per household	4 or less individuals	194 (77.6)	60 (69.0)	1.83	1.03-3.25	0.039	-	-	-
	More than 4 individuals	56 (22.4)	27 (31.0)						
Education	Less than 8 years	18 (7.2)	7 (8.0)	3.31	1.55-7.09	0.002	2.65	1.19-5.88	0.017
	8 to 12 years	141 (56.6)	66 (75.0)	3.24	1.46-7.19	0.04	2.36	0.98-5.69	0.056
	More than 12 years	90 (36.1)	15 (17.0)						
Economic status in childhood	Rich or middle class	136 (54.4)	36 (41.1)	1.33	0.78-2.25	0.292	-	-	-
	Poor or very poor	144 (45.6)	51 (58.6)						
Current situation compared to childhood	Better	176 (70.1)	65 (73.9)	0.98	0.55-1.74	0.936	-	-	-
	Same or worse	75 (29.9)	23 (26.1)						
Frequency of visit to dentist	Urgency	81 (32.3)	44 (50.0)	2.21	1.22-4.00	0.009	1.4	0.72-2.71	0.325
	Less than once a year	46 (18.3)	12 (13.6)	1.09	0.49-2.45	0.834	1.12	0.46-2.59	0.78
	Once or more a year	124 (49.4)	32 (36.4)						
Time since last visit	3 or more years	43 (17.3)	17 (19.3)	1.69	0.95-3.16	0.073	-	-	-
	1 to 2 years	68 (27.4)	27 (30.7)	1.69	0.85-3.37	0.137			
	Less than one year	137 (55.2)	44 (50.0)						

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Type of service	Public	33 (13.3)	13 (14.8)	1.34	0.64-2.81	0.432	-	-	-
	Dental insurance/ Others	50 (20.1)	15 (17.0)	0.89	0.44-1.82	0.761			
	Private	166 (66.7)	60 (68.2)						
How many times do you brush your teeth?	One or two times/ day	66 (25.6)	24 (33.3)	1.46	0.83-2.56	0.193	-	-	-
	3 or more times/ day	192 (74.4)	48 (66.7)						
Use of dental floss	No	83 (32.8)	47 (53.4)	2.39	1.40-4.06	0.001	1.9	1.06-3.40	0.03
	Yes	168 (66.4)	41 (46.6)						
Smoker	Yes	27 (10.7)	19 (21.6)	2.44	1.25-4.76	0.009	2.14	1.04-4.42	0.039
	No	224 (88.5)	69 (78.4)				1		
Diabetes	No	162 (64.0)	58 (65.9)	0.36	0.08-1.58	0.176	-	-	-
	Yes	89 (35.2)	29 (33.0)						

that smoking exposure, the absence of use of dental floss and low education level (£8 years) increased approximately two times the risk of experiencing moderate/ severe periodontal disease (Table 3).

For the elderly population, education level, type of dental service and diabetes mellitus condition were significantly associated with periodontal disease (Table 4). Adjusted analysis in the elderly population revealed that presence of diabetes mellitus increased almost four times the risk for moderate to severe periodontal disease. Also, elderly population who reported to use public dental service had five times higher risk of having moderate/severe disease than individuals that used private or dental insurance services (Table 4).

Discussion and Conclusion

The present population-based study assessed the prevalence of periodontal disease in the Southeast Brazilian adult and elderly population and its association with demographic, socioeconomic, behavioral and systemic factors. Compared to the last survey conducted in the city of Jundiaí in 1998 (unpublished data), it was observed an increase in the prevalence of periodontal disease (90.4% *versus* 98% in 1998 and 2014, respectively) in the adult population. These data are higher compared to the national epidemiological survey performed in Brazil in 2010, in which 82.2% of adults were CPI> 0 [7]. According to Vettore et al. [8], this rise may be associated in part, to a decline in tooth loss over the last few years.

Regarding the elderly population, it was not possible to assess whether there was any change in the periodontal status of the population from Jundiaí, since this track age was not considered in the survey of 1998. However, compared with the data of SBBrasil 2010[7], the prevalence of periodontal disease found in the elderly population was lower, 59% *versus* 63.6%, respectively. Considering the total population from Jundiaí, the prevalence of periodontal disease was lower in elderly individuals, probably

Table 4. Multivariate analyses of factors associated with moderate to severe periodontal disease in elderly from Jundiaí City.

Variables		Elderly (65-74 years)							
		Early periodontal disease	Moderate to severe periodontal disease	OR	IC 95%	p	OR adjusted	IC 95%	p
		n (%)	n (%)						
Sex	Male	23 (42.6)	22 (62.9)	0.47	0.20-1.12	0.087	-	-	-
	Female	31 (57.4)	13 (37.1)						
Race	White	37 (68.5)	28 (80.0)	1.26	0.49-3.28	0.631	-	-	-
	Non white	17 (31.5)	7 (20.0)						
Marital status	Living common law	39 (72.2)	24 (68.6)	0.77	0.31-1.92	0.574	-	-	-
	Not living common law	14 (25.9)	11 (31.4)						
Household income	< R$1620.00 ($405.00)	8 (15.4)	6 (17.1)	1.33	0.40-3.51	0.644	-	-	-
	R$1620 to R$3240 ($405 to $810)	23 (44.2)	9 (25.7)	0.52	0.141-1.932	0.33			
	> R$3240 ($810)	21 (40.4)	20 (57.1)						
Individuals per household	4 or less individuals	47 (88.7)	31 (88.6)	1.02	0.27-3.91	0.975	-	-	-
	More than 4 individuals	6 (11.3)	4 (11.4)						
Education	Less than 8 years	32 (62.7)	16 (44.4)	0.35	0.12-0.98	0.046	0.5	0.12-2.04	0.332
	8 to 12 years	10 (19.6)	7(19.4)	0.49	0.14-1.75	0.27	0.16	0.04-0.58	0.005
	More than 12 years	9 (17.6)	13 (36.2)						
Economic status in childhood	Poor or very poor	26 (48.1)	21 (60.0)	1.25	0.054-2.92	0.605	-	-	-
	Rich or middle class	28 (51.9)	14 (40.0)						
Current situation compared to childhood	Same or worse	13 (24.1)	3 (8.6)	0.44	0.13-1.48	0.185	-	-	-
	Better	41 (75.9)	32 (91.4)						
Frequency of visit to dentist	Urgency	25 (46.3)	13 (37.1)	0.64	0.24-1.71	0.376	-	-	-
	Less than once a year	11 (20.4)	7 (20.0)	0.72	0.22-2.29	0.573			
	Once or more a year	18 (33.3)	15 (42.9)						
Time since last visit	3 or more years	19 (35.2)	7 (20.0)	0.31	0.11-0.88	0.028	-	-	-
	1 to 2 years	15 (27.8)	5 (14.3)	0.28	0.086-0.09	0.032			
	Less than one year	20 (37.0)	23 (65.7)						
Type of service	Public	5 (9.3)	8 (22.9)	2.56	0.75-8.71	0.132	5.32	1.23-23.03	0.025
	Dental Insurance/ Others	9 (16.7)	3 (8.6)	0.46	0.09-2.38	0.352	0.35	0.06-2.21	0.265
	Private	40 (74.1)	24 (68.6)						

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How many times do you brush your teeth?	One or two times/ day	22 (41.5)	14(38.9)	0.90	0.38-2.13	0.805	-	-	-
	3 or more times/ day	31 (58.5)	22 (61.5)						
Use of dental floss	No	30 (55.6)	19 (54.3)	1.41	0.60-3.30	0.437	-	-	-
	Yes	23 (42.6)	16 (45.7)						
Smoker	Yes	1 (1.9)	3 (8.6)	0.82	0.48-48.20	0.181	3.2	0.26-38.71	0.36
	No	53 (98.1)	32 (91.4)						
Diabetes	Yes	11 (20.4)	13 (36.1)	2.21	0.86-5.71	0.102	3.78	1.20-11.91	0.023
	No	43 (79.6)	23 (63.9)						

due to high rates of tooth loss. In fact, the percentage of tooth loss among adults was 19.1 whereas elderly individuals presented a rate of 72,8% of teeth loss. As reported by Peres et .[17], the rate of tooth loss among adolescents and adults Brazilian seems to decline from 2003 to 2010, which was not observed among elderly population. This findings point to the existence of inequalities of the Brazilian National Policy of oral health, also known as Smiling Brazil. This national policy gives priority to particular community actions such as, water fluoridation, which has a significant impact to reduce the rate of decayed, missing, or filled teeth (DMFT) among adolescents and adults[18]. Therefore, there was not a community actions to prevent periodontal disease, which could have a significant impact on the reduction of tooth loss among elderly population, and consequently, reduce the prosthodontics needs.

It is important to highlight that, 41% of the elderly from Jundiaí had all their sextants excluded according to the criteria established for the CPI index (more than two teeth should be present for the sextant to be considered). This exclusion criteria may have led to an underestimation of the prevalence of periodontal disease among elderly population. Community Periodontal Index is recommended by WHO in oral health surveys, although has some limitations such as, the underestimation of the prevalence of periodontal diseases due to use of index teeth[19]. The standard protocol for assessing periodontal disease status in periodontal research and periodontal practice involves a full-mouth clinical examinations conducted on a six sites per tooth[20,21]. However, the application of this protocol in population surveys may not be feasible, mainly when the data collection is performed at home under natural light. In this case, full-mouth examination could trigger patient and examiner fatigue, which may potentially increase measurement errors[20,21]. Consequently, the present study was outlined using a partial record protocol to define the prevalence and severity of periodontal disease. Then, to estimate the severity of periodontal disease it was considered the association of probing depth and clinical attachment loss by the use of CPI and CAL indexes. This association of clinical parameters made possible the definition of periodontal disease both for the cumulative of periodontal attachment loss and for the current disease.

During this epidemiological survey, adult and elderly populations were characterized in terms of socioeconomic determinants, type of dental services, oral hygiene

habits, smoking and diabetes mellitus condition. The findings showed an association between the prevalence of moderate/severe periodontal disease and low educational level for both population. This data is comparable with the most recent national survey performed in Brazil and in Uruguay, which identified a higher prevalence of moderate/severe periodontal disease among adults with lower educational level[7,13]. Further, in a study conducted in China, the severe periodontal disease was more prevalent among illiterate adults or that they had not completed six years of schooling[22]. Educational level is a important determinant of employment and income[13]. So, it is expected that the socioeconomic status of families could be influenced by the educational level of their members[13]. According to some studies, the impact of socioeconomic status in periodontal disease may be explained by psychosocial stress caused by poverty, unemployment and poor living conditions[23]. Stress can negatively alter the immune-inflammatory response to periodontal disease, and also affect behaviors associated with periodontal diseases, such as oral hygiene and smoking habits[13].

Oral hygiene practices such as, tooth brushing and flossing, play an important role in the prevention of periodontal diseases. In this study, the absence of the flossing habit was associated with a higher prevalence of periodontal diseases in the adult population. This finding is in agreement with a recent Brazilian cross-sectional study[24], in which individual who never perform interproximal cleaning had 2.19 times higher chance of having gingivitis than those performed interproximal cleaning.

Diabetes mellitus is considered one of the major risk factors for destructive periodontal disease[11,25]. In this survey, elderly diabetic individuals had four times higher risk to have moderate/severe periodontal disease than non-diabetics in the multivariate analysis after adjusting for other risk factors. In the adult population, this statistical association was not observed, probably because of the low number of adults self-reported diabetics. Another true risk factor for periodontal disease is smoking habits as there are a higher prevalence and severity of periodontal disease in smokers regardless of oral hygiene[26,27]. The association between smoking and increased risk for periodontal disease (moderate/severe) was only found in the adult population from the city of Jundiaí, probably because of low numbers of elderly smokers. The literature has been shown a dose-dependent association between smoking and periodontitis using the number of cigarettes smoked per day[27,28]. However, in the present study, it was not possible to associate the severity of periodontal disease with the number of cigarettes/day, because of the subjects only self-reported as smoker or non-smoker.

An important aspect to be considered in this epidemiological survey is the type of dental service used by the population. The elderly population that reported to use public dental service had five times higher risk of having moderate/severe periodontal disease than individuals who reported to use dental insurance or private dental clinics. This fact could be associated to the absence of oral health care coverage for the elderly population in Jundiaí, which is focused on emergency demands only.

To conclude, this study showed that education level, smoking habits, diabetes, use of dental floss and type of dental service are factors associated to moderate/severe periodontal disease in a population from Jundiaí City. Moreover, these findings sug-

gest that local government from Jundiaí requires action on reducing inequalities and improving the accessibility of dental care to socially disadvantaged communities, particularly to elderly population.

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