

## The impacts of oral health-related quality of life of elderly people living at home: a cross-sectional study

Impactos da qualidade de vida relacionada à saúde bucal de idosos em domicílio: estudo transversal

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**Abstract** *The scope was to verify the impact of oral and sociodemographic conditions, the dental treatment needs and dental pain, on the quality of life of the elderly. This cross-sectional study was conducted in 15 primary health care areas. A backward multivariate linear regression model was used ( $p < 0.05$ ) with oral health related-quality of life as dependent variable. There were 335 elderly people with predominance of women (56.72%) and aged up to 74 years (59.40%). Those who had up to 8 years of education predominated (87.46%), and those who were still working were the minority (13.43%). Multivariate linear regression ( $p < 0.05$ ) showed association with missing teeth ( $\beta = 0,12$ ; IC 0,00:0,04;  $p < 0,04$ ) and dental prosthesis needs ( $\beta = 0,14$ ; IC 0,13:0,81;  $p < 0,01$ ), women ( $\beta = 0,18$ ; IC 0,23:0,85;  $p < 0,01$ ), less aged ( $\beta = -0,12$ ; IC -0,05:0,00;  $p < 0,02$ ), not working ( $\beta = -0,15$ ; IC -1,09:-0,20;  $p < 0,01$ ), with dental care need ( $\beta = 0,24$ ; IC 0,25:0,63;  $p < 0,01$ ) and dental pain ( $\beta = 0,14$ ; IC 0,10:0,64;  $p < 0,01$ ). Missing teeth, sociodemographic conditions, dental treatment needs and dental pain might impact oral health-related quality of life of elders.*

**Key words** *Aged, Aged 80 and over, Tooth loss, Quality of life, Public health*

**Resumo** *O objetivo foi verificar o impacto da condição bucal e sociodemográfica, necessidade de tratamento odontológico e dor dentária na qualidade de vida de idosos. Este estudo transversal realizou-se em 15 áreas de cuidados primários de saúde. O modelo de regressão linear multivariado foi utilizado ( $p < 0,05$ ) considerando qualidade de vida como variável dependente. Participaram 335 idosos, predomínio de mulheres (56,72%) com idade até 74 anos (59,40%). Ter até 8 anos de estudo predominou (87,46%) e os que trabalhavam eram minoria (13,43%). A regressão linear multivariada ( $p < 0,05$ ) apresentou associação da qualidade de vida com dentes perdidos ( $\beta = 0,12$ ; IC 0,00:0,04;  $p < 0,04$ ) e necessidade de próteses ( $\beta = 0,14$ ; IC 0,13:0,81;  $p < 0,01$ ), com mulheres ( $\beta = 0,18$ ; IC 0,23:0,85;  $p < 0,01$ ), idosos mais jovens ( $\beta = -0,12$ ; IC -0,05:0,00;  $p < 0,02$ ), que não trabalham ( $\beta = -0,15$ ; IC -1,09:-0,20;  $p < 0,01$ ), com necessidades de tratamento odontológico ( $\beta = 0,24$ ; IC 0,25:0,63;  $p < 0,01$ ) e dor dentária ( $\beta = 0,14$ ; IC 0,10:0,64;  $p < 0,01$ ). Dentes perdidos, aspectos sociodemográficos, necessidade de tratamento odontológico e dor dentária podem impactar a qualidade de vida relacionada à saúde bucal de idosos.*

**Palavras-chave** *Idoso, Idoso de 80 anos ou mais, Perda de dente, Qualidade de vida, Saúde pública*

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## Introduction

The last few decades were marked by a profound change in the demographic profile in Brazil<sup>1</sup>, and in other countries<sup>2</sup>, by the growth of the elderly population group. In addition to the difficulties inherent to age, because of coping with various risks throughout life, elderly persons usually present a great oral health burden, such as extensive tooth loss, and the few remaining teeth often present dental caries, manifested in crown and / or root, periodontal disease, without counting the needs related to oral rehabilitation.

Dental caries, periodontal disease, edentulism, dry mouth and pre-cancer / cancer lesions are the dental and oral conditions most frequently observed in the elderly<sup>3</sup>. These normative conditions have been discussed in the previously published literature, specially the importance of tooth loss and the oral health rehabilitation needs associated<sup>3-10</sup>. In recent years the relationship between these conditions was added to its perception, known as oral health-related quality of life. In the elderly, this topic has been investigated by the Oral Health Impact Profile (OHIP) questionnaire<sup>11</sup>, most often in its reduced version (OHIP-14)<sup>12</sup> that has been validated for Portuguese in Brazil<sup>13</sup>. This instrument is also used in other age groups and to evaluate clinical conditions<sup>14,15</sup>. OHIP-14 presents seven dimensions (functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability and handicap) with two issues related to each dimension. Initially, the studies presented their conclusions based on the mean scores of the impacts observed, however, later the prevalence, severity, and especially the extent of impacts were used to report the results of the studies<sup>16</sup>, in an adequate theoretical framework<sup>17</sup>. The severity is related to the OHIP-14 mean results, therefore resulting in the general impact investigated. The extent variable reveals the OHIP-14 mean only of those considered with impact.

The impact of the normative dental condition on oral health-related quality of life (OHRQoL) of the elderly has previously been investigated, usually focused on an isolated condition or few together. The need for dental prosthesis was found to be significantly associated with a negative impact on oral health-related quality of life; also significant were dental pain and lack of satisfaction with oral health<sup>18</sup>. The positive predictors were: satisfaction with the use of prosthesis, for rehabilitation treatment<sup>19</sup>, and a higher family

income for oral health-related quality of life<sup>18</sup>. Nevertheless, few studies have related the impact of the main oral conditions of the elderly relative to their severity and extent on the oral health-related quality of life of this population, other than the World Health Organization (WHO) recommendation for epidemiological surveys for older people (65-74 years) in Brazil<sup>20</sup>.

Thus, the objective of this cross-sectional study was to verify the impact of clinical (normative) dental variables (missing teeth; filled teeth; dental caries; clinical attachment loss; oral mucosal lesions, and dental prosthesis use / need); sociodemographic conditions (sex, age - in years, occupation and school - in years); the dental care need and self-reported of dental pain, on the severity and extent of the oral health related-quality of life of elderly people.

## Material and methods

The city of Bauru, ranked 37<sup>th</sup> among Brazilian cities with a Human Development Index (IDH-M=0,801), is in the central region of the state of São Paulo. In 2010, it had 343,937 inhabitants, of whom 23,633 (6,87%) were aged between 60 and 69 years, and 21,147 (6,15%) people of 70 years of age, or older. The predominance of females increased with age, with 56.01% and 60,52%, respectively<sup>21</sup>. The public health network in primary health care is composed by 25 Health Clinics (HC) for 10,41% of oral health coverage population<sup>22</sup>. This cross-sectional study report was made in compliance with the recommendations of the Strengthening the Reporting of Observational Studies in Epidemiology (Strobe Guidelines).

### Sample assessment and calibration process

The two examiners discussed the clinical variables prior to the pilot study with pictures. Then, five dentate and five edentulous elderly volunteers (65-74 years of age) were examined for each clinical variable at Vila Dutra Public Health Clinic in two different moments, in two days. The last round of exams was satisfactory for intra and inter-examiner Kappa statistics (Kappa>0,80). Only mucosal lesions were not observed in those elderly volunteers therefore it wasn't registered.

The population enrolled in the Vila Dutra Public Health Clinic participated in a pilot study to observe the data collection methodology, instruments used, and the time spent on collec-

tion. The pilot study lasted for six periods of 4 hours, to enable 35 participants to be examined and respond to the questionnaires twice, with a two-week interval between them. Inter-examiner and intra-examiner Kappa statistics were satisfactory for all variables related to the oral condition satisfactorily, and for the OHIP-14 instrument ( $Kappa > 0.80$ ). We performed the sample calculation for each oral condition investigated and for oral health-related quality of life (OHIP-14). The largest sample calculated among clinical (normative) dental variables and OHIP-14 was the dental prosthesis use (68,57%), hence with a minimum need of 341 elderly in the study to represent the elderly population covered by Oral Health Primary Health Attention in Bauru in 2015. The estimated sample was based on a finite population (4941), with a 5% error, 95% confidence level and a design effect of 1.1. This design effect is proposed because there is no public information by age groups for the neighborhoods or any regions from Bauru, nevertheless 10% was added to the calculus to let the final sample the most reliable as possible. Oral health coverage at Bauru for Primary Health Attention (37910 inhabitants) and the people older than 64 years (13,02% at Bauru) was considered for sampling process. This paper describes a study with other results not included here, and in the main methodology it was decided to include conveniently the Family Health Units. The city was divided into central, northern, southern, eastern and western regions. Despite the distribution of Health Clinics over the city is not equal it was decided to select three HC per region by means of lottery to represent Bauru elderly home population equally, therefore totaling fifteen subpopulations (15 HC) distributed throughout the city (figure 1), with exception for the western and northern regions which The Family Health Clinics were all conveniently selected. This estimated sample was considered to represent the people with 65 years old or more from the coverage area of Primary Oral Health Attention from Bauru, Brazil.

The target sampling (341) was divided by the fifteen HC regions established in the study for the city of Bauru, thus with 23 blocks for each region (Figure 1). All the blocks of the coverage area of each public health unit was numbered. Then, by simple sampling, 23 blocks (one block per senior citizen) were randomly selected. In each block, the research group began the journey walking through the left corner of the north face of the block, always working in a clockwise direction,

to enroll the individuals of the elderly age group with the aim to reach one participant by block. The first elderly person localized was invited to participate, and in the cases with more than one elder person in the house every one was invited to participate. Elderly persons 65 or more years old were selected, and only those who showed cognitive difficulties with understanding and answering the questions were excluded, nevertheless no instrument targeting cognitive condition was used.

All epidemiological examinations for oral conditions were performed in a room with adequate light, with the participant and examiner sitting opposite each other. A flat mirror (SSWhite Duflex, São Paulo) and CPI probe (Trinity, lot L0561C, São Paulo) were used, and before the exams dental brushing was performed by the volunteers.

### Independent variables

The indices used were Decayed/Missing/Filled/Teeth (DMFT), Clinical Attachment Loss (CAL), Oral Mucosal Lesions<sup>20</sup> and Dental Prosthesis Use / Need<sup>23</sup>. The oral condition of the elderly was represented in this study by the following independent variables derived from the indices cited in the previous paragraph: sound teeth, missing teeth (any reason), filled teeth, dental caries (crown or root), Clinical Attachment Loss, oral mucosal lesions, dental prosthesis (use / no use; need / no need).

The socio-demographic variables were collected by interview and included sex (male or female), skin color (not white or white), age (in years from 65), occupation (does not work, or work) and formal schooling (school - in years of formal education). The elderly was asked about dental care need (no or yes), and if they felt dental pain in the last 6 months (no or yes).

### Oral health-related quality of life (OHRQoL)

To assess the oral health-related quality of life, the OHIP-14 instrument was used by interview, based on the last six months of the time of data collection<sup>13</sup>. The possible responses were Never (0), Hardly ever (1), Occasionally (2), Fairly often (3) and Very often (4), and the sum of the score of each question resulted in a variation from zero to 56 (Severity). The highest impact responses, Fairly often (3) and Very often (4) were summed per individual and corresponded to the dependent variable OHIP-14 Extension, hence to

the effectively answers related to negative impact in quality of life. This sum corresponded to how many times each participant answered Fairly often (3) or Very often (4) for each of the fourteen questions of OHIP-14, hence ranging from zero to fourteen.

### Statistical analysis

The bivariate analysis performed was the Simple Regression Analysis between both dependent variables and all the independent variables ( $p < 0.05$ ). Two multivariate linear regressions were performed with the severity and extent of the OHIP-14 instrument as dependent variables. The first time, all the independent variables were included, in the second, only the variables that presented value of  $p < 0.20$ , characterizing two backward stepwise multivariate linear regressions.

In both cases, OHIP-14 severity and OHIP-14 extension, we analyzed the assumptions of multivariate linear regressions by assessing the residuals of the independent variables. The linearity of the parameters was evaluated by the correlation coefficient. The homocedasticity, characterized by the constant variance of residues, was evaluated by the Pesarán-Pesarán Test. The Durbin Watson test (DW Test) was used to evaluate the independence of the terms (null covariance). Normality of the residual's distribution was assessed by the Kolmogorov-Smirnov test. The collinearity was evaluated by the analysis of the tolerance value and the Variance Inflation Factor (the values accepted are Tolerance greater than 0.10 and VIF less than 10.00)<sup>24,25</sup>.

### Ethical aspects

This study was approved and conducted in compliance with the requirements and recommendations of Brazilian Law.

### Results

From the surrounding 15 public health clinics, there were 338 persons eligible by age, but 3 were excluded because of cognitive difficulties of understanding and expression. The refusals were not registered and there was three losts. Data about the studied population is presented in Table 1, and it is related to the mean severity and extension of the OHIP-14 instrument. There was a predominance of females (56,72%), and age

group between 65 and 74 years (59,40%), with a total range from 65 to 101 years of age. The elderly with up to eight years of formal schooling reported (87,46%), and not working elders (86,57%) predominated.

The results of the OHIP-14 instrument are presented in Table 2, with the prevalence, mean values of severity and extent of impact. For internal reliability, the Cronbach's alpha value for OHIP-14 (0,77) was calculated. The severity shown in the OHIP-14 instrument was higher, mainly in the dimension of physical pain related to *uncomfortable to eat*, followed by psychological discomfort (*self-conscious*) and psychological disability (*embarrassed*) and then by functional limitation (*pronounce* and *taste*). The extent of negative impacts was higher in the physical pain dimension (*uncomfortable to eat*), followed by psychological discomfort (*self-conscious*), psychological disability (*embarrassed*), functional limitation (*taste*).

The simple linear regressions between OHIP-14 severity and extension is presented at Table 3. In both analysis the statistically significant results ( $p < 0,05$ ) are related to the elders with normative dental prosthesis need, females, less age, to be not working, and to the perception of dental care need and dental pain.

The multivariate linear regression (Table 4) between the dependent variable severity of the negative impacts of the OHIP-14 instrument is presented in in two stages. In the first, all independent variables were included in the model. In the second stage, the model was assembled with variables with p value equal to or less than 0.20. The only oral condition associated with OHIP-14 severity in second stage was dental prosthesis need, and the socio-demographic variables associated were female sex, the not working elder person (occupation), the dental care need and dental pain. This model explained 24,00% ( $R^2$ ) of the OHIP-14 severity variability ( $p < 0,001$ ).

The extent of the negative impacts of OHIP-14 was the dependent variable shown in the multivariate linear backward analysis presented in Table 4, with the same methodology by the variable OHIP-14 severity. In the last step, the oral condition associated variables with p-value less than 0.20 were missing teeth and dental prosthesis need, and the socio-demographic variables were elders with less age, female sex, the not working elder person (occupation), dental prosthesis need and dental pain. This model explained 18,00% of the OHIP-14 extent variability ( $p < 0,001$ ).

**Table 1**, Distribution of OHIP-14 severity and extension by independent variables, Bauru, São Paulo State, Brazil, 2015,

		OHIP-14 Severity				OHIP-14 Extension	
		n	%	Mean	Standard Deviation	Mean	Standard Deviation
Sound teeth	zero	210	62,69	6,45	7,22	1,00	1,57
	01 - 10	89	26,57	6,85	7,11	0,99	1,50
	11 or more	36	10,75	5,14	0,67	0,67	1,29
Missing teeth	zero	1	0,3	2,00	0,00	-	-
	01 - 10	26	7,76	6,69	6,20	0,92	1,32
	11 or more	308	91,94	6,41	7,13	0,97	1,54
Filled teeth	zero	254	75,82	6,41	7,18	0,98	1,56
	01 - 10	71	21,19	6,52	6,74	0,94	1,45
	11 or more	10	2,99	5,70	6,43	0,70	1,25
Dental caries	zero	253	75,52	5,84	6,62	0,88	1,44
	01 - 10	80	23,88	8,36	8,05	1,25	1,75
	11 or more	2	0,6	1,50	2,12	-	-
Clinical attachment loss	No	204	60,90	6,11	6,75	0,94	1,49
	Present	131	31,10	6,94	7,48	1,01	1,58
Oral mucosal lesion	No	257	76,72	6,29	6,90	0,91	1,47
	Present	78	23,28	6,91	7,50	1,13	1,69
Dental prosthesis use	No use	76	22,69	7,01	6,28	1,01	1,35
	1 or more	259	77,31	6,27	7,25	0,95	1,57
Dental prosthesis need	No need	101	30,15	4,54	6,43	0,52	1,29
	Need	234	69,85	7,25	7,15	1,15	1,58
Sex	Male	145	43,28	5,20	6,14	0,70	1,31
	Female	190	56,72	7,38	7,54	1,16	1,65
Age (in years)	65 a 74	199	59,40	7,26	7,84	1,16	1,75
	75 or more	136	40,60	5,23	5,48	0,68	1,05
Occupation	No work	290	86,57	5,99	6,49	0,87	1,36
	Work	45	13,43	9,33	9,46	1,56	2,23
School (in years)	≤8 years	293	87,46	6,55	7,26	1,00	1,56
	>8 years	42	12,54	5,62	5,28	0,69	1,20
Dental care need	Not affirmed	173	51,64	3,39	4,33	0,40	0,97
	Affirmed	162	48,36	9,49	7,86	1,53	1,76
Dental pain	Not affirmed	276	83,69	5,18	5,67	0,75	1,22
	Affirmed	58	17,31	12,18	9,73	1,98	2,27
Total		335	100,00	6,41	7,05	0,96	1,53

Source: The authors.

Analysis of the residuals of the independent variables in both multivariate linear regressions demonstrated linearity of the parameters (OHIP-14 Severity  $r = 0,27$ ,  $p < 0,001$  / OHIP-14 Extension  $R = 0,15$ ,  $p < 0,001$ ), independence of terms (OHIP-14 Severity DW Test = 2,034 and OHIP-14 Extension DW test = 2,064, therefore acceptable result in both cases)<sup>24</sup> and absence of

collinearity (Tolerance > 0,10 and VIF < 10,00). However, there was no normality in the distribution of residues (OHIP-14 Severity KS = 0,076,  $p = 0,000$ , OHIP-14 Extension KS = 0,158,  $p = 0,000$ ) and analyzes showed heterocedasticity in the Pesarán-Pesarán Test ( $p < 0,000$ ; OHIP-14 Severity /  $p < 0,000$ ; OHIP-14 Extension).

**Table 2.** The severity, extent and prevalence of negative impacts according to the OHIP-14 dimensions reported by the elderly. Bauru, Brazil, 2015.

	Severity*	Extention**	Prevalence***		Cronbach Alpha
	Average (sd)	Average (sd)	n	%	
Functional limitation					
Pronounce	0,60 (1,14)	0,07 (0,26)	25	7,46	0,70
Taste	0,55 (1,22)	0,10 (0,30)	34	10,15	0,71
Physical pain					
Painful aching	0,53 (1,01)	0,05 (0,23)	18	5,37	0,71
Uncomfortable to eat	1,42 (1,55)	0,24 (0,43)	80	23,88	0,70
Psychological discomfort					
Self-conscious	1,01 (1,49)	0,18 (0,39)	62	18,51	0,69
Felt tense	0,45 (1,02)	0,06 (0,24)	20	5,97	0,69
Physical disability					
Diet	0,42 (0,96)	0,05 (0,23)	18	5,37	0,70
Interrupt meals	0,18 (0,60)	0,01 (0,09)	3	0,90	0,71
Psychological disability					
Difficult to relax	0,16 (0,57)	0,01 (0,09)	3	0,90	0,71
Embarrassed	0,76 (1,37)	0,14 (0,34)	46	13,73	0,69
Social disability					
Irritable	0,10 (0,47)	0,01 (0,08)	2	0,60	0,71
Usual jobs	0,04 (0,36)	0,01 (0,08)	2	0,60	0,72
Handicap					
Less satisfying life	0,11 (0,59)	0,02 (0,14)	7	2,09	0,70
Totally unable to function	0,06 (0,42)	0,01 (0,09)	3	0,90	0,77
<b>Total</b>	<b>6,39 (7,04)</b>	<b>0,94 (1,52)</b>	<b>149</b>	<b>44,48</b>	<b>0,77</b>

\* Values of OHIP-14.

\*\* Average answers for "fairly often" and "very often".

\*\*\* Number of participants and percentual who answered "fairly often" and "very often".

Source: The authors.

**Table 3.** Simple linear regression between OHIP-14 severity and extension with independent variables. Bauru, São Paulo State, Brazil, 2015.

	OHIP-14						
	Severity				Extension		
	$\beta$	95% CI	p-value	$\beta$	95% CI	p-value	
Sound teeth	-0,08	-0,05 0,01	0,16	-0,05	-0,21 0,08	0,36	
Missing teeth	0,03	-0,01 0,03	0,59	-0,01	-0,10 0,09	0,89	
Filled teeth	-0,05	-0,07 0,03	0,40	-0,04	-0,32 0,16	0,52	
Dental caries	0,07	-0,03 0,15	0,19	0,10	-0,04 0,78	0,08	
Clinical Attachment Loss	0,02	-0,15 0,23	0,71	0,03	-0,63 1,13	0,58	
Oral mucosal Lesion	0,09	-0,05 0,60	0,09	0,06	-0,63 2,35	0,26	
Dental prosthesis use	-0,01	-0,44 0,34	0,80	-0,04	-2,46 1,14	0,47	
Dental prosthesis need	0,19	0,28 0,98	0,01	0,18	1,13 4,38	0,01	
Sex	0,15	0,14 0,79	0,01	0,16	0,70 3,73	0,01	
Age (in years)	-0,17	-0,06 -0,01	0,01	-0,18	-0,27 -0,07	0,01	
Occupation	-0,15	-1,16 -0,21	0,01	-0,16	-5,57 -1,18	0,01	
School (in years)	-0,03	-0,20 0,12	0,62	-0,02	-0,85 0,59	0,72	
Dental care need	0,29	0,34 0,72	0,01	0,35	2,09 3,82	0,01	
Dental pain	0,18	0,19 0,76	0,01	0,26	1,91 4,49	0,01	

Source: The authors.

**Table 4.** Multivariate linear regression between the dependent variable Severity and Extention of OHIP-14 with the independent variables. Bauru, Brazil, 2015.

	$\beta$	95% CI		p-value	Colinearity		R <sup>2</sup>	R <sup>2</sup> adjusted	p-value
					Tolerance	VIF			
Severity	Constant	-1,49	13,45	0,12			0,26	0,24	<0,001
	Dental caries	0,10	-0,04	0,8	0,08	0,75	1,34		
	Missing teeth	0,10	-0,01	0,18	0,09	0,70	1,43		
	Dental prosthesis need	0,12	0,36	3,37	0,02	0,93	1,08		
	Age (in years)	-0,10	-0,19	0,00	0,05	0,90	1,11		
	Sex	0,19	1,33	4,09	0,01	0,94	1,06		
	Occupation	-0,15	-4,99	-1,01	0,01	0,95	1,05		
	Dental care need	0,30	1,70	3,38	0,01	0,91	1,09		
	Dental pain	0,21	1,45	3,83	0,01	0,96	1,04		
	Constant	-0,45	2,91	0,15				0,20	0,18
Extention	Dental caries	0,09	-0,02	0,17	0,11	0,75	1,34		
	Missing teeth	0,12	0,00	0,04	0,04	0,70	1,43		
	Dental prosthesis need	0,14	0,13	0,81	0,01	0,93	1,08		
	Age (in years)	-0,12	-0,05	0,00	0,02	0,90	1,11		
	Sex	0,18	0,23	0,85	0,01	0,94	1,06		
	Occupation	-0,15	-1,09	-0,20	0,01	0,95	1,05		
	Dental care need	0,24	0,25	0,63	0,01	0,91	1,09		
	Dental pain	0,14	0,10	0,64	0,01	0,96	1,04		

\*Backward multivariate linear regression (p<0.20)

Source: The authors.

## Discussion

Oral health-related quality of life research in the elderly through extension assessment was more sensitive to highlight the impact of the independent variables observed, despite of the minor determination coefficient (R<sup>2</sup>). It is reasonable to highlight that elders with less age and females were more sensitive to the negative impacts of oral health, also the not working elders. The perception of dental care need and dental pain also impacted both OHQoL impacts. The conditions related to tooth loss also showed negative impact in quality of life, for the missing teeth itself and dental prosthesis need.

The OHIP-14 severity carries the whole impact of a study, obviously related to a complete protocol in a quality of life investigation, nevertheless there is no cut point between impact and no impacted condition, therefore the higher determination coefficient (R<sup>2</sup>) does not surprise. An alternative to this methodologic discussion is the use of the extension concept, which highlight only the cases where the impact is effective, in this study represented by the answers “Fairly

often” and “Very often”. Despite the minor determination coefficient (R<sup>2</sup>), which is related to a partial protocol, the sensitive aspect is important to reveal stronger relation of quality of life perception to the independent variables as missing teeth in this study. Hence the OHIP-extension is a good alternative to OHIP-severity in the investigation of oral health related quality of life.

Only OHIP-14 extension was associated with missing teeth reinforcing the results of previous studies<sup>26</sup>. The indication of extracting the remaining teeth, and subsequently inserting dental prosthesis has been discussed, with the aim of ending a long period of dental pain. This would be a clinical and social decision<sup>(2)</sup> which has declined considerably in some countries<sup>27</sup>. Missing teeth is a serious health care failure denoting a shared responsibility between poor selfcare and the health care system that has been unable to promote the maintenance of minimally functional dentition. Therefore, there is obvious need for missing teeth prevention throughout life.

People with missing teeth, especially those who are edentulous, make inadequate food choices<sup>(28)</sup>; they may use inappropriate prosthesis and

also have a negative impact on oral health-related quality of life. In this study, the highest negative impact observed among the dimensions of the OHIP-14 instrument was on chewing, followed by concern and feeling ashamed of teeth, mouth or dentures, suggesting that the elderly attached greater importance to function and esthetics, aspects strongly related to missing teeth and the need for oral rehabilitation.

Direct consequences of the lack of maintenance of dental prosthesis were ulcerated lesions observed, probably related to recurrent traumas of poorly adapted prosthesis and fungi due to inadequate hygiene of removable prosthesis<sup>4</sup>. In both cases, incipient lesions do not cause pain or discomfort sensation at the hard palate or other oral areas investigated, therefore the absence of association with its perception in this study was understandable.

Untreated dental caries might be perceived in children<sup>29</sup>, adolescents<sup>14</sup>, and in older persons<sup>3</sup>, but in this study this disease was not perceived directly. The hypothesis we considered is that the remaining teeth of the elderly usually present dental caries in chronic stage, therefore associated to the tertiary dentine formed from the stimulus of dental caries to protect the pulp, minimizing the pain sensitivity. The impact of dental caries on the elderly has been evaluated before with DMFT<sup>31</sup>, but this observed impact did not consider carious teeth without treatment alone, but added to the restored and missing teeth, which represents the larger part of the DMFT index in this age group because of the extensive missing teeth. Even though, public policies for treatment and to combat the incidence of tooth decay and root caries since adulthood<sup>6</sup> should also be of concern to policy-makers to maintain tooth in elderly population, and in acceptable conditions.

The clinical attachment loss greater than 4 millimeters was not directly associated with OHIP-14 in this study, unlike the situation observed with data from SB Brazil Project 2010<sup>18</sup>, which used the Oral Impacts in Daily Performances (OIDP) instrument for the age group (65-74 years). In the elderly with a mean age of 67,02 years (5,81), a Swedish study used the OHIP-14 instrument and observed a negative impact related to the need for complex periodontal treatment, and at an age of less than 70 years<sup>32</sup>. Periodontal disease in adults has been associated with a negative impact on oral health-related quality of life, and its treatment has a positive effect<sup>33</sup>, but there are fewer studies with persons from the age of 75 and over, making it difficult

to contextualize the reduction in the impact on function with advancing age<sup>34</sup>.

The concept that the elderly present a low negative impact on oral health-related quality of life because they have adapted themselves to the difficulties of their oral condition after many years of life was supported by our results<sup>34</sup>. The elderly over the age of 74 years presented diminished negative perception of oral health-related quality of life, despite their oral conditions represented by significant tooth loss, and remaining teeth (when present) with treatment needs such as dental caries, clinical attachment loss, and oral rehabilitation needs. The perception of pain of dental origin and the need for self-reported treatment corroborated the concept that oral health-related quality of life was mediated by the clinical condition, which in turn was influenced by sociodemographic determinants<sup>31</sup>, confirmed in our results by the variables age, sex and occupation.

The female sex presented an association with higher impact on oral health-related quality of life, corroborating an earlier study<sup>35</sup>. Female sensitivity relative to oral health needs is higher than it is in men<sup>36</sup>, they more frequently seek dental treatments, for example, making them more vulnerable to tooth loss<sup>5</sup>. Thus, it was expected to find a higher negative impact on the elderly women.

Most of the elders wasn't working<sup>37</sup>, nevertheless occupation was an independent variable associated with the positive impact on oral health-related quality of life in the elderly. Nowadays, the elderly are increasingly engaged in work at home and even in formal jobs, socially justifying the investment in oral health care for the elderly, because with the improvement of their oral condition, elderly persons enjoy increased self-esteem and active social contact, contributing to the development of domestic labor activities or even employment<sup>38</sup>, it relates with the active aging.

Schooling is an important sociodemographic determinant and its association with oral health-related quality of life has been demonstrated in a previous study<sup>31</sup>, nevertheless this was not supported by our results.

In the multivariate regression model, there was no direct significance of dental caries, clinical attachment loss, and mucosal lesions, although all these questions presented high OHIP-14 values. Therefore, it was not surprising that the perception of dental pain (17,31%) and the dental care need (48,36%) were statistically significant in the multivariate regression model, since they harbored the perception of dental pain and the treat-



ment needs that the elderly persons presented in their complex oral condition. Pain of dental origin is common among the elderly and increases with age, and the higher the number of teeth kept in the mouth<sup>39</sup>. Thus, the remaining teeth of the elderly usually present complex dental care needs at this stage of life<sup>40</sup>, which is a separate challenge to health managers.

The limitations of this study may be related to the cross-sectional design used, as it would be desirable for studies on oral health-related quality of life to be conducted with longitudinal model. However, the oral health condition and the social determinants of the elderly do not change much over the course of time; the important amplitude in the age-range from 65 to 101 years was outstanding, favoring this logic. Nevertheless, it is important to affirm that this was a cross-sectional research and the objectives of this study design were well satisfied. Another limitation would be to consider the external validity of the study compromised, because the research was carried out in a single municipality. However, for the survey conducted in Bauru (where the data from the study came from), a city in the interior of the state of São Paulo, the DMFT index was 28,79 (5,53) and for the state of São Paulo<sup>(41)</sup> not in the same year - it was 28.22 (0,17). For these studies, similar values were also observed for other variables, such as, for example: “no need for maxillary dental prosthesis - 23,15%” in the present study, and 24,21% for the State of São Paulo in 2015. Therefore, the present study presented good potential for generalization and reasonable acceptable results.

Other limitations might be considered as many individual and contextual determinants could be included at the model performed in this study, nevertheless it was not plenty collect-

ed / included in this paper. Alcohol consumption and smoking habits may influence mucosal lesion prevalence as these behaviors are considered related to the incidence of pre-cancer/cancer lesions in vermilion zone of the lips and in oral mucosa<sup>3, 42</sup>. Also, these behaviors might be associated to dental caries, periodontal disease and tooth loss. The use of medication might influence saliva production and quality contributing to the incidence of dental caries and periodontal disease and compromising the dental prosthesis stability<sup>3</sup>. Hence, these conditions might also influence quality of life, nevertheless not part of this study.

In view of the increase in the elderly population and its important oral health needs, some actions should be taken, such as the inclusion of geriatric courses in dentistry undergraduate courses and strengthening of the public services in favor of health care of the elderly. Future studies should address, preferably in prospective type, not only relating oral health condition to quality of life, but also relating research and satisfaction of dental care, cases in which there is loss of cognition, motor capacity and frailty, and with focus on educational and preventive programs targeting the elderly and their caregivers.

## Conclusions

The negative impact diminished as the older persons aged, and females seemed to be more sensitive to this negative impact. Having an occupation at an older age suggested a positive impact, and the self-reported dental care need and dental pain showed negative impact. Therefore, these conclusions reinforce the need for oral health promotion throughout life cycles to favor oral health of the elderly.

## Collaborators

RS Bastos contributed to the conception and design, acquisition, analysis, and drafted the manuscript. JRP Lauris and JRM Bastos critically revised the manuscript. SRM Velasco, D Fogger-Teixeira and LM Sá contributed to the acquisition of data and critically revised the manuscript. All the authors gave the final approval.

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