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Frailty and oral health-related quality of life in community-dwelling older adults: a cross-sectional study

Roosevelt Silva BASTOS[a]
Leticia Marques SÁ[a]
Sofia Rafaela Maito VELASCO[b]
Debora Foger TEIXEIRA[c]
Larissa Sanches PAINO[d]
Mario Vianna VETTORE[e]

[a]Universidade de São Paulo – USP, Bauru School of Dentistry, Department of Pediatrics Dentistry, Orthodontics and Public Health, Bauru, SP, Brazil.

[b]Universidade de São Paulo – USP, Public Health School, Department of Epidemology, São Paulo, SP, Brazil.

[c]Universidade de São Paulo – USP, Bauru School of Dentistry, Department of Stomatology, Bauru, SP, Brazil.

[d]Universidade de São Paulo – USP, Bauru School of Dentistry, São Paulo, SP, Brazil.

[e]University of Agder - UiA, Department of Health and Nursing Sciences, Agder, Norway.

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Corresponding Author:
Roosevelt Silva Bastos
E-mail: rtbastos@usp.br

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Abstract: Poor oral health has been associated with frailty among older adults. However, limited evidence has been available on whether frailty can affect oral health-related quality of life (OHRQoL) in older adults. This study aimed to investigate the relationship between frailty and OHRQoL among community-dwelling older adults. A household-based cross-sectional study involving community-dwelling older adults aged 65 years and older was conducted in the city of Bauru, Brazil. Data on frailty status, sociodemographic characteristics, self-perceived dental care needs, and OHRQoL (OHIP-14) were collected through individual interviews. The use of and the need for total dental prostheses were assessed through clinical examinations. Logistic regression was used to determine whether frailty status and covariates were associated with OHRQoL prevalence measures (OHIP-14 total score ≥ 1 and OHIP-14 fairly/very often ≥ 1). The sample comprised 334 participants, among whom 58.7% and 41.3% were between 65–74 and 75–102 years old, respectively. The prevalence of moderate to severe frailty was 12.3%. Moderate to severe frailty (OR = 4.49; 95%CI 1.29–15.66), the need for lower dental prosthesis (OR = 2.20; 95%CI 1.27–3.81), and self-perceived dental care need (OR = 3.90; 95%CI 2.14–7.14) were associated with OHIP-14 total score ≥1. Moderate to severe frailty (OR = 2.95; 95%CI 1.33–6.55), being female (OR = 2.24; 95%CI 1.34–3.75), and self-perceived dental care need (OR = 4.80; 95%CI 2.86–8.03) were associated with OHIP-14 fairly/very often ≥1. Overall, our results showed that moderate to severe frailty was significantly associated with poor OHRQoL in community-dwelling older adults.

Keywords: Frailty; Oral Health; Aged; Quality Of Life

Introduction

The demographic distribution of the global population has been experiencing a shift because of the declining birth rates combined with greater life expectancy, resulting in an increase in the population of older adults.[1,2] The demographic transition in Brazil suggests a steady increase in the proportion of people aged 65 years or older from 7.3% in 2010 to 9.8% in 2020, with estimates projecting that such a figure could reach 25.5% by the year 2060.[3]

Although both aging and frailty commonly occur concomitantly, frailty should be differentiated from the aging process.[4] Frailty has been defined as "unintentional weight and muscle loss, exhaustion, and declines in grip strength, gait speed, and activity."[5] This frequently represents an individual's state of vulnerability across several dimensions.[6] Frailty is a strong predictor of functional decline, falls, hospitalization, disability, and ultimately death.[7] Thus, frail individuals need particularly more long-term primary health care.[8]

Cross-sectional[9,10] and longitudinal studies[11] have associated poor oral health conditions with frailty among the elderly. Overall, the oral health of older adults can be characterized by extensive tooth loss, with the remaining natural teeth usually being unsound.[12,13] Moreover, the elderly generally need dental care (e.g., dental prosthesis) and experience toothache.[12] Nearly half of older adults living in the state of São Paulo in 2015 required upper (49.0%) and lower full dentures (49.4%).[12] Furthermore, dental extractions (18.8%) and dental pain (5.6%) comprised the primary reasons for dental appointments in this age group.[14] Studies have shown that edentulism can be a predictor of all-cause mortality in older adults,[15] whereas poor oral health might increase the risk of frailty among older male adults.[16] Moreover, evidence suggests that oral frailty might be associated with social and physical function in community-dwelling older adults[9] and that poor oral health and sociodemographic characteristics can negatively impact oral health-related quality of life (OHRQoL) in older adults.[17,18,19]

OHRQoL is a multidimensional construct that assesses the individual's perceptions regarding the impact of oral health on functional status (e.g., chewing and speaking), pain and discomfort, social interaction, psychological disability, and social interaction.[20,21] Epidemiologic studies on the predictors of OHRQoL suggest that dental clinical measures, demographics, and socioeconomic status are relevant factors related to OHRQoL among older adults.[12,19,22]

Poor quality of life has been associated with frailty.[23] Hence, interventions aimed at mitigating and even preventing frailty have the potential to improve the quality of life of community-dwelling older adults.[24] Previous studies have shown that older adults experience poor OHRQoL.[12,19,21] However, the possible influence of frailty on OHRQoL among older adults remains unclear. Therefore, the present study aimed to investigate whether frailty, sociodemographic factors, dental clinical measures, and self-perceived dental care needs were associated with OHRQoL among community-dwelling older adults. This study tested the hypothesis that community-dwelling older adults with frailty were more likely to report poor OHRQoL even after adjusting for sociodemographic factors, dental clinical measures, and self-perceived dental care needs.

Methodology

Ethics

This study was approved by the Research Ethics Committee of Bauru School of Dentistry, University of São Paulo (CAAE 37043414.2.0000.5417) and was conducted following the Helsinki Declaration of 1975.

Study design and population

A household-based cross-sectional study was conducted in 2015 in the city of Bauru, São Paulo State, Brazil. Bauru is a developed and affluent city according to Human Development Index (HDI-M = 0.801) with 343,937 inhabitants as of 2010. Among them, 6.9% aged 60–69 years, whereas 6.2% aged 70 years or older. Among the 60–69 years and 70 years or older age groups, 56.0% and 60.5% were female, respectively. Twenty-five public Primary Health Care units in the city are funded by the Brazilian National Healthcare System. This study was presented following the Strengthening the Reporting of Observational Studies in Epidemiology guidelines.[25]

Pilot study and sample size calculation

A pilot study involving 35 older adults aged 65 to 74 years was conducted at the Vila Dutra Public Health Clinic to assess the data collection methods and estimate the study's sample size. The Edmonton Frail Scale (EFS)[4] and the Oral Health Impact Profile (OHIP-14) were completed twice at an interval of 14 days. The prevalence of moderate to severe frailty and OHIP-14 total score

≥ 1 was 16.2%. The sample size of 334 older adults was calculated on the basis of a 16% prevalence of poor OHRQoL (OHIP total score ≥ 1), with 90% power and 5% Type I error probability to detect 15% of the differences between participants with and without moderate to severe frailty.

Participants and data collection

Adults aged 65 years and older living at the central, southern, western, eastern, and northern areas of the city covered by the 15 public Primary Healthcare Units were invited to participate. Those with cognitive difficulties that impaired their understanding of the questions were excluded. Data were collected at the participant's households through individual interviews and oral examinations.

Oral health-related quality of life

OHRQoL was assessed using the Brazilian version of the OHIP-14 questionnaire.[26] All 14 items grouped into seven domains, that is functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap, measured the impact of oral health on quality of life during the last 6 months. The OHIP-14 is based on a four-point Likert scale (0 = Never, 1 = Hardly ever, 2 = Occasionally, 3 = Fairly often, and 4 = Very often). The final score can range from 0 to 56, with higher scores indicating worse OHRQoL. The prevalence of any impact on OHRQoL (OHIP-14 total score = 0 vs. ≥1) and the prevalence of one or more items indicating "fairly often" or "very often" (OHIP-14 fairly/very often = 0 vs. ≥1) were used as the outcome measures. The former OHRQoL outcome measure assesses the prevalence of oral impacts according to all possible response options (1–4),[27] whereas the latter measure accounts for the prevalence of severe oral impacts by considering only response options 3 (fairly) and 4 (very often).[28]

Frailty

The EFS[4] validated for the Brazilian population was used to assess participant's frailty.[29] The EFS comprises with 11 items grouped into the following nine domains: a) Cognition, placing numbers in the correct position in a predrawn circle to represent a clock and then placing the hands to indicate a time of "ten after eleven" (0 = no errors, 1 = minor spacing errors, 2 = other errors); b) general health status, number of times admitted to a hospital over the last year (0, 1–2, and ≥2) and self-rated general health (0 = excellent/very good/good, 1 = fair, 2 = poor); c) functional independence, the number of daily activities with which the respondent needs help, including meal preparation, shopping, transportation, telephone, housekeeping, laundry, managing money, and taking medications (0 = 0–1, 1 = 2–4, 2 = 5–8); d) social support, person informed whether he/she can count on someone when needing help with meeting his/her needs (0 = always, 1 = sometimes, 2 = never); e) medication use, five or more different prescriptions on a regular basis (0 = no, 1 = yes) and forgetting to use medications (0 = no, 1 = yes); f) nutrition, losing weight that the clothing has become looser (0 = no, 1 = yes); g) mood, often feeling sad or depressed (0 = no, 1 = yes); h) continence, losing control of urine (0 = no, 1 = yes); and i) functional performance, time between sitting in a chair (the knee joint angle usually > 90° of flexion) with back and arms resting, standing up, walking nearly 3 m, returning to the chair and sitting down (0 = 0–10 s, 1 = 11–20 s, 2 = >20 s). Respondents were classified into the following five categories on the basis of their final scores: 0–4 (no frailty), 5–6 (apparently vulnerable), 7–8 (mild frailty), 9–10 (moderate frailty), and ≥ 11 (severe frailty).[29] Three categories were used in this study: no frailty/apparently vulnerable (0–6 scores), mild frailty (7–8), and moderate to severe frailty (≥ 9).

Covariates

The covariates included sociodemographic characteristics, such as age (0 = 65 to 74 years, 1 = 75 years and older); sex (0 = male, 1 = female); monthly family income (0 = up to two minimum wages [MW], 1 = three or more MW); educational attainment (0 = up to 8 years of schooling, 1 = 9 or more years of schooling); employment status (0 = not working, 1 = working); and marital status (0 = single/widow/divorced, 1 = married).

Dental clinical status was assessed according to the use of and the need for upper and lower

dental prostheses. Data on use of dental prosthesis were originally coded as follows: 0 = no dental prosthesis, 1 = bridge, 2 = more than one bridge, 3 = partial denture, 4 = both bridge (s) and partial denture(s), and 5 = full removable denture. Use of dental prosthesis was categorized as follows: 0 = no use of dental prosthesis or 1 = use of one more dental prosthesis for analytical purposes. The need for dental prostheses was categorized as follows: 0 = no need for dental prosthesis, 1 = need for a one-unit dental prosthesis (one tooth replacement), 2 = need for a multiunit dental prosthesis (more than one tooth replacement), 3 = need for a combination of one and/or multiunit prostheses, and 4 = need for a full prosthesis (replacement of all teeth). The need for dental prostheses was categorized as follows: 0 = no need for dental prostheses or 1 = need for one or more dental prostheses. Self-perceived dental care needs were categorized as follows: 0 = no and 1 = yes.

Statistical analysis

The frequencies of frailty, sociodemographic characteristics, dental clinical measures, and self-perceived dental care needs were determined for the entire sample and calculated according to absolute (n) and relative frequencies (%), mean (standard deviation; SD), and median and mode of OHRQoL outcomes (OHIP-14 total score; OHIP-14 fairly/very often). Comparisons of independent variables between OHRQoL groups were performed using the chi-square test.

Crude logistic regression was carried out between frailty, each covariate, and OHRQoL outcomes (OHIP-14 total score; OHIP-14 fairly/very often). Hierarchical multivariable logistic regression models using the Wald stepwise backward procedure were used to determine the relationship between frailty and covariates and OHRQoL outcomes according to four blocks (Figure): Frailty (block 1), sociodemographic characteristics (age, sex, monthly family income, educational attainment, occupation, and marital status) (block 2), dental clinical status (use of and need for upper and lower dental prostheses) (block 3), and self-perceived dental care needs. Variables with a p value of < 0.20 during unadjusted analyses were included in the adjusted logistic regression. Variables included in the multivariable

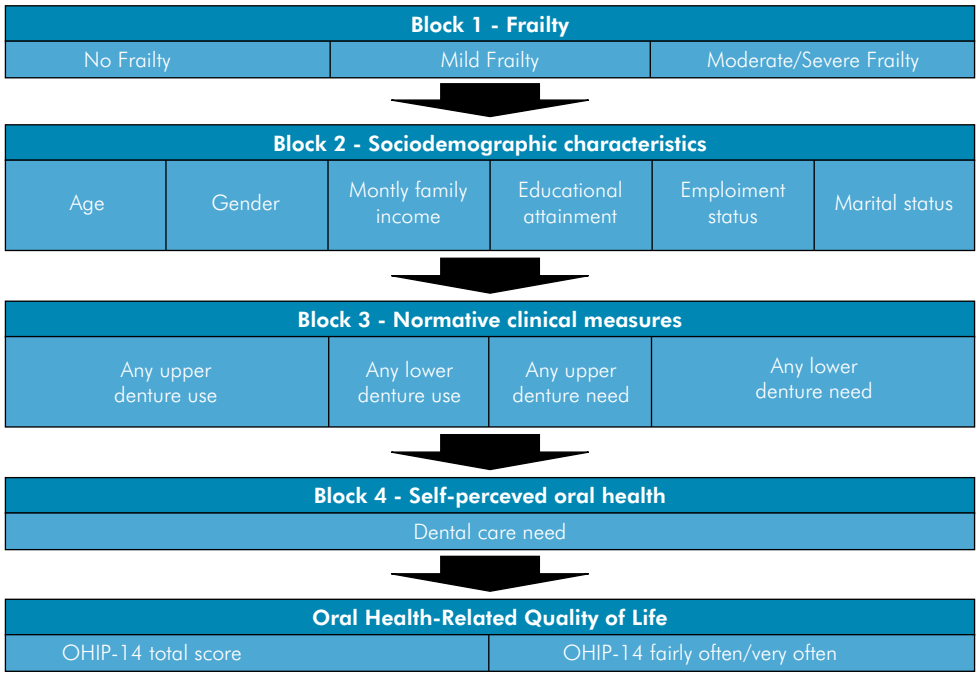

Figure 1. Theoretical conceptual model concerning frailty impact on OHRQoL of the community-dwelling older adults.

analysis were frailty, sex (only for OHIP-14 fairly/very often ≥ 1), employment status, upper dental prosthesis need (only for OHIP-14 fairly/very often), lower dental prosthesis need, and self-perceived dental care need (only for OHIP-14 total score ≥ 1). The significance level established for multivariable analysis was set at 5% ($p \leq 0.05$). Data were analyzed using SPSS v.24 (IBM, New York, USA).

Cronbach's alpha coefficient was used to evaluate the internal consistency of the EFS and OHIP-14 questionnaires.[30] Values above 0.60 (substantial/almost perfect) were considered acceptable as suggested by Landis and Koch.[31] Confirmatory factor analysis was used to confirm the associations between the multidimensional variables (EFS and OHIP-14) and their observed measures (items). The quality of logistic regression models was assessed by testing the multicollinearity of independent variables according to the variance inflation factor (VIF) using linear regression procedure and by the Hosmer and Lemeshow test concurrently with logistic regression to evaluate observed and predicted frequencies ($p > 0.05$). These quality procedures were performed using SPSS v.24 (IBM, New York, USA).

Results

Initially, 338 older adults agreed to participate. The interviews or dental examinations of three participants were not concluded as requested by them. Another participant who had incomplete dataset information was also excluded. Thus, the studied sample comprised 334 community-dwelling older adults representing the following areas: central (69; 20.66%), southern (41; 12.28%), western (105; 31.14%), eastern (18; 5.39%), and northern (102; 30.54%) areas. Among them, 196 (58.7%) aged 65–74 years, whereas 138 (41.3%) aged 75 and older. Moreover, 56% of the participants were women, 87% had up to 8 years of educational attainment, and 56% lived with his/her partner or family members. The prevalence of the use of upper and lower dental prostheses was 76.0% and 49.4%, respectively. The majority of the participants needed lower (57.8%) and upper dental prosthesis (65.0%), whereas 48% reported needing dental care.

The prevalence of moderate to severe frailty was 12.3%. Participants with moderate to severe frailty consisted mostly of adults aged 75 years and older (58.5%); women (78.0%); those from low-income families (95.1%); those with educational attainment up to 8 years (92.7%); nonworking individuals (82.9%); and single, widow, or divorced individuals (51.2%). The prevalence of the use of upper and lower dental prostheses among those with moderate to severe frailty was 70.7% and 41.5%, respectively. The prevalence of the need for upper and lower dental prostheses among those with moderate to severe frailty were 75.6% and 85.4%, respectively. Nearly 44% of the older adults with moderate to severe frailty reported needing dental care.

The prevalence of OHIP-14 total score ≥1 and OHIP-14 fairly/very often ≥1 among older adults with moderate to severe frailty were 14.9% and 18.8%, respectively. Older adults reporting poor OHRQoL (OHIP-14 total score ≥ 1 and OHIP-14 fairly/very often ≥ 1) were predominantly between 65 and 74 years of age, females, from low-income families, poorly educated, not working, and married. The use of upper and lower dental prostheses was higher among older adults with better OHRQoL (OHIP-14 total score = 0 and OHIP-14 fairly/very = 0) than among those with poor OHRQoL. The need for upper and lower dental prostheses and self-perceived dental care needs were more common among those with poor OHRQoL (OHIP-14 total score ≥ 1 and OHIP-14 fairly/very often ≥ 1) (Table 1).

Cronbach's alpha coefficients of the OHIP-14 and EFS were 0.77 and 0.70, respectively. Confirmatory factor analysis assessed the construct validity concerning the multidimensionality of the EFS and OHIP-14 questionnaires. The item loadings for the OHIP varied from 0.243 (item 2) to 0.615 (item 10). EFS item loading ranged from 0.021 (item 5) to 0.668 (item 4). The *p* values of the item loadings were <0.05, except for item 5 of the EFS questionnaire (Table 2).

Table 3 presents the unadjusted analysis of the relationship between frailty, sociodemographic characteristics, dental clinical measures, and self-perceived dental care needs and OHRQoL outcomes. Accordingly, the unadjusted analysis

Table 1. Distribution of frailty, sociodemographic characteristics, dental clinical measures, and self-perceived dental care needs according to oral health-related quality of life outcomes among community-dwelling older adults.

Variable	OHIP-14	OHIP-14 total score			OHIP-14 fairly/very often		
		Zero	≥1	p-value*	Zero	≥1	p-value*
	N (%); Mean (SD); Median; Mode	n (%)	N (%); Mean (SD); Median; Mode		n (%)	N (%); Mean (SD); Median; Mode	
No frailty/apparently vulnerable	240 (71.9); 5.9(6.7); 4; 0	62 (78.5)	178 (69.8);7.9(6.7);6;2	0.03	142 (76.3)	98 (66.2);11.3(7.1);10;4	0.01
Mild	53 (15.9);7.0(7.8);4;0	14 (17.7)	39 (15.3);9.5(7.7);7;4		31 (16.7)	22 (14.9);13.0(7.7);10;10	
Moderate to severe	41 (12.3);9.0(7.4);8;6	3 (3.8)	38 (14.9);9.7(7.2);8;6		13 (7.0)	28 (18.9);11.8(7.3)10;10	
Age							
65–74 years	196 (58.7);7.3(7.9);5;0	45 (57.0)	151 (59.2)9.5(7.7);7;4	0,7	102 (54.8)	94 (63.5);12.8(7.8);11;7	0.12
75 years or older	138 (41.3); 5.2(5.5);4;0	34 (43.0)	104 (40.8);6.8(5.3);5.5;4		84 (45.2)	54 (36.5);9.7(5.8);8;4	
Sex							
Male	145 (43.4);5.2(6.1);4;0	40 (50.6)	105 (41.2);7.2(6.2);6;2	0.15	93 (50.0)	52 (35.1);10.8(6.8);8;7	0.01
Female	189 (56.6);7.4(7.6);5;0	39 (49.4)	150 (58.8);9.3(7.4);7;4		93 (50.0)	96 (64.9);12.1(7.4);10;4	
Monthly family income							
Up to 2 MW	278 (83.2);6.6(7.2);4;0	64 (81.0)	214 (83.9);8.6(7.1);6;4	0.61	150 (80.6)	128 (86.5);11.8(7.2);10;4	0.19
3 MW or more	56 (16.8);5.4(6.3);4;0	15 (19.0)	41 (16.1);7.3(6.3);6;6		36 (19.4)	20 (13.5);10.9(7.4);8;7	
Educational attainment							
Up to 8 years	292 (87.4);6.5(7.3);4;0	72 (91.1)	220 (86.3);8.7(7.2);6;4	0.33	158 (84.9)	134 (90.5);11.8(7.4);10;4	0.14
9 years or more	42 (12.6);5.6(5.3);4.5;0	7 (8,9)	35 (13.7);6.7(5.1);6;4		28 (15.1)	14 (9.5);10.4(5.5);8.5;4	
Employment status							
Not working	270 (80.8);5.6(6.1);4;0	69 (87.3)	201 (78.8);7.5(5.9);6;4	0.10	159 (85.5)	111 (75.0);10.4(6.1);8;4	0.02
Working	64 (19.2);10.1(9.4);8;0	10 (12.7)	54 (21.2);12.0(9.1);10;8		27 (14.5)	37 (25.0);15.5(8.8);13;16	
Marital status							
Single, widow, divorced	146 (43.7);6.8(7.1);4;0	30 (38.0)	116 (45.5);8.6(7.0);6;4	0.25	76 (40.9)	70 (47.3);11.5(7.1);10;4	0.27
Married	188 (56.3);6.1(7.0);4;0	49 (62.0)	139 (54.5);8.3(7.0);6;4		110 (59.1)	78 (52.7);11.8(7.4);10;12	
Upper dental prosthesis use							
No	80 (24.0);6.7(6.3);6;0	15 (19.0)	65 (25.5);8.2(6.0);6;6	0.29	39 (21.0)	41 (27.7);10.7(6.2);9;4	0.16
Yes	254 (76.0);6.4(7.3);4;0	64 (81.0)	190 (74.5);8.5(7.3);6;4		147 (79.0)	107 (72.3);12.0(7.6);10;4	
Lower dental prosthesis use							
No	169 (50.6);6.9(6.8);4;0	30 (38.0)	139 (54.5);8.4(6.6);6;2	0.14	81 (43.5)	88 (59.5);11.0(6.8);9;4	0.01
Yes	165 (49.4);6.0(7.3)4;0	49 (62.0)	116 (45.5);8.5(7.4);6;2		105 (56.5)	60 (40.5);12.6(7.8);11;11	

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Upper dental prosthesis need							
No	141 (42.2);4.9(6.6);3;0	46 (58.2)	95 (37.3);7.2(6.9);5;4	0.01	97 (52.2)	44 (29.7);10.9(7.9);9.5;6	0.01
Yes	193 (57.8);7.6(7.2);6;0	33 (41.8)	160 (62.7);9.2(6.9);7;4		89 (47.8)	104 (70.3);12.0(6.9);10;4	
Lower dental prosthesis need							
No	117 (35.0);4.7(6.5);2;0	43 (54.4)	74 (29.0);7.4(6.9);6;2	0.01	84 (45.2)	33 (22.3);11.3(7.9);11;11	0.01
Yes	217 (65.0);7.4(7.2);6;0	36 (45.6)	181 (71.0);8.8(7.0);7;4		102 (54.8)	115 (77.7);11.7(7.1);10;4	
Self-perceived dental care need							
No	173 (51.8);3.5(4.6);2;0	61 (77.2)	112 (43.9);5.4(4.7);4;4	0.01	126 (67.7)	47 (31.8);8.3(5.9);7;4	0.01
Yes	161 (48.2);9.6(7.9);8;0	18 (22.8)	143 (56.1);10.8(7.5);9;6		60 (32.3)	101 (68.2);13.2(7.3);12;8	
Total	334 (100.0);6.4(7.1)4;0	79 (100.0)	255 (100.0);8.4(7.0);6;4		186 (100.0)	148 (100.0);11.7(7.2);10;4	

*Qui-square test.

showed that moderate to severe frailty, the use of lower dental prosthesis, the need for lower and upper dental prostheses, and self-perceived dental care needs were significantly associated with OHIP-14 total score ≥ 1 and OHIP-14 fairly/very often ≥ 1). The prevalence of OHIP-14 fairly/very often ≥1 was also associated with female sex and employment status (Table 3).

Moderate to severe frailty remained significantly associated with both OHRQoL outcomes in the adjusted analyses. Older adults with moderate to severe frailty were more likely to report at least one impact on OHRQoL (odds ratio = 4.49, 95% CI 1.29–15.66) and one or more impacts on OHRQoL fairly/very often (odds ratio = 2.95, 95%CI 1.33–6.55). Moreover, self-perceived dental care needs were associated with both OHRQoL outcomes. Participants needing lower dental prosthesis had higher odds of reporting at least one impact on OHRQoL. Women were more likely to report one or more impacts on OHRQoL fairly/very often (Table 4).

No differences were noted between the observed and predicted frequencies according to the Hosmer and Lemeshow test in the adjusted logistic regressions ($p > 0.05$). Moreover, the VIF values of less than 10 suggested the absence of multicollinearity.

Discussion

The present findings suggest that moderate to severe frailty was associated with poor OHRQoL among community-dwelling Brazilians aged 65 years and older. Our results also suggest that female sex, working status, the need for lower dental prosthesis, and self-perceived dental care needs were more likely to be associated with poor OHRQoL. These findings highlight the importance of oral health in frailty among older adults, which should be of paramount interest to oral health professionals and policymakers, especially those involved in providing primary dental care for this age group.

The prevalence of frailty in older persons may vary significantly between populations. A systematic review showed that frailty varied from 4.0% to 59.1% in the elderly, that the overall weighted prevalence was 10.7%, and that frailty increases with age and is more common in females.[32] The prevalence of moderate to severe frailty in our study was 12.3%. Moderate to severe frailty was higher among participants aged 75 years and older and in women (73.2%), which is consistent with previous studies.[32]

Frailty is a challenging process for older adults' oral health demands given that they may postpone dental visits because of the poor perception of oral health

Table 2. Confirmatory factor analysis of each OHIP-14 total score and EFS multidimensional variables.

OHIP-14 total score			EFS		
	Item	β*		Item	β**
1	Pronouncing any words	0.432	1	Cognition	0.301
2	Sense of taste	0.243	2	Hospital last year	0.248
3	Painful aching	0.341	3	Health description	0.311
4	Uncomfortable to eat any foods	0.468	4	Functional independence	0.668
5	Self-conscious	0.584	5	Social support	0.021
6	Felt tense	0.560	6	Five or more medications	0.318
7	Diet been unsatisfactory	0.430	7	Forget medications	0.201
8	Interrupt meals	0.490	8	Nutrition	0.192
9	Difficult to relax	0.599	9	Mood	0.288
10	Embarrassed	0.615	10	Continence	0.342
11	Irritable with other people	0.400	11	Functional performance	0.597
12	Difficult doing your usual jobs	0.376			
13	Less satisfying	0.611			
14	Totally unable to function	0.421			

* OHIP-14 total score (all items, $p < 0.05$); ** EFS (items 1–4, $p < 0.05$; item 5; $p > 0.05$; items 6–11, $p < 0.05$.)

needs. Hence, dental infections and inflammation may be aggravated among older people, resulting in worse oral health and obviously promoting a negative self-assessment of their oral health and OHRQoL.[33] A compromised oral health statuses may also contribute to the frailty process given the associated consequences, such as oral hygiene difficulties, chewing problems and malnourishment,[34,35] and sarcopenia.[36,37] The intercorrelation between these conditions suggests the existence of a complex net evolving frailty, oral health, and OHRQoL in older adults.[33] Moreover, a two-way relationship must be acknowledged considering that poor oral health might be a predictor of frailty in older adults and that fragility can also influence older adult's oral health and consequently OHRQoL.

The association between moderate to severe frailty and poor OHRQoL demonstrates the importance of frailty in the daily lives of community-dwelling older adults. The accumulation of risks throughout life may promote the concomitant occurrence of different chronic diseases, such as coronary heart disease, arthritis, chronic lung disease, and dental disease, which negatively impact the psychological wellbeing of the elderly.[38] Therefore, achieving good oral health among the elderly might be challenging given the accumulation of risks across the life span that may result in pain, discomfort, and bad breath due to oral diseases, such as dental caries, periodontal disease, and tooth loss.[12,18,19] Frail older adults experience more difficulties in maintaining sound oral health because of the associated functional and subjective limitations. One study found that perception of dental care needs was significantly associated with poor OHRQoL, reinforcing the importance of oral health promotion and adequate utilization of dental services throughout life.[21,39] Moreover, the present study showed that normative dental care needs assessed through the need for dental prosthesis were associated with frailty among older adults[40] and increased likelihood of poor OHRQoL.

Previous studies have shown that lower dental prosthetic needs were associated with frailty in older adults[40] and the negative impact of dental needs on OHRQoL in older adults.[12] Extensive tooth loss is a common condition in this age group.[41] However, upper dental prosthesis is usually more functionally and aesthetically acceptable than lower dental prosthesis given that the former allows for greater retention of the remaining alveolar bone.

Table 3. Unadjusted logistic regression analysis for the association between frailty, sociodemographic characteristics, dental clinical measures, and self-perceived dental care needs and oral health-related quality of life in community-dwelling older adults.

Variable	OHIP-14 total score*				OHIP-14 fairly/very often*			
	OR	95%CI		p-value	OR	95%CI		p-value
		Inferior	Superior			Inferior	Superior	
Frailty								
No frailty/apparently vulnerable	–				–			
Mild	0.97	0.49	1.91	0.93	1.03	0.56	1.88	0.93
Moderate to severe	4.41	1.32	14.80	0.02	3.12	1.54	6.33	0.01
Age								
65–74 years	–				–			
75 years or older	0.91	0.55	1.52	0.72	0.70	0.45	1.09	0.11
Sex								
Male	–				–			
Female	1.47	0.88	2.43	0.14	1.85	1.19	2.88	0.01
Monthly family income								
Up to 2 MW	–				–			
3 MW or more	0.82	0.43	1.57	0.55	0.65	0.36	1.18	0.16
Educational attainment								
Up to 8 years	–				–			
9 years or more	1.64	0.70	3.84	0.26	0.59	0.30	1.17	0.13
Employment status								
No working	-				-			
Working	1.85	0.90	3.84	0.10	1.96	1.13	3.41	0.02
Marital status								
Single, widow, divorced	–				–			
Married	0.73	0.44	1.23	0.24	0.77	0.50	1.19	0.24
Upper dental prosthesis use								
No	–				–			
Yes	0.69	0.37	1.29	0.24	0.69	0.42	1.15	0.15
Lower dental prosthesis use								
No	–				–			
Yes	0.51	0.31	0.86	0.01	0.53	0.34	0.82	0.01
Upper dental prosthesis need								
No	–				–			
Yes	2.35	1.40	3.93	0.01	2.58	1.63	4.06	0.01
Upper dental prosthesis need								
No	–				–			
Yes	2.92	1.74	4.91	0.01	2.87	1.77	4.65	0.01
Dental care need								
No	–				–			
Yes	4.41	2.46	7.88	0.01	4.71	2.96	7.52	0.01

*$p < 0.05$

Table 4. Adjusted logistic regression analysis for the association between frailty, sociodemographic characteristics, dental clinical measures, and self-perceived dental care needs and oral health-related quality of life in community-dwelling older adults.

Variable	OHIP-14 total score*				OHIP-14 fairly/very often*			
	OR	95%CI		p-value	OR	95%CI		p-value
		Inferior	Superior			Inferior	Superior	
Frailty								
No frailty/apparently vulnerable	–				–			
Mild	0.99	0.48	2.04	0.98	1.03	0.52	2.03	0.95
Moderate to severe	4.49	1.29	15.66	0.02	2.95	1.33	6.55	0.01
Sex								
Male	–				–			
Female	–				2.24	1.34	3.75	0.01
Employment status								
No working	–				–			
Working	1.50	0.69	3.27	0.31	1.68	0.91	3.14	0.10
Upper dental prosthesis need								
No	–				–			
Yes	–				1.55	0.83	2.88	0.17
Lower dental prosthesis need								
No	–				–			
Yes	2.20	1.27	3.81	0.01	1.61	0.84	3.11	0.15
Dental care need								
No	–				–			
Yes	3.90	2.14	7.14	0.01	4.80	2.86	8.03	0.01

*$p < 0.05$

Older adults may lose their perception of the impact of aesthetic aspects on quality of life as they age, except for pain and function,[42] which can improve the provision of dental prosthesis that restores speaking and chewing function.

Demographics and social determinants have been identified as relevant predictors of oral health conditions. Thus, sociodemographic variables were considered possible confounders and included in the adjusted analyses. Sex remained associated with OHRQoL in the multivariate regression model, a finding consistent with previous evidence, given that female older adults were more likely to report on the negative impact of oral health on quality of life compared with their male counterparts.[19] Although frailty and aging refer to distinct concepts, the former is a chronic condition strongly associated with the aging process. However, the present study showed that age was not associated with OHRQoL. The lack of an association between age and OHRQoL in our study might indicate that older adults have a weak perception regarding OHRQoL perhaps due to the frailty process, reinforcing the urgent need for dental care in this population regardless of socioeconomic status given that socioeconomic variables were also not associated with OHRQoL.

The use of logistic regression analysis in this study may be considered appropriate and reliable considering the lack of multicollinearity and Hosmer and Lemeshow test results. Multicollinearity occurs when two independent variables express similar results. In other words, two or more independent variables are correlated. The absence of multicollinearity suggests that the estimates are precise and unbiased. The Hosmer and Lemeshow test compares the observed and estimated frequencies

using the chi-square test. In this study, the observed and predicted frequencies did not differ significantly.

The positive aspects of this research were our use of a probabilistic sample and validated questionnaires to assess frailty status and OHRQoL. These methodological aspects suggest the adequate internal and external validity of the study. For instance, the prevalence of frailty and oral health conditions in older adults were similar to those presented in a previous population-based study in Brazil.[12] Nevertheless, some limitations of the present study must be acknowledged. Sometime had already elapsed since the oral health survey had been conducted (2015). The cognition status of the participants was subjectively assessed before data collection. Hence, the lack of an instrument to assess cognition might have influenced the reliability of the collected data because of the possible inclusion of older adults with chronic cognitive conditions. However, the inclusion of community-dwelling older adults might suggest that the participants had adequate cognition to answer the questionnaires. The present study could not determine causal relationships between variables because of its cross-sectional design. Finally, our findings cannot be extrapolated to other age groups and institutionalized older adults, such as those living in older adult care homes.

Dental care and oral health policies are paramount for improving the oral health of older adults. Moreover, oral health promotion and preventive dental care through primary health care starting at a younger age may prevent oral diseases throughout life and can potentially enhance the oral health of older adults, especially among those who have frailty. Finally, future research using longitudinal data is needed to elucidate the role of frailty and differences in socioeconomic status on OHRQoL in older adults.

Conclusion

The present study showed that moderate to severe frailty, as well as female sex, the need for lower dental prosthesis, and self-perceived dental care needs, had an impact on OHRQoL in community-dwelling older adults.

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