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Research Article

Oral Disease and 3-Year Incidence of Frailty in Mexican Older Adults

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Abstract

Background: Poor oral health has been associated with some components of frailty. The objective of this study was to identify the association between clinical measures of oral health and the incidence of frailty among community-dwelling older adults aged 70 or older in Mexico City.
Methods: A 3-year cohort study with a probabilistic representative sample of home-dwelling elders of one district of Mexico City was performed. Baseline and follow-up interview and oral clinical evaluations were carried out by standardized examiners in participants' homes. Dependent variable was incident frailty defined according to the frailty phenotype. Independent variables were the utilization of dental services, the presence of xerostomia, the number of natural teeth, use of removable dental prostheses, presence of severe periodontitis, and presence of root remnants. Sociodemographic, behavioral, and health measures were included as confounders. The association between oral health conditions and incident frailty was modeled using Poisson regression models with robust variance estimators. The models were adjusted for confounders and interactions.
Results: We identified a 14.8% cumulative incidence of frailty. Each additional tooth was associated with a lower probability of developing frailty by 5.0% (risk ratio = 0.90; 95% CI 1.02–1.10). The 3-year risk ratio of developing frailty was 2.13 times higher (95% CI 1.01–4.50) among participants having severe periodontitis.
Conclusions: The number of teeth and the presence of severe periodontitis are associated with the development of frailty after controlling for confounders. Further studies are needed on this topic.

Keywords: Frailty—Incidence—Oral health—Periodontitis—Tooth loss—Cohort

Frailty is a geriatric syndrome characterized by reduced physiological reserve and greater vulnerability to inner and external stressors (1–4) that leads to functional impairment, dependence, cognitive decline, and even mortality (1,3–5). It is unlikely that a single cause underlies its development (Figure 1) (1,6), and it has been proposed that inflammation and nutrition are characteristics influencing the pathophysiological mechanisms of frailty (2–8). Therefore, it is important to identify the elements that increase the risk of frailty (1,3,4).

Poor oral health is common among older adults (9,10) and has been associated with chronic diseases and some components of frailty. Four possible pathways link poor oral health to frailty: the

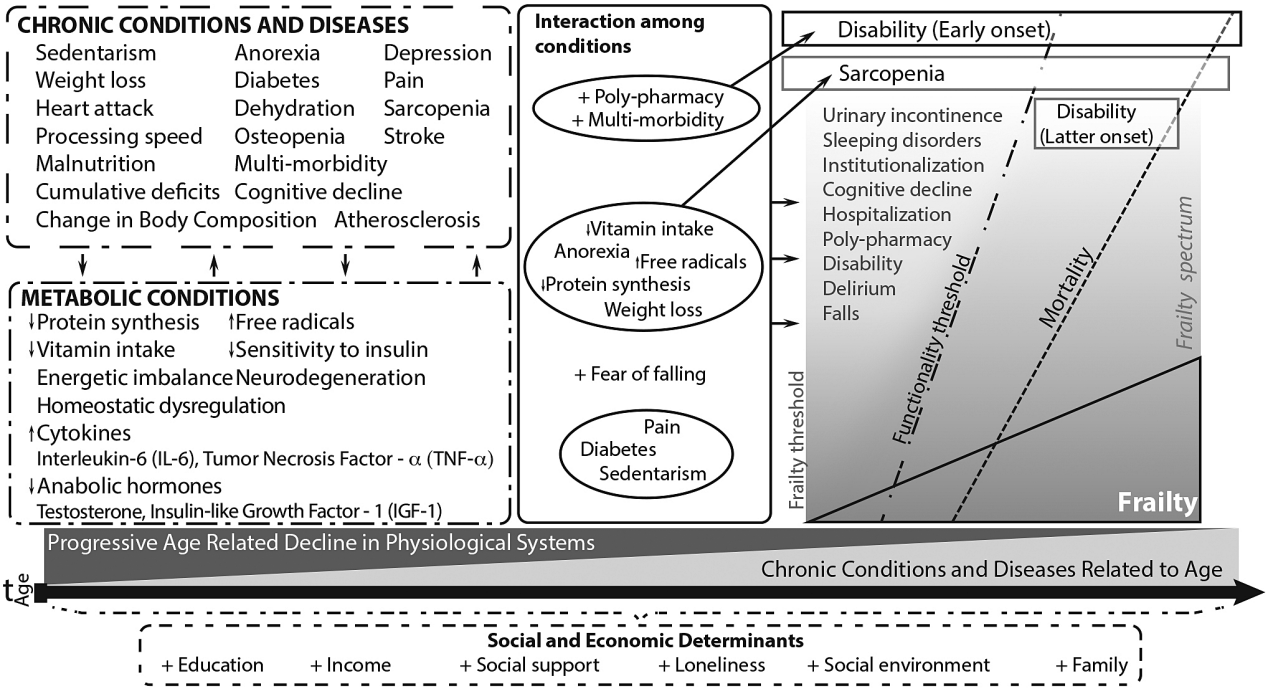

Figure 1. Characteristics associated with the incidence of frailty.

functional (through an impact on nutritional status); the physiologic/biologic (being closely related to a chronic inflammatory response); the psychosocial (impact on self-esteem and depression); and the therapeutic (the prevention and control of actual damage) (11). To our knowledge, no prospective studies have examined the association between poor oral health and the incidence of frailty. However, cross-sectional studies have shown an association between poor oral health and the probability of being frail (11–13). In prospective studies, Weyant and colleagues reported that periodontal disease was associated with weight loss (1-year period) (14), Hämäläinen and colleagues reported an association between periodontal disease and steeper declines in handgrip strength (over a 5-year follow-up) (15); Ritchie and colleagues and Avlund and colleagues reported that edentulism and number of teeth were associated with weight loss (2-year period) (16) and the onset of fatigue (at 5- and 10-year follow-ups) (17). Moreover, Semba and colleagues reported that older women with dentures and difficulty chewing or swallowing had a lower 5-year survival (18). Despite the prospective approach used by these studies, none of the findings demonstrate causality.

The objective of this study was to identify the associations of tooth loss, severe periodontitis, xerostomia, use of removable dental prostheses (RDPs), and dental services in the previous year with the incidence of frailty over a 3-year period in community-dwelling persons aged 70 years and older. We hypothesized that individuals with poor oral health (fewer teeth, severe periodontitis, xerostomia, not using RDPs, or not using dental services) would be at a higher risk of developing frailty.

Methods

The prospective Mexican Study of Nutritional and Psychosocial Markers of Frailty (The Coyoacán Cohort Study) aimed to evaluate the nutritional, psychosocial, and medical determinants of frailty among Mexican community-dwelling older adults (19). The study protocol was approved by the Ethical Committee of the National Institute of Medical Sciences and Nutrition "Salvador Zubiran," México (Reference file: 1679). Participants signed written informed consents and were able to withdraw at any time.

The target population was nearly 32,000 older adults aged 70 years and older living in Coyoacán who were registered in a local government program that covered 95.0% of the community-dwelling older adults in Mexico City (19). The initial sample for the cohort included 1,294 community-dwelling adults. Participants were selected by stratified random sampling from the list of program beneficiaries in 2008. A total of 1,124 adults participated in at least one component of the survey (86.9% participation rate), 75.0% of whom (n = 843) received a dental examination. A follow-up visit was conducted in 2011 and included 47.5% (n = 534) of those initially interviewed. Reasons for nonparticipation at follow-up were categorized as being untraceable (23.0%), refusal (16.1%), death (11.1%), or change of address (2.2%).

There were 595 nonfrail participants with dental information at baseline. Of these, 57.7% (n = 343) had follow-up data, but 26.5% (n = 91/343) were excluded because of having an incomplete frailty evaluation, and 4.4% (n = 15/343) were excluded for having missing data on one or more covariates. Thus, 39.8% (n = 237/595) of the study sample completed the follow-up.

Variables

Frailty was defined according to the frailty phenotype (3). Frail individuals were identified by having three or more of the following criteria: weight loss (self-reported weight loss of ≥5 kg in the previous 6 months); exhaustion (assessed with two questions from the Center for Epidemiologic Studies-Depression Scale (20), namely, "I felt that everything I did was an effort" and "I could not get going," with responses "a moderate amount of the time" and "most of the time" considered positive); low physical activity (the lowest quintile stratified by sex on the Physical Activity Scale for the

Elderly questionnaire (21); slowness (defined as a positive answer to either of the two questions from the Short-Form Health Survey questionnaire (SF-36) (22), namely, "Do you have difficulty walking one block?" and "Do you have difficulty climbing several flights of stairs?"); and weakness (positive answer to the SF-36 (22) item "Do you have difficulty lifting or carrying objects weighing over 5 kg, such as a heavy bag of groceries?").

Oral health and disease experience were assessed through clinical and subjective measures. Examinations were performed by four final-year dental students under artificial light using a dental mirror and periodontal probe (CP11.5, Hu-Friedy). The interview evaluated the individual's utilization of dental services in the previous 12 months (Have you used dental services during the past 12 months? Yes/No) and the presence of xerostomia (Do you frequently feel your mouth dry? Yes/No). Dental examinations consisted of an assessment of the number of natural teeth (0–32), use of RDPs, presence of severe periodontitis, and presence of root remnants (having less than one third of the dental crown of any tooth). Periodontal status was assessed using a modified periodontal screening and recording index (23), measuring six sites per tooth and recording the highest score on each tooth; severe periodontitis was indicated by the presence of at least three teeth with ≥5.5-mm pocket depth and furcation involvement or ≥3.5-mm gingival recession. The intra-examiner reliability for the periodontal examination was good (κ = .7).

A number of sociodemographic, behavioral, and health measures that have previously been associated with the incidence of frailty were included as possible confounders of the possible association between oral health and incident frailty (Figure 1). Gender, age (in years), marital status (married vs not married), and years of education were the sociodemographic characteristics obtained. The behavioral measure was smoking (never/former/current); and the health measures included cognitive performance assessed by the Mini-Mental State Examination (MMSE) (24), number of medications taken, and previous diagnoses of heart attack, stroke, hypertension, diabetes, osteoporosis, or arthritis.

Statistical Analysis

All analyses were performed in STATA version 13 (StataCorp. 2013. Stata Statistical Software: Release 13. College Station, TX: StataCorp LP.). We first compared the study sample with the group of individuals lost to follow-up in terms of their baseline sociodemographic, behavioral, and health characteristics (Table 1). We then compared the incidence of frailty by baseline sociodemographic, behavioral, and health characteristics using Student's *t* test and Chi-square test.

Poisson regression with robust variance estimators was used to estimate risk ratios (RRs) (25). Because periodontitis can be measured only in dentate persons, we constructed two Poisson regression models (one for the number of teeth [0–32] and one for severe periodontitis) with incident frailty as the dependent variable. We first estimated the nonadjusted associations between the independent variables and covariates (sociodemographic, behavioral, and health characteristics) and incident frailty (Table 2). We then gradually adjusted each model for potential confounders, specifically variables with a univariate *p* value below or equal to .20, as well as those that have been widely associated with frailty (such as the sociodemographic characteristics of age, gender, and education) in Model 1 and health measures (hypertension, diabetes, osteoporosis, cognitive performance, and the number of prescribed medications) in Model 2.

Tooth loss occurs as a consequence of caries and periodontal disease (26), and periodontal diseases have been associated with diabetes (27,28). We therefore evaluated the effect of the interaction between severe periodontitis and diabetes, as well as of the number of teeth and diabetes (data upon request). A third fully adjusted

Table 1. Baseline Characteristics of the Study Sample and Those Who Were Not Followed Up

	Study Sample	Not Followed Up	*p* Value[a]
n (%)	237 (39.8)	358 (60.2)	
Age in years, mean (*SD*)	76.4 (5.2)	77.7 (6.3)	.008
Years of education, mean (*SD*)	6.9 (4.8)	7.5 (5.9)	.207
Women, *n* (%)	122 (51.5)	185 (51.7)	.962
Married, *n* (%)	122 (51.5)	175 (48.9)	.536
Number of medicines taken, mean (*SD*)	2.6 (1.8)	2.5 (2.0)	.765
MMSE score, mean (*SD*)	22.9 (3.5)	23.1 (3.4)	.498
Stroke, *n* (%)	6 (2.5)	7 (2.0)	.632
Hypertension, *n* (%)	137 (57.8)	197 (56.1)	.687
Diabetes, *n* (%)	44 (18.6)	82 (23.0)	.193
Osteoporosis, *n* (%)	36 (15.2)	33 (9.4)	.032
Arthritis, *n* (%)	44 (18.6)	39 (10.9)	.008
Smoking, *n* (%)			.221
Former	108 (45.6)	138 (38.6)	
Current	26 (11.0)	41 (11.5)	
Utilization of dental services, *n* (%)	111 (46.8)	192 (53.6)	.105
Xerostomia, *n* (%)	105 (44.3)	148 (41.3)	.474
Number of teeth, mean (*SD*)	12.1 (9.6)	11.6 (8.9)	.511
Number of teeth, mean (*SD*)[b]	15.3 (8.2) [188]	14.1 (7.8) [294]	.127
Edentate, *n* (%)	49 (20.7)	64 (17.9)	.394
Severe periodontitis, *n* (%)	49 (26.1)	95 (32.4)	.137
Utilization of RDP, *n* (%)	136 (57.4)	223 (62.3)	.231
Tooth remnants, *n* (%)	111 (46.8)	143 (39.9)	.096

Note: MMSE = Mini-Mental State Examination; RDP = removable dental prostheses.

[a]Chi-square test was used for categorical measures and *t* test for continuous measures. [b]482 dentate participants were included for the prevalence of severe periodontitis.

model estimated the association between the number of teeth on incident frailty after controlling for the recognized determinants of frailty as well as for the interaction between the number of teeth and diabetes (Model 3). A similar modeling strategy was applied for the presence of severe periodontitis in the subgroup of dentate adults (n = 188).

Results

We analyzed data from 237 adults aged 70 to 95 years. The characteristics of the sample are shown in Table 1. The study sample was younger and included more people with osteoporosis and arthritis than those who did not complete the follow-up.

The 3-year cumulative incidence of frailty was 14.8%. The prevalence of edentulism was 20.7%. Of the dentate participants (n = 188), the mean number of teeth was 15.3 (*SD* 8.2; range 1–32), and 26.1% of them had severe periodontitis (Table 2).

The unadjusted analyses showed that the incidence of frailty was higher among older participants, those with hypertension, diabetes, or osteoporosis, and those taking more medications. In contrast, those with more years of education (as well as those with higher MMSE scores) were less likely to develop frailty. None of the oral health variables showed an association with incident frailty (Table 2).

An unadjusted model showed that the number of teeth was not significantly associated with incident frailty, even after controlling for sociodemographic and medical confounders (Models 1 and 2 in Table 3). However, the inclusion of the interaction term revealed that diabetes was an effect modifier for the number of teeth, because this variable then showed a lower probability of incident frailty (RR 0.95; 95% confidence interval [CI] 0.91–0.98). Similarly, the unadjusted model with severe periodontitis showed that the presence of severe periodontitis at baseline was associated with incident frailty. After controlling for sociodemographic and health characteristics (Model 2) and including the interaction term between number of teeth and diabetes (Model 3), severe periodontitis remained associated with the incidence of frailty (Table 3).

For all participants, each additional tooth was associated with a 5.0% (1/RR) (95% CI 1.02–1.10 [1/95% CI]) lower probability of developing frailty after controlling for sociodemographic and health characteristics, as well as for diabetes as an effect modifier. Among the dentate participants (n = 188), the 3-year risk of developing frailty in those having severe periodontitis (≥3 teeth with ≥5.5-mm probing depth and furcation involvement or ≥3.5-mm gingival recession) was 2.52 times (95% CI 1.25–5.07) the risk of those without severe periodontitis after controlling for confounders and the number of teeth. After including the interaction term between number of teeth and diabetes, the risk of developing frailty was 2.13 times (95% CI 1.01–4.5) greater for those with severe periodontitis than for those without severe periodontitis.

Discussion

The objective of this study was to determine whether tooth loss, severe periodontitis, xerostomia, use of a removable prosthesis, and utilization of dental services were associated with the incidence of frailty in community-dwelling persons aged 70 years and older. Severe periodontitis at baseline was associated with incident frailty at 3 years, whereas the probability of developing frailty was reduced for each additional tooth present.

Regarding the limitations and strengths of this study, one weakness was the relatively low participation rate at follow-up (57.7%) and that only 39.8% (237/595) of the overall sample had complete data at follow-up. Death is a frequent source of attrition in cohort

Table 2. 3-Year Cumulative Incidence of Frailty by Baseline Characteristics (n = 237)

	Not Frail	Incident Frailty	RR (95% CI)	p[a]
n (%)	202 (85.2)	35 (14.8)		
Age in years, mean (*SD*)	75.7 (4.7)	80.3 (6.4)	1.11 (1.07–1.15)	<.001
Education in years, mean (*SD*)	7.3 (4.9)	5.4 (4.3)	0.93 (0.87–0.99)	.048
Gender (Women, %)	50.5	57.1	1.26 (0.68–2.34)	.470
Marital status (Not married, %)	46.5	60.0	1.59 (0.85–2.98)	.147
Number of medications, mean (*SD*)	2.4 (1.8)	3.7 (4.0)	1.35 (1.19–1.54)	<.001
MMSE score, mean (*SD*)	23.2 (3.5)	21.1 (3.5)	0.86 (0.79–0.95)	.002
Stroke (Yes, %)	2.5	2.9	1.13 (0.18–6.96)	.897
Hypertension (Yes, %)	55.0	74.3	2.11 (1.03–4.31)	.041
Diabetes (Yes, %)	15.8	34.3	2.29 (1.23-4-24)	.009
Osteoporosis (Yes, %)	12.4	31.4	2.56 (1.38–4.76)	.003
Arthritis (Yes, %)	17.4	25.7	1.51 (0.76–3.00)	.238
Smoking				
Never (%)	42.6	48.6		
Never/Former (%)	46.0	42.9	0.84 (0.44–1.60)	.598
Never/Current (%)	11.4	8.6	0.70 (0.22–2.21)	.542
Oral health and incident frailty				
Utilization of dental services (No, %)	53.0	54.3	1.05 (0.56–1.94)	.886
Xerostomia (Yes, %)	43.6	48.6	1.19 (0.64–2.19)	.583
Number of teeth, mean (*SD*)	12.6 (9.6)	9.5 (9.5)	0.97 (0.94–1.01)	.100
Number of teeth among dentate, mean (*SD*)[b]	15.5 (8.2)	14.0 (8.4)	0.98 (0.94–1.03)	.402
Severe periodontitis (Yes, %)[b]	19.8	25.7	1.70 (0.79–3.65)	.171
Utilization of RDP (No, %)	44.6	31.4	1.13 (0.18–6.96)	.897
Root remnant (Yes, %)	49.0	34.3	0.59 (0.31–1.13)	.115

Note: CI = confidence interval; MMSE = Mini-Mental State Examination; RDP = removable dental prostheses; RR = risk ratio.
[a]Chi-square test was used for categorical measures and t test for continuous measures. [b]Estimated among 188 dentate participants.

Table 3. Poisson Regression Models for the Association of Baseline Number of Teeth (upper) and Severe Periodontitis (lower) with 3-Year Incidence of Frailty

	Model 1	Model 2	Model 3
Oral Health Measures	RR (95% CI)	RR (95% CI)	RR (95% CI)
Model for number of teeth (n = 237)			
Age (years)	**1.10 (1.06–1.14)***	**1.09 (1.05–1.14)***	**1.08 (1.04–1.13)***
Gender (Men/Women)	1.06 (0.59–1.92)	0.73 (0.42–1.29)	0.77 (0.42–1.42)
Education (years)	**0.93 (0.87–0.99)***	**0.94 (0.88–0.99)***	**0.94 (0.88–1.00)***
Hypertension (No/Yes)		1.83 (0.98–3.44)	1.58 (0.83–3.01)
Diabetes (No/Yes)		1.62 (0.85–3.07)	0.70 (0.29–1.67)
Osteoporosis (No/Yes)		**2.30 (1.19–4.44)***	**2.39 (1.27–4.46)***
MMSE score		0.94 (0.85–1.04)	0.94 (0.86–1.03)
Number of medications		**1.23 (1.08–1.40)***	**1.26 (1.11–1.44)***
Number of teeth (0–32)	**0.98 (0.95–1.01)**	**0.98 (0.95–1.01)**	**0.95 (0.91–0.98)***
Interaction term (Number of teeth × Diabetes)			**1.08 (1.02–1.15)***
Model for severe periodontitis among dentate participants (n = 188)			
Age (years)	**1.09 (1.05–4.36)***	**1.09 (1.03–1.16)***	**1.09 (1.02–1.16)***
Gender (Men/Women)	1.33 (0.68–2.61)	0.92 (0.48–1.77)	0.93 (0.46–1.87)
Education (years)	**0.89 (0.82–0.92)***	0.93 (0.85–1.02)	0.91 (0.83–1.00)
Hypertension (No/Yes)		**2.94 (1.26–6.84)***	**2.56 (1.09–6.03)***
Diabetes (No/Yes)		1.95 (0.94–4.04)	0.62 (0.11–3.49)
Osteoporosis (No/Yes)		1.88 (0.83–4.25)	1.81 (0.79–4.10)
MMSE score		0.92 (0.81–1.05)	0.94 (0.83–1.06)
Number of medications		**1.23 (1.06–1.44)***	**1.26 (1.07–1.49)***
Severe periodontitis (No/Yes)	**2.14 (1.05–4.36)***	**2.52 (1.25–5.07)***	**2.13 (1.01–4.50)***
Number of teeth (0–32)			**0.94 (0.90–0.99)***
Interaction term (Number of teeth × Diabetes)			1.08 (0.99–1.18)

Note: CI = confidence interval; MMSE = Mini-Mental State Examination; RR = risk ratio.
*$p < .05$.

studies with older adults (29). One reason for the attrition by mortality in this study might be frailty itself; we observed a mortality rate of 8.3% (49/595), and among them, 61.0% were prefrail at baseline. Other reasons for attrition were "refusal to be interviewed or examined" (15.6%) and being "unable to be located" (12.9%), which could also be associated with frailty or decline in health condition. It has been shown that loss to follow-up associated with missing data not at random processes introduces biased estimations (30), which could have been the case in this study; therefore, we expect that the incidence of frailty was underestimated.

Another weakness of the study was the measurement of severe periodontitis, because we measured only clinical pocket depth at six sites for each tooth. Although pocket depth is not as accurate a measurement as periodontal attachment loss, we believe it was able to identify severe periodontitis based on our operational definition (three teeth ≥5.5-mm pocket depth and furcation involvement or ≥3.5-mm gingival recession). Using this criterion, we estimated a general prevalence of 20.1%, which is similar to estimates from other older populations (in Germany, 21.6%, based on a probing depth ≥6 mm in persons aged 75 and older (31) and in Puerto Rico, 24.0% prevalence rate for severe periodontitis, determined by having ≥2 teeth with clinical attachment loss ≥6 mm and ≥1 tooth with pocket depth ≥5 mm in persons aged 70 and older (32)).

An additional limitation of the study was that the estimations of covariates were obtained by self-report. The reliability and validity of self-report measurements are subject to recall bias and have a greater chance of residual confounding (33). It has been reported that the estimations of the prevalence of chronic conditions by self-report are lower in older populations, and persons of low socioeconomic status have a higher probability of being undiagnosed (34); despite these findings, self-report is a method frequently used in surveys. One investigation estimated the agreement of self-reported diabetes and other chronic conditions in persons older than 60 years and found that the concordance for diabetes was $\kappa = .75$ (35). We compared the prevalence of self-reported conditions in this study with those reported by Mexican adults aged 70–79 years in the WHO Study on global AGEing and adult health (SAGE) (36) and found that the estimates of diabetes (18.6% and 17.9%, respectively) and arthritis (18.6% and 18.4%, respectively) were similar. However, the prevalence of stroke was lower in our study (2.5% vs 8.4% in the SAGE study), whereas the estimate for hypertension was higher (57.8% vs 38.1%). In a sample of persons (mean age 70.6 years) participating in the 2012 Mexican Health and Nutrition Survey, the prevalence of diabetes was also similar to ours (22.2%), but the prevalence of hypertension was lower (37.7%) (37).

Considering the limitations of the study, we can expect some degree of bias in the associations between severe periodontitis and frailty; however, the prevalence of severe periodontitis did not significantly differ between the participants who remained in the study and those who were lost to follow-up.

One of the strengths of this study was the heterogeneous socioeconomic characteristics of the population residing in the area selected for the study. The design of the study included the measurement of dental, general health, cognitive, and functional variables, which enabled the assessment of several confounding factors. Additionally, to our knowledge, this is the first cohort study on frailty and oral health conducted in a Latin American middle-income country. The socioeconomic constraints and cultural characteristics of some

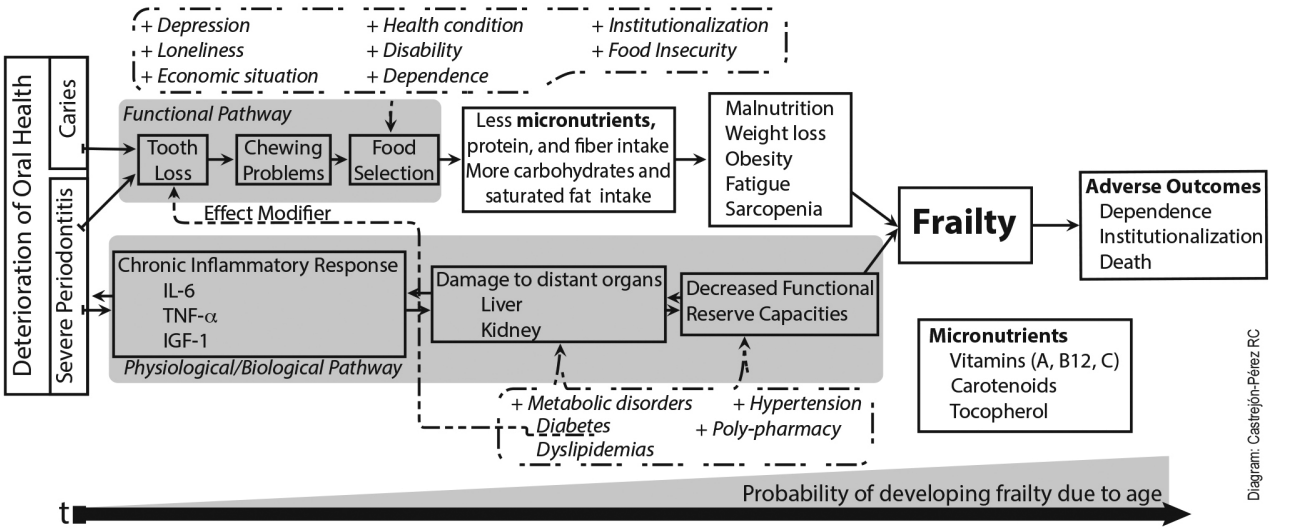

Figure 2. Pathways that link the number of teeth and severe periodontitis with the incidence of frailty.

Mexican elders are associated with poor oral health conditions and low utilization of dental services, which is reflected mainly in the number of teeth and edentulism, likely strengthening the association of oral health with frailty. A lack of oral health policies and of preventive and curative programs for the elderly people is common in low- and middle-income countries (10).

The socioeconomic and cultural differences in the oral health status of older people have been addressed by the World Health Organization (10) and by other studies (38). The Fifth wave of the Survey of Health, Ageing and Retirement in Europe (SHARE) showed how the degree of development in 14 European countries and Israel was reflected in dental conditions, with a higher average number of teeth (≥22.2) and a lower prevalence of edentulism (≤6.8%) in countries such as Sweden, Denmark, and Switzerland. These values were higher and lower, respectively, than those observed in our study (12.1 teeth and 20.1% prevalence of edentulism) (39).

These study findings suggest that there is an association between the presence of severe periodontitis and the incidence of frailty. Evidence suggests that chronic inflammation is a key underlying mechanism of the pathophysiology of frailty (4,5,7). Periodontitis, as a chronic inflammatory condition (27) that usually begins in adulthood, may contribute to this type of physiological decline in older age. This phenomenon implies a cumulative effect over time, which could potentially explain the associations observed in this study (Figure 2). The scarce amount of longitudinal evidence is conflicting; whereas some studies support an association between periodontal measures and specific components of frailty (14,15), others have reported no association (Figure 2) (16). It is possible that the association identified in our study is explained by additional common risk factors linked to periodontitis and frailty, such as smoking, depression, obesity, and socioeconomic level. Also, we must consider that poor oral health has been associated with poor general health, and good oral hygiene with positive health outcomes.

The second main finding indicated that the number of teeth may be a protective factor against the development of frailty. In this case, there is plenty of evidence on the association between number of teeth and nutritional status (Figure 2) (18,40), and malnutrition has been recognized as an important factor in the development of frailty (2,3,6,8). A possible pathway linking tooth loss and frailty is Tooth loss → Chewing problems → Food selection → Malnutrition → Frailty. We can expect a positive impact of functional dentition on nutritional status, taking into account that additional characteristics (eg, depression, economic constraints, and loneliness) could act as confounders. An additional explanation could rely on the lifestyle, which was not included in the present study and could be potentially related to both conditions (the number of teeth and incident frailty).

Although poor oral health has been associated with a number of chronic conditions, the relationship is far from causal and is most likely because oral diseases, including periodontal disease and tooth loss, share the same social determinants, risk factors, and biologic pathways as other chronic conditions (10).

Clinicians should be aware of the oral health conditions of older adults and should encourage them to improve their oral hygiene practices, promote the retention of their natural teeth, and recommend dental care when needed. The World Health Organization recommends oral health promotion to be integrated into general health programs for older people to improve their healthy lifestyle behaviors and quality of life (10).

As for future research, our findings await corroboration from new longitudinal studies that use more accurate periodontal measurements. These types of studies would determine whether changes in oral health status are important contributors to frailty.

Within the limitations of the present study, our findings suggest that having severe periodontitis may be considered a risk marker for frailty, whereas each additional tooth present reduces the probability of developing frailty. Further studies are needed to confirm these findings.

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Conflict of Interest

The authors declare no conflict of interests relevant to this manuscript's subject.

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