Oral health and frailty: An analysis of cross-sectional data from the Canadian Longitudinal Study on Aging.

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Introduction

Oral health is a critical component of general health. Frailty is a clinical state in which there is an increase in an individual's vulnerability for developing increased dependency and/or mortality when exposed to a stressor[1]. This study explores the relationship between oral health and frailty using cross-sectional data from the Canadian Longitudinal Study on Aging (CLSA)[2].

Methods

Data from the comprehensive baseline wave of the CLSA of 30,097 individuals was analyzed to find the prevalence of dental status, defined by self-reported edentulism, partial denture use, and those not wearing dentures finding it uncomfortable or comfortable to eat. Data collection was from the 11 data collection sites (DCS) of the CLSA, located across Canada; baseline recruitment was for participants age 45-85 years old, community living, and living within 25km of a DCS[3]. Multiple logistic regression and linear regression were used to assess the association of dental status and the outcomes of frailty, as defined by Fried's frailty phenotype (with 5 criteria of slowness, weakness, low physical activity, exhaustion, and weight loss), and a frailty index (FI) of ~80 cumulative health deficits, adjusted for participant socioeconomics, health, and health behaviors. All analyses used weighted data from the CLSA.

Dental status was characterized by grouping participants based on their answers to being not have any teeth (edentulous), to wearing dentures, and to endorsing any eating discomfort because of a problem with their mouth or teeth in the past 12 months.

Frailty phenotype criteria was defined by being in the worst age group (45-54,55-64, 65-74, 75-85 years old) and sex (female and male) specific quintile for: 1) timed walk speed (slowest); 2) grip strength (weakest); and 3) physical activity (PA) as measured by the PA scale for the elderly (PASE: lowest PA); or as endorsing being 4) exhausted (answered as "most days" to the Center for Epidemiologic Studies Short Depression Scale (CES-D10) questions "How often did you feel that everything you did was an effort?" and/or "How often did you feel that you could not "get going"?); or as endorsing 5) unintentional weight loss (wasting as losing more than 5 lbs in the past 6 months and not being overweight or obese). Frail individuals are those with 3 or more criteria; Pre-frail individuals are those with 2 criteria.

Table 1. Participant characteristics by dental status.

	Dental Status				
	Edentulous	Partial Dentures/False Teeth	No Dentures and Uncomfortable to Eat	No Dentures and Comfortable to Eat	All Participants
	% (95% CI)*	% (95% CI)*	% (95% CI)*	% (95% CI)*	% (95% CI)*
	5.7 (5.4-6.0)	17.2 (16.7-17.7)	22.0 (21.4-22.6)	55.1 (54.4-55.8)	100.00
	n= 1883	n-= 5548	n= 5807	n= 15501	n= 28739
Characteristic					
Age Group					
45-54 years	14.2 (12.0-16.8)	20.8 (19.3-22.3)	51.5 (50.0-52.9)	46.5 (45.6-47.5)	41.8 (41.1-42.5)
55-64 years	22.2 (20.1-24.2)	29.6 (28.3-30.9)	30.8 (29.6-32.0)	30.4 (29.7-31.2)	30.0 (29.4-30.5)
65-74 years	31.2 (29.0-33.5)	27.8 (26.6-29.0)	12.3 (11.6-13.1)	15.5 (15.0-16.1)	17.6 (17.2-18.0)
75-85 years	32.4 (30.2-34.7)	21.8 (20.8-22.9)	5.4 (4.9-5.9)	7.5 (7.1-7.1-7.8)	10.6 (10.3-10.9)
Sex (Female)					
Female	54.4 (51.6-57.2)	51.2 (49.6-52.9)	52.1 (50.5-53.7)	48.9 (47.9-49.9)	50.3 (49.6-51.1)
Income <50 K	55.8 (53.1-58.5)	36.2 (34.7-37.6)	19.2 (18.1-20.3)	15.0 (14.4-15.5)	21.4 (20.9-21.9)
50-100 K	27.9 (25.6-30.3)	38.0 (36.5-39.5)	33.9 (32.5-35.3)	32.4 (31.5-33.2)	33.4 (32.8-34.0)
>100 K	16.3 (14.1-18.7)	25.8 (24.4-27.3)	46.9 (45.4-48.4)	52.6 (51.7-53.5)	45.3 (44.6-45.9)
Smoking Status					
Current	17.8 (15.8-20.0)	11.0 (10.0-12.0)	9.5 (8.7-10.4)	6.8 (6.3-7.3)	8.6 (8.3-9.0)
Number of Chronic Conditions >2	24.0 (21.9-26.2)	16.2 (15.2-17.3)	8.4 (7.7-9.2)	7.1 (6.7-7.5)	9.6 (9.3-10.0)
2	27.4 (25.1-29.8)	21.8 (20.6-23.0)	16.1 (15.1-17.2)	15.6 (15.0-16.2)	17.3 (16.8-17.8)
<2	48.6 (45.9-51.3)	62.0 (60.5-63.4)	75.5 (74.3-76.7)	77.3 (76.6-78.0)	73.1 (72.5-73.6)
BMI Category					
Underweight	1.2 (0.7-2.2)	0.6 (0.4-0.8)	0.8 (0.6-1.1)	0.6 (0.4-0.7)	0.7 (0.6-0.8)
Overweight	38.1 (35.7-40.6)	41.9 (40.5-43.4)	38.9 (37.5-40.3)	40.1 (39.3-41.0)	40.0 (39.4-40.7)
Obese	34.9 (32.5-37.4)	31.5 (30.2-32.9)	28.6 (27.3-29.9)	27.6 (26.8-28.4)	28.8 (28.2-29.4)
Normal weight	25.8 (23.6-28.1)	26.0 (24.7-27.3)	31.7 (30.4-33.1)	31.7 (30.9-32.6)	30.5 (29.9-31.1)
Nutritional Risk					
<38	46.2 (43.6-48.8)	38.0 (36.6-39.5)	38.8 (37.4-40.2)	30.0 (29.2-30.9)	34.1 (33.5-34.7)

* Weighted percentages and 95 % confidence intervals (CI) adjusted for complex sampling plan of the CLSA.

- Number of chronic conditions was categorized as counting the number of participant chronic condition categories as follows: (1) heart disease (heart disease, heart failure, heart attack, angina); 2) stroke; 3) diabetes (diabetes or high blood sugar); 3) asthma or COPD; 4) hearing impairment; 5) cataracts or glaucoma; 6) arthritis (rheumatoid arthritis or hand, knee, or hip osteoarthritis); 8) Alzheimer's; 9) Parkinsonism.
- Body mass index (BMI) was determined using anthropometric measurements taken during the DCS visit and normal weight, underweight, overweight, and obese was defined by WHO BMI nutritional status categories.
- Nutrition risk was assessed using the Seniors in the community: risk evaluation for eating and nutrition, Abbreviated Version II (SCREEN II-AB) questionnaire. Individuals with a score of less than 38 were considered at high nutritional risk.

Results

Table 1 shows the socioeconomic, health behavior, and health status of the 28,739 participants included in the analysis (1358 individuals did not answer oral health questionnaire). As dental status worsens (from 1) not wearing dentures and being comfortable to eat, - 2) not wearing dentures and being uncomfortable to eat, - 3) wearing partial dentures, - 4) edentulous) participants are older, poorer, have more chronic conditions, are more likely to be female, to smoke, and are less likely to be normal weight and not at nutritional risk.

The percentage of participants who are frail and pre-frail was higher among those with poor dental status (Figure 1 and Table 2). Dental status was significantly associated with being frail (adjOR=1.77, 1.34, and 1.70 respectively for edentulous, partial denture use, and uncomfortable to eat compared with no denture use and comfortable to eat , Table 3). Also, as dental status worsens, FI increases (adjβ= 0.013, 0.007, and 0.013 for edentulous, partial dentures, or being uncomfortable ,Table 4). Figure 2 shows the mean FI predicted by the regression model at each age, adjusted for all other characteristics, and showing the ~10% increase for uncomfortable to eat and wearing partial dentures and ~15% increase for edentulous, compared to comfortable to eat and over the mean FI of ~11%.

Figure 1. % Frailty Phenotype, Comparing Participants by Dental Status

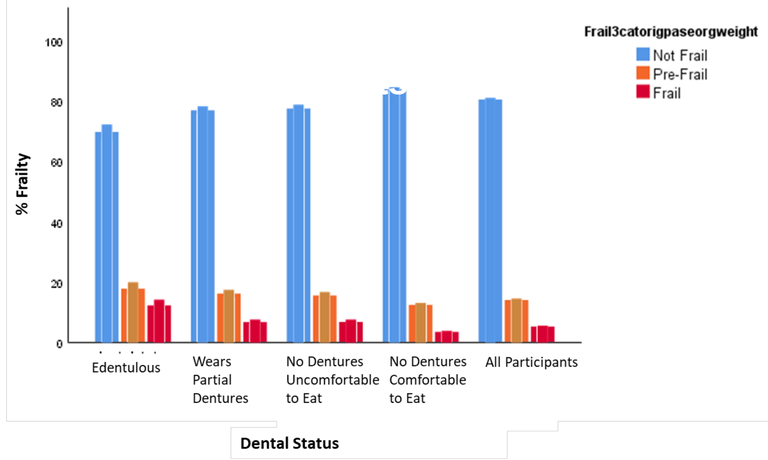


Table 3. Frailty Phenotype: Odds Ratio of Frailty (versus Healthy or Pre-Frail) ╪

			95% CI			95% CI			95% CI	
Characteristic	**Variable**	**ORadj**	**Low**	**High**	**ORadj**	**Low**	**High**	**ORadj**	**Low**	**High**
Age	**Years old**	1.05	1.02	10.7	1.03	1.00	1.05	1.03	1.01	10.7
Sex	**Female**	1.26	1.12	1.42	1.14	1.00	1.30	1.11	0.97	1.27
	Male	REF	-	-	REF	-	-	REF	-	-
Dental Status	**Edentulous**	3.71	3.10	3.35	1.90	1.53	2.37	1.77	1.42	2.22
	Partial Dentures	2.05	1.77	2.37	1.33	1.1.12	1.58	1.34	1.12	1.60
	Uncomfortable	1.97	1.70	2.27	1.80	1.53	2.12	1.70	1.40	2.00
	Comfortable	REF	-	-	REF	-	-	REF	-	-
Income	**<50K**				3.33	2.78	4.00	2.68	2.23	3.23
	50-100K				1.72	1.43	2.07	1.58	1.31	1.91
	>100K				REF	-	-	REF	-	-
Smoking Status	**Current**				1.87	1.55	2.26	1.50	1.23	1.84
	Not Current				REF	-	-	REF	-	-
Number of Chronic Conditions	**>2**				2.52	2.19	2.89	2.19	1.89	2.54
	≤2				REF	-	-	REF	-	-
BMI Category	**Underweight**							2.83	1.62	4.97
	Overweight							0.73	0.61	0.87
	Obese							1.26	1.06	1.49
	Normal Weight							REF	-	-
At Nutritional Risk	**Yes**							2.99	2.58	3.46
	No							REF	-	-

╪ weighted odds ratio adjusted for complex sample plan; Adjusted for characteristics in each column.
CI=confidence intervals.
REF=reference group for association.

Table 2. Results of the logistic regression model on the association between dental status and the outcome of frailty phenotype and frailty phenotype components*.

	Slowest Quintile Walk Speed**			Weakest Quintile Grip Strength			Lowest Quintile Physical Activity			Exhaustion			Wasting			Pre-Frail (2 criteria)***			Frail (3+ criteria)		
	OR*	95% CI Upper	Lower	OR*	95% CI Upper	Lower	OR*	95% CI Upper	Lower	OR*	95% CI Upper	Lower	OR*	95% CI Upper	Lower	OR*	95% CI Upper	Lower	OR*	95% CI Upper	Lower
Edentulous	**1.17**	**1.02**	**1.35**	1.07	0.92	1.22	**1.19**	**1.03**	**1.37**	**1.50**	**1.29**	**1.74**	**1.97**	**1.28**	**3.03**	1.16	0.98	1.37	**1.89**	**1.52**	**2.35**
Partial Dentures	1.07	0.97	1.18	1.01	0.92	1.11	1.00	0.90	1.10	**1.45**	**1.31**	**1.61**	1.34	0.98	1.83	1.14	1.02	1.27	**1.36**	**1.14**	**1.62**
Uncomfortable to Eat	**1.16**	**1.05**	**1.28**	**1.21**	**1.11**	**1.33**	**1.15**	**1.05**	**1.27**	**1.64**	**1.50**	**1.81**	1.16	0.90	1.56	**1.31**	**1.18**	**1.45**	**1.77**	**1.50**	**2.10**
Comfortable to Eat	REF	.	.	REF	.	.	REF	.	.	REF	.	.	REF	.	.	REF	.	.	REF	.	.

- Fully adjusted odds ratio; adjusted for age, sex, income, number of chronic conditions, BMI category (WHO BMI classifications), smoking, and dental status.
- ** Lowest quintile represents the poorest walk speed, which is the longest timed walk.
- ** Comparing those with 2 criteria (Pre-Frail) with Healthy (0 or 1 criteria).

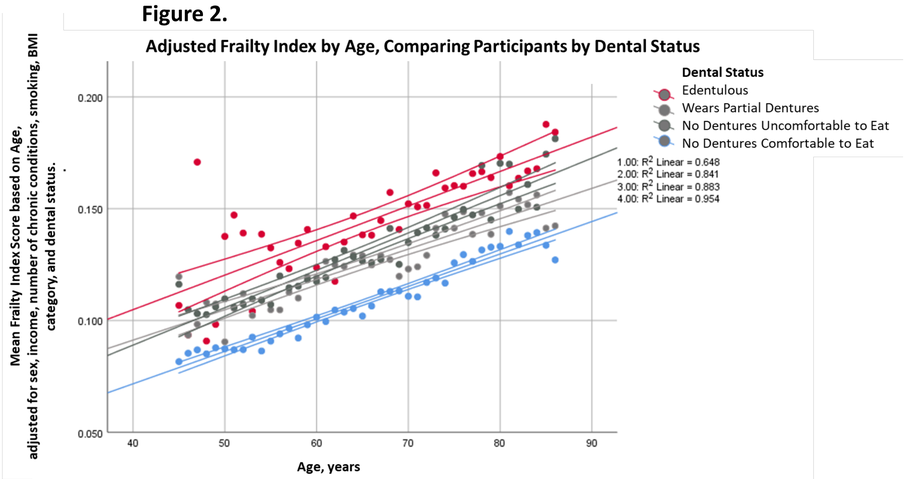
Table 4. Frailty Index, Regression Parameter Estimates β ╪

			95% CI			95% CI			95% CI	
Characteristic	**Variable**	**βadj**	**Low**	**High**	**βadj**	**Low**	**High**	**βadj**	**Low**	**High**
Age	**Years old**	0.001	0.001	0.001	0.0003	0.0002	0.0004	0.0005	0.0004	0.0006
Sex	**Female**	0.041	0.029	0.042	0.036	0.035	0.038	0.038	0.037	0.040
	Male	REF	-	-	REF	-	-	REF	-	-
Dental Status	**Edentulous**	0.035	0.031	0.039	0.016	0.012	0.020	0.013	0.009	0.016
	Partial Dentures	0.019	0.016	0.021	0.009	0.007	0.011	0.007	0.005	0.009
	Uncomfortable	0.019	0.017	0.021	0.015	0.013	0.016	0.013	0.011	0.015
	Comfortable	REF	-	-	REF	-	-	REF	-	-
Income	**<50K**				0.033	0.031	0.036	0.026	0.024	0.028
	50-100K				0.012	0.011	0.014	0.010	0.008	0.011
	>100K				REF	-	-	REF	-	-
Smoking Status	**Current**				0.014	0.035	0.038	0.010	0.007	0.013
	Not Current				REF	-	-	REF	-	-
Number of Chronic Conditions	**>2**				0.075	0.072	0.078	0.067	0.064	0.069
	≤2				REF	-	-	REF	-	-
BMI Category	**Underweight**							0.036	0.022	0.050
	Overweight							0.012	0.010	0.013
	Obese							0031	0.029	0.033
	Normal Weight							REF	-	-
At Nutritional Risk	**Yes**							0.023	0.021	0.024
	No							REF	-	-

╪ weighted regression coefficient adjusted for complex sample plan; Adjusted for characteristics in each column.
CI=confidence intervals.
REF=reference group for association.

Figure 2.

Adjusted Frailty Index by Age, Comparing Participants by Dental Status



Conclusions

Tooth loss and eating discomfort are associated with frailty. The accumulation of dental status deficits and dental frailty may lead to an increased risk of poorer health outcomes as we age.

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