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The Indirect Association of Life Satisfaction in the Relationship between Self-Rated Oral Health and Cognitive Function

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ABSTRACT: Background: While oral diseases are the most prevalent noncommunicable conditions in older adults and are associated with poorer cognitive outcomes, the psychosocial mechanisms mediating this association remain unclear. This study aimed to examine whether life satisfaction mediates the relationship between self-rated oral health and cognitive function of older adults. **Methods:** We conducted a cross-sectional analysis of 1090 participants aged 50 years old or older from the 2018 Health and Retirement Study (HRS). Our cross-sectional study used data from Experimental Module 3 of the 2018 HRS wave that collected data on dental health and dental health services. Using Structural Equation Modeling (SEM) with bootstrapping to test mediation, we investigated whether oral health was related to the cognitive health of older adults and examined whether life satisfaction mediated the association between self-rated oral health and cognitive function. Analyses were adjusted for covariates, including age, sex, education, race/ethnicity, smoking status, health insurance, hypertension and diabetes. **Results:** Poorer oral health was associated with lower levels of life satisfaction ($B = -0.173, p < 0.001$), and higher life satisfaction was associated with higher levels of cognitive function ($B = 0.409, p < 0.001$). The indirect effect was significant (-0.071 (Confidence Interval [CI] $-0.117, -0.034$)), while the direct effect was not statistically significant. **Conclusions:** Life satisfaction may play a potential mediating role in the relationship between self-rated oral health and cognitive function, which highlights the importance of psychosocial mechanisms in connecting self-rated oral health to cognitive outcomes.

KEYWORDS: Oral health; cognitive function; life satisfaction; older adults; healthy aging

1 Introduction

Oral diseases are among the most prevalent noncommunicable conditions in the United States (US) that disproportionately affect older adults and contribute to a diminished quality of life [1]. Earlier research has shown that poor oral health, including tooth loss, periodontal disease, and oral pain can adversely affect essential daily functions such as the interpersonal communication, and social participation of older adults [2–5]. These impairments may contribute to inadequate nutritional intake, increased depressive symptoms, declines in physical health, and reduced psychological wellbeing and life satisfaction that highlight the broader functional and health-related consequences of oral disease in aging populations [4–6].

Recent studies have focused on the relationship between the oral health and cognitive function of older adults [7–10]. These studies have provided evidence that oral health indicators including tooth loss, periodontal disease, and self-rated poor oral health are significantly associated with poorer overall cognitive performance and an increased risk of dementia [11–14]. A systematic review indicated that these links are most consistent in specific cognitive domains such as learning and memory, complex attention, and executive function, which emphasizes the need for detailed cognitive assessment in oral health research [15]. That these associations have been observed consistently in both cross-sectional and longitudinal studies conducted in a wide variety of countries and populations, suggests that oral health may serve as an important health indicator in the cognitive aging process.

Community-based studies have provided evidence that oral health status is closely associated with subjective psychological factors such as life satisfaction [16–20]. Yet the findings of these studies suggest that poor oral health is consistently linked to reduced functional abilities, daily performance, increased psychological distress and lack of social participation that contributes to lower levels of life satisfaction. According to Liu et al. (2023) [14], not only does a direct association between self-rated oral health and cognitive function exists, but there is also a partial mediating effect of life satisfaction, findings that suggest that good oral health may indirectly protect cognitive function by enhancing life satisfaction, whereas deterioration in oral health may weaken cognitive reserve through reduced social participation and psychological withdrawal. The higher the level of life satisfaction, the more cognitive function can be improved through mechanisms such as social participation, psychological wellbeing, resilience, and functional independence, factors that work together to strengthen cognitive reserve and mitigate cognitive decline.

Despite growing interest in the relationships between oral health, cognitive function, and life satisfaction, research gaps persist. First, earlier studies mainly focused on the direct association between oral health and cognition, with limited longitudinal and intervention studies being conducted to evaluate whether improving oral health can prevent cognitive decline or enhance quality of life [16,21]. These research approaches yield limited explanations of indirect or mediating mechanisms that may explain how these variables are connected. Thus, our study extends existing research by reproducing the psychosocial pathways proposed in a large, unweighted cohort from a national survey sample (HRS) of cognitively intact older adults across the United States using more comprehensive demographic and health-related covariates [22–24]. Moreover, the goal of our study was to investigate the role of life satisfaction as a potential mediator linking oral health and cognitive health. In addition, little research has simultaneously included relevant demographic and health-related factors such as education, chronic conditions, and health behaviors that may confound or shape these relationships [25–27].

Thus, this study aims to investigate whether oral health was related to the cognitive health of older adults and examine whether life satisfaction mediates the association between self-rated oral health and cognitive function, with values presented as unstandardized path coefficients. All the models we will be using are adjusted for relevant covariates including age, sex, race/ethnicity, education, smoking status, diabetes, hypertension, and health insurance coverage. This body of research underscores the need for a more nuanced understanding of the complex mechanisms linking oral health, cognitive health, and life satisfaction and highlights the importance of examining this relationship in cognitively intact older adults, a population for whom early identification and preventive interventions may be particularly effective.

2 Methods

2.1 Study Population

Data used for this study were collected from the USA Health and Retirement Study (HRS). HRS is a nationally representative longitudinal survey of community-dwelling individuals over 50 years of age that has been conducted every two years since 1992. HRS captures data on broad aspects of aging, including health, cognition, healthcare services use, work and retirement, family connections, and income and wealth. The HRS is funded by the National Institute on Aging (grant number NIA U01AG009740) and is conducted by the University of Michigan. A full description of the HRS has been provided elsewhere [23,28]. Whenever possible, we use data from the RAND HRS Longitudinal file [22,24]. The RAND HRS provides easy-to-use, cleaned, and derived variables from the core and exit interviews of the HRS original data across all waves combined and makes it publicly available for use.

Our cross-sectional study used data from Experimental Module 3 of the 2018 HRS wave that collected data on dental health and dental health services [29]. HRS administers several experimental modules in each wave at the end of the core interview. These modules are administered to 10 percent of respondents who participated in the core interview. Each respondent responding to the experimental module only answers one module per wave. This module was administered to community dwelling self-respondents. To derive our analytic sample, we only used data collected from those who answered the dental module ($n = 1391$) and excluded respondents with cognitive impairment or dementia ($n = 258$) and those below 50 years of age. Our final analytic sample ($n = 1090$) excluded respondents with missing data on life satisfaction, oral health, and any covariate data as shown in Fig. 1.

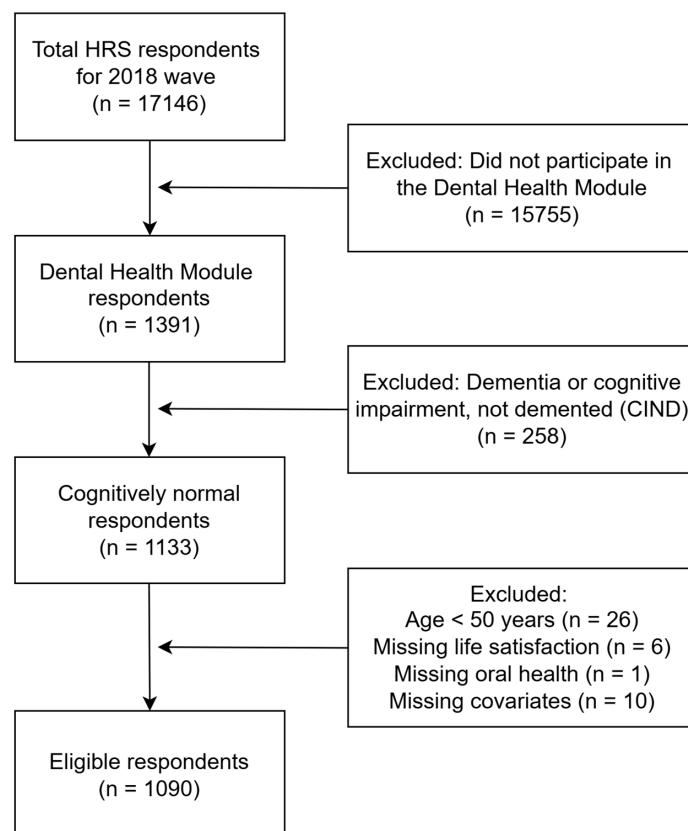


Figure 1: Flow diagram of eligible participant selection from the 2018 health and retirement study.

Ethical approval for the HRS was granted by the Institutional Review Board of the institution responsible (University of Michigan UM Health Sciences/Behavioral Sciences IRB Protocol: HUM00061128) for data collection, and all participants provided written informed consent prior to participation.

2.2 Cognitive Function Assessment

Consistent with previous studies assessing cognitive function using HRS cognitive scores [30,31], the dependent variable in this study was the cognitive function score. In the HRS, a range of measures are employed to assess the global cognitive state of respondents. HRS provides a 27-point scale (ranging from 0 to 27) that measures respondent episodic memory, attention, and working memory [32]. Three activities were performed by the respondents to measure their cognitive score: immediate and delayed recall of 10 words that are randomly assigned to respondents (0–20 score), serial sevens subtraction (0–5), and backward counting (0–2). A summary score is then derived to assess global cognitive status with higher scores indicating higher levels of cognitive function [32]. For respondents who took the self-administered web-based survey, HRS provided a wholly imputed backward count score to compute the summary score that was then adjusted by subtracting one from the total score [33]. Langa-Weir classification provides three categories of cognitive state from the 27-point scale: Normal (12–27); Cognitively Impaired with no dementia (CIND) (7–11); and Dementia (0–6). This classification has been previously validated by Crimmins et al. (2011) [34] using data from the Aging, Demographics, and Memory Study. For our study, we restricted the sample to respondents with global cognitive scores in the normal range.

2.3 Oral Health Assessment

In the Dental Health and Dental Health Services module, respondents were asked to describe the condition pertaining to their mouth and teeth as excellent, very good, good, fair, or poor. Responses were scored from 1 to 5 (1 = excellent, 2 = very good, 3 = good, 4 = fair, and 5 = poor), with higher scores indicating poorer self-rated oral health.

2.4 Life Satisfaction

All respondents who took part in the core survey were asked to think about their life as a whole and respond to how satisfied they were with it. Responses were recorded on a 5-point Likert scale ranging from 1 = not at all satisfied to 5 = completely satisfied, with higher scores indicating greater life satisfaction. This single-item life satisfaction measure has been validated and found to strongly correlate with more comprehensive, multiple-item life satisfaction measures [35].

2.5 Covariates

We considered a number of variables as covariates. The covariates we selected were based on the literature [25–27] and data availability in the 2018 wave. All covariates were self-reported. The covariates included age (continuous) and the following categorical variables: sex (male, female), education (less than high school, high school graduate, some college, college graduate and above), race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, other), smoking status (never smoked, ever smoked), health insurance (no, yes), hypertension (no, yes), and diabetes (no, yes). Hypertension and diabetes were based on self-reported physician diagnoses. Race/ethnicity was included as a potential confounder of the association between oral health and cognitive function.

2.6 Statistical Analysis

We calculated summary statistics to describe our study participants. First, we summarized categorical variables by n (%) and continuous variables by mean and standard deviation (SD). Second, we calculated the mean and standard deviation of cognitive function scores for categorical data and compared the means with a two-sample t -test or one-way analysis of variance (ANOVA). Test statistics (t/F) and p -values were reported for this test (Table 1). We treated oral health and life satisfaction scores as continuous variables in our models. Several studies have justified that Likert scales or ordinal variables with five or more categories can be robustly analyzed using continuous parametric methods as they do not exhibit extreme skewness [36,37]. Spearman rank correlation coefficients were calculated to assess the bivariate association among oral health, life satisfaction, and cognitive function (Table 2). Three models were fitted to understand the association between oral health and cognitive function: (1) unadjusted, (2) adjusted for demographic and education variables, and (3) further adjusted for behavioral and clinical indicators (Table 3) [38,39]. In the final model, we conducted mediation analysis within a structural equation modeling (SEM) framework [38] using the 'Lavaan' package (version 0.6.21) for R [39] to estimate the mediation effect of life satisfaction on the association between oral health and cognitive function (Fig. 2). We used a non-parametric bootstrapping method with 1000 samples to obtain a 95% confidence interval (CI) to test the significance of the indirect estimate. The results were considered statistically significant if the confidence interval excluded 0 [40]. The results of the mediation models are presented in Supplementary Tables S1 and S2. In Table 4, we present the unstandardized estimates, 95% confidence intervals, and effect sizes of the direct, indirect, and total effect. We restricted our analyses to participants with complete data on all study variables. Of the 1107 age-eligible respondents, 17 (1.5%) were excluded due to missing study data. A comparison of included and excluded participants on available demographic characteristics showed no statistically significant differences in age, sex, or race/ethnicity, although educational attainment differed between groups (Supplementary Table S3). All analyses were performed using unweighted data in R 4.5.1 (R Foundation for Statistical Computing, Vienna, Austria). We assessed statistical significance at $p < 0.05$.

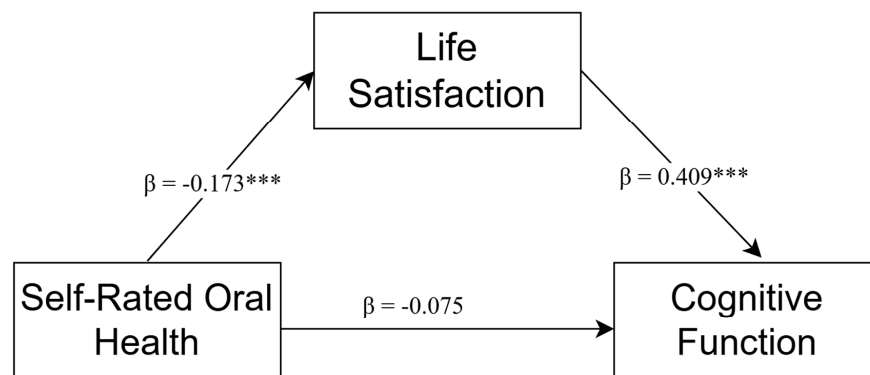


Figure 2: Mediation model of the association between self-rated oral health and cognitive function through life satisfaction. Values shown are unstandardized path coefficients from the structural equation model adjusting for age, sex, race/ethnicity, education, smoking status, diabetes, hypertension, and health insurance coverage. *** $p < 0.001$.

3 Results

Characteristics of participants in our study are shown in Table 1. There were 1090 participants with a mean cognitive score of 16.99 (SD: 3.08) and a mean age of 66.31 years (SD: 9.91). Fifty-eight percent of the participants were female, and most of our participants were non-Hispanic whites (65%), had either

completed high school (30%) or had some college education (29%), and were covered by health insurance (94%). Male participants differed significantly from females on their cognitive scores (16.67 vs. 17.22, $t = -2.97$, $p = 0.003$). Significantly different cognitive scores were observed across race/ethnicity ($F = 7.77$, $p < 0.001$), smoking status ($t = 2.52$, $p = 0.01$), diabetes status ($t = 2.96$, $p = 0.003$), and hypertension status ($t = 4.74$, $p < 0.001$). Participants without diabetes and hypertension had higher mean cognitive scores, and no significant difference in cognitive scores was observed by health insurance coverage ($t = -1.00$, $p = 0.32$). Cognitive scores increased generally across categories of life satisfaction ($F = 8.37$, $p < 0.001$) and decreased significantly with declining self-rated oral health status ($p < 0.001$).

Table 1: Baseline characteristics of the study sample and mean cognitive scores by participant characteristics (N = 1090).

Variables	N (%) or Mean (SD)	Cognitive Score, Mean (SD)	t/F	p-Value
Cognitive Score^a	16.99 (3.08)	-	-	-
Age^a	66.31 (9.91)	-	-	-
Sex^b	-	-	-2.97 ^c	0.003
Male	462 (42.39)	16.67 (2.91)	-	-
Female	628 (57.61)	17.22 (3.19)	-	-
Race/Ethnicity^b	-	-	7.77 ^d	<0.001
Non-Hispanic White	712 (65.32)	17.29 (3.02)	-	-
Non-Hispanic Black	168 (15.41)	16.24 (3.13)	-	-
Hispanic	149 (13.67)	16.36 (2.80)	-	-
Other	61 (5.60)	17.15 (3.79)	-	-
Education^b	-	-	32.20 ^d	<0.001
Less than High School	116 (10.64)	15.30 (2.76)	-	-
High School graduate	332 (30.46)	16.46 (2.77)	-	-
Some College	312 (28.62)	16.99 (3.13)	-	-
College graduate and above	330 (30.28)	18.12 (3.04)	-	-
Ever Smoke^b	-	-	2.52 ^c	0.01
No	511 (46.88)	17.24 (3.08)	-	-
Yes	579 (53.12)	16.77 (3.08)	-	-
Diabetes^b	-	-	2.96 ^c	0.003
No	787 (72.20)	17.16 (3.12)	-	-
Yes	303 (27.80)	16.56 (2.94)	-	-
Hypertension^b	-	-	4.74 ^c	<0.001
No	447 (41.01)	17.52 (3.17)	-	-
Yes	643 (58.99)	16.62 (2.97)	-	-
Health Insurance Coverage^b	-	-	-1.00 ^c	0.32
No	68 (6.24)	16.60 (3.34)	-	-
Yes	1022 (93.76)	17.02 (3.07)	-	-
Life Satisfaction^b	-	-	8.37 ^d	<0.001
1. Not at all satisfied	19 (1.74)	15.26 (2.35)	-	-

Table 1: *Cont.*

Variables	N (%) or Mean (SD)	Cognitive Score, Mean (SD)	t/F	p-Value
2. Not very satisfied	44 (4.04)	15.82 (2.65)	-	-
3. Somewhat satisfied	277 (25.41)	16.43 (3.02)	-	-
4. Very satisfied	499 (45.78)	17.45 (3.08)	-	-
5. Completely satisfied	251 (23.03)	17.02 (3.11)	-	-
Self-Rated Oral Health^b			7.94 ^d	<0.001
1. Excellent	118 (10.83)	17.37 (3.38)	-	-
2. Very Good	284 (26.06)	17.63 (3.14)	-	-
3. Good	368 (33.76)	16.99 (2.86)	-	-
4. Fair	202 (18.53)	16.34 (3.06)	-	-
5. Poor	118 (10.83)	16.19 (3.03)	-	-

Note: SD: Standard Deviation; NH: Non-Hispanic. ^asummarized as mean (SD); ^bsummarized as n (%); ^ct-value. ^dF-value.

Results of Spearman rank correlation analysis between self-rated oral health, life satisfaction, and cognitive function are shown in Table 2. Poorer oral health was significantly correlated with lower levels of life satisfaction ($\rho = -0.23$, $p < 0.001$) and lower cognitive function ($\rho = -0.16$, $p < 0.001$), though life satisfaction was positively correlated with cognitive function ($\rho = 0.12$, $p < 0.001$). Each pair of correlation analyses conducted was statistically significant.

Table 2: Spearman rank correlations among oral health, life satisfaction, and cognitive function.

Parameter	Oral Health	Life Satisfaction	Cognitive Function
Oral Health	1	-	-
Life Satisfaction	-0.23***	1	-
Cognitive Function	-0.16***	0.12***	1

Notes: Higher oral health scores indicate poorer self-rated oral health, whereas higher life satisfaction and cognitive function scores indicate better outcomes. *** $p < 0.001$.

Table 3 summarizes results from sequential regression models. Poorer oral health was associated with lower cognitive function scores ($B = -0.416$, $p < 0.001$). After adjusting for age, sex, race/ethnicity, and education, the association remained statistically significant ($B = -0.160$, $p = 0.049$) but was weakened. With further adjustment for smoking, diabetes, hypertension, and health insurance status, the association was further reduced and was no longer statistically significant ($B = -0.146$, $p = 0.08$). Most of the core socio-demographic factors were strongly associated with cognitive function in model 2. Notably, older age ($B = -0.054$, $p < 0.001$) and non-Hispanic Black race ($B = -1.10$, $p < 0.001$) were associated with lower cognitive function, while female sex ($B = 0.643$, $p < 0.001$), and education levels (all p -value ≤ 0.001) were associated with higher cognitive function. A similar significant statistical association for these variables was present in the fully adjusted model. Being hypertensive ($B = -0.418$, $p = 0.03$) was significantly associated with lower cognitive function in the fully adjusted model.

The results of the regression coefficients from the structural equation model are summarized in Supplementary Tables S1 and S2. In the life satisfaction model, poorer oral health was significantly associated with lower levels of life satisfaction ($B = -0.173$, $p < 0.001$). In the cognitive function model, life satisfaction was significantly associated with higher cognitive function ($B = 0.409$, $p < 0.001$), but oral health was not significantly associated with cognitive function after accounting for life satisfaction ($B = -0.075$, $p = 0.38$).

Age, sex, race/ethnicity, and education remained significantly associated with cognitive function, with higher levels of education associated with higher cognitive scores. Fig. 2 displays the corresponding mediation model with unstandardized path coefficients.

Table 3: Association between Self-Rated oral health and cognitive function in cognitively intact survey respondents.

Variable	Model 1		Model 2		Model 3	
	B (SE)	P-Value	B (SE)	p-Value	B (SE)	p-Value
Oral health	−0.416 (0.080)	<0.001	−0.160 (0.081)	0.049	−0.146 (0.082)	0.08
Age	-	-	−0.054 (0.009)	<0.001	−0.050 (0.010)	<0.001
Female (ref: male)	-	-	0.643 (0.177)	<0.001	0.601 (0.179)	<0.001
NH-Black	-	-	−1.100 (0.255)	<0.001	−0.997 (0.260)	<0.001
Hispanic	-	-	−0.538 (0.281)	0.055	−0.534 (0.284)	0.06
Other race	-	-	−0.450 (0.389)	0.25	−0.421 (0.390)	0.28
HS graduate/GED	-	-	1.056 (0.320)	0.001	1.060 (0.323)	0.001
Some college	-	-	1.476 (0.329)	<0.001	1.430 (0.333)	<0.001
College and above	-	-	2.589 (0.336)	<0.001	2.533 (0.342)	<0.001
Ever smoked	-	-	-	-	−0.117 (0.180)	0.52
Diabetes	-	-	-	-	0.037 (0.207)	0.86
Hypertension	-	-	-	-	−0.418 (0.192)	0.03
Health insurance	-	-	-	-	0.111 (0.379)	0.77

Notes: SE: Standard error. Model 1 is unadjusted; Model 2 adjusts for age (years), sex, race/ethnicity, and education; Model 3 additionally adjusts for smoking, diabetes, hypertension, and health insurance coverage. B = regression coefficient. Race reference group = NH-White; sex reference group = male; education reference group = Less than High School.

The mediation model was just-identified ($\chi^2(0) = 0.000$, CFI = 1.000, TLI = 1.000, RMSEA = 0.000, SRMR = 0.000). Because the model had zero degrees of freedom, these global fit indices reflect perfect fit by definition and are not informative for evaluating model fit. The model explained 10.1% of the variance in life satisfaction ($R^2 = 0.101$) and 15.2% of the variance in cognitive function ($R^2 = 0.152$).

Table 4 displays the total, direct, and indirect unstandardized effects of self-rated oral health on cognitive function mediated through life satisfaction. The 95% bootstrap confidence interval for the indirect effect of life satisfaction did not include 0 (−0.117, −0.034), whereas the 95% bootstrap confidence interval for the direct (−0.240, 0.094) and total effect (−0.312, 0.021) included 0. The direct effect of oral health on cognitive function was −0.075 (SE: 0.085), while the indirect effect through life satisfaction was −0.071 (SE: 0.021). The total effect of oral health on cognitive function was −0.146 (SE: 0.084).

Table 4: Direct, indirect, and total effects of Self-Rated oral health on cognitive function through life satisfaction.

	Effect ^a	SE	95% CI LL ^b	95% CI UL ^b
Total effect	−0.146	0.084	−0.312	0.021
Direct effect of oral health status	−0.075	0.085	−0.240	0.094
Indirect effect through life satisfaction	−0.071	0.021	−0.117	−0.034

Note: SE: standard error; CI: confidence interval; LL: lower limit; UL: upper limit. ^aUnstandardized estimates. ^bBootstrap confidence interval.

4 Discussion

This study examined the association between the self-rated oral health and cognitive functioning of older adults and investigated whether life satisfaction may represent a possible pathway linking these variables. Our findings indicate that poorer perceived oral health was negatively associated with life satisfaction, and that lower levels of life satisfaction were significantly related to reduced cognitive function. This finding stresses the potential importance of oral health in relation to life satisfaction and in supporting the cognitive function of older adults. However, given our cross-sectional design, these results should be interpreted as statistical associations rather than evidence that improving oral health will directly increase cognitive function or reduce dementia risk.

Earlier studies provided evidence that oral health was associated with the cognitive function of older adults in a wide variety of cultural settings [9,26,41–43]. The findings of these studies indicate that older adults who perceived that they had better oral health were less likely to develop cognitive decline or impairment. Our study findings are aligned with the conclusions of these studies that found that higher levels of perceived oral health were positively associated with the cognitive function of older adults. This accumulated evidence emphasizes the importance of oral hygiene and continued care for older adults.

However, earlier research has provided evidence that older adults encounter significant challenges to maintaining access to needed preventive and restorative care that include substantial financial and logistical barriers (e.g., absence of dental insurance; accessibility of dental care). Subsequently, recent US data show that approximately 13–16% of older adults have at least one tooth with untreated decay, and that tooth loss remains common in late life with more than half of adults over age 75 having fewer than 21 teeth, a proportion that rises to about 80% among those living in poverty [44–47]. Thus, we provide practical suggestions on how to reduce the substantial barriers that older adults experience in accessing dental care services.

A growing body of literature describes the multidimensional aspects of oral health and their impact on the cognitive health of older adults [7,8,15]. These studies have primarily focused on biological pathways, such as systemic inflammation associated with periodontal disease or reduced masticatory stimulation resulting from tooth loss. Even though we have captured a subjective perception of oral health, our results extend the potential importance of perceived oral health to the life satisfaction and, indirectly, cognitive function of older adults. This finding suggests that perceived oral health may influence cognitive outcomes and life satisfaction through broader psychosocial processes.

The most notable finding of our study is that a significant pathway between self-rated oral health and life satisfaction exists among older adults. This finding underscores the broader implications of oral health conditions for life satisfaction in older adults. Earlier studies have provided evidence that improved life satisfaction is significantly associated with multiple aspects of health such as physical health, cognitive functioning, and psychological wellbeing. While causal conclusions cannot be drawn from cross-sectional data, our findings extend the existing body of literature that describes how oral health is positively associated with cognitive health through enhanced life satisfaction.

Our interpretation of these findings is that higher levels of life satisfaction through high perceived oral health may influence cognitive functioning through mechanisms such as psychological wellbeing, social participation, resilience, and functional independence. Taken together, the patterns demonstrated in this study can be best understood as indicating that life satisfaction may be involved in the statistical association between self-rated oral health and cognitive function and that our findings support a possible psychosocial pathway hypothesis rather than a causal inference. Although the estimated effect size may not be large, it indicates a change in cognitive scores related to differences in self-assessed oral health and life satisfaction. While these coefficients show relatively small changes in cognitive function at the individual

level, considering the high prevalence of oral disease and the importance of cognitive health for maintaining independence in old age, even these small effects could potentially have significant implications at the population level if the oral health and psychosocial wellbeing of many older adults can be improved.

In geriatric dentistry, low levels of oral health literacy and low socioeconomic status represent key challenges to improving the oral health of older adults in the US [43–46]. According to the Centers for Disease Control and Prevention [48], complete tooth loss is several times more frequent among older adults with low income, limited education, a history of smoking, and untreated cavities, and is disproportionately more common in non-Hispanic Black and Mexican American older adults than their non-Hispanic White counterparts. Our findings also highlight potential disparities in oral health and their associations with the life satisfaction and cognitive function of older adults. These findings emphasize the importance of promoting access to oral health education and preventive dental services, particularly for populations that may encounter significant barriers to accessing necessary dental care.

Several limitations need to be addressed when interpreting our study findings. As this study is based on a cross-sectional design, cause-effect relationship among variables cannot be inferred. Future studies are needed to conduct a longitudinal analysis whose goal is to deepen our understanding of how oral health leads to changes in cognitive function and life satisfaction. In addition, an inverse relationship between cognitive function and oral health may be plausible. A few studies have provided evidence that impaired cognitive function is associated with poor oral health among older adults. It would be beneficial if future research examined this inverse relationship so that this bidimensional relationship can be confirmed. A cognitive decline can contribute to the deterioration of oral health by reducing self-care abilities, oral hygiene practices, and the utilization of dental services. Since the cross-sectional design of this study cannot distinguish these directions, a longitudinal study to investigate bidirectional relationships should be conducted. Also, excluding participants living with cognitive impairment without dementia (CIND) or with dementia may reduce variability in cognitive outcomes and limit generalizability to older adults with cognitive impairment. It is suggested that future studies should examine these pathways across the full spectrum of cognitive functioning. In terms of the measurement of oral health and life satisfaction, as we used a secondary data set and self-rated, single-item indicators, this self-assessment and single item measurement may have introduced reporting bias. Multiple aspects of oral health and life satisfaction must be examined to create a comprehensive understanding of oral health and life satisfaction and its impact upon cognitive functioning. Our data analyses did not account for HRS sampling weights, stratification, or clustering that may have affected variance estimation and limited generalizability to the broader U.S. older adult population. In addition, educational attainment differed between participants included and excluded due to missing data, indicating the potential for selection bias despite the small number of exclusions. Last, although we adjusted for several established covariates, residual confounding remains possible due to the observational nature of the study. Additional factors that may have influenced both oral hygiene and cognitive function include marital status, access to and frequency of dental care, financial resources, social isolation, physical activity, and baseline cognitive status. Future studies that incorporate these variables should provide a more comprehensive understanding of how oral health, life satisfaction, and cognitive outcomes are interconnected.

5 Conclusions

We examined whether life satisfaction may represent a potential psychosocial pathway linking the self-rated oral health and cognitive function of cognitively intact older adults in the United States. Poorer oral health was associated with lower levels of life satisfaction, and higher levels of life satisfaction was

associated with better cognitive function. The indirect effect was significant, while the direct effect was not statistically significant. Our findings advance our understanding of the complex relationships between the oral health, life satisfaction, and cognitive function of older adults. By identifying life satisfaction as a potential mediator, our findings suggest that dental health programs aimed at improving oral health or enhancing life satisfaction may positively impact cognitive health, and increase awareness of oral health. Increasing awareness of oral health and strengthening community and publicly supported programs can help to address gaps in dental care and support healthier aging, but future longitudinal and intervention studies are needed to evaluate whether such efforts lead to measurable changes in cognitive outcomes.

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Author Contributions: The authors confirm contribution to the paper as follows: Junhyoung Kim and Seoyoon Lee; methodology, King David Oware and Gang Han; formal analysis, King David Oware; writing—original draft preparation, Junhyoung Kim, Seoyoon Lee, and Hee-Jung Park; writing—review and editing, Junhyoung Kim, Seoyoon Lee, Hee-Jung Park, Hye Jin Park, King David Oware, Gang Han, and Yongseop Kim. All authors reviewed and approved the final version of the manuscript.

Availability of Data and Materials: The data that support the findings of this study are openly available in Health and Retirement Study (HRS) Website at <https://hrs.isr.umich.edu/about>.

Ethics Approval: Ethical approval for the HRS was granted by the Institutional Review Board of the institution responsible (University of Michigan UM Health Sciences/Behavioral Sciences IRB Protocol: HUM00061128) for data collection, and all participants provided written informed consent prior to participation. Most HRS data are publicly accessible through the official website, and because we relied exclusively on publicly available data without direct interaction with human subjects, no additional ethical review was required.

Conflicts of Interest: The authors declare no conflicts of interest.

Supplementary Materials: The supplementary material is available online at <https://www.techscience.com/doi/10.32604/ijmh.2026.083002/s1>, Table S1: Regression of life satisfaction on oral health and covariates; Table S2: Regression of cognitive function on oral health, life satisfaction and covariates; Table S3: Comparison of demographic characteristics between participants included in the complete-case analysis and those excluded because of missing study data.

References

1. Huang X, Kang L, Bi J. Epidemiology of oral health in older adults aged 65 or over: Prevalence, risk factors and prevention. *Aging Clin Exp Res*. 2025;37(1):193. [[CrossRef](#)].
2. Al Shammery NH. Exploring the impact of oral health on the quality of life in older patients: A cross-sectional study. *BDJ Open*. 2024;10(1):60. [[CrossRef](#)].
3. Muhammad T, Srivastava S. Tooth loss and associated self-rated health and psychological and subjective wellbeing among community-dwelling older adults: A cross-sectional study in India. *BMC Public Health*. 2022;22(1):7. [[CrossRef](#)].
4. Takeuchi N, Sawada N, Ekuni D, Morita M. Association between oral condition and subjective psychological well-being among older adults attending a university hospital dental clinic: A cross-sectional study. *PLoS One*. 2023;18(11):e0295078. [[CrossRef](#)].
5. Tran TD, Krausch-Hofmann S, Duyck J, de Almeida Mello J, De Lepeleire J, Declerck D, et al. Association between oral health and general health indicators in older adults. *Sci Rep*. 2018;8:8871. [[CrossRef](#)].

6. Nascimento GG, Li H, Malhotra R, Leite FRM, Peres KG, Chan A, et al. Chewing disability is associated with cognitive impairment among older adults: A population-based cohort study. *J Gerontol Ser A Biol Sci Med Sci*. 2024;79(5):glae074. [[CrossRef](#)].
7. Kwon HJ, Ahn JH, Won MH, Kim DW. Chronic periodontitis and systemic inflammation in the elderly: Implications for neurodegeneration. *J Neuroinflamm*. 2026;23(1):43. [[CrossRef](#)].
8. Teixeira FB, Saito MT, Matheus FC, Prediger RD, Yamada ES, Maia CSF, et al. Periodontitis and Alzheimer's disease: A possible comorbidity between oral chronic inflammatory condition and neuroinflammation. *Front Aging Neurosci*. 2017;9:327. [[CrossRef](#)].
9. Yamaguchi S, Murakami T, Satoh M, Komiyama T, Ohi T, Miyoshi Y, et al. Associations of dental health with the progression of hippocampal atrophy in community-dwelling individuals: The ohasama study. *Neurology*. 2023;101(10):e1056–68. [[CrossRef](#)].
10. You J, Kaushal A, Wang P, Ding Y, Kim J, Wu B, et al. Oral health and cognitive function in older adults: Evidence from the Health and Retirement Study. *iScience*. 2026;29:115086. [[CrossRef](#)].
11. Asher S, Stephen R, Mäntylä P, Suominen AL, Solomon A. Periodontal health, cognitive decline, and dementia: A systematic review and meta-analysis of longitudinal studies. *J Am Geriatr Soc*. 2022;70(9):2695–709. [[CrossRef](#)].
12. Li J, Xu H, Pan W, Wu B. Association between tooth loss and cognitive decline: A 13-year longitudinal study of Chinese older adults. *PLoS One*. 2017;12(2):e0171404. [[CrossRef](#)].
13. Li L, Zhang Q, Yang D, Yang S, Zhao Y, Jiang M, et al. Tooth loss and the risk of cognitive decline and dementia: A meta-analysis of cohort studies. *Front Neurol*. 2023;14:1103052. [[CrossRef](#)].
14. Liu G, Lu Z, Shan Y, Wang J, Shi X, Zong D, et al. Association between self-reported oral health and cognitive function among the community-dwelling elderly in Jinan, China: The mediating effect of life satisfaction. *Front Psychol*. 2023;14:1116325. [[CrossRef](#)].
15. Nangle MR, Riches J, Grainger SA, Manchery N, Sachdev PS, Henry JD. Oral health and cognitive function in older adults: A systematic review. *Gerontology*. 2019;65(6):659–72. [[CrossRef](#)].
16. Locker D, Clarke M, Payne B. Self-perceived oral health status, psychological well-being, and life satisfaction in an older adult population. *J Dent Res*. 2000;79(4):970–5. [[CrossRef](#)].
17. McGrath C, Bedi R. A study of the impact of oral health on the quality of life of older people in the UK—findings from a National Survey. *Gerodontology*. 1998;15(2):93–8. [[CrossRef](#)].
18. Proffitt L. The relationship between oral health deficits and oral health related quality of life in the older adult population [dissertation]. Kingston, RI, USA: University of Rhode Island; 2021. [[CrossRef](#)].
19. van de Rijt LJM, Stoop CC, Weijenberg RAF, de Vries R, Feast AR, Sampson EL, et al. The influence of oral health factors on the quality of life in older people: A systematic review. *Gerontologist*. 2020;60(5):e378–94. [[CrossRef](#)].
20. Ye N, Deng B, Hu H, Ai Y, Liu X, Zhou S, et al. The association between oral health and mild cognitive impairment in community-dwelling older adults. *Front Public Health*. 2024;12:1464439. [[CrossRef](#)].
21. Lee KH, Plassman BL, Pan W, Wu B. Mediation effect of oral hygiene on the relationship between cognitive function and oral health in older adults. *J Gerontol Nurs*. 2016;42(5):30–7. [[CrossRef](#)].
22. Health and Retirement Study. RAND HRS Longitudinal File 2022 (V1) public use dataset. Produced and distributed by the University of Michigan with funding from the National Institute on Aging (Grant No. NIA U01AG009740). Ann Arbor, MI, USA: University of Michigan; 2025.
23. Sonnega A, Faul JD, Ofstedal MB, Langa KM, Phillips JW, Weir DR. Cohort profile: The health and retirement study (HRS). *Int J Epidemiol*. 2014;43(2):576–85. [[CrossRef](#)].
24. Health and Retirement Study. Sample Evolution: 1992–2018. Ann Arbor, MI, USA: University of Michigan; 2025.
25. Alley D, Suthers K, Crimmins E. Education and cognitive decline in older Americans: Results from the AHEAD sample. *Res Aging*. 2007;29(1):73–94. [[CrossRef](#)].
26. Kelekar U, Pan X, Philippou E, Muhammad T, Heyn PC, Wu B. Associations between oral health measures and cognitive function in middle aged and older Indian adults. *Sci Rep*. 2025;15(1):13183. [[CrossRef](#)].
27. Luo H, Tan C, Adhikari S, Plassman BL, Kamer AR, Sloan FA, et al. Effects of the co-occurrence of diabetes mellitus and tooth loss on cognitive function. *Curr Alzheimer Res*. 2021;18(13):1023–31. [[CrossRef](#)].
28. Fisher GG, Ryan LH. Overview of the health and retirement study and introduction to the special issue. *Work Aging Retire*. 2018;4(1):1–9. [[CrossRef](#)].

29. Health and Retirement Study. 2018 Health and Retirement Study: Experimental Module 3-Dental Health and Dental Health Services. Ann Arbor, MI, USA: University of Michigan; 2018.
30. Han SH, Burr JA, Zhang S. Helping behaviors and cognitive function in later life: The impact of dynamic role transitions and dose changes. *Soc Sci Med.* 2025;383:118465. [[CrossRef](#)].
31. Hofbauer LM, Rodriguez PFS. The mediating role of lifestyle activities in the association between social deprivation and cognition in older adulthood: Results from the health and retirement (HRS) study. *J Aging Health.* 2025;37(9):555–66. [[CrossRef](#)].
32. Ofstedal MB, Al E. Documentation of cognitive functioning measures in the Health and Retirement Study. Ann Arbor, MI, USA: University of Michigan; 2005. [[CrossRef](#)].
33. McCammon RJ, Fisher GG, Hassan H, Faul JD, Rodgers WL, Weir DR. Health and Retirement Study imputation of cognitive functioning measures: 1992-2018 (Version 7.0). Ann Arbor, MI, USA: University of Michigan; 2022 [cited 2026 Jan 1]. Available from: https://hrs.isr.umich.edu/sites/default/files/biblio/COGIMP9218_dd.pdf.
34. Crimmins EM, Kim JK, Langa KM, Weir DR. Assessment of cognition using surveys and neuropsychological assessment: The Health and Retirement Study and the Aging, Demographics, and Memory Study. *J Gerontol B Psychol Sci Soc Sci.* 2011;66(Suppl 1):i162–71. [[CrossRef](#)].
35. Diener E, Lucas RE, Oishi S. Advances and open questions in the science of subjective well-being. *Collabra Psychol.* 2018;4(1):15. [[CrossRef](#)].
36. Rhemtulla M, Brosseau-Liard PÉ, Savalei V. When can categorical variables be treated as continuous? A comparison of robust continuous and categorical SEM estimation methods under suboptimal conditions. *Psychol Methods.* 2012;17(3):354–73. [[CrossRef](#)].
37. Robitzsch A. Why ordinal variables can (almost) always be treated as continuous variables: Clarifying assumptions of robust continuous and ordinal factor analysis estimation methods. *Front Educ.* 2020;5:589965. [[CrossRef](#)].
38. Baron RM, Kenny DA. The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *J Pers Soc Psychol.* 1986;51(6):1173–82. [[CrossRef](#)].
39. Rosseel Y. lavaan: an R package for structural equation modeling. *J Stat Soft.* 2012;48(2):1–36. [[CrossRef](#)].
40. Efron B, Tibshirani RJ. An Introduction to the Bootstrap. New York, NY, USA: Chapman & Hall; 1993.
41. Bhoopathi Haricharan P, Feine J, Juwara L, de Souza RF. “Chew on This: Oral health is associated with cognitive function among Canadians enrolled in the Canadian Longitudinal Study on Aging”. *J Dent.* 2025;157:105720. [[CrossRef](#)].
42. Chen Y, Li C, Fan Y, Jiao L, Silverman M, Ishimaru M, et al. Associations of oral health status and swallowing function with cognitive impairment in the aging population: A cross-sectional study. *BMC Oral Health.* 2023;23(1):912. [[CrossRef](#)].
43. Xie Y, Xia X, Tian X, Hu Y, Li Y, Tan X, et al. The association between cognitive impairment and oral health or oral hygiene behaviors among multiethnic older adults in Western China: A cross-sectional multicenter study. *BMC Public Health.* 2025;25(1):259. [[CrossRef](#)].
44. de Sam Lazaro SL, Nitschke Durben AM, Kline JJ. Barriers and opportunities to support the oral health of older adults: A rapid review of health policy and systems. *Int J Aging Hum Dev.* 2023;96(1):51–62. [[CrossRef](#)].
45. Dye BA. The absence of dental care in medicare and health inequities. *JAMA Netw Open.* 2023;6(9):e2333310. [[CrossRef](#)].
46. Lowenstein A, Singh ML, Papas AS. Addressing disparities in oral health access and outcomes for aging adults in the United States. *Front Dent Med.* 2025;6:1522892. [[CrossRef](#)].
47. National Institute of Dental and Craniofacial Research. Dental caries (tooth decay) in seniors (aged 65 and older). Bethesda, MD, USA: NIDCR; 2019.
48. Centers for Disease Control and Prevention. Health disparities in oral health. Atlanta, GA, USA: CDC; 2024 [cited 2026 Jan 1]. Available from: <https://www.cdc.gov/oral-health/health-equity/index.html>.