Socio-behavioral predictors of self-reported oral health-related quality of life

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Abstract

Purpose—To examine the relationship between social and financial support, behavioral and sociodemographic variables, and oral health-related quality of life (OHRQoL) in a national probability sample.

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Methods—The National Health and Nutrition Examination Survey (NHANES) 2003–2004 data system was used; there were 12,761 persons selected for the sample, 10,122 of those were interviewed (79.3 %). Oral health-related quality of life, the outcome measure, was evaluated using seven items derived from the 14-item NHANES Oral Health Impact Profile (OHIP) included in the home interview. The aggregated OHRQoL scores ranged from 7 to 28. We included only adults, aged 20 and older, who self-reported their alcohol use during home interview ($n = 5,014$). Independent variables were social and financial support, and behavioral variables (smoking and alcohol use), with sociodemographic variables as covariates. Multiple linear regression analysis used weighted data representing 124 million persons.

Results—Lack of financial support reduced OHRQoL, but not social support. Smoking reduced OHRQoL, but not alcohol use. Compared to ages 20–24, persons aged 24–44 and aged 45–64 had significantly lower OHRQoL scores, but persons aged 65+ did not. Latinos' OHRQoL scores were lower than those of whites; there were no differences between whites and other ethnic groups.

Conclusion—The model provides insights into the perception of OHRQoL in that oral health related to the ability to pay for care. Those in the middle years (24–64) rate their OHRQoL lower than do their younger cohorts; there is no difference in OHRQoL between the young and the old.

Introduction

The prevalence of dental problems and the high cost of dental care mean that dental treatment is increasingly more expensive. As a result, lack of access to dental care and the unavailability of cost-effective surveillance tools make for a fundamental problem. Self-report is the most convenient, non-invasive, and cost-effective method of obtaining information on oral health needs and outcomes: these data are easy to obtain, do not require clinical assessments, and can be elicited at almost any location. But, because of personal perception and bias, self-reported outcomes often differ significantly from clinically determined standards [1–3]. Self-reports of oral health would be ideal for quickly evaluating oral health status, particularly for screening the oral health of large populations. However, various factors, such as personal beliefs and cultural background, often cause self-reported health outcomes to differ significantly from those of clinically determined standards [4–7]. Additional factors, such as competing needs from existing systemic diseases and socioeconomic status, may cause people to pay less attention to oral health and further widen the difference between self-reported and clinically determined oral health status [8]. For complex reasons, the accuracy of individual self-reported oral health measures varies from item to item, yet little research has been done about the performance of individual self-reported oral health items, particularly those that are used in large-scale surveys, and it is not clear which items perform better than others. This has significantly limited the use of self-reported oral health data in dental screening, evaluation, treatment, prevention, and research.

One such self-report measure—oral health-related quality of life (OHRQoL)—is key to assessing an individual's perceived oral health functioning [9–13]. OHRQoL has a substantial impact on overall functioning and well-being and as such, is an integral part of health-related quality of life. The ability to chew and swallow food comfortably, to speak, and to interact socially are important activities of daily living that can be compromised by common oral manifestations of many diseases, including diabetes, lupus, osteoporosis, respiratory infections, HIV, cardiovascular disease, and stroke [14–17]. For patients with chronic disease, medications may also compound the problem through side effects such as dry mouth, sore throat, and loss of appetite. Conditions, such as oral cancer and HIV, as well as age-related changes in the oral mucosa, may result in oral lesions, which have a negative impact on emotional well-being, as the appearance of the mouth and teeth plays an important role in maintaining a favorable self-image. Heavy alcohol consumption and tobacco use are synergistic in their effect on the mouth, namely dehydration of cell walls that enhance the ability of cancer-causing compounds like tobacco to permeate mouth tissue. In each of the systemic conditions noted above, an individual's OHRQoL is affected not only by the physiological challenges incumbent with these oral disorders, including pain, but also by the psychosocial consequences.

Locker [18] has argued on behalf of the essential conceptual unity of oral health and general health, in view of recent challenges to the traditional medical model by the more holistic socioenvironmental model of health [19, 20]. To this end, studies of oral health status and OHRQoL have noted the strong association between indicators of oral functioning and well-being, and physical and mental health [21, 22]. However, as Locker and others [23, 24] have noted, further studies are needed to understand the meaning and significance of the functional and psychosocial impacts of oral disorders on an individual's quality of life. There is also the issue of cross-cultural relevance of the consequences of oral disorders, as both the nature and significance of these impacts can vary between populations representing different cultural backgrounds and world orientations [25, 26]. Using the *National Health and Nutrition Examination Survey* (NHANES) 2003–2004 Oral Health Impact Profile (OHIP), Sanders [27] found that first-generation Latinos in the United States experienced better OHRQoL outcomes than non-Latino whites, a protective factor that is paradoxical given the relative economic disadvantage, restrictions to needed dental care, and language barriers experienced by members of this group. However, as Sanders suggests, nativity status, in itself, may not be sufficient to explain this protective advantage; cultural factors, such as familial ties, obligations, and loyalties, are well-recognized values associated with the extended Latino immigrant family [28]. Using the NHANES 2003–2004 OHIP, Sanders et al. [29] conducted a cross-national study of respondents in the United States and Australia and found that members of socioeconomically disadvantaged groups in the two developed nations had more severe oral disease and poorer OHRQoL, together with limited access to needed dental care. A recent study has used the NHANES 2003–2004 OHRQoL measure to understand perceived dental needs in the United States, emphasizing the perceived need to relieve dental pain [30].

The disproportional impact of oral disease among economically disadvantaged people with limited access to dental care underlies our own analyses of sociobehavioral correlates of OHRQoL, with dual goals of informing future oral health surveys and elevating the

standard of oral health care in North America and other regions of the world. In this study, we use data from the NHANES 2003–2004 survey to understand how the differences between continuous oral health measures, namely OHRQoL, are associated with individual demographic, socioenvironmental, and behavioral data.

Methods

Sampling and data collection

A number of publicly available national surveys contain oral health information. Among the different surveys, the nationally representative NHANES is designed to assess the health and nutritional status of adults and children in the United States. The survey uses a stratified, multistage probability sampling design of the civilian non-institutionalized United States population, with oversampling of low-income persons, African Americans, Mexican Americans, adolescents aged 12–19 years, and persons 60 years and older. The cross-sectional NHANES survey offers comprehensive dental and oral health datasets with both self-report and clinical examination measures. Now, an ongoing survey, NHANES has a long history of collecting oral health data and has matured through four waves, with its results released in 2-year waves. We used the 2003–2004 NHANES wave [31], which collected oral health information on conditions never assessed in previous US national health surveys [32]. For NHANES 2003–2004, there were 12,761 persons selected for the sample, 10,122 of those were interviewed (79.3 %), and 9,643 (75.6 %) were examined in the mobile examination centers (MEC).

Inclusion criteria

We included only adults, aged 20 and older, who self-reported their alcohol use during the NHANES 2003–2004 home interview ($n = 5{,}014$).

Dependent variable

OHRQoL was evaluated using the NHANES OHIP, consisting of seven questions derived from the 14-item OHIP [33], which was included in the oral health section of the questionnaire administered during the home interview. The theoretical framework of the OHIP is based on the World Health Organization's International Classification of Impairments, Disabilities, and Handicaps [34]. The OHIP is used worldwide, having been translated into more than 20 languages, with a valid and consistent Spanish version tested in a cross-sectional study conducted in Chile [35]. The NHANES OHIP questions assess the impact of oral disorders on various dimensions of quality of life and well-being, including functional limitation, physical pain, psychological discomfort, and social disability, "during the last year." Responses for the NHAMES OHIP are recorded using a five-point ordinal scale and coded 0 = never, 1 = hardly ever, 2 = occasionally, 3 = fairly often, 4 = very often.

Covariates

NHANES study subjects reported all covariates in the home interview; we selected covariates for their known association with quality of life and personal well-being, based upon previous studies. These include sociodemographic variables (age, ethnicity, gender,

and education), socioenvironmental variables (household size, emotional and financial support), and behavioral variables (alcohol use and smoking).

Data and statistical analysis

The nationally representative oral health data system from NHANES 2003–2004 was used for the analyses. This wave of NHANES data has a total number of 10,122 individuals, over 20 years old, 5,014 of whom answered all the OHRQoL and alcohol use questions. The measures used in the analysis include demographics, household size, emotional and financial support, and alcohol use. The dependent variable is the summation of the response to the following questions:

How often during the last year (have you/has Selected Participant) had the following issue:

1. painful aching anywhere in the mouth;

2. felt that life in general was less satisfying because of problems with teeth, mouth, or dentures;

3. difficulty doing usual jobs or attending school because of problems with teeth, mouth, or dentures;

4. sense of taste been affected by problems with teeth, mouth, or dentures;

5. avoided particular foods because of problems with teeth, mouth, or dentures;

6. found it uncomfortable to eat any food because of problems with teeth, mouth, or dentures;

7. been self-conscious or embarrassed because of teeth, mouth, or dentures.

We rescaled each item on a four-point ordinal scale coded 4 = often, 3 = occasionally, 2 = hardly ever, and 1 = never, with a higher score indicating better OHRQoL. The aggregated OHRQoL scores theoretically ranged from 7 to 28. We renumbered the responses so that the higher number would reflect better OHRQoL. In addition, we combined responses from the lower end of the scale (i.e., fairly often and very often) because the response rates were very low. We have one outcome variable related to OHRQoL: the summation of all seven items for an overall OHRQoL score, which is continuous.

The statistical analysis was conducted at three levels. First, through univariate analysis, we calculated the marginal distribution of each of the outcome measures, predictors, and covariates. For the continuous measures, we calculated the weighted mean, standard deviation, and the range of minimum and maximum. For categorical variables, we calculated the weighted frequency distributions and percentage in the population. Then we used weighted bivariate analysis to examine the association between each of the continuous or categorical outcome measures, with each of the predictors and covariates. Finally, we built one weighted multiple regression model for the continuous outcome; adjusted for the demographics, such as age group, ethnicity, gender, education, and household size. Because of the missing issue for alcohol use and social support (emotional support and financial support) measures, we built models to adjust alcohol and social support, individually and simultaneously. SAS statistical software, Version 9.2, was used for all analyses.

Results

This analysis reports the results of those adults, aged 20 and older, who answered all the OHRQoL and alcohol use questions during the NHANES 2003–2004 home interview (n = 5,014).

Table 1 presents the weighted frequencies for each item used to construct OHRQoL for our study, representing 204 million individuals.

The most often reported OHRQoL concern were "painful aching in the mouth" and "uncomfortable to eat any food," each at 7 % of the population. The least often reported OHRQoL concerns were "difficulty doing usual jobs or attending school" (1 %) and "sense of taste affected" (2 %).

Table 2 presents the mean values for OHRQoL by sociodemographic and behavioral variables, and for emotional and financial support. The table also presents the weighted frequencies for each of the variables. The overall OHRQoL mean for the entire population is 25.34. As in Table 1, OHRQoL tends to be toward the high end of the range, indicating that most people view their oral health as "good" in terms of not having any problems. The bivariate analysis provides some insight into the variables that may be important indicators of OHRQoL. For example, age appears to be important, albeit in a counterintuitive sense, in that the oldest age group reports the highest overall OHRQoL. Ethnicity also appears to play a role, as does gender, with African Americans reporting the lowest scores, Latinos reporting the highest scores, and with men reporting higher scores than women. Not unexpectedly, higher education is strongly associated with the highest scores, and current cigarette smokers with the lowest. Those without financial support have lower scores.

Table 3 presents a multilinear regression analysis examining the variables used previously in Table 2. Unlike the bivariate analysis, this model takes into account the association of all the variables simultaneously. It is interesting that the two middle-aged groups, when compared to the youngest groups, report significantly lower OHRQoL relative to the reference group, aged 20–24, while the oldest group, over 65, reports no difference. With regard to ethnicity, Latinos, compared to whites (the reference group), report significantly higher OHRQoL, while African Americans are not significantly different from whites in our analysis. Men have a significant higher QHRQoL than women. In the bivariate analysis, there was almost a linear relationship between education and OHRQoL; however, in the multivariate analysis, while this linear relationship is also found, it is not quite as strong as in the bivariate analysis. The educational variable shows some inconsistencies in the relationship between educational level and OHRQoL. For example, compared to college graduates, those with less than a high school diploma report significantly lower (p = 0.0003) OHRQoL, while OHRQoL of high school graduates is not quite statistically significant (p = 0.06), and the scores of those with some college are statistically significant at the p = 0.02 level. Current smokers of cigarettes reported statistically significant lower OHRQoL than those who do not smoke, while there was not a difference between previous smokers and smokers of other types of tobacco, and non-smokers. While emotional support was significant neither in the bivariate nor in the multivariate analyses, lack of financial support was significant in

both analyses, indicating that compared to those with financial support, those lacking such support reported lower OHRQoL scores.

Discussion

In this study, we have examined sociodemographic, behavioral, and social support variables, which are associated with OHRQoL. As indicated above, age related with OHRQoL in that both the youngest and the oldest age group view their OHRQoL more positively than the middle group (aged 25–64). This may be related to the fact that the youngest age group is in good oral health, while the older adults view their oral health as they do their general health, namely in positive terms compared to their peers and to their sense that they have survived to this stage of life [36]. Therefore, when older adults describe their OHRQoL in negative terms, it has greater importance than those in their middle years, because their tendency is to positively overestimate their quality of life. With respect to gender, even though women utilize dental and health services, in general, more so than men, our data show that men rate their OHRQoL higher. Men will often see themselves as "immune" from threats, such as oral disease, or deny the need for dental care, and typically delay accessing such care. Women, on the other hand, seek care and receive professional feedback, including diagnosis and treatment plans, which in turn, may evoke a negative perception of their OHRQoL.

In considering ethnicity, Latinos rate their OHRQoL higher than whites even though their access to care is considerably lower and their oral disease rates are higher. We know the that rates of other important health indicators—the similar rates of low birth weight infants between Latina and white women [37], and low cancer rates and low rates of obesity among first-generation Latino immigrants—support the concept of a Latino "advantage" and the "epidemiological paradox" [38]. For instance, the experiences of first-generation Latino family life may influence the individual's perception of OHRQoL and may also have implications for health beliefs among the members of succeeding generations. Counter to this perspective, the problems experienced by young Latinos resulting from the early onset of Type 2 diabetes [39] may, in fact, alter perceptions of health status within this ethnic group.

Smoking cigarettes, as a negative health behavior, provides a strong indicator of lower OHRQoL, which is consistent with research findings. This sense of poor OHRQoL is probably associated, to some degree, with the general indictment of smoking as having a deleterious effect on health. Dental care is often perceived as being an expensive, discretionary service, rather than a basic health care need. Our results indicate that, compared to persons with financial support, those who do not have financial support rate their OHRQoL lower.

To summarize the implications of this model's findings, Table 3 estimates that a young, white woman – with a college education or higher, not using alcohol or tobacco, and having financial support – would have an OHRQoL score of 27.2, almost a perfect score. Compared to this individual, a person, 45–64, who has less than a high school education, smokes cigarettes, and has no financial support, would have an OHRQoL score of 22.4, as estimated by this model. This is an 18 % reduction in OHRQoL, based upon the four

variables. This provides some insight into the potential impact of demographic, behavioral, and social support factors in determining the quality of life on a national level. Hence, our model points to the usefulness of OHRQoL measures in delineating oral health risk in a national sample and supports the idea that self-reported quality of life indicators, together with demographic, support, and behavioral variables, can be useful as a rapid assessment tool. OHRQoL measures, together with other oral health status measures, may also help target oral screening and evaluation in large populations and may even potentially conserve limited clinical resources by focusing on the members of high-risk groups in an effort to persuade them to engage more rigorously on behalf of their diagnostic, preventive, and restorative care.

This analysis shows that quantitative prediction of OHRQoL can be determined from demographic, behavioral, and support variables. Although demographic characteristics are well-known predictors of OHRQoL, financial support was also significant in our analysis, while emotional support did not emerge as a significant factor. In our study of the quality of life of persons receiving medical care for HIV [22], there was a strong association between OHRQoL and mental health, indicative of a substantial relationship between emotional well-being and oral health. In that population, the relationship between OHRQoL and mental health suggests that there is an emotional component, which was not reflected in terms of emotional support, but may be reflected in other ways. Future research in this area will need to examine more deeply this relationship between OHRQoL, emotional support, and the sense of emotional well-being.

Acknowledgments

Abbreviations

MEC	Mobile examination centers
NHANES	National Health and Nutrition Examination Survey
OHIP	Oral Health Impact Profile
OHRQoL	Oral health-related quality of life

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Table 1

Weighted distribution of the original items related to oral health-related quality of life

Oral health-related quality of life questions	Weighted frequency	Standard deviation	Percent	Standard error of percent
Q1 Painful activity in the mouth				
4 = Often	13,755,543	1,460,238	6.73	0.48
3 = Occasionally	25,128,226	2,013,694	12.30	0.61
2 = Hardly ever	42,636,848	3,780,291	20.87	1.06
1 = Never	122,768,565	8,556,598	60.10	1.22
Q2 Life less satisfying because of oral problems				
4 = Often	9,666,526	1,160,051	4.73	0.36
3 = Occasionally	11,641,547	1,190,583	5.70	0.39
2 = Hardly ever	17,505,766	1,471,936	8.57	0.42
1 = Never	165,475,343	11,068,539	81.00	0.82
Q3 Difficulty doing usual jobs or attending school because of oral problems				
4 = Often	3,023,349	542,861	1.48	0.23
3 = Occasionally	4,200,819	483,792	2.06	0.23
2 = Hardly ever	9,475,600	861,084	4.64	0.30
1 = Never	187,589,414	12,932,951	91.83	0.56
Q4 Uncomfortable eating any food because of oral problems				
4 = Often	3,969,630	781,556	1.94	0.36
3 = Occasionally	5,309,418	627,190	2.60	0.27
2 = Hardly ever	8,053,339	971,541	3.94	0.32
1 = Never	186,956,795	12,678,172	91.52	0.49
Q5 Sense of taste affected because of oral problems				
4 = Often	13,096,247	1,508,461	6.41	0.64
3 = Occasionally	20,859,177	2,236,911	10.21	0.64
2 = Hardly ever	16,919,789	1,076,817	8.28	0.54
1 = Never	153,413,968	10,929,286	75.10	0.87
Q6 Avoided particular foods because of oral problems				
4 = Often	11,892,496	1,399,645	5.82	0.48
3 = Occasionally	23,879,152	2,399,654	11.69	0.56

Oral health-related quality of life questions	Weighted frequency	Standard deviation	Percent	Standard error of percent
2 = Hardly ever	21,196,021	1,988,158	10.38	0.62
1 = Never	147,321,513	9,372,732	72.11	0.96
Q7 Self-conscious or embarrassed because of oral problems				
4 = Often	13,349,033	1,537,101	6.53	0.51
3 = Occasionally	13,083,742	1,299,563	6.40	0.54
2 = Hardly ever	13,548,754	1,143,398	6.63	0.26
1 = Never	164,307,652	11,157,718	80.43	0.65
Total	204,289,182	13,958,362	100.00	

Table 2

Bivariate analysis of oral health-related quality of life by sociodemographic, behavioral and support variables

Covariate	Weighted frequency	Mean of oral health-related quality of life	Standard error	p value
Age				
20–24	23,430,000	25.45	0.15	Reference
25–44	82,330,000	25.32	0.15	0.2700
45–64[a]	67,610,000	25.04	0.14	0.0228
65+[a]	30,920,000	25.95	0.11	0.0036
Ethnicity				
White	146,590,000	25.36	0.12	Reference
Latino[a]	23,320,000	25.74	0.14	0.0197
African American[a]	23,000,000	24.93	0.23	0.0487
Other	11,380,000	25.07	0.31	0.1915
Gender				
Female	106,310,000	25.18	0.10	Reference
Male[a]	97,980,000	25.51	0.13	0.0221
Education				
College Degree	47,770,000	26.12	0.12	Reference
Some college[b]	63,830,000	25.27	0.11	<0.0001
High School[b]	55,020,000	25.09	0.24	<0.0001
Less than High School[b]	37,470,000	24.80	0.17	<0.0001
Household size				
2–3 per house	108,160,000	25.48	0.13	Reference
1 person	28,650,000	25.17	0.15	0.0592
4 or more	67,470,000	25.18	0.18	0.0883
Alcohol				
No use	32,860,000	25.29	0.16	Reference
Moderate	110,340,000	25.37	0.10	0.3358
Heavy	11,790,000	24.87	0.44	0.1848

Covariate	Weighted frequency	Mean of oral health-related quality of life	Standard error	p value
Missing	49,290,000	25.42	0.21	0.3112
Smoking				
No use	89,120,000	25.87	0.12	Reference
Previous smoker	56,010,000	25.56	0.15	0.3358
Smoke other tobacco	7,190,000	25.55	0.38	0.1848
Smoke cigarettes [b]	51,940,000	24.16	0.16	<0.0001
Emotional support				
Have support	117,290,000	25.31	0.12	Reference
No support	7,430,000	24.65	0.50	0.0996
Missing	79,570,000	25.44	0.13	0.2312
Financial support				
Have support	98,500,000	25.48	0.14	Reference
No support [b]	25,480,000	24.44	0.20	<0.0001
Missing	80,310,000	25.45	0.13	0.4376

[a] p < 0.05

[b] p < 0.0001

Table 3

Multiple linear regression of oral health-related quality of life by sociodemographic, behavioral, and support variables

Covariates	Oral health-related quality of life		
	Estimate	Standard error	p value
Intercept[b]	27.24	0.29	<.0001
Age			
20–24			Reference
25–44[a]	−1.28	0.44	0.0116
45–64[a]	−1.03	0.30	0.0037
65+	−0.16	0.31	0.6198
Ethnicity			
White			Reference
Latino[a]	0.91	0.21	0.0006
African American	−0.18	0.23	0.4477
Other	−0.46	0.40	0.2686
Gender			
Female			Reference
Male[a]	0.42	0.15	0.0123
Education			
College degree			Reference
Some college[a]	−0.53	0.20	0.0202
High school	−0.57	0.28	0.0612
Less than high school[a]	−1.29	0.27	0.0003
Household size			
2–3 per house			Reference
1 person	−0.42	0.23	0.0828
4 or more	0.10	0.31	0.7496
Alcohol			
No use			Reference

| Covariates | Oral health-related quality of life | | |
	Estimate	Standard error	p value
Moderate	−0.14	0.25	0.5930
Heavy	−0.40	0.50	0.4283
Smoking			
Non-smoker			Reference
Previous smoker	−0.38	0.20	0.0825
Smoke other tobacco	0.16	0.38	0.6798
Smoke cigarette [b]	−1.67	0.32	0.0001
Emotional support			
Have support			Reference
No support	−0.16	0.57	0.7796
Financial support			
Have support			Reference
No support [a]	−0.83	0.28	0.0103

[a] $p < 0.05$

[b] p 0.0001