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Research Article

Clinical Oral Health Recommended Care and Oral Health Self-Report, NHANES, 2013-2014

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Purpose. The purpose of this study was to determine the concordance of self-reported responses to oral health questions versus clinically evaluated recommended need for oral healthcare by calibrated dentists to determine usefulness of the questions for epidemiological studies. We additionally examined other factors associated with concordant self-reports versus clinical evaluations. *Materials and Methods*. We used a cross-sectional study design with 4,205 participants, ages 30 years and above, who had complete oral health self-perception data and dental referral data in the NHANES 2013-14. Calibrated dentists completed clinical oral healthcare assessments. The assessments were dichotomized to (1) recommendation for immediate care and (2) routine oral health care. Self-reported oral health needs were measured with 6 items (an overall oral health self-perception question, oral pain within the previous year, impact on job/school, suspected periodontal disease, tooth appearance, and tooth mobility). The key item of interest was the overall oral health self-perception question. *Results*. Concordance with clinically evaluated recommended need for oral healthcare varied from 52.0% (oral pain) to 65.4% (overall oral health self-perception). Many subgroup differences were observed. *Conclusions*. The overall self-perception of oral health and the clinical evaluation of oral healthcare need were substantially concordant; other self-reported measures were moderately concordant. This is useful information and points to the need for a minimum set of measures that can provide actionable information and capture the need for clinical dental care.

1. Introduction

The World Dental Federation (FDI) policy-makers adopted a new definition of oral health in 2016. In addition to addressing well-being and the absence of disease or infirmity, they defined oral health as being multifaceted, *fundamental* to health and quality of life, and *subject to an individual's circumstances* [1]. The FDI policy-makers described oral health as involving speaking, smiling, tasting, touching, chewing, swallowing, and emoting [1]. The burden of poor oral health and its consequences have resulted in a call for oral health to be included in all health policies [2]; a call derived from the voices of the people for overall better care, better health, and lower cost [3]. There are many known factors (social, psychosocial, economic, and cultural) that interact holistically with biological factors and have pivotal roles in *overall health* outcomes subject to an individual's circumstances [4]. Likewise, social, psychosocial, economic, and cultural factors also impact *self-perception* of health. However, in terms of clinical diagnoses and/or assessments, self-perception questions and clinical examinations may not have adequate agreement [5]. In a clinical setting, the

discordance between patient's self-report of symptoms or lack thereof and a healthcare provider's clinically derived diagnosis/assessment is often resolved. However, on a population level, using data to learn about ways to improve quality requires measures (1) that are of importance, (2) that are efficient and do not involve a lot of time, (3) that measure what is intended, and (4) that are helpful in informing policy [3]. As such, to address a population's oral health needs for policy determination, it is important to know the agreement between questions involving oral health self-perceptions/self-report of needs versus clinically evaluated oral healthcare need so that the fewest and the best questions can be used in population research.

A number of researchers have examined oral health self-reports and oral health outcomes. For example, researchers found agreement between the self-reported number of missing teeth and the clinically determined number of missing teeth in adults, ages 70 years and above [6].

However, researchers also determined that self-reports of periodontal disease had good specificity but low sensitivity with clinical determinations among Veterans [7]. Among healthcare professionals, self-reports of periodontal surgery were associated with clinically determined periodontal disease measured in bone loss [8]. And, in a study in which researchers completed a full mouth clinical assessment for periodontal disease, the self-report of periodontal disease was in agreement with the clinical results [9]. In circumstances where only self-reports are available, valid correspondence with oral health needs is important to advance knowledge and to inform both treatment planning and policy development. Self-reported symptoms and health status matter. For example, since self-reported smokers were more than twice as likely to report poor oral health than nonsmokers and more likely to seek dental care symptomatically [10], report oral-facial pain [11], or report having higher dental needs [12], their dental treatment planning requires the consideration of their self-report.

However, there is a lack of consistency in epidemiological studies using self-reports with reference to oral health, due to the differences in which researchers ask oral health self-report questions, the end-points/outcomes for research that are considered, and the samples that are chosen. In summary, establishing which self-report questions have the best concordance with clinical evaluations has the potential to improve efficiency, improve reliability of epidemiological studies without the expense of clinical assessment, provide useful information for policy development, and ultimately improve oral healthcare without excessive measurement.

The purpose of this study was to determine the concordance of self-reported oral health questions versus the clinical evaluation of oral healthcare need by calibrated dentists to determine useful epidemiological questions. The determination of operant, valid questions about oral health is needed so that patient's behaviors/symptoms/conditions can be determined efficiently and diplomatically. Our focus is to provide data-driven evidence on the oral health questions that were relatively more concordant with the clinical determinations for the need of immediate or routine dental care. Tension exists for both the provider and patient when required to collect *extraneous* data which wastes time, is not helpful, and does not improve health outcomes [3].

The present study received West Virginia University Institutional Review Board acknowledgement (protocol number 1606141771). The conceptual framework for this study was the Multidimensional Conceptual Model of Oral Health in which clinical oral health need is identified as oral tissue damage [13]. In the model, tissue damage and oral disease (oral pain and discomfort, oral functional limits, and oral disadvantage) are factors for self-rated oral health.

2. Methods

2.1. Data Source. The data source for the present study was National Health and Nutrition Examination Surveys (NHANES) 2013-14 [14], which is available to researchers from the NHANES website. The Centers for Disease Control and Prevention researchers for the NHANES used stratified, multistage probability sampling designs for the surveys. The NHANES participants were civilians who were noninstitutionalized and who lived in the U.S., including Washington, DC. The researchers for the NHANES oversampled smaller subgroups to increase estimate accuracy.

Data for the full mouth periodontal examination were collected in a mobile examination center by calibrated licensed dentists who used #5 reflecting mirrors, Hu Friedy PCP-2 (Hu Friedy, Chicago, IL) periodontal probes with markings of 2-4mm; 6-mm, and 10-12 mm parallel to the tooth's long axis for the periodontal examination, and #23 dental explorers for the dental examination [14]. A reference examiner conducted 20-25 examination replications per year to verify calibration. The examiners reported if there was a need for a participant to seek dental care, or if the participant needed to continue routine care. Participants for the periodontal examination in the NHANES, 2013-14 were ages 30 years and above. Participants for the dental examination in the NHANES, 2013-2014 were ages 1 year and above.

The participants in the NHANES, 2013-2014, also responded to interview questions involving the status of their teeth and gingiva, demographic information, and questions regarding health and nutrition. Details of the NHANES study are available at the NHANES website, https://wwwn.cdc.gov/nchs/nhanes/Default.aspx[14].

Eligibility for this study's data set included complete data for the dentists' oral health recommendations and responses from questions about oral health self-perception and oral pain in adults aged 30 years and above. The final sample size consisted of 4,205 adults.

2.2. Multidimensional Measures of Self-Reported Oral Health. We used six self-reported oral health measures: overall oral health self-perception; oral pain; impact on work/school; suspected periodontal disease; tooth appearance; and tooth mobility. The key oral health self-perception question was as follows: Overall, how would (you/survey participant [SP]) rate the health of (your/his/her) teeth and gums?" The possible responses were "Excellent, Very Good, Good, Fair, and Poor." [14] The responses to these questions were dichotomized to Excellent/Very Good/Good and Fair/Poor.

The question about oral pain was as follows: "How often during the last year (have you/ has SP) had painful aching anywhere in (your/his/her) mouth?" The impact on work/school question was as follows: "How often during the last year (have you/has SP) had difficulty doing (your/his/her) usual jobs or attending school because of problems with (your/his/her) teeth, mouth or dentures? The possible responses were "Very Often, Fairly Often, Occasionally, Hardly Ever, or Never." [15] The responses for these questions were dichotomized to (1) Very often/Fairly often; and (2) Occasionally and Hardly Ever/Never.

The periodontal question was as follows: "People with gum disease might have swollen gums, receding gums, sore or infected gums or loose teeth" followed by asking "(Do you/Does SP) think (you/s/he) might have gum disease?" The tooth appearance question was as follows: "During the past three months, (have you/has SP) noticed a tooth that doesn't look right?" [15] And the tooth mobility question was the mobile tooth question: the possible responses to these questions were yes or no.

The "How often during, suspected periodontal disease, appearance of a tooth or teeth not looking right during the previous three months, and a loose tooth/teeth not due to injury" were also used [14].

2.3. Concordance/Discordance between Self-Reports and Recommended Oral Health Care. We grouped adults into two groups: (1) the concordant group (self-reported responses which were in agreement with the clinical evaluation of oral healthcare need such that a self-report of concern/need and clinical evaluation of immediate need agreed *or* a self-report of no concerns/needs and clinical evaluation of routine care agreed); and (2) the discordant group (self-reported responses and clinical evaluation of oral healthcare need were not in agreement).

2.4. Outcomes. The primary outcome was the concordance of the overall oral health self-perception question with the clinical evaluation of oral healthcare need. We determined the percentage of agreement between the self-perception of fair or poor care and the clinical evaluation of oral healthcare need.

We were also interested in the specificity of the overall health self-perception question versus clinical evaluation of oral healthcare need. We determined the percentage of agreement between the self-perception of excellent/very good/good and the clinical evaluation of routine care.

2.5. Statistical Analyses. Due to the complex nature of NHANES, SAS® version 9.4 (SAS Institute, Inc., Cary, NC) was used with the supplied weights in the data set. The analyses also accounted for stratification, primary sampling unit values, and eligibility. We used chi-square tests to assess the statistical significance of unadjusted associations. We also performed logistic regressions on concordance between clinical evaluation of recommended care and self-reported oral health measures after controlling for sex, race/ethnicity, age, education, federal poverty level, insurance coverage, obesity, alcohol use, smoking status, physical activity, presence of chronic conditions (cancer, cardiovascular disease, and diabetes), general health status, and dental visits.

The level of statistical significance for alpha was set at 0.05. Strength of concordance was set at 0-20% as poor; 21-20% as slight; 41-60% as moderate, 61-80% as substantial; and 81-100% as almost perfect, based upon similar guidelines for the Kappa coefficient by Landis and Koch [16].

3. Results

In Table 1, we report the weighted percentages for the clinical evaluation of oral healthcare need versus the self-reported responses to questions about oral health status (overall oral health self-perception, oral pain, impact on work/school, suspected periodontal disease, tooth appearance which "does not looking right", and tooth mobility). The percentages in the columns are for immediate or routine oral healthcare need for each self-reported response. Each response to the questions about oral health status was statistically significant, that is, more people who reported fair/poor oral health self-perception were more likely to have a clinical determination of needing immediate care; more people reporting pain were more likely to have a clinical determination of needing immediate care; more people who reported that there was an impact on work/school due to an oral condition were more likely to have a clinical determination of needing immediate care; more people reporting a suspected periodontal disease were more likely to have a clinical determination of needing immediate care; and more people who reported that a tooth's appearance did not look right were more likely to have a clinical determination of needing immediate care.

Table 2 has the concordance of the self-reported oral healthcare measures with the clinical evaluation of oral healthcare need in which the concordant group was in agreement with the self-report of a need with a clinical evaluation of oral healthcare need, *or was in* agreement with the self-report of no need with a clinical evaluation of routine oral healthcare; and the discordant group was in disagreement with the clinical evaluation of oral healthcare need. Clinical evaluation of oral healthcare need and the self-report for overall oral health self-perception had the highest concordance at 65.4%. The lowest concordance was with oral pain (aching anywhere in the mouth during the last year) at 52.0%.

The bivariate associations of concordant self-reported oral health with clinical evaluation of oral healthcare need are in Table 3. There were significant differences in concordance when considering sex, race/ethnicity, education, federal poverty level, insurance coverage, and diabetes for both overall oral health self-perception and oral pain. There were also significant differences in concordance when considering body mass index, smoking, cardiovascular disease, self-reported general health, and dental visit for the relationship with oral pain.

The adjusted odds ratios (AOR) and 95% confidence intervals (CI) from logistic regressions on concordance are in Table 4. Overall, females were more likely to have concordance than males. Non-Hispanic White individuals were more likely to have concordance than racial minorities. Participants with insurance, who were not obese, or who

Table 1: Oral health and recommended care versus variables of interest. Adults aged 30 years or older in National Health Examination and Nutrition Survey 2013-2014.

	Immediate Care		Routine Care		Chi-sq	Prob	Sig
	N	wt %	N	wt %			
ALL	**2,411**	**50.2**	**1,794**	**49.8**			
Overall oral health self-perception							***
Fair/Poor	1,089	79.3	253	39.6	368.373	< .001	
Ex/Vg/Good	1,322	20.7	1,541	60.4			
Oral Pain[1]							***
Yes	221	66.6	83	49.1	27.625	< .001	
No	2,190	33.4	1,711	50.9			
Impact on work/school							***
Yes	295	66.6	106	48.7	39.768	< .001	
No	2,116	33.4	1,688	51.3			
Suspected periodontal disease[2]							***
Yes	558	67.3	208	46.7	63.326	< .001	
No	1,853	32.7	1,586	53.3			
Tooth appearance does not look right							***
Does not look right	*581*	*82.3*	99	45.7	184.747	< .001	
Looks right	*1,830*	*17.7*	1,695	54.3			
Tooth mobility[3]							***
Mobile	*527*	*71.9*	181	46.8	106.808	< .001	
No mobility	*1,884*	*28.1*	1,613	53.2			

Note: based on 4,205 participants, who were 30 years and older and who had no missing data for the dentists' oral health recommendations and responses from questions about oral health self-perception and oral pain. Ex/Vg/Good, Excellent/Very Good/Good.[1] Aching anywhere in the mouth during the last year.[2] If participant thought he or she "might have gum disease" (NHANES, 2017).[3] Participant was asked if "any teeth [were] becoming loose without an injury" (NHANES, 2017].

Table 2: Concordance of self-reported oral health measures and oral health recommended care. National Health and Nutrition Examination Surveys 2013-2014.

Total	**N 4,205**	Wt %
Overall oral health self-perception		
Concordant	2,630	65.4
Discordant	1,575	34.6
Oral pain[1]		
Concordant	1,932	52.0
Discordant	2,273	48.0
Impact on work/school		
Concordant	1,983	52.6
Discordant	2,222	47.4
Suspected periodontal disease[2]		
Concordant	2,144	55.6
Discordant	2,061	44.4
Tooth appearance "does not look right" within the previous 3 months		
Concordant	2,276	57.8
Discordant	1,929	42.2
Tooth mobility.[3]		
Concordant	2,140	55.7
Discordant	2,065	44.3

Note: based on 4,205 participants, who were 30 years and older and who had no missing data for the dentists' oral health recommendations and responses from questions about oral health self-perception and oral pain.[1] Aching anywhere in the mouth during the last year.[2] If participant thought he or she "might have gum disease" (NHANES, 2017).[3] Participant was asked if "any teeth [were] becoming loose without an injury" (NHANES, 2017].

Table 3: Weighted % of concordance between clinical oral health recommended care and self-reported oral health measures adults aged 30 years or older in National Health and Examination Nutrition Survey, 2013-14.

	Overall Oral health self-perception	Oral Pain[1]	Impact on Job or school	Suspected Periodontal Disease	Tooth Appearance "does not look right"	Tooth mobility[3]
ALL	**65.4**	**52.0**	**52.6**	**55.6**	**57.8**	**55.7**
Sex	***	***	***	***	***	***
Female	69.2	57.1	57.8	59.8	62.4	60.4
Male	61.4	46.5	47.0	51.2	52.9	50.8
Race/Ethnicity	***	***	***	***	***	***
Non-Hispanic White	68.0	57.0	56.9	60.4	61.5	60.4
Non-Hispanic Black	57.5	40.0	42.1	45.0	49.5	45.8
Hispanic	61.9	39.3	42.3	43.4	50.8	43.9
Other	58.6	44.2	45.3	48.0	48.1	46.7
Age groups		*			*	
30 - 44 years	67.4	54.4	55.8	56.0	60.7	57.0
45 - 54 Years	68.7	51.8	52.0	56.4	59.8	57.2
55 - 64 Years	64.4	47.6	48.5	55.1	53.2	52.2
65, or older	65.5	55.9	54.9	57.0	59.4	61.1
Education	***	***	***	***	***	***
Less than high school	67.2	41.2	42.2	46.2	52.1	44.0
High school graduate	61.1	41.6	43.3	50.6	51.2	50.7
Some College	64.7	50.3	51.4	54.3	55.8	53.6
College	68.2	65.1	64.3	64.3	66.7	66.2
Federal Poverty Level	*	***	***	***	***	***
0 - < 1.25	63.3	38.4	39.4	45.4	52.4	44.4
1.25 to < 2.00	62.6	44.1	44.5	50.7	53.6	48.7
2.00 - < 4.00	62.9	48.1	50.7	52.7	54.0	54.3
4.00 and above	69.1	64.6	63.6	65.3	65.5	65.3
Missing	67.2	52.5	52.4	52.9	55.1	54.4
Insurance coverage	**	***	***	***	***	***
Yes	66.4	55.7	55.9	58.8	60.4	59.2
No	59.7	35.5	34.0	37.9	43.6	36.7
Obesity		***	***		*	*
No	66.7	55.4	55.7	57.0	60.0	58.3
Yes	63.5	47.2	48.2	53.5	54.8	52.0
Alcohol use		***	***	***	***	***
Non-Drinker	64.2	51.9	54.6	55.9	57.2	54.5
Moderate use	68.3	58.7	59.3	61.6	63.2	62.1
Heavy use	62.1	42.8	41.8	46.4	50.2	48.5
Missing	63.7	46.0	46.1	51.3	54.4	49.9
Smoking		***	***	***	***	***
Current	66.1	40.0	40.3	42.1	49.7	43.2
Former	63.1	51.9	51.3	57.1	57.3	56.0
Never	66.4	56.1	57.3	59.5	60.8	59.8
Physical activity				*	*	*
Yes	65.8	52.7	53.3	56.6	58.8	56.6
No	64.3	50.1	50.6	53.0	55.2	53.2

Table 3: Continued.

	Overall Oral health self-perception	Oral Pain[1]	Impact on Job or school	Suspected Periodontal Disease	Tooth Appearance "does not look right"	Tooth mobility[3]
Cancer			*			*
Yes	68.3	56.3	58.1	58.8	59.6	60.3
No	65.0	51.3	51.7	55.1	57.6	55.0
Cardiovascular disease		*				
Yes	65.4	52.5	53.8	59.2	59.6	53.3
No	65.5	52.0	52.5	55.2	57.7	56.0
Diabetes	*	***	***		*	**
Yes	60.4	43.4	42.7	52.2	51.0	48.6
No	66.4	33.6	54.4	56.3	59.1	57.1
General health		***	***	*	**	***
Excellent/very good	65.9	59.6	59.1	59.3	61.7	62.8
Good	63.1	48.6	50.0	54.1	54.6	52.5
Fair/poor	69.1	44.3	44.7	52.1	56.6	48.7
Missing	65.5	49.5	53.1	53.0	57.6	53.8
Dental visit		***	***	***	***	***
1 year or less	65.7	59.3	59.7	60.2	61.2	62.6
More than 1 year	64.9	39.1	39.9	47.6	51.8	43.6

Note: based on 4,205 participants, who were 30 years and older and who had no missing data for the dentists' oral health recommendations and responses from questions about oral health self-perception and oral pain. Asterisks represent significant group differences in concordance versus discordance based on Rao-Scott Chi-square tests.[1]Aching anywhere in the mouth during the last year.[2]If participant thought he or she "might have gum disease" (NHANES, 2017).[3]Participant was asked if "any teeth [were] becoming loose without an injury" (NHANES, 2017). *** $p < .001$; ** $.001 \leq p < .01$; * $.01 \leq p < .05$.

were never-smokers were more likely to be concordant. Reported fair/poor *general health was* associated with high concordance between clinical oral health recommended care and oral health self-perception.

4. Discussion

When using multidimensional measures of self-reported oral health, we found that the greatest concordance with clinical evaluation of oral healthcare need was with the question for overall oral health self-perception. Clinical evaluation of oral healthcare need and the self-report for overall oral health self-perception had a substantial concordance at 65.4%. The question may be a useful tool in oral health epidemiological studies, similar to the usefulness of the overall self-rated *general* health question in systemic epidemiology [17–19].

Another noteworthy finding is the moderate concordance of the *appearance* of teeth with clinically evaluated oral healthcare need. Although we do not know whether participants were self-conscious of the *color, or shape* rather considering than carious/periodontal condition of their tooth/teeth when they answered the question, the literature does include "pressures to conform" as a factor influencing body image and self-awareness [20]. The media present images of the perfect smile and ultra-white teeth with which to compare one's teeth. Reports in the media include the obsession of many people with ultra-white teeth [21], and those cultural influences may be affecting the participants' responses to this particular question.

Although not a focus of this study, additional analysis indicated that the specificity of the overall oral health self-perception question was 60.4%; and, the specificities of the other measures were between 50.9% and 53.3%. These findings have implications for referral patterns. Future research is needed to explore the reasons behind the low specificity. Additionally, when these measures are used in epidemiological research, caution is necessary in interpreting results associated with these oral health questions.

The subgroup analyses also included variations in concordance between the clinical evaluation of oral healthcare need and self-reports. Some subgroups were consistently concordant (example: female, racial minorities) on all of the measures; other groups were not. These findings suggest that when researchers use the self-reported measures on some subpopulations (smokers, middle-aged adults), the self-reported measures may not be as reliable in indicating clinical need.

4.1. Similar Studies. There is a lack of recent, similar studies with which to compare this study due to the differences in which the questions for self-report are asked, the endpoints/outcomes considered, and populations chosen for the research. For example, in a study of black women (median age 38 years), there were similar self-report questions; however, only periodontal disease status and intensity (and not all other clinical evaluations of oral healthcare needs) were considered [22]. Similarly, in another study, there was moderate agreement with the women's self-report of the removal

Table 4: Adjusted odds ratios (AORs) and 95% confidence intervals (CIs) from logistic regressions on concordance between recommended care and self-reported oral health measures. Adults Aged 30 and older in National Health and Examination Nutrition Survey, 2013-14.

	Overall Oral Health Self-Perception	Oral Pain[1]	Impact on job or school	Suspected Periodontal Disease[2]	Tooth appearance "does not look right"	Tooth mobility[3]
	AOR [95%CI]	AOR [95%CI]	AOR [95%CI]	AOR [95%CI]	AOR [95%CI]	AOR [95%CI]
Sex						
Female	1.46*** [1.28, 1.67]	1.57*** [1.33, 1.84]	1.58*** [1.28, 1.95]	1.45** [1.12, 1.86]	1.54*** [1.29, 1.82]	1.59*** [1.35, 1.87]
Male (ref)						
Race/ethnicity						
Non-Hispanic Black	0.56*** [0.43, 0.72]	0.51*** [0.40, 0.66]	0.59*** [0.46, 0.77]	0.54*** [0.44, 0.66]	0.60*** [0.49, 0.75]	0.59*** [0.50, 0.70]
Hispanic	0.66* [0.46, 0.94]	0.54*** [0.40, 0.66]	0.61*** [0.46, 0.77]	0.52*** [0.38, 0.73]	0.63** [0.47, 0.85]	0.57*** [0.45, 0.71]
Other	0.52*** [0.35, 0.78]	0.47*** [0.34, 0.65]	0.52*** [0.36, 0.75]	0.50*** [0.35, 0.73]	0.47*** [0.33, 0.67]	0.47*** [0.35, 0.61]
Non-Hispanic White (ref)						
Age in years						
30 - 44 years (Ref)						
45 - 54 years	0.99 [0.80, 1.22]	0.76* [0.60, 0.97]	0.73 [0.53, 1.00]	0.92 [0.73, 1.16]	0.83 [0.66, 1.05]	0.85 [0.64, 1.14]
55- 64 years	0.80 [0.57, 1.14]	0.56*** [0.40, 0.77]	0.57** [0.38, 0.84]	0.78 [0.56, 1.09]	0.58*** [0.41, 0.82]	0.62* [0.40, 0.97]
65, or older	0.81 [0.54, 1.22]	0.74 [0.54, 1.02]	0.69 [0.45, 1.08]	0.78 [0.57, 1.05]	0.72 [0.49, 1.04]	0.83 [0.61, 1.12]
Insurance coverage						
Yes (ref)						
No	0.71** [0.57, 0.89]	0.51*** [0.40, 0.64]	0.55*** [0.44, 0.70]	0.54*** [0.44, 0.66]	0.58*** [0.49, 0.69]	0.55*** [0.46, 0.65]
Self-reported General Health						
Fair/poor	1.51*** [1.22, 1.86]	0.97 [0.72, 1.31]	0.98 [0.76, 1.27]	1.17 [0.99, 1.39]	1.26 [0.91, 1.74]	0.98 [0.77, 1.26]
Excellent/very good/good (ref)						
Physical Activity						
No	0.96 [0.79, 1.17]	1.02 [0.86, 1.21]	0.98 [0.76, 1.26]	0.84 [0.69, 1.02]	0.86 [0.74, 1.01]	0.95 [0.83, 1.08]
Yes (ref)						
Obese						
Obese	0.74** [0.61, 0.90]	0.62*** [0.51, 0.76]	0.65*** [0.52, 0.81]	0.78 [0.60, 1.01]	0.67*** [0.55, 0.82]	0.67** [0.52, 0.87]
No (Ref)						
Smoking status						
Current smoker	0.93 [0.67, 1.29]	0.57*** [0.43, 0.77]	0.56*** [0.39, 0.80]	0.46*** [0.31, 0.67]	0.65** [0.47, 0.88]	0.56 [0.67, 1.18]
Former smoker	0.88 [0.64, 1.21]	0.85 [0.64, 1.14]	0.85 [0.60, 1.20]	0.86 [0.67, 1.09]	0.90 [0.64, 1.27]	0.89 [0.67, 1.18]
Never smoker (ref)						

Table 4: Continued.

	Overall Oral Health Self-Perception	Oral Pain[1]	Impact on job or school	Suspected Periodontal Disease[2]	Tooth appearance "does not look right"	Tooth mobility[3]
	AOR [95%CI]	AOR [95%CI]	AOR [95%CI]	AOR [95%CI]	AOR [95%CI]	AOR [95%CI]
Dental visit						
More than 1 year	0.97 [0.73, 1.29]	0.48∗∗∗ [0.40, 0.57]	0.50∗∗∗ [0.42, 0.59]	0.70∗∗∗ [0.60, 0.82]	0.73∗∗∗ [0.61, 0.87]	0.51∗∗∗ [0.41, 0.65]
1 year or less (ref)						

Note: based on 4,205 participants, who were 30 years and older and who had no missing data for the dentists' oral health recommendations and responses from questions about oral health self-perception and oral pain. Asterisks represent significant group differences in concordance compared to the reference group based on logistic regressions. [1]Aching anywhere in the mouth during the last year.[2]If participant thought he or she "might have gum disease" (NHANES, 2017).[3]Participant was asked if "any teeth [were] becoming loose without an injury" (NHANES, 2017).∗∗∗ $p < .001$; ∗∗ $.001 \leq p < .01$; ∗ $.01 \leq p < .05$.

of periodontally involved teeth and (clinically determined) severe periodontitis (Kappa=0.25; 95%CI, 0.17, 0.31); however, the study's focus was periodontal disease and not overall oral health [23].

4.2. Study Strengths. This current study has several strengths. The researchers used a large, current, nationally representative study for the data source. Several self-report questions were included in the research. The dental examiners who conducted the research to establish the NHANES 2013-2014 data source were calibrated, licensed dentists who determined if a dental need existed or if routine care should be maintained. "Overall oral health need" was used in this study. This is consistent with the 2016 FDI World Dental Federation members' emphasis upon the new definition for oral health; that is, oral health is multifaceted such that speech, sensing (smell, taste, and touch), and muscle action (chewing, swallowing, and emoting) can occur with confidence and without pain/discomfort/disease of the craniofacial complex [24]. Included in the definition are the influences of physical and mental well-being (recognized as a continuum influenced by individual and cultural values/attitudes); biopsychosocial attributes of life leading to quality life; and change (circumstantial, perceptual, experiential, etc.) [24].

4.3. Study Limitations. There are challenges to the use of broad questions concerning oral health in research. Measures need to be valid and consistently used by researchers. In a study in New Zealand and Australia, Locker's single question for global oral health rating [25] was slightly altered and validated with caries, tooth loss, periodontal disease, and the short form of the Oral Health Impact Profile (OHIP-14) in adults, ages 35-44 years [26]. Altered questions make comparisons difficult. Additionally, the FDI definition suggests that age, sex, and culture will influence oral health self-perception. Self-perception questions are less involved than clinical oral evaluations; however, they must be considered proxies that vary by population and questions posed. A consensus-based set of measures for oral healthcare is being developed with patient perception as a major feature; therefore, having the appropriate measures may improve research and quality of care [27].

In addition to the limitations imposed by definition variability, there are other limitations. One includes the nature of the observational study design's purpose to establish association rather than causation. Studies in which self-report is used also have the potential for social desirability bias and therefore misclassifications. Although many covariates were used in this study, there is also the potential for having missed an important confounding factor.

4.4. Clinical Considerations. The ultimate goal of oral health research is to provide the information for oral healthcare practitioners to learn the evidence-based practices to provide the best preventive and restorative care for their patients, to improve oral healthcare quality, and eliminate redundancy and waste. To maximize these effects, research studies need good study designs with more uniform/standardized questions and terminologies which accurately reflect the patient presentation. Having useful questions to direct the conversation not only is more efficient, but also is more respectful and considerate of the patient's time and circumstances.

5. Conclusion

The overall self-perception of oral health and the clinical evaluation of oral healthcare need were substantially concordant; other self-reported measures were moderately concordant. This is useful information and points to the need for a minimum set of measures that can provide actionable information and capture the need for clinical dental care.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Disclosure

The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Conflicts of Interest

The authors report no conflicts of interest.

Authors' Contributions

All authors contributed to the conception and design of the research. R. Constance Wiener and Usha Sambamoorthi conducted the statistical analyses. R. Constance Wiener wrote the first draft. All authors contributed to the manuscript and approved the final version.

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