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Predictors of self-reported oral health in the Black Women's Health Study

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Abstract

Objectives: To describe the self-reported oral health of participants in the Black Women's Health Study (BWHS), a national cohort of 59,000 Black women, and to assess factors associated with this self-report.

Methods: Annual follow-up of the BWHS cohort occurs via surveys. The 2011 questionnaire included oral health self-report items, on which 38,573 respondents had complete data. Sample characteristics were summarized using descriptive statistics. We assessed correlations with several covariates by estimating odds ratios using multivariable-adjusted logistic regression models.

Results: Those who reported fair or poor oral health were more likely to report current smoking, recent tooth loss, diabetes or hypertension diagnoses, lower education levels, obesity, and higher parity. Few factors were related to self-reported gum disease with bone loss.

Conclusions: The oral health of US Black women is poorly understood. Correlates of oral health in the BWHS are largely consistent with what has been observed in other populations.

Keywords

oral health; minority health; self-report; women's health

Introduction

Racial disparities in oral health are widely documented in the United States,^{1,2} with Blacks having higher rates of tooth decay, root caries, tooth loss, edentulism,^{1,2} and periodontal disease,^{1,3} as well as lower rates of restorative care^{4,5} compared to Whites. Furthermore, poor oral health, including periodontitis, has been associated with numerous adverse health

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outcomes including cardiovascular disease,⁶ type 2 diabetes,⁷ cancer,⁸ and all-cause mortality.⁹ The observed disparities, however, are not fully explained by differences in important factors such as income, education,^{10,11} and dental insurance coverage.^{1,4,5}

While racial disparities in oral health have been widely documented, gender-specific racial disparities in oral health have received less attention. Extensive evidence shows that health and healthcare utilization also differ according to gender, intersecting with observed differences by race.¹² For example, Black women experience higher rates of morbidity and mortality compared to White women for nearly every major health outcome.^{13–15} However, the extent of the observed racial disparity among women often differs from that observed among men. Racial disparities in obesity, for example, are greater among women than among men.¹⁶ Thus, a clear need exists for research into the gender and race-specific distributions of health outcomes and the associated risk factors, including those related to oral health.

Detailed data on the oral health status of Black women in the United States are severely lacking. Surveillance efforts, as well as observational studies, do not include appreciable numbers of Black women to understand the true prevalence of poor oral health, or the distribution of gender-and race-specific oral health risk factors. Given the documented burden of chronic disease among Black women, we expect that poor oral health status will be highly prevalent among this population, given the common chronic disease risk factors.

The Black Women's Health Study (BWHS) is a large, prospective study of 59,000 US Black women and presents an important and unique opportunity to explore the race and gender-specific predictors of self-reported oral health for this population. The aim of this investigation is to describe the distribution of self-reported oral health among the BWHS cohort according to several known risk-indicators of poor oral health, and to evaluate these as predictors of self-reported oral health status independent of important covariates. Thus, we conducted a cross-sectional analysis of predictors of oral health self-reported outcomes among a sample of BWHS participants.

Methods

This study was approved by the Boston University Medical Campus Institutional Review Board.

Study population

The BWHS began in 1995 when 59,000 women enrolled through mailed health questionnaires. The participants were largely subscribers of *Essence* magazine (95 percent), with small numbers of members of selected Black women's professional organizations and friends and relatives of early respondents. Participants indicate their ongoing informed consent by completing and returning or submitting the questionnaires. Additional details on the recruitment and enrollment procedures can be found elsewhere.¹⁷ At baseline, subjects were 21 to 69 years of age (median = 38 years), 97 percent had completed high school, and 94 percent reported having health insurance. More than 80 percent were from California, Georgia, Illinois, Indiana, Louisiana, Maryland, Massachusetts, Michigan, New Jersey, New

York, South Carolina, Virginia, and the District of Columbia. On the 1995 baseline questionnaire, BWHS participants provided data on demographic characteristics, medical and reproductive history, smoking and alcohol use, physical activity, anthropometric measures (e.g., height, weight), and other factors. Biennial postal and web questionnaires are used to update exposure and outcome information. Over nine completed questionnaire cycles, follow-up of the baseline cohort has been complete for more than 85 percent of potential person years. The present investigation focused on the portion of the sample that completed the 2011 questionnaire ($n = 42,767$). We excluded 4,194 women who did not respond to all four oral health questions (see below), leaving a total analytic sample of 38,573 women.

Survey measures

The BWHS follow-up questionnaire administered in 2011 included four questions on oral health that were drawn from existing US national surveillance initiatives and/or patterned after prior research. They included the following:

- “Overall, how would you rate the health of your teeth and gums?” (Excellent, Very good, Good, Fair, Poor)
- “Has a dentist ever told you that you have gum disease with bone loss?” (hereafter referred to as “periodontal disease”) (Yes, No)
- “Since March 2009, have you had a dental cleaning?” (Yes, No)
- “In the past four years, how many teeth have you lost?” (Enter Number)

For the purposes of this investigation, we considered self-rated oral health (Excellent, Very good, Good vs. Fair, Poor) and self-reported periodontal disease (Yes vs. No) as the outcomes/dependent variables of interest, both of which have been clinically validated in this study population,¹⁸ while the remaining were examined as independent predictors (see below).

Additional survey measures were compiled from various questionnaire cycles based on when the related survey item was administered and evaluated as independent predictors of our outcomes of interest. If the survey item was not collected in 2011, data from the most recent questionnaire cycle prior to 2011 were used. Specifically, data on age, weight, physical exam, medication use, diabetic status, and parity were collected in the 2011 questionnaire. Height was ascertained in 1995; years of education were obtained in 1995 and updated in 2003; smoking status and alcohol consumption in 2009. The short-form National Cancer Institute-Block¹⁹ food frequency questionnaire was included on the 2001 questionnaire, from which we identified the “prudent” dietary pattern (high in fruit/vegetables).²⁰ As previously mentioned, the BWHS is a questionnaire-based cohort. Thus, all data are based on self-report.

Predictors of self-reported oral health

Independent predictors of interest were those previously identified in the literature as risk indicators for poor oral health.^{1,2,5-7} For the analysis, variables were operationalized from the survey measures as follows: Categories of age in years (30–39, 40–49, 50–59, 60

years), geographic region (Northeast, South, Midwest, West), education (12, 13–15, 16 years), current smoking (none, 1–14, 15 cigarettes/day), current alcohol consumption (none, 1–6, 7 drinks/week), prudent dietary pattern (quintiles of the score), doctor's appointment in the past 2 years (yes/no), number of teeth lost in the previous 4 years (none, 1–2, 3–7, 8), dental cleaning in the past 2 years (yes/no), type-2 diabetes (yes/no), hypertension (yes/no), and parity (nulliparous, 1, 2, 3). Body mass index (BMI) was calculated as kg/m^2 and categorized according to traditional cut points (<25, 25–29, 30 kg/m^2). Hypertension (yes/no) was classified based on reported use of antihypertensive medications or a diagnosis of hypertension with use of diuretics. Diabetics (yes/no) were those reporting physician-diagnosed diabetes. Both classifications have been previously validated in this cohort as having high accuracy.^{21,22}

Statistical analysis

We summarized sample characteristics by calculating means and standard deviations. Chi-square tests of proportions compared characteristics across categories of self-rated oral health status (excellent-to-good/fair-or-poor) and self-reported periodontal disease (yes/no). We estimated odds ratios (OR) and 95 percent confidence intervals (CIs) using crude and multivariable-adjusted logistic regression models (PROC LOGISTIC, SAS version 9.3). Tests of linear trends in the OR were conducted and the associated *P* values reported for all predictors. In multivariable analyses, all independent predictors of the specified outcome were eligible for inclusion, aside from the number of teeth lost when predictors of self-reported periodontal disease were under evaluation. Model selection methods included stepwise selection methods using an alpha level of 0.05, as well as assessments of the change in magnitude of the odds ratio when a variable was included as a covariate. All models included the full set of eligible covariates based on either stepwise selection or meaningful changes to the estimates of effect.

Results

Table 1 displays participant characteristics. In 2011, participants were 54.5 (± 10.1) years of age on average. Approximately half had graduated college (49 percent), were obese (47 percent), and had hypertension (52 percent); 9 percent were current smokers, and 17 percent were type 2 diabetics. With respect to oral health, 17 percent rated the health of their teeth and gums as fair or poor, 20 percent reported receipt of periodontal disease diagnosis by a dentist, 8 percent reported loss of at least three teeth in the past 4 years, and 77 percent reported having had a dental cleaning in the previous 2 years.

As shown in Table 1, compared to women reporting excellent-to-good oral health, those reporting fair-or-poor oral health tended to be older, less educated, obese, more often smokers, and reported recent tooth loss, diabetes or hypertension diagnoses, poorer diet, and higher parity. Women reporting periodontal disease diagnoses tended to be older and reported more tooth loss in the previous 4 years than those who did not.

Table 2 reports the crude and multivariable adjusted results of regression analyses estimating the associations of participant characteristics with self-rated oral health and self-reported periodontitis. Several factors were associated with both outcomes in crude and adjusted

models: older age, higher BMI, current smoking, current alcohol consumption, and poorer diet. Associations tended to be stronger when predicting self-rated oral health compared to self-reported periodontal disease, aside from age category. Adjusted OR for 40–49, 50–59, and 60 were 1.59, 3.10, and 4.06, respectively, for self-reported periodontal disease. Whereas, the adjusted OR for self-rated oral health were 1.18, 1.49, and 1.60, respectively. Lower educational attainment (< 12 years) was associated with fair-or-poor self-rated oral health (OR = 1.51; 95 percent CI: 1.39–1.64) whereas it was inversely associated with periodontal disease (OR = 0.85; 95 percent CI: 0.78–0.91). Failure to have a recent dental cleaning was associated with higher odds of fair-to-poor self-rated oral health (OR = 3.85; 95 percent CI: 3.62–4.09), but lower odds of periodontitis (OR = 0.83; 95 percent CI: 0.78–0.88). Parity, a recent doctor visit, and diagnoses of diabetes and hypertension were each associated with fair-to-poor self-rated oral health but not with periodontal disease. Geographic region had null associations with both outcomes in crude and adjusted models (data not shown).

Discussion

To our knowledge, this is the largest analysis of self-reported oral health conducted exclusively in a sample of African American women. Oral health status was assessed at one point in time using previously validated self-report measures,^{23–25} some of which were validated clinically in a subset of the BWHS population.¹⁸ We found that the predictors of self-reported oral health in the BWHS are largely consistent with what has been observed in other populations, but we also found different risk factor patterns according to the outcome studied. A large number of predictors of poor overall health were associated with fair-to-poor self-rated oral health, while self-reported periodontal disease was associated with fewer factors. Lower educational attainment was associated with lower odds of reporting periodontal disease diagnoses, whereas it was associated with higher odds of reporting fair-to-poor oral health.

The prevalence of self-reported fair-or-poor oral health in our study was 17 percent. This was substantially lower compared to other reports among Black/African American adult populations in the United States. In a population based study conducted in the Detroit tri-county area consisting of Black and White adults ($N = 535$; 54 percent Black, 58 percent female), 46 percent of African Americans reported fair-to-poor oral health (compared to 26 percent of Whites).²⁶ In the National Survey of American Life (NSAL) ($N = 5,493$), a largely Black sample (85 percent) consisting of subjects of American and Caribbean ancestry, 28 percent reported fair or poor oral health.²⁷ National Health and Nutrition Examination Survey (NHANES) data from the 2009–2010 cycle, adults aged 30 and older ($N = 3,743$; 18 percent Non-Hispanic Black) reported an overall prevalence of fair-to-poor self-rated oral health of 26 percent.²³ With regard to periodontal disease, NHANES data from 2009 to 2012 revealed that 59 percent of African Americans (both male and female) undergoing oral examination were found to have periodontitis, with 15.6 percent having severe periodontitis (compared to 7 percent of whites).²⁸ In a recent study of the Veterans Health Administration Dental encounter System, 29 percent of the 17,681 African American men and women in the study (of which approximately 1,300 were female) were reported to have periodontitis.⁵ In the BWHS, 20 percent of women reported gum disease with bone

loss, a self-report measure with demonstrated clinical validity with severe periodontitis. Clinical validation of self-reported periodontal disease with bone loss in the BWHS resulted in a 0.71 and 0.65 sensitivity and specificity, respectively.¹⁸

It is possible that our overall lower rates of self-reported oral health outcomes compared to other study samples reflect the higher education and preventive care, and lower smoking levels of our participants. Additionally, in the BWHS, 77 percent of participants reported having a recent dental cleaning which is slightly higher than the frequency (71 percent) among Black NHANES (1999–2004) participants aged 60 years and older ($n = 811$; 60 percent female).²⁹ Not having a recent dental cleaning was associated with increased risk of reporting poor oral health in both the BWHS and NHANES.²⁹

In the present study, we found low educational attainment to be inversely associated with the risk of reporting periodontal disease, but directly associated with reports of fair-to-poor oral health. The latter is contrary to what was observed in the combined 1999–2004 NHANES data¹ where having lower education was strongly associated with an increased risk of clinically ascertained periodontal disease. The age and educational distributions of the BWHS and NHANES were appreciably different. The mean age of BWHS participants in 2011 was 55 years, compared to 46 years in the NHANES. Additionally, 84 percent and 54.5 percent of participants, respectively, reported 13 or more (some college) years of completed education. Periodontitis in the NHANES was measured by a dental professional using the CDC case definition.³⁰ As described above, our validation of self-reported periodontal disease demonstrated comparable validity.¹⁸ It is possible that in the BWHS, being older and less educated resulted in fewer dental visits and thus fewer opportunities to be diagnosed with periodontal disease. Further exploration of our data did in fact reveal an inverse association between education and reporting a recent dental visit (data not shown), thereby supporting the likelihood that our results related to level of education and self-reported periodontal disease are a reflection of fewer opportunities for diagnosis among those women.

The current study provides two main advantages over previous studies – the large sample size and the availability of dental data on adult African American women, an understudied population with a high prevalence of poor oral health. Previous studies have been limited to the elderly,²⁹ are limited by sample size,^{1,23,29,31} or did not report their data according to gender and race.⁵ Additionally, we have previously demonstrated the clinical validity of the oral health self-report measures of the order of magnitude found in other studies.¹⁸ The present investigation also poses some limitations. Because participants had to be sufficiently literate to complete detailed health questionnaires, BWHS participants underrepresent the 17 percent of Black women nationally of the same ages who did not graduate from high school. However, study participants represent most US Black women and are residents of all regions of the continental United States. Additionally, the BWHS is a longitudinal, observational cohort and not all follow-up cycles obtain the same information. Thus, information on some predictors of interest may have come at a time prior to the assessment of the outcome, as many as 10 years (e.g., dietary pattern). This may explain why we observed little-to-no effect of diet for either outcome. Last, the data obtained in the BWHS are all based on self-

report. However, several of the measures have shown clinical validity, both in this cohort and others.

In summary, there is increasing evidence that oral health is an important contributor to systemic health. The role of oral health is poorly studied and poorly understood among US Black women who have poorer overall health outcomes than their white counterparts. We found that the predictors of oral health in the BWHS are largely consistent with what has been observed in other populations. Furthermore, in depth study of oral health is needed in this population in order to gain a clearer understanding of the sources of health disparities. The BWHS is well positioned to contribute this knowledge.

Acknowledgments

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Table 1

Participant* Characteristics According to Self-Rated Oral Health and Periodontal Disease with Bone Loss among 38,573 BWHS Participants, 2011

Variables	Total BWHS % N = 38,573	Excellent to good (N = 31,997)	Fair to poor (N = 6,576)	P	No (N = 30,722)	Yes (N = 7,851)	P
<i>Demographic</i>							
Age, years ^a							
30–39	4	5	3		6	2	
40–49	30	31	22		33	19	
50–59	35	34	38		33	39	
60	31	30	37	<0.001	28	40	<0.001
Education, years (1995)							
12	16	14	26		17	16	
13–15	35	34	41		35	37	
16	49	52	33	<0.001	49	48	<0.001
BMI, kg/m ²							
<25	21	22	17		22	20	
25–30	32	33	27		32	32	
30	47	45	56	<0.001	46	48	0.06
Total parity							
Nulliparous	24	25	19		24	23	
1	27	27	27		27	28	
2	27	28	26		27	29	
3	22	20	28	<0.001	22	21	<0.001
<i>Behavioral</i>							
Smoking, cigarettes/day (2009)							
None	82	84	73		83	80	
1–14	7	6	13		7	9	
15	2	1	4	<0.001	1	2	<0.001
Alcohol consumption, drinks/week (2009)							
None	57	56	58		57	54	
1–6	32	33	28		32	34	

Variables	Total BWHS % N = 38,573		Self-rated oral health %		Gum disease with bone loss %	
	Excellent to good (N = 31,997)	Fair to poor (N = 6,576)	P	No (N = 30,722)	Yes (N = 7,851)	P
7	4	5	<0.001	4	5	<0.001
Prudent dietary pattern (2001)						
Quintile 1 (lowest)	15	19		14	16	
Quintile 2	15	15		15	15	
Quintile 3	15	13		15	14	
Quintile 4	15	11		15	14	
Quintile 5 (highest)	15	10	<0.001	15	14	<0.001
Dental/medical						
Number of teeth lost [‡]						
None	34	22		35	30	
1–2	17	25		16	2	
3–7	6	16		5	10	
8	2	5	<0.001	1	3	<0.001
Recent MD appointment [‡]	87	82	<0.001	87	87	0.85
Recent dental cleaning [‡]	77	50	<0.001	76	79	<0.001
Type 2 diabetes	17	25	<0.001	17	18	0.60
Hypertension	52	59	0.05	52	51	0.07

Data are presented as percentages unless otherwise indicated. Percentages may not sum to 100% due to missing data. MD, medical doctor.

* Values are age-standardized to the age distribution of the Black Women's Health Study cohort in 2011.

[‡] Between 2007 and 2011.

[‡] Between March 2009 and March 2011.

[¶] Not age-standardized.

Table 2

Odds Ratios (OR) for Self-Rated Oral Health and Gum Disease with Bone Loss among 38,573 BWHHS Participants, 2011

Variables	Fair to Poor self-rated oral health*				Gum disease with bone loss†			
	OR	Unadjusted (95% CI)	P trend	Multivariable-adjusted [§] (95% CI)	P trend	Unadjusted (95% CI)	P trend	Multivariable-adjusted (95% CI)
<i>Demographic</i>								
Age, years								
30–39	1.00	Ref.		1.00	Ref.	1.00	Ref.	
40–49	1.18	(1.01–1.37)		1.18	(1.00–1.39)	1.62	(1.36–1.93)	1.59 (1.33–1.89)
50–59	1.86	(1.60–2.17)		1.49	(1.27–1.76)	3.30	(2.78–3.91)	3.10 (2.61–3.69)
60	2.07	(1.78–2.41)	<0.001	1.60	(1.35–1.90)	4.06	(3.42–4.81)	4.06 (3.41–4.85) <0.001
Education, years								
12	1.84	(1.73–1.95)		1.51	(1.39–1.64)	1.00	(0.93–1.07)	0.85 (0.78–0.91)
13–15	2.95	(2.75–3.17)		1.33	(1.24–1.42)	1.02	(0.97–1.08)	0.99 (0.94–1.05)
16	1.00	Ref.	<0.001	1.00	Ref.	1.00	Ref.	1.00 Ref. <0.001
BMI, kg/m ²								
<25	1.00	Ref.		1.00	Ref.	1.00	Ref.	1.00 Ref.
25–30	1.09	(1.00–1.18)		1.01	(0.93–1.11)	1.12	(1.05–1.21)	1.09 (1.02–1.17)
30	1.66	(1.47–1.70)	<0.001	1.21	(1.12–1.32)	1.10	(1.03–1.18)	1.10 (1.02–1.18) 0.019
Parity								
Nulliparous	1.00	Ref.		1.00	Ref.	1.00	Ref.	1.00 Ref.
1	1.26	(1.16–1.37)		1.14	(1.05–1.25)	1.12	(1.04–1.20)	1.08 (1.01–1.17)
2	1.32	(1.22–1.43)		1.07	(0.98–1.17)	1.32	(1.23–1.42)	1.14 (1.06–1.23)
3	2.06	(1.90–2.23)	<0.001	1.23	(1.13–1.35)	1.24	(1.15–1.34)	0.96 (0.89–1.05) 0.757
<i>Behavioral</i>								
Cigarettes smoked/day								
None	1.00	Ref.		1.00	Ref.	1.00	Ref.	1.00 Ref.
1–14	2.28	(2.09–2.49)		1.39	(1.25–1.53)	1.35	(1.23–1.48)	1.18 (1.08–1.30)
15	3.74	(3.16–4.43)	<0.0001	2.02	(1.67–2.45)	1.96	(1.64–2.33)	1.56 (1.30–1.88) <0.001
Alcoholic drinks/week								
None, <1/week	1.00	Ref.		1.00	Ref.	1.00	Ref.	1.00 Ref.

Variables	Fair to Poor self-rated oral health*						Gum disease with bone loss [†]					
	Unadjusted			Multivariable-adjusted [§]			Unadjusted			Multivariable-adjusted [§]		
	OR	(95% CI)	P trend	OR	(95% CI)	P trend	OR	(95% CI)	P trend	OR	(95% CI)	P trend
1-6	0.78	(0.73-0.83)		0.96	(0.90-1.03)		1.06	(1.01-1.12)		1.12	(1.06-1.19)	
7	1.20	(1.06-1.36)	<0.0001	1.30	(1.13-1.50)	0.203	1.40	(1.25-1.57)	<0.001	1.33	(1.18-1.50)	<0.001
Prudent dietary pattern												
Quintile 1 (lowest)	1.78	(1.61-1.97)		1.58	(1.41-1.77)		0.89	(0.82-0.98)		1.15	(1.05-1.27)	
Quintile 2	1.41	(1.27-1.57)		1.32	(1.18-1.48)		0.94	(0.86-1.03)		1.13	(1.03-1.25)	
Quintile 3	1.25	(1.13-1.39)		1.18	(1.05-1.33)		0.91	(0.83-1.00)		1.04	(0.95-1.14)	
Quintile 4	1.06	(0.95-1.18)		1.03	(0.92-1.16)		0.97	(0.88-1.06)		1.04	(0.95-1.14)	
Quintile 5 (highest)	1.00	Ref.	<0.0001	1.00	Ref.	0.0001	1.00	Ref.	0.016	1.00	Ref.	<0.01
Dental/Medical												
Number of teeth lost [‡]												
None	1.00	Ref.		1.00	Ref.		—	—		—	—	
1-2	2.93	(2.71-3.17)		2.54	(2.33-2.76)		—	—		—	—	
3-8	8.04	(7.27-8.88)		5.87	(5.26-6.54)		—	—		—	—	
8	10.86	(9.24-12.8)	0.0022	5.00	(4.19-5.97)	<0.001	—	—		—	—	
Recent dental cleaning [§]												
Yes	1.00	Ref.		1.00	Ref.		1.00	Ref.		1.00	Ref.	
No	4.71	(4.45-4.98)		3.85	(3.62-4.09)		0.90	(0.84-0.95)		0.83	(0.78-0.88)	
Recent doctor visit [§]												
Yes	1.00	Ref.		1.00	Ref.		1.00	Ref.		1.00	Ref.	
No	1.61	(1.49-1.72)		1.19	(1.10-1.30)		0.91	(0.84-0.98)		1.02	(0.95-1.11)	
Type 2 diabetes												
Yes	1.94	(1.82-2.07)		1.38	(1.29-1.49)		1.23	(1.15-1.31)		1.05	(0.98-1.12)	
No	1.00	Ref.		1.00	Ref.		1.00	Ref.		1.00	Ref.	
Hypertension												
Yes	1.72	(1.63-1.82)		1.24	(1.16-1.32)		1.28	(1.21-1.34)		0.96	(0.91-1.02)	
No	1.00	Ref.		1.00	Ref.		1.00	Ref.		1.00	Ref.	

* Referent: Excellent/very good/good.

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[†]Referent: No gum disease with bone loss.

[‡]Between 2007 and 2011.

[§]March 2007 to March 2009.

[¶]Multivariable adjustment for age, education, smoking, dietary pattern, parity, MD appointment within the past 2 years, number of teeth lost, dental cleaning within the past 2 years, type-2 diabetes, and hypertension.

^{//}Multivariable adjustment for age, education, smoking, dietary pattern, parity, MD appointment within the past 2 years, dental cleaning within the past 2 years, type-2 diabetes, and hypertension.