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Periodontal Disease and Incident CKD in US Hispanics/Latinos: The Hispanic Community Health Study/Study of Latinos

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Rationale & Objective: Recent studies suggest that periodontal disease may be associated with incident chronic kidney disease (CKD). However, studies have focused on older populations, and US Hispanics/Latinos were not well represented.

Study Design: Observational cohort.

Setting & Participants: We analyzed data from the Hispanic Community Health Study/Study of Latinos who completed a baseline visit with a periodontal examination and a follow-up visit, and did not have CKD at baseline.

Predictors: Predictors included ≥30% of sites with clinical attachment loss ≥3 mm, ≥30% of sites with probing depth ≥4 mm, percentage of sites with bleeding on probing, and absence of functional dentition (<21 permanent teeth present).

Outcomes: Outcomes were incident low estimated glomerular filtration rate (eGFR) (eGFR <60 mL/min/1.73 m^2 and decline in eGFR ≥1 mL/min/year); incident albuminuria (urine albumin:creatinine ratio [ACR] ≥30 mg/g); and change in eGFR and ACR.

Analytic Approach: Poisson and linear regression.

Results: For the sample (n = 7.732), baseline mean age was 41.5 years, 45.2% were male, 11.7% had ≥30% of sites with clinical attachment loss ≥3 mm, 5.1% had ≥30% of sites with probing depth ≥4 mm, 30.7% had ≥50% of sites with bleeding on probing, and 16.2% had absent functional dentition. During a median follow-up of 5.9 years, 149 patients developed low eGFR and 415 patients developed albuminuria. On multivariable analysis, presence versus absence of ≥30% of sites with probing depth ≥4 mm and absence of functional dentition were each associated with increased risk for incident low eGFR (incident density ratio, 2.31; 95% CI, 1.14-4.65 and 1.65, 95% CI, 1.01-2.70, respectively). None of the other predictors were associated with outcomes.

Limitations: Only a single kidney function follow-up measure.

Conclusions: In this cohort of US Hispanics/Latinos, we found that select measures of periodontal disease were associated with incident low eGFR. Future work is needed to assess whether the treatment of periodontal disease may prevent CKD.

Visual Abstract included

Complete author and article information provided before references.

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Hispanics and Latinos make up the fastest growing minority population in the United States[1] and are disproportionately burdened by chronic kidney disease (CKD).[2-4] It is estimated that 13.7% of Hispanic/Latino adults in the United States have CKD.[5] Furthermore, according to the US Renal Data System Report, Hispanics and Latinos are 33% more likely to experience end-stage kidney disease compared with non-Hispanics.[3] Consequently, there is a critical need to develop effective strategies to prevent CKD in this population.

Periodontal disease is a chronic inflammatory response to bacterial microorganisms that reside in the dental biofilm and if ignored may result in irreversible changes to the tissues supporting the teeth, ultimately leading to edentulism.[6] Using data from the National Health and Nutrition Examination Survey, Eke et al[7] reported that the overall prevalence of periodontitis was higher in Mexican Americans than non-Hispanic whites (66.7% vs 42.6%) and that the prevalence of severe periodontitis was 2-fold higher in Mexican Americans (17.3% vs 6.3%). More recently, using data from the Hispanic Community Health Study/Study of Latinos (HCHS/SOL), Sanders et al[8] reported that the prevalence of moderate periodontitis ranges widely across Hispanic/Latino heritage groups, from 18.1% in Dominicans to 41.7% among Cubans.

In addition to its association with loss of teeth, periodontitis has long been linked to an increased risk of cardiovascular disease and mortality.[9-12] Furthermore, several cross-sectional studies have reported that individuals with CKD have a higher prevalence of periodontitis.[13-15] More recently, several longitudinal studies evaluated the relationship between periodontitis and incident CKD.[16-20] However, these studies mostly focused on older adults and did not include a substantial sample of US Hispanics/Latinos. The objective of this study was to evaluate the association of periodontal disease with incident CKD among Hispanics/Latinos using data from HCHS/SOL, a large and diverse cohort study of US Hispanic/Latino adults.

PLAIN-LANGUAGE SUMMARY

Recent studies suggest that periodontal disease may be associated with the development of chronic kidney disease (CKD). However, most of these studies did not include a substantial number of US Hispanics/Latinos. We analyzed data from 7,732 adults in the Hispanic Community Health Study/Study of Latinos who completed a baseline visit with a periodontal examination. After 6 years of follow-up, select measures of periodontal disease were associated with the development of CKD. Future work is needed to evaluate whether the treatment of periodontal disease may prevent the development of CKD.

METHODS

Study Participants

HCHS/SOL is a population-based cohort of 16,415 Hispanics/Latinos aged 18 to 74 years from randomly selected households in 4 US field centers (Chicago, IL; Miami, FL; Bronx, NY; San Diego, CA) with baseline examinations that included a dental examination (2008-2011), a yearly telephone follow-up assessment, and a follow-up clinic visit (2014-2017). Participants self-reported their background as Cuban, Dominican, Mexican, Puerto Rican, Central American, or South American. Study design and cohort selection have been described.[21,22] Briefly, a stratified 2-stage area probability sample of household addresses was selected in each field center. The first sampling stage randomly selected census block groups with stratification based on Hispanic/Latino concentration and proportion of high/low socioeconomic status. The second sampling stage randomly selected households, with stratification, from US Postal Service registries that covered the randomly selected census block groups. Last, the study oversampled the 45- to 74-year age group to facilitate examination of target outcomes. Sampling weights were generated to reflect the probabilities of selection at each stage. For this study, of the 16,415 enrolled in HCHS/SOL, 1,867 were excluded because of prevalent CKD at baseline (defined as estimated glomerular filtration rate [eGFR] <60 mL/min/1.73 m^2 or urine albumin-to-creatinine ratio [ACR] ≥30, Fig 1). Of the 1,867 with prevalent CKD, 249 had only eGFR <60 mL/min/1.73 m^2, 1,437 had only ACR ≥30 mg/g, and 181 had both ACR ≥30 mg/g and eGFR <60 mL/min/1.73 m^2. In addition, we excluded 1,184 because of not having a periodontal examination, 3,828 because of lack of completion of the follow-up visit, and 215 because of self-reported membership in other/mixed Hispanic/Latino background group. Of the 8,081 meeting inclusion criteria, 187 were excluded because of missing kidney function measures (eGFR, urine ACR) at the follow-up visit. Of the remaining 7,894 participants, 162 were excluded because of missing covariate data (health insurance status [n = 54], HbA1c [n = 28], or other covariates [n = 780]). Therefore, a complete case analysis of the remaining 7,732 adults who had no missing data for any covariates was conducted.

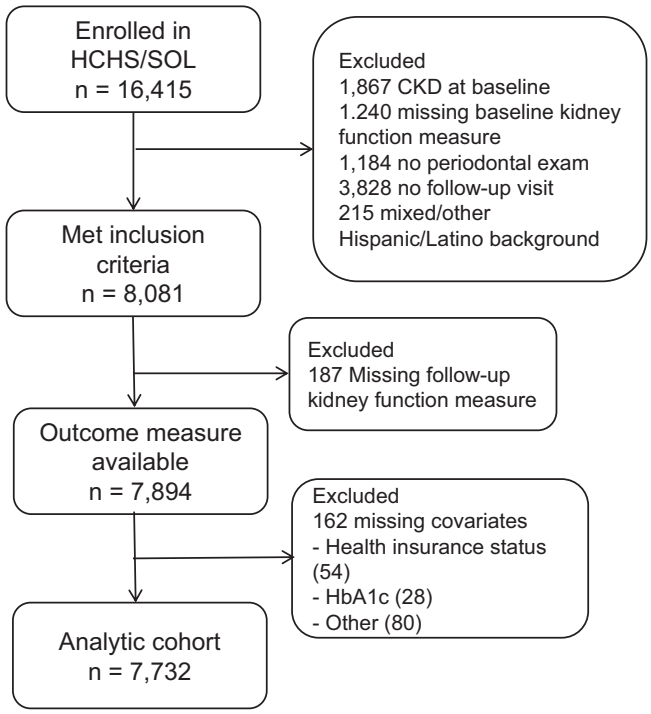

Figure 1. Analytic cohort flowchart. Prevalent chronic kidney disease (CKD) was defined as defined as estimated glomerular filtration rate (eGFR) <60 mL/min/1.73 m^2 or urine albumin-to-creatinine ratio (ACR) ≥30. Of the 1,867 with prevalent CKD, 249 had only eGFR <60 mL/min/1.73 m^2, 1,437 had only ACR ≥30 mg/g, and 181 had both ACR ≥30 mg/g and eGFR <60 mL/min/1.73 m^2. Abbreviation: HCHS/SOL, Hispanic Community Health Study/Study of Latinos.

This study was approved by the Institutional Review Boards at each participating center (University of Illinois at Chicago, 2013-1261; Einstein, 2007-432; University of Miami, 2013-1007; San Diego State, 1586091; University of North Carolina, 07-1003), where all participants gave written consent, and is in adherence to the Declaration of Helsinki.

Measurements and Variable Definition

The baseline study examination included clinical measurements, questionnaires, and fasting venous blood and urine specimens. Demographic factors, socioeconomic status, cigarette smoking, alcohol use, place of birth, language of interview, physical activity, medical history, and dental care use were obtained using standard questionnaires. Medication use was ascertained by conducting a scanned inventory of all currently used medications. Blood pressure (BP) was defined as the average of 3 repeat seated measurements obtained after a 5-minute rest. Hypertension was defined as systolic BP ≥140 mm Hg, diastolic BP ≥90 mm Hg, or use of antihypertensive medication.

Diabetes mellitus was defined as fasting plasma glucose of ≥126 mg/dL, 2-hour post-load glucose levels of ≥200 mg/dL, HbA1c level of ≥6.5%, or use of antidiabetic medication (Table S1 shows medication classification).[23]

Exposure

At the baseline visit, study participants received a full-mouth periodontal examination following a standardized protocol.[8] Measurements of probing pocket depth and gingival recession were recorded on 6 sites (mesiobuccal, midbuccal, distobuccal, mesiolingual, distolingual, and lingual) per tooth, except third molars. Probing depth is the distance from the free gingival margin to the bottom of the sulcus, whereas gingival recession is the distance from the cementoenamel junction to the free gingival margin. Clinical attachment level was calculated as the sum of probing depth and gingival recession. Examiners were recalibrated annually to a gold standard examiner, and agreement was high for clinical attachment level (92.9%) and probing depth (95.8%).[8] Consistent with previous studies, we evaluated the following measures of periodontitis as predictors: (1) ≥30% of sites with clinical attachment level ≥3 mm and (2) ≥30% of sites with probing depth >4 mm.[24,12] In addition, we evaluated bleeding on probing, assessed as the percentage of tooth sites that bled (per 10% increase). Because periodontal disease is a leading cause of tooth loss, in a secondary analysis, we evaluated the absence versus presence of functional dentition (defined as ≥21 permanent teeth present, including dental implants).[25,26]

Outcomes

Measures of kidney function were obtained at the baseline visit and the follow-up visit. Glomerular filtration rate was estimated using the CKD Epidemiology Collaboration creatinine-cystatin C equation.[27] We evaluated 3 outcomes: (1) incident low eGFR defined as development of eGFR <60 mL/min/1.73 m^2 with eGFR decline ≥1 mL/min/year;[28,29] (2) incident albuminuria defined as ACR ≥30 mg/g at the follow-up examination; and (3) change in kidney function (eGFR and ACR). Creatinine was measured in serum and urine on a Roche Modular P Chemistry Analyzer using a creatinase enzymatic method (Roche Diagnostics, Indianapolis, IN). Serum creatinine measurements were isotope dilution mass spectrometry traceable. Urine albumin was measured using an immunoturbidometric method on the ProSpec nephelometric analyzer (Dade Behring GMBH. Marburg, Germany D-35041). Serum cystatin C was measured using a turbidimetric method on the Roche Modular P Chemistry Analyzer (Gentian AS, Moss, Norway).

Statistical Analysis

Descriptive statistics for demographic and clinical characteristics were summarized as mean or median for continuous variables and as frequency (proportion) for categorical variables. Continuous and categorical variables were compared using analysis of variance or χ^2 tests, respectively. All reported values were weighted to adjust for sampling probability and nonresponse and accounted for the complex survey sampling design. All hypothesis tests were 2 sided with a significance level of .05. Assumptions of all models and tests were checked.

The association between periodontal disease and incident CKD was estimated using Poisson regression with robust variance while accounting for the complex survey sampling design using time elapsed between visits baseline and follow-up as an offset variable. The association between periodontal disease and changes in kidney function was estimated using linear regression. Annual change in eGFR was calculated as the difference between baseline and follow-up eGFR divided by the number of years elapsed between the 2 visits. Change in ACR was calculated in the same manner. Potential confounding variables at baseline were chosen a priori on the basis of the existing literature.[30,31] Model 1 adjusted for field center, age, sex, Hispanic/Latino background group, income, education, marital status, health insurance, last dental visit within the previous year, nativity status, and years in the United States. Model 2 additionally adjusted diabetes, hypertension, cardiovascular disease, smoking status, alcohol use, body mass index, glycosylated hemoglobin, baseline eGFR, and ACR. We explored effect modification by age, sex, and diabetes status at baseline by separately testing interaction terms between periodontal disease and each of these variables in the final regression model. All analyses were conducted using the complex survey procedures in SAS software, version 9.3 (SAS Institute Inc.).

RESULTS

Characteristics of Study Population

The mean age was 41.5 years, and 45.2% were men. The prevalence of individuals with ≥30% of sites with clinical attachment level ≥3 mm was 11.7%, the prevalence of ≥30% of sites with probing depth ≥4 mm was 5.1%, and 16.2% had absent functional dentition. In addition, the prevalence of bleeding on probing ≥50% was 30.7%. Compared with those without ≥30% of sites with clinical attachment level ≥3 mm, those with ≥30% of sites with clinical attachment level ≥3 mm were older, more likely to be Spanish speakers, and born outside of the United States (Table 1). This group was more likely to have hypertension and diabetes, as well as higher systolic BP, higher total and low-density lipoprotein cholesterol, higher triglycerides, and higher glycosylated hemoglobin. Individuals with ≥30% of sites with clinical attachment level ≥3 mm also had lower eGFR. A similar pattern was seen when examining characteristics by probing depth status (Table 1). In addition, compared with those without ≥30% of sites with probing depth ≥4 mm, individuals with ≥30% of sites with probing depth ≥4 mm were less likely to report ≥1 alcohol drink intake per week

Table 1. Distribution of Baseline Characteristics by Clinical Attachment Level and Probing Pocket Depth Status in Target Population of Hispanic Community Health Study/Study of Latinos 2008-2011

	≥30% of Sites With CAL ≥3 mm		≥30% of Sites With PD ≥4 mm	
Variables	**No (n = 6,594)**	**Yes (n = 1,138)**	**No (n = 7,275)**	**Yes (n = 457)**
Age, y, mean (SE)	39.8 (0.3)	53.8 (0.7)[a]	41.3 (0.3)	44.2 (1.1)[a]
Male, % (SE)	43.8 (0.9)	56.0 (1.9)[a]	44.3 (0.8)	61.6 (3.5)[a]
Income, ≤$20,000, % (SE)	39.9 (1.2)	49.5 (2.5)[a]	40.5 (1.1)	50.8 (4.4)[c]
Education, less than high school, % (SE)	29.1 (1.0)	41.4 (2.4)[a]	29.7 (0.9)	46.2 (4.3)[a]
Health insurance, yes, % (SE)	49.7 (1.2)	49.7 (2.6)	50.2 (1.2)	41.1 (4.7)
Hispanic/Latino background, % (SE)				
Mexican	45.4 (1.9)	31.5 (2.6)[a]	43.1 (1.9)	56.1 (4.7)[b]
Cuban	17.7 (1.7)	34.2 (2.8)[a]	19.9 (1.7)	15.1 (3.4)
Puerto Rican	14.4 (0.9)	13.8 (1.6)	14.4 (0.9)	14.3 (3.8)
Dominican	9.5 (0.8)	7.2 (1.1)	9.4 (0.8)	5.5 (1.5)[c]
Central American	7.6 (0.7)	7.1 (1.1)	7.7 (0.6)	5.0 (1.1)[c]
South American	5.4 (0.5)	6.1 (0.8)	5.6 (0.4)	3.9 (1.1)
Primary language Spanish, % (SE)	76.8 (1.1)	93.2 (1.1)[a]	78.2 (1.0)	88.0 (2.7)[b]
US born, % (SE)	21.4 (1.0)	6.1 (1.3)[a]	19.7 (0.9)	17.1 (4.3)
Years in United States, mean (SE)	19.4 (0.4)	20.6 (0.7)[a]	19.5 (0.4)	21.3 (0.9)[a]
Married/living with partner, % (SE)	52.6 (1.1)	58.0 (2.4)[c]	53.1 (1.0)	54.4 (4.1)
Current smoker, % (SE)	17.4 (0.8)	28.3 (2.0)[a]	18.2 (0.8)	27.2 (3.5)[b]
Alcohol use ≥1 drink per week, % (SE)	18.2 (0.9)	20.6 (1.9)	18.9 (0.9)	10.5 (1.9)[b]
Comorbidities, % (SE)				
Diabetes	10.9 (0.5)	23.6 (1.7)[a]	11.9 (0.5)	21.2 (2.5)[a]
Hypertension	17.0 (0.7)	33.0 (2.0)[a]	18.8 (0.7)	20.8 (2.8)
Cardiovascular disease	3.9 (0.4)	6.6 (1.0)[b]	4.3 (0.4)	3.2 (0.9)
Body mass index, kg/m^2, mean (SE)	29.3 (0.1)	29.0 (0.2)[a]	29.2 (0.1)	29.9 (0.4)[a]
Systolic BP, mm Hg, mean (SE)	117.6 (0.3)	126.7 (0.8)[a]	118.5 (0.3)	122.4 (1.0)[a]
Diastolic BP, mm Hg, mean (SE)	71.5 (0.2)	74.1 (0.5)[a]	71.7 (0.2)	73.7 (0.7)[a]
ACE inhibitor or ARB, % (SE)	8.8 (0.5)	17.9 (1.6)[a]	9.9 (0.5)	8.8 (1.5)
Dental visit within past 12 mo, % (SE)	52.1 (1.0)	47.4 (2.5)	52.3 (1.0)	38.3 (4.6)[b]
Total cholesterol, mg/dL, mean (SE)	194.1 (0.8)	209.6 (1.8)[a]	195.4 (0.7)	207.1 (4.1)[a]
Low-density lipoprotein cholesterol, mg/dL, mean (SE)	120.3 (0.7)	132.6 (1.6)[a]	121.1 (0.6)	132.8 (3.5)[a]
High-density lipoprotein cholesterol, mg/dL, mean (SE)	48.8 (0.2)	46.6 (0.6)[a]	48.8 (0.2)	44.7 (0.9)[a]
Triglycerides, mg/dL, mean (SE)	128.1 (1.8)	158.7 (4.2)[a]	129.5 (1.5)	172.1 (16.5)[a]
HbA1c, %, mean (SE)	5.6 (0.1)	6.0 (0.1)[a]	5.6 (0.1)	6.1 (0.1)[a]
HbA1c in diabetic patients, %, mean (SE)	7.2 (0.1)	7.5 (0.2)[a]	7.2 (0.1)	8.3 (0.4)[a]
HbA1c in nondiabetic patients, %, (SE)	5.4 (0.1)	5.6 (0.1)[a]	5.4 (0.1)	5.5 (0.1)[a]
eGFR, mL/min/1.73 m^2, mean (SE)	110.0 (0.4)	96.3 (0.9)[a]	108.6 (0.4)	106.2 (1.3)[a]
eGFR >90 mL/min/1.73 m^2, % (SE)	86.9 (0.6)	65.2 (2.1)[a]	84.4 (0.6)	82.9 (2.2)
eGFR 60-89 mL/min/1.73 m^2, % (SE)	13.1 (0.6)	34.8 (2.2)[a]	15.6 (0.6)	17.1 (2.2)
Albumin/creatinine ratio, median (IQR)	6.0 (4.4-9.2)	6.1 (4.4-9.3)	6.0 (4.4-9.2)	6.3 (4.4-9.7)
C-reactive protein, mg/L, mean (SE)	3.6 (0.1)	3.7 (0.3)[a]	3.6 (0.1)	4.4 (1.3)[a]

Abbreviations: ACE, angiotensin-converting enzyme; ARB, angiotensin receptor blocker; BP, blood pressure; CAL, clinical attachment level; eGFR, estimated glomerular filtration rate; HbA1c, glycosylated hemoglobin; IQR, interquartile range; PD, probing pocket depth; SE, standard error.
[a]$P < .001$.
[b]P value $< .01$.
[c]$P < .05$.

and a dental visit within the past 12 months. Baseline characteristics of the HCHS/SOL target population based on the entire cohort, eligible participants, those who did not complete a follow-up visit, and those included in the final analytic cohort are presented in Table S2.

Association of Periodontitis With Outcomes

During 5.9 years of median follow-up, 149 developed low eGFR (2.3 per 1000 person-years) and 415 developed albuminuria (8.45 per 1000 person-years). Of those with incident low eGFR, 19.5% also experienced incident albuminuria at follow-up; and of those with incident albuminuria, 7.0% also experienced incident low eGFR at follow-up. Periodontal disease severity (as assessed by status of clinical attachment level, probing depth, bleeding on probing, and functional dentition) was associated with higher rates of incident low eGFR (Fig 2). From baseline to the follow-up visit, the mean change in eGFR was −0.39

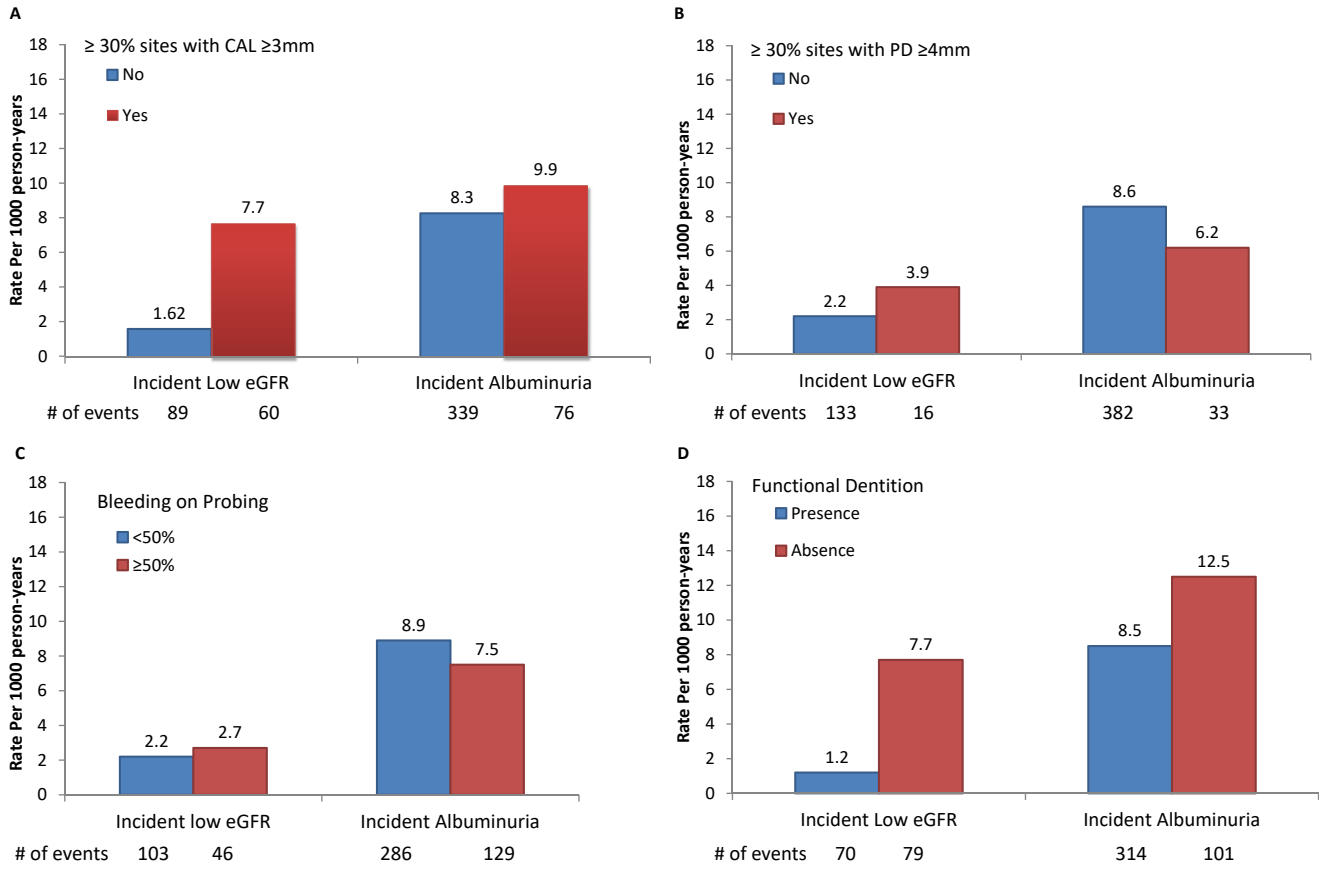

Figure 2. Event rates by status of clinical attachment level (CAL, A), pocket depth (PD, B), percentage of sites with bleeding on probing (BOP, C), and functional dentition (D). Abbreviation: eGFR, estimated glomerular filtration rate.

(standard error, 0.12) mL/min/1.73 m^2/year and the median change in ACR was −1.86 mg/g/year (95% confidence interval [CI], −3.77 to 0.30).

On the basis of multivariable analyses, ≥30% sites with probing depth ≥4 mm and absence of functional dentition were each associated with increased risk for incident low eGFR (incident density ratio [IDR], 2.31; 95% CI, 1.14-4.65 and IDR, 1.65, 95% CI, 1.01-2.70, respectively, Table 2). There was no significant association between clinical attachment level status or percent of sites with bleeding on probing with incident low eGFR. We did not find a significant association between the assessed measures with incident albuminuria, with the exception of percent of sites with bleeding on probing that was associated with a reduced risk of incident albuminuria (IDR, 0.93; 95% CI, 0.88-0.99 per 10% increase, Table 3). In addition, absence of functional dentition was associated a significant decline in eGFR (ß −0.29, 95% CI, −0.49 to −0.09 mL/min/1.73 m^2/year) and probing depth ≥4 mm was associated with a decline in log ACR (ß −0.39, 95% CI, −0.74 to −0.05 mg/g) (Table 4). There was no association between the other measures with change in eGFR or ACR. Additionally, there was no evidence of effect modification by age, sex, or diabetes status.

DISCUSSION

In this large, prospective community-based cohort study of Hispanics/Latinos, we did not find consistent associations between periodontal disease and kidney disease outcomes. However, select periodontal measures (including >30% sites with probing depth ≥4 mm and absence of functional

Table 2. Association Between Periodontal Measures and Incident Low Estimated Glomerular Filtration Rate[a]

	Incident Density Ratio (95% CI)	
Measure	**Model 1**	**Model 2**
≥30% with CAL ≥3 mm, yes vs no	1.79 (1.04-3.05)	1.37 (0.83-2.25)
≥30% with PD ≥4 mm, yes vs no	2.85 (1.41-5.78)	2.31 (1.14-4.65)
BOP, per 10% increase	1.08 (0.99-1.18)	1.06 (0.97-1.15)
Absence of functional dentition[b]	2.21 (1.24-3.93)	1.65 (1.01-2.70)

Abbreviations: BOP, bleeding on probing; CAL, clinical attachment level; CI, confidence interval; PD, pocket depth.
Model 1 adjusts for baseline, age, sex, Hispanic/Latino background group, field center, socioeconomic status (income, education), marital status, health insurance, last dental visit, nativity status, and years in the United States.
Model 2 = Model 1 plus baseline, diabetes, hypertension, cardiovascular disease, BMI, smoking, alcohol use, glycosylated hemoglobin, eGFR, and ACR.
[a]Defined as eGFR <60 mL/min/1.73 m^2 with eGFR decline ≥1 mL/min/year.
[b]Less than 21 permanent teeth, including dental implants.

Table 3. Association Between Periodontal Measures and Incident Albuminuria[a]

Measure	Incident Density Ratio (95% CI)	
	Model 1	Model 2
≥30% with CAL ≥ 3 mm, yes vs no	1.13 (0.73-1.75)	1.01 (0.70-1.45)
≥30% with PD ≥ 4 mm, yes vs no	0.78 (0.48-1.27)	0.64 (0.39-1.06)
BOP, per 10% increase	0.97 (0.90-1.04)	0.93 (0.88-0.99)
Absence of functional dentition[b]	0.93 (0.59-1.45)	0.73 (0.49-1.11)

Abbreviations: BOP, bleeding on probing; CAL, clinical attachment level; CI, confidence interval; PD, pocket depth.
Model 1 adjusts for baseline, age, sex, Hispanic/Latino background group, field center, socioeconomic status (income, education), marital status, health insurance, last dental visit, nativity status, and years in the United States.
Model 2 = Model 1 plus baseline, diabetes, hypertension, cardiovascular disease, BMI, smoking, alcohol use, glycosylated hemoglobin, eGFR, and ACR.
[a]Defined as ACR ≥30 mg/g.
[b]Less than 21 permanent teeth, including dental implants.

dentition) were associated with increased risk for incident low eGFR. To our knowledge, this represents the first study in the United States to evaluate this association in a large and diverse cohort of Hispanics/Latinos.

Several cross-sectional studies have reported a positive association between periodontal disease and CKD. In the Atherosclerosis Risk in Communities Study, investigators found that individuals with severe periodontitis were more than twice as likely to have CKD compared with those without periodonditis.[13] Likewise, a subsequent study of 11,955 adults in National Health and Nutrition Examination Survey III reported that those with periodontal disease were 85% more likely to have stage 3 or 4 CKD.[14] However, the cross-sectional nature of these studies preclude any inference of causality.

Prior studies that reported an association between periodontal disease and incident CKD have focused on older populations.[16-19] Participants were aged more than 70 years in 2 studies from Asia that reported an association between periodontal disease with a significant loss in eGFR.[16,17] Likewise, participants were elderly in 2 US studies, which also found an association between periodontal disease and kidney function decline. Using data from the Osteoporotic Fracture in Men Study, which included 761 men with a mean age of 73, Grubbs et al[19] reported a significant association between periodontal disease and incident low eGFR (defined as eGFR <60 mL/min/1.73 m^2 and >5% decline/year). Similar findings were reported in an analysis of data from the Jackson Heart Study, which included 755 Africans Americans with a mean age of 65 years.[18] Our study extends the findings of these recent studies in older individuals to a younger Hispanic/Latino population in the United States. Given the relatively younger age of our cohort, the cumulative impact of periodontal disease on kidney function over the life course could have serious long-term implications. Furthermore, investigation of periodontal disease as a potential risk factor for incident CKD is of importance in a population who experiences higher rates of CKD progression compared with non-Hispanic whites.[3,32]

Although we observed a significant association of probing depth with incident low eGFR, this association was not seen with clinical attachment level. Although the clinical attachment level is thought to be more indicative of cumulative past disease, probing depth is more of an indicator of current disease activity and inflammation.[33,34] Others have hypothesized that bacterial infection results in activation of pathways (ie, systemic inflammation, activation of oxidative stress, innate immunity) that may place individuals at increased risk for kidney function decline.[13,18] We also found that absence of functional dentition was associated with an increased risk for incident low eGFR, a significant finding because periodontal disease is a leading cause of tooth loss.[25]

In contrast to our findings with incident low eGFR, we found no consistent associations between periodontal measures and incident albuminuria. Reasons for this are not clear. It is possible that periodontal disease may have a larger impact on hemodynamic factors that influence GFR than on factors influencing albuminuria (eg, endothelial

Table 4. Association between Periodontal Measures and Change in Estimated Glomerular Filtration Rate and Albuminuria, ß Coefficient (95% Confidence Interval)

Measure	eGFR mL/min/1.73 m^2/y		Log ACR mg/g Creatinine/y	
	Model 1	Model 2	Model 1	Model 2
≥30% with CAL ≥3 mm, yes vs no	−0.07 (−0.31 to 0.17)	−0.14 (−0.36 to 0.08)	−0.17 (−0.56 to 0.23)	−0.23 (-0.49 to 0.04)
≥30% with PD ≥4 mm, yes vs no	−0.26 (−0.56 to 0.04	−0.25 (−0.55 to 0.06)	−0.44 (−0.9 to 0.02)	−0.39 (−0.74 to −0.05)
BOP, per 10% increase	−0.01 (−0.04 to 0.01)	−0.01 (−0.04 to 0.01)	−0.01 (−0.06 to 0.03)	−0.03 (−0.07 to 0.01)
Absence of functional dentition[a]	−0.24 (−0.44 to −0.03)	−0.29 (−0.49 to −0.09)	0.25 (−0.12 to 0.62)	0.07 (−0.22 to 0.37)

Abbreviations: BOP, bleeding on probing; CAL, clinical attachment level; CI, confidence interval; PD, pocket depth. Model 1 adjusts for baseline, age, sex, Hispanic/Latino background group, field center, socioeconomic status (income, education), marital status, health insurance, last dental visit, nativity status, and years in the United States.
Model 2 = Model 1 plus baseline, diabetes, hypertension, cardiovascular disease, BMI, smoking, alcohol use, glycosylated hemoglobin, eGFR, and ACR.
[a]Less than 21 permanent teeth, including dental implants.

function). Of note, the Osteoporotic Fracture in Men Study and Jackson Heart Study did not assess albuminuria.[18,19] Similar to our study, the Pomerania Study, which included 1,512 participants with a mean age of 40 years, measured urine albumin and did not find a significant association between periodontal disease and incident albuminuria.[20] Additionally, it is not clear why we observed a significant association between percent of sites with bleeding on probing and reduced risk of albuminuria, but this requires further investigation.

The major strength of this study was the large, diverse community-based sample, providing the opportunity to evaluate the association of periodontal disease with incident CKD among US Hispanics/Latinos, a population who is at high risk for end-stage kidney disease. In addition, participants underwent a full-mouth periodontal examination, which decreases the likelihood that periodontal disease prevalence was underestimated. However, our findings should be considered in light of several limitations. There was only 1 follow-up measure of serum creatinine, cystatin C, and urine albumin. In addition, the GFR estimating equation used has not been validated in Hispanics/Latinos. Finally, we were not able to ascertain the outcome measures in individuals who did not complete the follow-up visit, but individuals who did not have a follow-up visit were somewhat younger than the analytic cohort, which suggests that they were less likely to develop the outcome.

We observed an association between select periodontal measures (ie, probing depth ≥4 mm and absence of functional dentition) and incident low eGFR in this relatively young, large, and diverse cohort of US Hispanic/Latino adults. Our findings are consistent with those from other studies and may have potential public health significance for a population who experiences high rates of kidney failure. Future work is needed to investigate the impact of treatment of periodontal disease on the prevention of CKD.

SUPPLEMENTARY MATERIAL

Supplementary File (PDF)

Table S1: HCHS/SOL Antidiabetic Medication Classes and Codes

Table S2: Baseline Characteristics of Target Population of Hispanic Community Health Study/Study of Latinos 2008-2011

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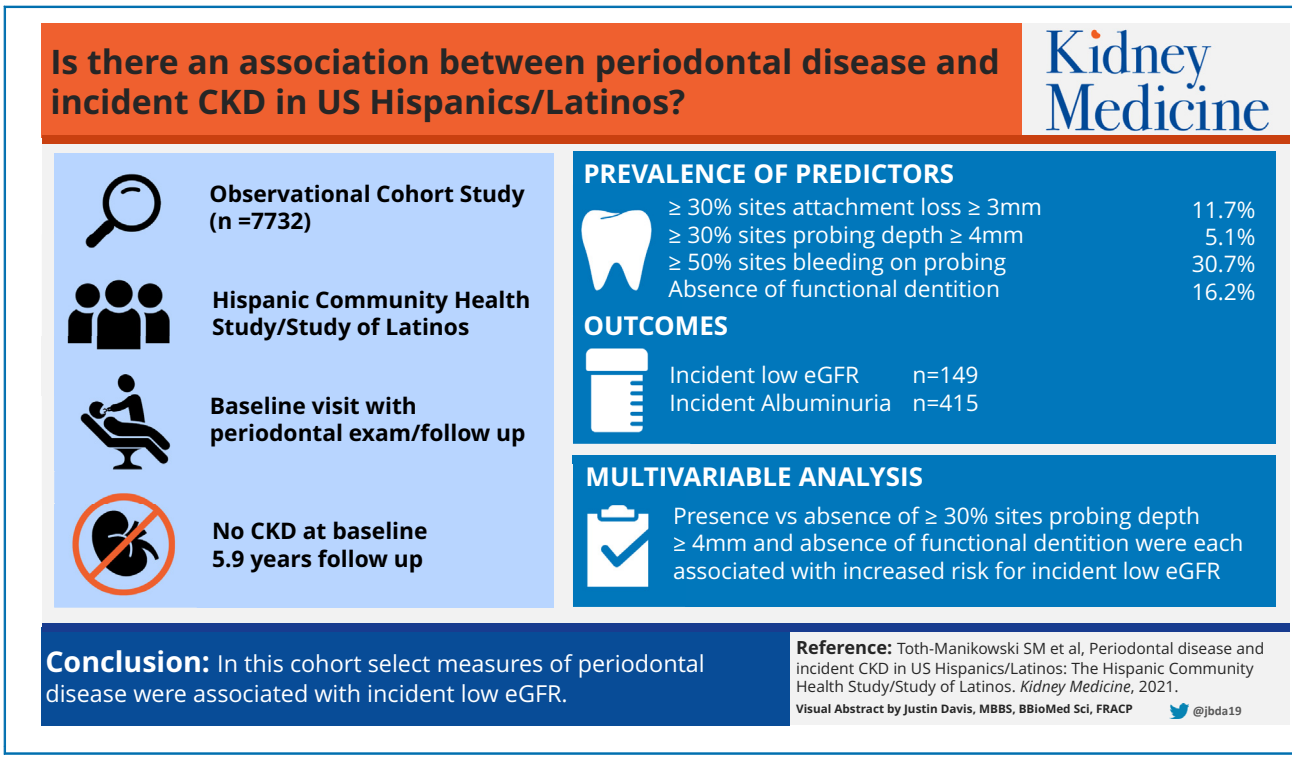
Is there an association between periodontal disease and incident CKD in US Hispanics/Latinos?
Kidney Medicine
Observational Cohort Study (n =7732)
Hispanic Community Health Study/Study of Latinos
Baseline visit with periodontal exam/follow up
No CKD at baseline
5.9 years follow up
PREVALENCE OF PREDICTORS
≥ 30% sites attachment loss ≥ 3mm 11.7%
≥ 30% sites probing depth ≥ 4mm 5.1%
≥ 50% sites bleeding on probing 30.7%
Absence of functional dentition 16.2%
OUTCOMES
Incident low eGFR n=149
Incident Albuminuria n=415
MULTIVARIABLE ANALYSIS
Presence vs absence of ≥ 30% sites probing depth ≥ 4mm and absence of functional dentition were each associated with increased risk for incident low eGFR
Conclusion: In this cohort select measures of periodontal disease were associated with incident low eGFR.
Reference: Toth-Manikowski SM et al, Periodontal disease and incident CKD in US Hispanics/Latinos: The Hispanic Community Health Study/Study of Latinos. Kidney Medicine, 2021.
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