Racial and Ethnic Differences in Albuminuria in Individuals With Estimated GFR Greater Than 60 mL/min/1.73 m^2: Results From the Kidney Early Evaluation Program (KEEP)

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Background: Albuminuria is an important marker for chronic kidney disease and progression to end-stage renal disease in the general population; understanding racial and ethnic differences can help inform efforts to reduce health disparities. We sought to estimate independent associations of race/ethnicity with albuminuria to determine whether observed differences were attributable to known kidney disease risk factors.

Methods: This cross-sectional study included 64,161 Kidney Early Evaluation Program (KEEP) participants, 2000-2008, with estimated glomerular filtration rate ≥ 60 mL/min/1.73 m^2, not on regular dialysis therapy, and without a previous kidney transplant. Albuminuria (urine albumin-creatinine ratio ≥ 30 mg/g) was examined by self-reported race and ethnicity. Covariates were age, sex, educational level, body mass index, diabetes status or glucose level, hypertension status or blood pressure measurement, smoking status, health insurance status, and geographic region.

Results: Albuminuria prevalences were 8% (n = 2,303) in whites, 11% (n = 2,310) in African Americans, 9% (n = 730) in Hispanics, 10% (n = 381) in Asians, and 15% (n = 344) in American Indians/Alaska Natives. Compared with whites, odds of albuminuria were higher for all groups after multivariate adjustment. Odds were highest for American Indians/Alaska Natives (adjusted OR, 1.93; 95% CI, 1.70-2.20), then Asians (adjusted OR, 1.42; 95% CI, 1.26-1.61), African Americans (adjusted OR, 1.38; 95% CI, 1.29-1.47), and Hispanics (adjusted OR, 1.19; 95% CI, 1.08-1.31).

Conclusions: In the KEEP study population, albuminuria prevalence was higher in African Americans, Hispanics, Asians, and American Indians/Alaska Natives than in non-Hispanic whites, suggesting a need for screening for early detection of kidney damage, especially in people at increased risk, in the community primary care setting.

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INDEX WORDS: Albuminuria; health disparities; Kidney Early Evaluation Program (KEEP); screening.

The prevalence of chronic kidney disease (CKD) and end-stage renal disease (ESRD) is increasing in the United States.[1] The incidence and prevalence of ESRD are higher in racial and ethnic minority groups than in whites, yet rates of CKD, defined as estimated glomerular filtration rate (eGFR) < 60 mL/min/1.73 m^2, are similar or lower.[2] These findings highlight the complexity of racial/ethnic differences in kidney disease. Some of the confusion may be caused by limitations of the serum creatinine–based equations used to estimate kidney function.[3,4] Albuminuria is an important marker for the onset and progression of CKD and for cardiovascular disease. Because albuminuria is a direct manifestation of kidney injury, it may be a more objective measure of risk of ESRD than GFR estimated using serum creatinine level.[5-7] Albuminuria consistently predicts cardiovascular events and mortality in the general population and long-term risk of ESRD.[8-12] Even low levels of albuminuria, in what currently would be considered the normal range, have been shown to predict cardiovascular events and death.[13,14]

Some studies have shown racial/ethnic differences in microalbuminuria among patients with diabetes.[15,16] In the National Health and Nutri-

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tion Examination Survey (NHANES), for participants aged ≥ 20 years, albuminuria prevalence was higher for African Americans than for non-Hispanic whites.[2] However, no study has examined differences in abnormal albuminuria, equivalent to CKD stages 1 or 2 defined using the National Kidney Foundation's Kidney Disease Outcomes Quality Initiative (KDOQI) guidelines,[5] in multiple racial/ethnic groups with and without diabetes and hypertension from across the United States. Different risk factor patterns for albuminuria with eGFR ≥ 60 mL/min/1.73 m^2 and CKD defined as eGFR < 60 mL/min/1.73 m^2 have been described.[17] Understanding racial and ethnic differences regarding the prevalence of albuminuria in the general population is important to help inform efforts to reduce health disparities in ESRD.

Using data from the National Kidney Foundation's Kidney Early Evaluation Program (KEEP), we evaluated the association of race/ethnicity with albuminuria in a screened US population. We sought to estimate the independent associations of race/ethnicity with albuminuria in participants with eGFR ≥ 60 mL/min/1.73 m^2 to determine whether observed racial differences were attributable to known kidney disease risk factors.

METHODS

KEEP Study Population

As previously described, KEEP is a free community-based voluntary screening program designed to identify individuals at increased risk of kidney disease and encourage follow-up care.[18] KEEP screenings are conducted in urban and rural locations throughout the United States through each state's local National Kidney Foundation affiliate.[18,19] Officially launched nationwide in August 2000 and now in its ninth year, KEEP has screened > 128,000 participants from 49 states and the District of Columbia. In this study, we included eligible KEEP participants from August 2000 through December 31, 2008, aged at least 18 years with a personal diagnosis of diabetes mellitus or hypertension or a family history of diabetes, hypertension, or CKD.

Screening Protocol

Screening data were collected for participant demographic characteristics, personal and family medical history, and health behaviors.[18] One-time systolic and diastolic blood pressure measurements and height and weight measurements were performed.[18] Blood and urine specimens were collected and processed to determine serum creatinine, fasting blood glucose, and urine albumin levels.[18] Lipid and hemoglobin A_{1c} data became available starting May 1, 2005. Serum creatinine values for KEEP participants were calibrated against values measured at the Cleveland Clinic Research Laboratory using the Roche enzymatic assay (Roche Pharmaceuticals, www.roche.com). Subsequently, eGFR using the original (raw) serum creatinine value was recalculated using the 4-variable Modification of Diet in Renal Disease (MDRD) Study equation with the newly calibrated serum creatinine values.[20,21] Spot urine specimens were collected and tested for microalbuminuria using the Micral assay (Roche Pharmaceuticals) until September 2001, then using the Clinitek assay (Bayer Diagnostics, www.bayer.com).[18]

Study Population

Participants who had undergone kidney transplant or were on regular dialysis treatment were excluded from this analysis. From the eligible KEEP study population (n = 107,114), we included participants with a serum creatinine measurement for whom eGFR could be determined (n = 101,770). From these, we excluded 1,862 participants with missing race/ethnicity data or who self-identified as non-Hispanic other race. Because we were interested in participants at risk of decreased eGFR, we excluded those with eGFR < 60 mL/min/1.73 m^2 (n = 24,150). Of 75,758 participants with eGFR ≥ 60 mL/min/1.73 m^2, data for all variables of interest were present for 85% (n = 64,161), who constituted our study population.

Predictor Variables and Covariates

Race and ethnicity information, obtained using self-report at the time of screening with the KEEP questionnaire, was categorized into 5 racial/ethnic groups: non-Hispanic white, African American, Asian, American Indian/Alaska Native, and Hispanic. Persons of Hispanic origin may be of any race; however, these race groups included only persons of non-Hispanic origin.

Potential covariates were determined a priori as characteristics believed to influence CKD risk: age; sex; obesity; diabetes; hypertension; smoking; family history of diabetes, hypertension, or CKD; educational level; presence of health insurance; and geographic region. Age was determined using self-reported date of birth at the time of screening and categorized into 4 groups: 18-45, 46-60, 61-75, and >75 years. Obesity was defined as body mass index ≥ 30 kg/m^2. Diabetes was defined using participant self-report, fasting glucose values ≥ 126 mg/dL, or nonfasting glucose values ≥ 140 mg/dL. Hypertension was defined using participant self-report or as systolic blood pressure ≥ 140 mm Hg or diastolic blood pressure ≥ 90 mm Hg in the absence of diabetes or CKD and systolic blood pressure ≥ 130 mm Hg or diastolic blood pressure ≥ 80 mm Hg with diabetes or CKD present.

Smoking status was self-reported and categorized as current or former/never. Family history of diabetes, hypertension, or kidney disease was determined by participant self-report of a first-degree relative with the condition. Educational level was self-reported and categorized as less than high school or high school equivalent and higher. Health insurance status was dichotomized according to participant self-report of health insurance coverage or not at the time of

screening. To account for potential regional differences in CKD by race/ethnicity, we categorized the United States into the 4 census geographic regions: Northeast (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont, New Jersey, New York, and Pennsylvania), Midwest (Illinois, Indiana, Michigan, Ohio, Wisconsin, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota); South (Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia, Alabama, Kentucky, Mississippi, Tennessee, Arkansas, Louisiana, Oklahoma, and Texas), and West (Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming, Alaska, California, Hawaii, Oregon, and Washington).

Outcome Variables

Our main outcome variable was abnormal albuminuria, or urine albumin-creatinine ratio (ACR) $\geq$ 30 mg/g. Because we limited our study population to participants with eGFR $\geq$ 60 mL/min/1.73 m^2, the presence of albuminuria was equivalent to CKD stages 1 or 2 according to KDOQI guidelines.[5] We further categorized albuminuria as microalbuminuria (ACR, 30-299 mg/g) and macroalbuminuria (ACR $\geq$ 300 mg/g). KEEP does not record urine ACR as a specific number, but as $<$30, 30-299, or $\geq$300 mg/g.

Statistical Analysis

We used a complete-case analysis approach in which we analyzed participants with available data for all covariates of interest. Demographic information was similar for included and excluded participants, except that participants excluded because of missing values (n = 11,595) were slightly older (mean age, 55.7 vs 52.1 years) with slightly higher prevalences of diabetes (35% vs 31%) and hypertension (71% vs 66%).

We compared demographic characteristics and CKD risk-factor prevalence by race/ethnicity using χ^2 analyses. We compared mean age and clinical and laboratory characteristics across racial/ethnic groups using analysis of variance. We tabulated proportions and respective 95% confidence intervals of participants with albuminuria (ACR $\geq$ 30 mg/g) by race/ethnicity and the proportions with microalbuminuria (ACR 30-299 mg/g) and macroalbuminuria (ACR $\geq$ 300 mg/g).

We conducted univariate and multivariate logistic regression analyses to determine the association of race/ethnicity with the presence of albuminuria in participants with eGFR $\geq$ 60 mL/min/1.73 m^2. Albuminuria was the dependant variable. Age as a categorical variable, along with the other a priori covariates, was included in multivariate analyses. We repeated the same analysis to determine the association of race/ethnicity with the presence of macroalbuminuria.

Last, we conducted subgroup analysis in participants without diabetes or hypertension. We tabulated the proportions with albuminuria (ACR $\geq$ 30 mg/g) by race/ethnicity and conducted univariate and multivariate logistic regression analyses using the same covariates, other than diabetes and hypertension.

Statistical analyses were performed using the SAS statistical package (release 9.1; SAS Institute Inc, www.sas.com).

The Institutional Review Board at Hennepin County Medical Center approved the KEEP study, including research protocol, process of obtaining informed consent, and data management procedures. The Cleveland Clinic Institutional Review Board approved this study.

RESULTS

Of 64,161 KEEP participants in our study, 45% (n = 28,579) were white, 33% (n = 21,435) were African American, 12% (n = 7,954) were Hispanic, 6% (n = 3,912) were Asian, and 4% (n = 2,281) were American Indian/Alaska Native. Most participants were women, and overall mean age was 52 years (Table 1). More than half the American Indian/Alaska Native and African American participants were obese; less than a quarter of Asian participants were obese. Hispanics and American Indians/Alaska Natives were least likely to self-report having health insurance at the time of screening. African American participants had a higher mean systolic blood pressure compared with the other groups (Table 2).

Abnormal albuminuria (urinary ACR $\geq$ 30 mg/g) was present in 8% (n = 2,303) of whites, 11% (n = 2,310) of African Americans, 9% (n = 730) of Hispanics, 10% (n = 381) of Asians, and 15% (n = 344) of American Indians/Alaska Natives. Stratifying the outcome by microalbuminuria (ACR 30-299 mg/g) and macroalbuminuria (ACR $\geq$ 300 mg/g) showed significant racial/ethnic differences (Fig 1), with a higher prevalence of macroalbuminuria in Hispanics and American Indians/Alaska Natives than in whites.

Odds of albuminuria were higher for all groups compared with whites in both unadjusted and multivariate adjusted analyses; approximately 20% higher for Hispanics, 40% higher for African Americans and Asians, and 90% higher for American Indians/Alaska Natives (Table 3). Subgroup analyses of participants without diabetes or hypertension showed no association between race/ethnicity and albuminuria in either unadjusted or adjusted analyses, except for American Indians/Alaska Natives, for whom odds of albuminuria were twice as high as odds for whites (Table 3).

In our examination of the association of race/ethnicity with macroalbuminuria, even after multivariate adjustment, American Indians/Alaska Natives retained nearly 3-fold odds of macroalbuminuria compared with whites (Table 4). Odds of

Table 1. Baseline Demographic Characteristics of KEEP Participants With Estimated Glomerular Filtration Rate ≥ 60 mL/min/1.73 m^2 Stratified by Race/Ethnicity

Characteristics	White (%)	African American (%)	Hispanic (%)	Asian (%)	American Indian/ Alaska Native (%)	*P*[a]
No. of participants	28,579	21,435	7,954	3,912	2,281	
Age (y), mean[b]	55 ± 15	51 ± 14	46 ± 14	52 ± 14	48 ± 15	<0.001
Women	65	72	67	62	74	<0.001
Obesity	41	53	42	18	57	<0.001
Diabetes	32	30	30	29	39	<0.001
Hypertension	67	70	55	55	61	<0.001
Current smoker	12	13	11	6	26	<0.001
Family history						
Diabetes	55	63	65	52	78	<0.001
Hypertension	78	85	74	78	73	<0.001
Kidney disease	17	20	22	17	24	<0.001
≥High school education	92	88	66	88	82	<0.001
Health insurance, yes	88	81	53	77	68	<0.001
Region						<0.001
Northeast	26	18	21	36	9	
Midwest	16	13	14	5	20	
South	45	66	44	18	31	
West	13	3	21	41	40	

Note: N = 64,161.
Abbreviation: KEEP, Kidney Early Evaluation Program.
[a]χ^2, except for mean age, for which analysis of variance was used.
[b]Mean ± standard deviation.

macroalbuminuria were also about 40% higher for Hispanics than whites. However, odds ratios for the other groups were only modestly increased and did not reach statistical significance.

DISCUSSION

We found a higher prevalence of albuminuria in African Americans, Hispanics, Asians, and American Indians/Alaska Natives compared with non-Hispanic whites in the KEEP population, and differences persisted even after adjustment for demographics, diabetes, hypertension, obesity, and socioeconomic factors. Furthermore, the racial/ethnic differences were not uniform. Risk of prevalent macroalbuminuria was highest for Hispanics and American Indians/Alaska Natives. In participants without known diabetes or hypertension, only American Indians/Alaska Natives were at higher risk of prevalent albuminuria. Although diabetes and hypertension seem to have major roles in a higher prevalence of albuminuria in all racial/ethnic groups, further independent risk appears to be present in American Indians/Alaska Natives in isolation of these established risk factors.

Reasons for the higher albuminuria prevalence in American Indians/Alaska Natives likely are multifactorial and may include genetics, environmental factors, or further residual confounding. The population comprises > 500 unique tribes that are culturally diverse and geographically dispersed in rural and urban settings.[22] Diabetes, an important risk factor for albuminuria, is increasing in this population.[17,23,24] Hypertension also is a strong and independent risk factor for albuminuria in this population.[17] American Indians/Alaska Natives may have some shared genetic predisposition to albuminuria[25] or the risk may be related to environmental factors that are unaccounted for or to exposure to toxins,

Table 2. Baseline Clinical and Laboratory Characteristics of KEEP Participants With Estimated Glomerular Filtration Rate ≥ 60 mL/min/1.73 m^2 Stratified by Race/Ethnicity

Characteristics	White (n = 28,579)	African American (n = 21,435)	Hispanic (n = 7,954)	Asian (n = 3,912)	American Indian/ Alaska Native (n = 2,281)	*P*
Body mass index (kg/m^2)	29.7 ± 6.7	31.6 ± 7.1	29.8 ± 6.3	26.1 ± 5.6	31.9 ± 7.0	<0.001
Waist circumference (in)	39.5 ± 6.6	39.9 ± 6.5	38.4 ± 5.7	36.3 ± 6.5	42.3 ± 8.3	<0.001
Systolic blood pressure (mm Hg)	132.8 ± 18.9	134.0 ± 19.8	128.5 ± 19.1	127.2 ± 18.8	128.5 ± 17.5	<0.001
Diastolic blood pressure (mm Hg)	79.1 ± 11.0	81.5 ± 11.8	78.2 ± 1.1	78.0 ± 11.2	77.3 ± 11.2	<0.001
Total cholesterol (mg/dL)[a]	198.7 ± 41.9	197.6 ± 40.6	200.0 ± 41.1	197.3 ± 38.1	188.8 ± 38.5	0.2
High-density lipoprotein cholesterol (mg/dL)[a]	53.9 ± 16.8	58.7 ± 7.4	50.2 ± 14.5	53.0 ± 15.7	55.7 ± 14.9	<0.001
Low-density lipoprotein cholesterol (mg/dL)[a]	106.5 ± 35.3	107.6 ± 34.9	108.3 ± 31.6	102.5 ± 30.8	100.8 ± 34.9	0.6
Triglycerides (mg/dL)[a]	169.0 ± 121.0	119.3 ± 82.3	178.5 ± 135.0	161.6 ± 114.8	192.5 ± 147.9	<0.001
Fasting blood glucose (mg/dL)	105.7 ± 37.7	106.8 ± 43.1	108.0 ± 41.6	106.5 ± 30.1	114.8 ± 51.5	0.02
Hemoglobin A_{1c} (%)[a,b]	7.0 ± 1.6	7.2 ± .9	7.6 ± 1.9	7.8 ± 2.1	7.6 ± 2.1	<0.001

Note: N = 64,161. Values expressed as mean ± standard deviation. Conversion factors for units: total, low-density lipoprotein, and high-density lipoprotein cholesterol in mg/dL to mmol/L, ×0.02586; triglycerides in mg/dL to mmol/L, ×0.01129; glucose in mg/dL to mmol/L, ×0.05551.

Abbreviation: KEEP, Kidney Early Evaluation Program.

[a]Data available only after May 1, 2005.

[b]Only participants with diabetes.

such as heavy metals like lead, cadmium, and uranium.[26,27] Some of the increased risk observed in American Indians/Alaska Natives without diabetes or hypertension could be related to a higher prevalence of earlier stages of these conditions, such as prediabetes and prehypertension, metabolic syndrome, or cardiovascular disease, that we were unable to account for in this study.[28]

Prior studies of albuminuria have focused on patients with diabetes, a specific health maintenance organization group, or population samples, such as NHANES, with racial/ethnic representation limited to African Americans and Mexican Americans. Our study examined differences in prevalent albuminuria in multiple racial/ethnic groups from throughout the United States and included participants with and without known diabetes and hypertension. In African Americans, Hispanics, and Asians, we found a higher prevalence of albuminuria, consistent with prior studies.[2,15,16] These results were not surprising given the strong association of albuminuria with the development of ESRD[11,12,29,30] and the known differences in ESRD incidence and prevalence among racial/ethnic minorities.[2] Risk of macroalbuminuria also was particularly strong in Hispanics and could be related to their burden of diabetes and hypertension.[31] Prevention, early detection, and aggressive treatment of diabetes and hypertension might help reduce racial differences in albuminuria.

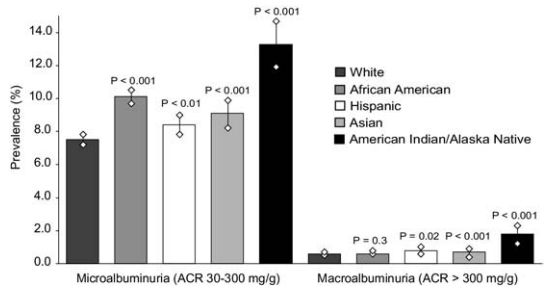

Figure 1. Racial/ethnic differences in prevalences of microalbuminuria and macroalbuminuria, Kidney Early Evaluation Program (KEEP) participants, 2000-2008. Diamond shapes represent upper and lower limits of 95% confidence intervals for prevalence estimates. *P* values shown are χ^2 comparisons for each racial/ethnic group to non-Hispanic whites; global χ^2 *P* for microalbuminuria and macroalbuminuria < 0.001. Abbreviation: ACR, albumin-creatinine ratio.

The National Kidney Foundation released a position statement on testing for CKD, which can be done using 2 simple tests: a urine test to detect proteinuria and a blood test for information to estimate GFR.[32] According to the National Kidney Disease Education Program, health care professionals should screen persons with diabetes annually, persons with hypertension at

Table 3. Odds Ratios of Albuminuria by Race/Ethnicity in KEEP Participants, 2000-2008

Race/Ethnicity	eGFR ≥ 60 mL/min/1.73 m² (n = 64,161)		eGFR ≥ 60 mL/min/1.73 m² With No Diabetes or Hypertension (n = 19,036)	
	Unadjusted OR (95% CI)	Adjusted[a] OR (95% CI)	Unadjusted OR (95% CI)	Adjusted[b] OR (95% CI)
White	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
African American	1.38 (1.30-1.46)[c]	1.38 (1.29-1.47)[c]	1.06 (0.88-1.29)	1.06 (0.87-1.30)
Hispanic	1.15 (1.06-1.26)[d]	1.19 (1.08-1.31)[d]	1.05 (0.83-1.33)	1.00 (0.77-1.31)
Asian	1.23 (1.10-1.38)[d]	1.42 (1.26-1.61)[c]	1.03 (0.75-1.41)	1.03 (0.74-1.43)
American Indian/Alaska Native	2.03 (1.79-2.29)[c]	1.93 (1.70-2.20)[c]	2.04 (1.46-2.84)[c]	2.09 (1.47-2.98)[c]

Note: eGFR given in mL/min/1.73 m²; conversion factor for mL/s/1.73 m², ×0.01667.

Abbreviations: CI, confidence interval; eGFR, estimated glomerular filtration rate; KEEP, Kidney Early Evaluation Program; OR, odds ratio.

[a]Adjusted for age; sex; obesity; diabetes; hypertension; smoking status; family history of diabetes, hypertension, or kidney disease; education level, presence of health insurance, and geographic region.

[b]Adjusted for all above except diabetes and hypertension.

[c]$P < 0.001$.

[d]$P < 0.05$.

the time it is diagnosed and then every 3 years, and persons with a family history of ESRD at least every 3 years; some recommendations are opinion based.[33] Providers also should consider that the risk of kidney failure is higher for African Americans, American Indians/Alaska Natives, and Asians.[33] Our findings strongly suggest an indication to consider screening all American Indians and Alaska Natives aged 18 years or older for albuminuria in addition to those with diabetes, as recommended by the Indian Health Service.[34] In other groups, screening for albuminuria in people with diabetes or hypertension and a family history of CKD may be adequate, particularly in African Americans, Hispanics, and Asians. Screening for albuminuria identifies individuals at increased renal risk.[35] Such screening may be cost-effective in people with diabetes and hypertension,[36] and it is an important part of a public health approach to CKD.[37,38]

Table 4. Odds Ratios for Macroalbuminuria by Race/Ethnicity in KEEP Participants With Estimated Glomerular Filtration Rate ≥ 60 mL/min/1.73 m²

Race/Ethnicity	Unadjusted OR (95% CI)	Adjusted[a] OR (95% CI)
White	1.00 (reference)	1.00 (reference)
African American	1.14 (0.91-1.43)	1.14 (0.90-1.45)
Hispanic	1.40 (1.05-1.88)[b]	1.38 (1.01-1.90)[b]
Asian	1.22 (0.81-1.84)	1.28 (0.84-1.97)
American Indian/ Alaska Native	3.13 (2.21-4.44)[c]	2.71 (1.87-3.93)[c]

Note: N = 64,161.

Abbreviations: CI, confidence interval; KEEP, Kidney Early Evaluation Program; OR, odds ratio.

[a]Adjusted for age; sex; obesity; diabetes; hypertension; smoking status; family history of diabetes, hypertension, or kidney disease; education level, presence of health insurance, and geographic region.

[b]$P < 0.05$.

[c]$P < 0.001$.

Because this is a cross-sectional study, we cannot determine causality or account for changes in outcomes or risk factors over time. Our cohort is derived from a group of voluntary screened participants, of whom more than 60% were women, in KEEP, a program that targets individuals at increased risk of kidney disease. Therefore, our results may overestimate the prevalence of albuminuria in the racial/ethnic groups represented. However, CKD in the KEEP cohort has been shown to be similar to CKD in the subgroup of participants with CKD in NHANES.[39] Some data are based on self-report from questionnaires and therefore subject to potential recall and ascertainment bias; however, ascertainment of disease status using self-report has been shown to be valid.[40] In general, participants with and without missing data in our study were similar, except that those with missing data had a slightly higher prevalence of diabetes and hypertension. Thus, we may have underestimated the effect of these 2 conditions in our results. Because single measurements of urine albumin and creatinine were used rather than repeated measurements over time, as

recommended for clinical practice,[5] the prevalence of albuminuria might be overestimated. However, single urine samples have been accepted as adequate for the detection of albuminuria.[41] Last, we did not have information regarding treatment with specific medications indicated for albuminuria, such as angiotensin-converting enzyme inhibitors, which can cause regression of albuminuria. If these agents were prescribed differently in the racial/ethnic groups, this potentially could be a missed confounder in this study.

Effective screening of specific racial/ethnic groups at increased risk may lead to improved detection of early CKD, allowing early intervention that may help those at highest risk of complications, such as cardiovascular disease and progression to ESRD. Future studies are needed to assess the effectiveness of earlier screening for albuminuria in these at-risk populations for the prevention of renal outcomes, cardiovascular outcomes, and mortality.

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