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Access to Health Care Among Adults Evaluated for CKD: Findings From the Kidney Early Evaluation Program (KEEP)

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Abstract

Background—Data are scant regarding access to health care in patients with chronic kidney disease (CKD). We performed descriptive analyses using data from the National Kidney Foundation's Kidney Early Evaluation Program (KEEP), a nationwide health screening program for adults at high risk of CKD.

Methods—From 2000–2010, a total of 122,502 adults without end-stage renal disease completed KEEP screenings; 27,927 (22.8%) met criteria for CKD (10,082, stages 1–2; 16,684, stage 3; and 1,161, stages 4–5). CKD awareness, self-rated health status, frequency of physician visits, difficulty obtaining medical care, types of caregivers, insurance status, and medication coverage and estimated costs were assessed.

Results—Participants with CKD were more likely to report fair/poor health status than those without CKD. Health care utilization increased at later CKD stages; ~95% of participants at stages 3–5 had visited a physician during the preceding year compared with 83.7% of participants without CKD. More Hispanic and African American than white participants at all CKD stages reported not having a physician. Approximately 40% of participants younger than 65 years reported fair/poor health status at stages 4–5 compared with ~30% who were 65 years and older. Younger participants at all stages were more likely to report extreme or somewhat/moderate difficulty obtaining medical care. Comorbid conditions (diabetes, hypertension, and prior

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cardiovascular events) were associated with increased utilization of care. Utilization of nephrology care was poor at all CKD stages; <6% of participants at stage 3 and <30% at stages 4–5 reported ever seeing a nephrologist.

Conclusions—Lack of health insurance and perceived difficulty obtaining medical care with lower health care utilization, both of which are consistent with inadequate access to health care, are more likely for KEEP participants who are younger than 65 years, nonwhite, and without previously diagnosed comorbid conditions. Nephrology care is infrequent in elderly participants with advanced CKD who are nonwhite, have comorbid disease, and have high-risk states for cardiovascular disease.

INDEX WORDS

Chronic kidney disease; health care access; health insurance; medication payment; socioeconomic status; educational status

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Access to health care has been defined as “the timely use of personal health services to achieve the best possible outcomes.”[1] Barriers to health care access prevent high-quality care from achieving expected positive clinical outcomes.[1] The increasing prevalence of chronic kidney disease (CKD) in the United States has led to a concomitant increase in overall morbidity and mortality related to CKD. Conceivably, improved access to health care in patients with or at risk of CKD could lead to a slowing of this epidemic.

However, to date, the literature for access to health care in kidney disease remains scant and is focused primarily on the dialysis population. Previous reports have shown that poorer access to care in African Americans with CKD compared with whites is linked to higher risk of incident end-stage renal disease[2,3] and later initiation of dialysis therapy.[4] Fewer studies have examined factors other than race that influence access. Lack of insurance has been reported as a risk factor for CKD progression[5] and poorer control of CKD risk factors, such as hypertension.[6] However, other indicators of health care access, such as difficulty obtaining medical care, type of physician provider, difficulty paying for physician services or medications, and patient-provider interactions,[1] remain unexplored in the population with or at risk of CKD.

Understanding the barriers to CKD care may provide information to allow policy changes that can favorably improve current standards of care, particularly health care delivery and utilization. In addition, health care access for patients with CKD at earlier disease stages, when opportunities to halt or slow disease progression may exist, could emerge as the most important area for intervention. We therefore used data from the Kidney Early Evaluation Program (KEEP) to explore health care access in adults evaluated for CKD. We studied the distribution of various measures of access to medical care across CKD stages and assessed for disparities in these measures across racial and ethnic groups, age groups, and chronic disease states (diabetes, hypertension, and cardiovascular disease [CVD]) that often accompany CKD.

METHODS

Study Design and Population

KEEP is an ongoing nationwide free health screening program run by the National Kidney Foundation to increase awareness of CKD in people considered at high risk.[7] We identified all KEEP participants 18 years and older from 2000–2010 and excluded those with missing laboratory measurements or receiving renal replacement therapy. The analytic sample after exclusions consisted of 122,502 participants.

Measures of Kidney Function

Laboratory tests were performed on site by trained medical personnel. Serum creatinine was calibrated to the Cleveland Clinic Research Laboratory. Estimated glomerular filtration rate (eGFR) was calculated using the CKD Epidemiology Collaboration (CKD-EPI) equation.[8] CKD stages were defined as follows: stage 1, eGFR ≥90 mL/min/1.73 m^2 and albumin-creatinine ratio (ACR) ≥30 mg/g; stage 2, eGFR of 60–89 mL/min/1.73 m^2 and ACR ≥30 mg/g; stage 3, eGFR of 30–59 mL/min/1.73 m^2; stage 4, eGFR of 15–29 mL/min/1.73 m^2; and stage 5, eGFR <15 mL/min/1.73 m^2. Albuminuria was categorized as normoalbuminuria (ACR <30 mg/g), microalbuminuria (30–300 mg/g), or macroalbuminuria (>300 mg/g).

Assessment of Participant Demographics and CKD Risk Factors

Participants were interviewed with a standardized questionnaire. Self-reported demographic characteristics included age, race, and level of education. Hypertension, diabetes, hyperlipidemia, CVD, and stroke were identified by self-report or medication use. In addition, hypertension was defined as an average of twice-measured blood pressure ≥140/90 mm Hg; diabetes, as measured blood glucose level ≥126 mg/dL (fasting) or ≥200 mg/dL (if last meal within 8 hours); and hyperlipidemia, as measured total cholesterol level >200 mg/dL or triglyceride level >150 mg/dL. Family history of CKD was positive if the participant identified any family members with kidney disease or receiving dialysis treatment.

Assessment of Health Care Access

CKD awareness was based on knowledge of kidney disease, urine protein, or urine blood as relayed by a health care professional. Health status was self-reported. Health care utilization was classified based on the last reported visit to any physician. Subjective measure of health care accessibility was ascertained by self-report of difficulty obtaining medical care on a 4-point Likert scale from extremely difficult to not difficult. We categorized source of medical care as generalist (family practitioner, internist, or geriatrician), nephrologist, other specialist (cardiologist or endocrinologist), other caregiver (obstetrician/gynecologist, physician assistant, or nurse practitioner), or none. Health insurance, type of coverage plan, and insurance benefits for medications were assessed by self-report. Self-paying >$75/mo for medications was considered a significant burden.

Statistical Analysis

Variables are expressed as mean ± standard deviation or count with proportion, as appropriate. Comparisons between groups were performed with the analysis of variance test for normally distributed continuous variables and χ^2 test for categorical variables. Variables with missing data are included due to the descriptive nature of the analyses, and numbers of missing data points are reported in table footnotes. All hypothesis testing was 2 tailed, with $P < 0.05$ considered statistically significant. Statistical analysis was performed with SAS, version 9.1 (www.sas.com).

RESULTS

Baseline Characteristics

The study population included 122,502 adults without end-stage renal disease who participated in KEEP screenings in 2000–2010 and for whom laboratory data were complete; of these, 27,927 (22.8%) met criteria for CKD (Table 1). The distribution of CKD stages was stages 1–2, 8.2%; stage 3, 13.6%; and stages 4–5, 1.0%. Participants with CKD were more likely to be 65 years or older. Racial/ethnic groups were chiefly non-Hispanic white (n = 56,753; 46.3%) and African American (n = 38,379; 31.3%). In the subgroup with CKD stages 3–5, the proportion of non-Hispanic whites was higher (~60%); proportions of

non-Hispanic African American and Hispanic participants were lower than in the subgroup without CKD. Education level was more likely to be high school or less for participants with than without CKD. Traditional CVD risk factors, such as hypertension, diabetes, dyslipidemia, prior history of CVD, and tobacco use, were predictably more prevalent in participants with CKD.

Access to Health Care by CKD Stage

Awareness of CKD was low in participants with CKD stages 3 (22.5%) and 4–5 (52.7%; Table 2). Participants with CKD were more likely to report fair or poor health status than those without CKD. Health care utilization increased at later CKD stages; ~95% of participants with CKD stages 3–5 had visited a physician within the preceding year compared with 83.7% of participants without CKD. More participants with CKD stages 3 and 4–5 reported no difficulty obtaining medical care (47.8% and 41.0%, respectively); participants with no CKD or CKD stages 1–2 were more likely to perceive some difficulty in access to medical care (12.1% and 12.6%, respectively). Less than 6% of participants with CKD stage 3 and <30% of participants with CKD stages 4–5 reported seeing a nephrologist (alone or with a generalist; Tables 2 and 3). At CKD stages 1–2, only ~2.5% of participants reported seeing a nephrologist before the screening. Participants with CKD stages 4–5 were on average as likely to see a nephrologist as another specialist (eg, cardiologist or endocrinologist). Participants with CKD stages 3 and 4–5 were more likely to have health insurance (86.8% and 85.0%, respectively) than participants without CKD (75.8%), and Medicare was the most common type of insurance. Although more participants with CKD stages 3 and 4–5 than without CKD reported having insurance benefits and medication coverage, they also reported higher out-of-pocket expenses for medications (> $75/mo) than participants without CKD or with early stages of CKD.

Access to Health Care by Race/Ethnicity

Differences in measures of access to health care between non-Hispanic white, non-Hispanic African American, and Hispanic participants at various stages of CKD are shown in Table 4. Awareness of CKD was lower in African Americans than whites or Hispanics at every stage of CKD. Proportionately more Hispanic participants than white or African American participants reported fair or poor health status at CKD stages 1–2 and 3. Health care utilization with last physician visit in the previous year was >80%, 90%, and 95% at CKD stages 1–2, 3, and 4–5, respectively, for all racial/ethnic groups, but lower in Hispanic participants with CKD stages 1–2 and 3. Perceived difficulty obtaining medical care was notable for Hispanics, who, compared with white and African American participants, were significantly more likely to report that access was extremely or moderately difficult at all CKD stages. More Hispanic and African American than white participants at all CKD stages reported not having a physician. About a quarter of participants with CKD stages 4–5 had seen a nephrologist (alone or with a generalist) before the KEEP screening, with no significant differences across racial/ethnic groups. White participants were more likely to have health insurance and accompanying medication coverage than African American and Hispanic participants, a difference most pronounced at the earliest (stage 1) and latest (stages 4–5) CKD stages.

Access to Health Care by Age

Awareness of CKD was lower in elderly (age ≥65 years) than younger participants (Table 5), most notably at CKD stages 4–5 (46.7% and 67.0%, respectively). Elderly participants at all CKD stages were more likely to rate their health status as excellent or good. Younger participants were more likely to rate their health status as fair or poor, especially at CKD stages 4–5; ~40% reported fair or poor health status compared with ~30% of elderly participants. Elderly participants more commonly (>95%) than younger participants had

seen a physician within the last year, and younger participants at all CKD stages were more likely to report extreme or somewhat/moderate difficulty obtaining medical care. However, elderly participants with CKD stages 3–5, compared with younger counterparts, were less likely to have seen a nephrologist (alone or with a generalist) before the screening. This discrepancy was observed along with greater utilization of specialists (eg, cardiologists and endocrinologists) by elderly participants at all stages of CKD. Rates of health insurance coverage and medication benefits were significantly higher for elderly than younger participants at all CKD stages.

Access to Health Care by Chronic Health Condition

Measures of access to health care at CKD stages 3–5 with accompanying diabetes, hypertension, or CVD are listed in Table 6; patterns were similar for each of these chronic conditions. Awareness of CKD was higher in the presence of comorbid diabetes, hypertension, or CVD, and self-rated health status was more likely to be fair or poor. These comorbid conditions were associated with higher utilization of physician visits accompanied by a greater likelihood of reporting that medical care was not very difficult or not difficult to obtain. Participants with diabetes, hypertension, or prior CVD events were more likely than participants without these conditions to have seen a nephrologist in addition to a generalist and/or other specialist, but <10% reported seeing a nephrologist.

DISCUSSION

Barriers to health care access affecting patients, physicians, and the health care delivery system complicate the management of almost every chronic disease. In this report, we describe access to health care for participants in KEEP, the largest nationwide CKD screening program. Advanced stages of CKD were associated with greater likelihood of insurance coverage, higher utilization of medical care, and an overall perception of less difficulty obtaining care, yet these measures did not translate to improved self-rated health status. Suboptimal involvement of nephrologists may contribute because <6% of participants with CKD stage 3 and <30% with stages 4–5 reported seeing a nephrologist before the screening. African American and Hispanic participants reported more difficulty accessing care than white participants, including lower rates of insurance coverage and physician visits, and these discrepancies persisted across all stages of CKD. Compared with younger participants with CKD, those 65 years or older reported overall better health status in the setting of better insurance coverage and more frequent utilization of generalist and specialist care, although nephrologists were strikingly underutilized across all age groups with CKD. In participants with more advanced stages of CKD, the presence of comorbid diabetes, hypertension, and prior CVD events was associated with improved awareness of CKD and less difficulty obtaining care, including greater utilization of nephrology care.

Awareness of CKD was low overall for KEEP participants; only ~20% of participants with CKD stage 3 and 50% with stages 4–5 were aware of their kidney disease. Low awareness of CKD in individuals at stages 3–5 also has been shown in other national cohorts, such as the National Health and Nutrition Examination Survey (NHANES), Reasons for Geographic and Racial Differences in Stroke (REGARDS) Study, and Jackson Heart Study.[9–11] Similar to findings in these cohorts, CKD awareness in KEEP mildly improved with decreasing eGFR, younger age, and the presence of another chronic health condition. In our study, white participants were more likely than African American participants to be aware of CKD. Importantly, except for younger age, awareness of CKD in KEEP tended to accompany factors associated with easier access to health care, particularly utilization of physician visits.

Health care utilization in KEEP, assessed by the timing of the last physician visit reported by participants and perceived difficulty obtaining health care, was demonstrably higher with increasing severity of CKD. This finding may be attributed to the presence of comorbid conditions, such as prior CVD events, warranting specialist care or hospitalization. In addition, complications of CKD, such as anemia or secondary hyperparathyroidism, may require more frequent involvement with a nephrologist alone or in conjunction with a generalist.[12] Hispanic and African American participants were less likely than whites to have seen a physician within the last year and more likely to report difficulty obtaining medical care at all CKD stages. Although cultural beliefs and area racial composition may explain some of these discrepancies,[13] differences in insurance coverage and overall education status also likely have a substantial role. More health care utilization was reported by elderly participants in KEEP than by their younger counterparts, and this divergence cannot be due solely to the higher burden of CKD in the older age group. The presence of comorbid conditions clearly has a role, as does the far greater likelihood of having health insurance (such as Medicare).[14]

We found that across all racial/ethnic and age groups and CKD stages, the presence of comorbid conditions led to greater utilization of health care, including more regular physician visits. Although this observation is comforting, the quality of care delivered in these visits and their associated health care costs must be considered. The low rate of nephrologist involvement in this cohort is striking. Overall, only ~5% of all KEEP participants with CKD had seen a nephrologist before the screening, and <30% of participants with CKD stages 4–5. Thus, greater utilization of health care does not necessarily translate to a higher rate of interaction with nephrologists. This is particularly troublesome at advanced stages of CKD, when discussions about renal replacement therapy options should be ongoing, and at the earliest stages of CKD (stages 1–2), when implementation of appropriate diagnostic assessments and therapeutic interventions (eg, initiation of renin-angiotensin system blockade, discontinuation of nephrotoxic medications, and designing appropriate diet and exercise regimens) by a nephrologist might have the greatest effect. Although >85% of participants with CKD stages 1–2 had seen a physician within the past year, only ~2.5% had seen a nephrologist. Innovative models of CKD practice, such as nurse-coordinated nephrologist-supervised approaches[15] and multidisciplinary nephrology teams with primary care collaboration[16] to provide optimal and cost-effective care, are being studied, and the hope is that such innovations will increase the presence of nephrologists in patient care.

Nephrologist involvement was commonly in collaboration with a generalist and other specialist. Minimal racial/ethnic difference was seen in this pattern of physician comanagement despite a known faster decrease in GFR in African Americans and Hispanics.[17] Slightly fewer elderly participants with CKD stages 3 and 4–5 identified a nephrologist as the source of care, whereas greater involvement of nephrologists was seen in the presence of chronic health conditions. These observations may reflect patterns of nephrologist referral by primary care physicians that may vary depending on their self-efficacy in managing CKD, interaction with nephrologists, and perceived patient barriers to health care access.[18–20] Nephrologist care is strongly recommended for all patients with CKD stages 4–5 because early nephrology referral is associated with reduced morbidity and mortality when dialysis therapy is started,[21] but not all patients with CKD stage 3 need to be seen by a nephrologist, especially those without proteinuria or at low risk of progression (eg, eGFR consistently >45 mL/min/1.73 m^2).[22] In our cohort, rates of nephrology visits were lower than reported elsewhere,[23] which may be explained in part by study design. KEEP participants volunteer for CKD screening, whereas patients with CKD who already see a nephrologist may not choose to participate. Whether patient-related factors such as poor understanding of the CKD process, denial of disease state, or barriers to nephrology access

contributed to the suboptimal or late nephrology involvement is not known.[24] Nevertheless, identification of 1,161 adults with CKD stages 4–5 and 16,684 with CKD stage 3 in a relatively unaware population over 10 years demonstrates the potential influence of a national screening program in making patients and their primary care physicians aware of CKD in time to institute appropriate nephrology involvement.

Our findings have important public health policy implications because they highlight the role of targeted screening activities, such as KEEP, in reducing the burden of CKD-related morbidity and mortality. The screening activity, by raising awareness and facilitating interaction with the medical community, can be viewed as an attempt to improve access to care for individuals with CKD. To date, there has been a surprising paucity of data about access to care in CKD. The Atherosclerosis Risk in Communities (ARIC) Study is the only other large national cohort to report in individuals with CKD a similar trend of decreased health care utilization and insurance coverage in African Americans compared with whites.[25] Such disparities in CKD care across different racial and ethnic groups (including Hispanics, who fare poorly in our cohort), socioeconomic strata, and public versus private health care systems are areas of active investigation.[13,26,27] Here, we highlight other groups characterized by poor access to health care, particularly young people with early-stage CKD and all people with CKD and no insurance coverage. The KEEP study population is a high-risk group with high prevalence rates of hypertension, diabetes, CVD, and CKD and good representation of minority subgroups, allowing for analysis of populations at particularly high risk of CKD progression due to poor access to care.

Our study has limitations. Much of the data presented are based on participant recall and thus are subject to error and/or bias. However, the KEEP questionnaire is standardized and data were collected by trained interviewers in an attempt to limit recall bias. KEEP participants are a high-risk population who volunteer for screening, and our findings may not be generalizable to the entire population. Diagnosis of CKD at the screening visit was made by a single blood and urine test for creatinine and proteinuria. In clinical practice, repeated tests over a 3-month period are required to confirm a diagnosis. However, potential measurement errors should be nondifferential and any bias, if present, should be toward the null. Finally, although we were able to study several measures of access to care, other key components, including the efficacy of patient-physician communication, trust and satisfaction in caregivers, waiting times for physician visits, and difficulty with travel to such visits, were not studied and likely contribute to difficulty in health care access.

In conclusion, this descriptive report from the KEEP population highlights differences in CKD awareness, health care utilization, sources of care, health insurance status, and medication coverage across different stages of CKD. We also highlight discrepancies in health care access in patients with CKD by race/ethnicity, age, and chronic health conditions. These results suggest that a substantial need remains to improve access to medical care in patients with CKD, particularly those who are nonwhite, young, or lack insurance. Involvement of nephrologists at all CKD stages remains poor and does not significantly improve with better access to health care. Thus, screening activities may provide a route to increase awareness of CKD and improve timely utilization of nephrology care, which currently represents the best chance to reduce the global burden of CKD-related morbidity and mortality.

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Table 1

Demographic Characteristics of the KEEP Study Population

Characteristic	CKD				*P*
	None	Stages 1–2	Stage 3	Stages 4–5	
No.	94,575	10,082	16,684	1,161	
Age (y)	53 ± 14.53	55 ± 15.11	70 ± 11.33	71 ± 13.70	<0.001
Age ≥65 y	21,094 (22.30)	2,850 (28.27)	11,640 (69.77)	816 (70.28)	<0.001
Women	64,557 (68.26)	6,827 (67.71)	11,429 (68.50)	717 (61.76)	<0.001
Race/ethnicity					<0.001
White[a]	41,849 (44.34)	3,762 (37.41)	10,482 (62.92)	660 (56.99)	
African American[a]	30,419 (32.23)	3,716 (36.95)	3,949 (23.71)	295 (25.47)	
Hispanic	4,016 (4.25)	451 (4.47)	418 (2.51)	27 (2.33)	
Asian	8,180 (8.65)	1,026 (10.18)	945 (5.66)	100 (8.61)	
Other	10,111 (10.69)	1,127 (11.18)	890 (5.33)	79 (6.80)	
Highest education[b]					<0.001
<High school	12,454 (13.17)	1,760 (17.46)	2,971 (17.81)	262 (22.57)	
High school graduate	23,617 (24.97)	2,765 (27.43)	5,032 (30.16)	373 (32.13)	
Some college	24,356 (25.75)	2,539 (25.18)	3,898 (23.36)	261 (22.48)	
College graduate	20,852 (22.05)	1,883 (18.68)	2,572 (15.42)	151 (13.01)	
Professional degree	12,179 (12.88)	983 (9.75)	1,981 (11.87)	98 (8.44)	
Creatinine (mg/dL)	0.86 ± 0.18	0.86 ± 0.19	1.28 ± 0.25	2.74 ± 1.39	<0.001
eGFR (mL/min/1.73 m^2)[c]	90.74 ± 17.78	89.48 ± 18.83	49.56 ± 7.78	22.56 ± 6.10	<0.001
Albuminuria					<0.001
<30 mg/g	94,575 (100.00)	0 (0.00)	13,237 (79.34)	438 (37.73)	
30–300 mg/g	0 (0.00)	9,381 (93.05)	2,933 (17.58)	431 (37.12)	
>300 mg/g	0 (0.00)	701 (6.95)	514 (3.08)	292 (25.15)	
BMI (kg/m^2)	30.16 ± 6.81	31.45 ± 7.65	30.01 ± 6.35	29.66 ± 6.41	<0.001
Hypertension	58,714 (62.08)	7,619 (75.57)	14,527 (87.07)	1,097 (94.49)	<0.001
Systolic BP (mm Hg)[b]	131.65 ± 18.64	139.37 ± 22.55	138.04 ± 20.57	141.15 ± 23.15	<0.001
Diastolic BP (mm Hg)[b]	79.47 ± 11.12	82.33 ± 12.83	77.11 ± 11.99	75.54 ± 13.56	<0.001

Characteristic	CKD				*P*
	None	Stages 1–2	Stage 3	Stages 4–5	
Diabetes	26,341 (27.85)	4,629 (45.91)	7,152 (42.87)	614 (52.89)	<0.001
Fasting blood glucose (mg/dL)[b]	105.45 ± 35.57	128.93 ± 69.46	113.53 ± 42.26	118.91 ± 39.11	<0.001
Dyslipidemia[b]	49,558 (52.40)	5,342 (52.99)	10,389 (62.27)	669 (57.62)	<0.001
Total cholesterol (mg/dL)[b]	196.48 ± 40.82	196.49 ± 44.92	192.42 ± 44.56	187.30 ± 52.02	<0.001
Cardiovascular disease	19,228 (20.33)	2,728 (27.06)	6,286 (37.68)	549 (47.29)	<0.001
Tobacco use[b,d]	33,956 (35.90)	4,100 (40.67)	6,583 (39.46)	501 (43.15)	<0.001
Family history					
Kidney disease[b]	16,702 (17.66)	1,963 (19.47)	2,631 (15.77)	229 (19.72)	<0.001
Diabetes[b]	53,276 (56.33)	5,844 (57.96)	8,168 (48.96)	571 (49.18)	<0.001
Hypertension[b]	73,432 (77.64)	7,553 (74.92)	11,481 (68.81)	762 (65.63)	<0.001

Note: Data are presented as mean ± standard deviation for continuous variables and number (percentage) for categorical variables.

Abbreviations: BMI, body mass index; BP, blood pressure; CKD, chronic kidney disease; eGFR, estimated glomerular filtration rate; KEEP, Kidney Early Evaluation Program.

[a] Non-Hispanic.

[b] Numbers of missing values for categorical variables were as follows: dyslipidemia, 32,476; tobacco use, 4,580; family history of kidney disease, 6,956; family history of diabetes, 6,546; family history of hypertension, 7,250; and highest level of education, 1,515. Missing values for continuous variables were excluded and numbers of missing values were as follows: BMI, 1,266; systolic BP, 777; diastolic BP, 779; fasting blood glucose level, 93,610; and total cholesterol level, 32,478.

[c] Calculated using the CKD Epidemiology Collaboration (CKD-EPI) equation.

[d] Indicates 100 or more lifetime cigarettes.

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Table 2

Health Status and Physician Access Among KEEP Participants With and Without CKD

	CKD				
Variables	**None**	**Stages 1–2**	**Stage 3**	**Stages 4–5**	***P***
No.	94,575	10,082	16,684	1,161	
CKD awareness[a]	12,884 (13.6)	2,240 (22.2)	3,759 (22.5)	612 (52.7)	<0.001
Self-rated health status[a]					<0.001
Excellent	4,634 (4.9)	286 (2.8)	493 (3.0)	19 (1.6)	
Good or very good	48,980 (51.8)	4,366 (43.3)	7,946 (47.6)	391 (33.7)	
Fair	13,290 (14.1)	2,013 (20.0)	3,378 (20.2)	301 (25.9)	
Poor	1,854 (2.0)	412 (4.1)	564 (3.4)	100 (8.6)	
Most recent physician visit[a]					<0.001
Within last y	79,124 (83.7)	8,695 (86.2)	15,648 (93.8)	1,103 (95.0)	
1–2 y ago	9,033 (9.6)	771 (7.6)	601 (3.6)	21 (1.8)	
>2 y ago	5,425 (5.7)	471 (4.7)	246 (1.5)	20 (1.7)	
Difficulty obtaining medical care[a]					<0.001
Extremely	4,467 (4.7)	537 (5.3)	375 (2.2)	43 (3.7)	
Somewhat or moderately	11,479 (12.1)	1,273 (12.6)	1,383 (8.3)	118 (10.2)	
Not very	14,783 (15.6)	1,464 (14.5)	2,601 (15.6)	167 (14.4)	
Not difficult	37,561 (39.7)	3,754 (37.2)	7,967 (47.8)	476 (41.0)	
Type of physician					<0.001
Generalist only	41,678 (44.1)	4,377 (43.4)	7,423 (44.5)	422 (36.3)	
Nephrologist only	102 (0.1)	29 (0.3)	43 (0.3)	25 (2.2)	
Generalist and nephrologist	1,079 (1.1)	236 (2.3)	937 (5.6)	292 (25.2)	
Other specialist[b]	21,639 (22.9)	2,667 (26.5)	5,678 (34.0)	276 (23.8)	
Other care providers[c]	18,030 (19.1)	1,469 (14.6)	1,573 (9.4)	53 (4.6)	
None	12,047 (12.7)	1,304 (12.9)	1,030 (6.2)	93 (8.0)	
Insurance coverage[a]	71,687 (75.8)	7,360 (73.0)	14,480 (86.8)	987 (85.0)	<0.001
Type of insurance[a,d]					<0.001
Medicare	20,332 (21.5)	2,792 (27.7)	9,950 (59.6)	715 (61.6)	

Variables	CKD None	Stages 1–2	Stage 3	Stages 4–5	*P*
Medicaid	2,713 (2.9)	435 (4.3)	351 (2.1)	34 (2.9)	
HMO	13,223 (14.0)	1,093 (10.8)	1,171 (7.0)	58 (5.0)	
PPO	10,769 (11.4)	821 (8.1)	779 (4.7)	29 (2.5)	
Veteran's benefits	1,056 (1.1)	100 (1.0)	176 (1.1)	15 (1.3)	
Private	7,733 (8.2)	664 (6.6)	700 (4.2)	31 (2.7)	
Other	12,550 (13.3)	1,212 (12.0)	1,325 (7.9)	92 (7.9)	
Unknown	1,404 (1.5)	122 (1.2)	98 (0.6)	11 (0.9)	
Medication coverage[a]	48,516 (51.3)	4,785 (47.5)	9,978 (59.8)	614 (52.9)	<0.001
Out-of-pocket payment for prescription medications[a]					<0.001
<$20/mo	29,210 (30.9)	2,585 (25.6)	3,350 (20.1)	184 (15.8)	
$20–$40/mo	13,952 (14.8)	1,394 (13.8)	2,641 (15.8)	141 (12.1)	
$41–$75/mo	8,814 (9.3)	984 (9.8)	2,105 (12.6)	130 (11.2)	
$76–$100/mo	5,589 (5.9)	668 (6.6)	1,442 (8.6)	107 (9.2)	
$101–$250/mo	5,062 (5.4)	676 (6.7)	1,612 (9.7)	127 (10.9)	
>$250/mo	1,859 (2.0)	318 (3.2)	632 (3.8)	74 (6.4)	

Note: Data are presented as number (percentage).

Abbreviations: CKD, chronic kidney disease; HMO, health maintenance organization; KEEP, Kidney Early Evaluation Program; PPO, preferred provider organization.

[a]Numbers of missing values: CKD awareness, 536; self-rated health status, 33,475; most recent physician visit, 1,344; difficulty obtaining medical care, 34,054; source of care, 14,474; insurance coverage, 4,170; type of insurance, 29,948; medication coverage, 37,120; and out-of-pocket payment for prescription medications, 38,846.

[b]Cardiologist or endocrinologist.

[c]Obstetrician/gynecologist, nurse practitioner, or physician assistant.

[d]Insurance type was selected by the order listed in the column and is otherwise not mutually exclusive.

Table 3

Nephrologist Care by eGFR and Albuminuria

	ACR = 0–29 mg/g		ACR = 30–299 mg/g		ACR ≥300 mg/g	
	No.	**Nephrologist Care**	**No.**	**Nephrologist Care**	**No.**	**Nephrologist Care**
eGFR						
≥90 mL/min/1.73 m^2	46,319	461 (1.0)	4,338	93 (2.1)	269	13 (4.8)
60–89 mL/min/1.73 m^2	48,256	720 (1.5)	5,043	133 (2.6)	432	26 (6.0)
45–59 mL/min/1.73 m^2	10,024	361 (3.6)	1,825	108 (5.9)	250	28 (11.2)
30–44 mL/min/1.73 m^2	3,213	298 (9.3)	1,108	144 (13.0)	264	41 (15.5)
<29 mL/min/1.73 m^2	438	82 (18.7)	431	135 (31.3)	292	100 (34.2)
Total	108,250	1,922 (1.8)	12,745	613 (4.8)	1507	208 (13.8)

Note: Number of missing values in source of care, 14,474.

Abbreviations: ACR, albumin-creatinine ratio; eGFR, estimated glomerular filtration rate.

Table 4

Health Status and Access to Health Care by Race/Ethnicity, Stratified by CKD Stage

Variables	White[a]	African American[a]	Hispanic	*P*
CKD stages 1–2	n = 3,762	n = 3,716	n = 451	
CKD awareness	957 (25.4)	738 (19.9)	114 (25.3)	<0.001
Self-rated health status				<0.001
Excellent	132 (3.5)	90 (2.4)	12 (2.7)	
Good or very good	1,792 (47.6)	1,600 (43.1)	189 (41.9)	
Fair	643 (17.1)	768 (20.7)	134 (29.7)	
Poor	154 (4.1)	117 (3.1)	36 (8.0)	
Most recent physician visit				<0.001
Within last y	3,321 (88.3)	3,237 (87.1)	366 (81.2)	
1–2 y ago	250 (6.6)	270 (7.3)	48 (10.6)	
>2 y ago	145 (3.9)	155 (4.2)	33 (7.3)	
Difficulty obtaining medical care				<0.001
Extremely	146 (3.9)	159 (4.3)	69 (15.3)	
Somewhat or moderately	395 (10.5)	423 (11.4)	96 (21.3)	
Not very	591 (15.7)	520 (14.0)	65 (14.4)	
Not difficult	1,577 (41.9)	1,450 (39.0)	138 (30.6)	
Type of physician				<0.001
Generalist only	1,595 (42.4)	1,602 (43.1)	224 (49.7)	
Nephrologist only	11 (0.3)	6 (0.2)	0 (0)	
Generalist and nephrologist	90 (2.4)	83 (2.2)	9 (2.0)	
Other specialist[b]	1,183 (31.4)	93 (25.1)	90 (20.0)	
Other care providers[c]	539 (14.3)	628 (16.9)	48 (10.6)	
None	344 (9.1)	465 (12.5)	80 (17.7)	
Insurance coverage	3,041 (80.8)	2,788 (75.0)	242 (53.7)	<0.001
Medications coverage	2,049 (54.5)	1,793 (48.3)	181 (40.1)	<0.001
CKD stage 3	n = 10,482	n = 3,949	n = 418	
CKD awareness	2,500 (23.9)	720 (18.2)	117 (28.0)	<0.001
Self-rated health status				<0.001
Excellent	341 (3.3)	89 (2.3)	16 (3.8)	
Good or very good	5,342 (51.0)	1,729 (43.8)	178 (42.6)	
Fair	1,955 (18.7)	873 (22.1)	126 (30.1)	
Poor	348 (3.3)	110 (2.8)	23 (5.5)	
Most recent physician visit				<0.001
Within last y	9,863 (94.1)	3,740 (94.7)	378 (90.4)	
1–2 y ago	385 (3.7)	100 (2.5)	24 (5.7)	
>2 y ago	137 (1.3)	54 (1.4)	10 (2.4)	
Difficulty obtaining medical care				<0.001
Extremely	161 (1.5)	91 (2.3)	31 (7.4)	
Somewhat or moderately	746 (7.1)	358 (9.1)	68 (16.3)	

Variables	White[a]	African American[a]	Hispanic	P
Not very	1,746 (16.7)	527 (13.3)	66 (15.8)	
Not difficult	5,314 (50.7)	1,804 (45.7)	179 (42.8)	
Type of physician				<0.001
Generalist only	4,419 (42.2)	1,903 (48.2)	189 (45.2)	
Nephrologist only	20 (0.2)	12 (0.3)	3 (0.7)	
Generalist and nephrologist	622 (5.9)	199 (5.0)	23 (5.5)	
Other specialist[b]	3,912 (37.3)	1,136 (28.8)	131 (31.3)	
Other care providers[c]	1,020 (9.7)	414 (10.5)	26 (6.2)	
None	489 (4.7)	285 (7.2)	46 (11.0)	
Insurance coverage	9,486 (90.5)	3,297 (83.5)	308 (73.7)	<0.001
Medications coverage	6,683 (63.8)	2,196 (55.6)	233 (55.7)	<0.001
CKD stages 4–5	n = 660	n = 295	n = 27	
CKD awareness	347 (52.6)	143 (48.5)	16 (59.3)	0.04
Self-rated health status				0.1
Excellent	13 (2.0)	4 (1.4)	0 (0)	
Good or very good	245 (37.1)	93 (31.5)	11 (40.7)	
Fair	160 (24.2)	87 (29.5)	10 (37.0)	
Poor	59 (8.9)	18 (6.1)	3 (11.1)	
Most recent physician visit				0.9
Within last y	625 (94.7)	283 (95.9)	26 (96.3)	
1–2 y ago	13 (2.0)	6 (2.0)	1 (3.7)	
>2 y ago	10 (1.5)	3 (1.0)	0 (0)	
Difficulty obtaining medical care				<0.001
Extremely	19 (2.9)	8 (2.7)	6 (22.2)	
Somewhat or moderately	50 (7.6)	33 (11.2)	9 (33.3)	
Not very	93 (14.1)	43 (14.6)	3 (11.1)	
Not difficult	312 (47.3)	113 (38.3)	7 (25.9)	
Type of physician				0.2
Generalist only	226 (34.2)	122 (41.4)	10 (37.0)	
Nephrologist only	10 (1.5)	8 (2.7)	0 (0)	
Generalist and nephrologist	174 (26.4)	71 (24.1)	7 (25.9)	
Other specialist[b]	178 (27.0)	58 (19.7)	7 (25.9)	
Other care providers[c]	32 (4.8)	16 (5.4)	0 (0)	
None	40 (6.1)	20 (6.8)	3 (11.1)	
Insurance coverage	600 (90.9)	241 (81.7)	13 (48.1)	<0.001
Medications coverage	392 (59.4)	149 (50.5)	11 (40.7)	<0.001

Note: Unless otherwise indicated, data are presented as number (percentage). Asian and other race/ethnicity was excluded from analyses.

Abbreviation: CKD, chronic kidney disease.

[a]Non-Hispanic.

[b]Cardiologist or endocrinologist.

[c] Obstetrician/gynecologist, nurse practitioner, or physician assistant.

Table 5

Health Status and Access to Health Care by Age, Stratified by CKD Stage

	CKD Stages 1–2[a]			CKD Stage 3[b]			CKD Stages 4–5 [c]		
Variables	**Age <65 y**	**Age ≥65 y**	***P***	**Age <65 y**	**Age ≥65 y**	***P***	**Age <65 y**	**Age ≥65 y**	***P***
No.	7,232	2,850		5,044	11,640		345	816	
CKD awareness	1,700 (23.5)	540 (18.9)	<0.001	1,341 (26.6)	2,418 (20.8)	<0.001	231 (67.0)	381 (46.7)	<0.001
Self-rated health status			<0.001			<0.001			0.001
Excellent	199 (2.8)	87 (3.1)		148 (2.9)	345 (3.0)		4 (1.2)	15 (1.8)	
Good or very good	3,048 (42.1)	1,318 (46.2)		2,131 (42.2)	5,815 (50.0)		100 (29.0)	291 (35.7)	
Fair	1,426 (19.7)	587 (20.6)		1,012 (20.1)	2,366 (20.3)		90 (26.1)	211 (25.9)	
Poor	321 (4.4)	91 (3.2)		224 (4.4)	340 (2.9)		47 (13.6)	53 (6.5)	
Most recent physician visit			<0.001			<0.001			<0.001
Within last y	5,988 (82.8)	2,707 (95.0)		4,496 (89.1)	11,152 (95.8)		316 (91.6)	787 (96.4)	
1–2 y ago	699 (9.7)	72 (2.5)		327 (6.5)	274 (2.4)		10 (2.9)	11 (1.3)	
>2 y ago	434 (6.0)	37 (1.3)		164 (3.3)	82 (0.7)		15 (4.3)	5 (0.6)	
Difficulty obtaining medical care			<0.001			<0.001			<0.001
Extremely	502 (6.9)	35 (1.2)		264 (5.2)	111 (1.0)		34 (9.9)	9 (1.1)	
Somewhat or moderately	1,060 (14.7)	213 (7.5)		620 (12.3)	763 (6.6)		66 (19.1)	52 (6.4)	
Not very	1,003 (13.9)	461 (16.2)		712 (14.1)	1,889 (16.2)		50 (14.5)	117 (14.3)	
Not difficult	2,388 (33.0)	1,366 (47.9)		1,897 (37.6)	6,070 (52.1)		88 (25.5)	388 (47.5)	
Type of physician			<0.001			<0.001			<0.001
Generalist only	3,070 (42.5)	1,307 (45.9)		2,208 (43.8)	5,215 (44.8)		104 (30.1)	318 (39.0)	
Nephrologist only	24 (0.3)	5 (0.2)		26 (0.5)	17 (0.1)		16 (4.6)	9 (1.1)	
Generalist and nephrologist	167 (2.3)	69 (2.4)		294 (5.8)	643 (5.5)		99 (28.7)	193 (23.7)	
Other specialist[d]	1,619 (22.4)	1,048 (36.8)		1,338 (26.5)	4,340 (37.3)		60 (17.4)	216 (26.5)	
Other care providers[e]	1,232 (17.0)	237 (8.3)		683 (13.5)	890 (7.6)		20 (5.8)	33 (4.0)	
None	1,120 (15.5)	184 (6.5)		495 (9.8)	535 (4.6)		46 (13.3)	47 (5.8)	
Insurance coverage	4,761 (65.8)	2,599 (91.2)	<0.001	3,710 (73.6)	10,770 (92.5)	<0.001	231 (67.0)	756 (92.6)	<0.001
Medications coverage	3,030 (41.9)	1,755 (61.6)	<0.001	2,395 (47.5)	7,583 (65.1)	<0.001	134 (38.8)	480 (58.8)	<0.001

Note: Unless otherwise indicated, data are presented as number (percentage).

Abbreviation: CKD, chronic kidney disease.

[a] Numbers of missing values: awareness of CKD, 39; self-rated health status, 3,005; most recent physician visit, 145; difficulty obtaining medical care, 3,054; insurance status, 362; and medication coverage, 3,301.

[b] Numbers of missing values: awareness of CKD, 71; self-rated health status, 4,303; most recent physician visit, 189; difficulty obtaining medical care, 4,358; insurance status, 740; and medication coverage, 4,775.

[c] Numbers of missing values: awareness of CKD, 7; self-rated health status, 350; most recent physician visit, 17; difficulty obtaining medical care, 357; insurance status, 50; and medication coverage, 389.

[d] Cardiologist or endocrinologist.

[e] Obstetrician/gynecologist, nurse practitioner, or physician assistant.

Table 6

Health Status and Access to Health Care in CKD Stages 3–5 by Comorbid Conditions

	Diabetes			Hypertension			Cardiovascular Events[a]		
Variables	**No**	**Yes**	***P***	**No**	**Yes**	***P***	**No**	**Yes**	***P***
No.	10,079	7,766		2,220	15,624		11,010	6,835	
CKD awareness	2,139 (21.2)	2,232 (28.7)	<0.001	427 (19.2)	3,944 (25.2)	<0.001	2,340 (21.3)	2,031 (29.7)	<0.001
Self-rated health status			<0.001			<0.001			<0.001
Excellent	386 (3.8)	126 (1.6)		129 (5.8)	383 (2.5)		394 (3.6)	118 (1.7)	
Good or very good	5,046 (50.1)	3,291 (42.4)		1,111 (50.0)	7,225 (46.2)		5,296 (48.1)	3,041 (44.5)	
Fair	1,600 (15.9)	2,079 (26.8)		306 (13.8)	3,373 (21.6)		1,774 (16.1)	1,905 (27.9)	
Poor	207 (2.1)	457 (5.9)		43 (1.9)	621 (4.0)		258 (2.3)	406 (5.9)	
Most recent physician visit			<0.001			<0.001			<0.001
Within last y	9,289 (92.2)	7,462 (96.1)		1,928 (86.8)	14,823 (94.9)		10,190 (92.6)	6,561 (96.0)	
1–2 y ago	462 (4.6)	160 (2.1)		177 (8.0)	444 (2.8)		460 (4.2)	162 (2.4)	
>2 y ago	211 (2.1)	55 (0.7)		87 (3.9)	179 (1.1)		211 (1.9)	55 (0.8)	
Difficulty obtaining medical care			<0.001			<0.001			<0.001
Extremely	219 (2.2)	199 (2.6)		73 (3.3)	345 (2.2)		280 (2.5)	138 (2.0)	
Somewhat or moderately	806 (8.0)	695 (8.9)		206 (9.3)	1,295 (8.3)		866 (7.9)	635 (9.3)	
Not very	1,558 (15.5)	1,210 (15.6)		331 (14.9)	2,436 (15.6)		1,602 (14.6)	1,166 (17.1)	
Not difficult	4,614 (45.8)	3,829 (49.3)		972 (43.8)	7,471 (47.8)		4,932 (44.8)	3,511 (51.4)	
Type of physician			<0.001			<0.001			<0.001
Generalist only	4,612 (45.8)	3,233 (41.6)		948 (42.7)	6,896 (44.1)		5,533 (50.3)	2,312 (33.8)	
Nephrologist only	44 (0.4)	24 (0.3)		5 (0.2)	63 (0.4)		45 (0.4)	23 (0.3)	
Generalist and nephrologist	576 (5.7)	653 (8.4)		99 (4.5)	1,130 (7.2)		623 (5.7)	606 (8.9)	
Other specialist[b]	3,011 (29.9)	2,943 (37.9)		664 (29.9)	5,290 (33.9)		2,750 (25.0)	3,204 (46.9)	
Other care providers[c]	1,080 (10.7)	546 (7.0)		297 (13.4)	1,329 (8.5)		1,233 (11.2)	393 (5.7)	
None	756 (7.5)	367 (4.7)		207 (9.3)	916 (5.9)		826 (7.5)	297 (4.3)	
Insurance coverage	8,778 (87.1)	6,689 (86.1)	0.1	1,860 (83.8)	13,606 (87.1)	<0.001	9,370 (85.1)	6,097 (89.2)	<0.001
Medications coverage	5,809 (57.6)	4,783 (61.6)	<0.001	1,226 (55.2)	9,365 (59.9)	<0.001	6,080 (55.2)	4,512 (66.0)	<0.001

Note: Unless otherwise indicated, data are presented as number (percentage). Numbers of missing values: awareness of CKD, 78; self-rated health status, 4,653; most recent physician visit, 206; difficulty obtaining medical care, 4,715; insurance status, 790; and medication coverage, 5,164.

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Abbreviation: CKD, chronic kidney disease.

[a]Includes angina, heart attack, bypass surgery, angioplasty, stroke, heart failure, abnormal heart rhythm, and diagnosis of coronary artery disease.

[b]Cardiologist or endocrinologist.

[c]Obstetrician/gynecologist, nurse practitioner, or physician assistant.