Associations Between Access to Care and Awareness of CKD

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Background: Most individuals with chronic kidney disease (CKD) in the United States are unaware of their condition, creating challenges in implementing early interventions to delay disease progression. Whether characteristics expected to enhance health care access are associated with greater CKD awareness has not been studied adequately.

Method: Data from volunteer participants in the National Kidney Foundation's Kidney Early Evaluation Program (KEEP), 2000-2010, with presumed CKD (estimated glomerular filtration rate [eGFR] <60 mL/min/ 1.73 m² or albumin-creatinine ratio >30 mg/g) were analyzed. Given that the diagnosis of CKD was based on a single measurement of kidney function, the diagnosis is presumed, but not confirmed. Associations of CKD awareness with measures of access to care (health insurance coverage, type of health insurance, prescription drug coverage, and self-reported level of difficulty obtaining care) were examined using logistic regression.

Results: Of 29,144 participants with CKD, 6,751 (23%) reported CKD awareness. No significant association was found between availability of health insurance or prescription drug coverage and CKD awareness; results did not vary by diabetic status or in analyses restricted to participants with eGFR <60 mL/min/1.73 m². Participants reporting extreme or some difficulty obtaining medical care were more likely than those reporting no difficulty to be aware of CKD (adjusted OR, 1.25; 95% CI, 1.05-1.50).

Conclusions: Most KEEP participants with CKD are unaware of the condition, results that are not modified by the availability of health insurance or prescription drug coverage. The mechanisms underlying the association of perceived difficulty in access to care with greater CKD awareness require further study. *Am J Kidney Dis.* 59(3)(S2):S16-S23. *Published by Elsevier Inc. on behalf of the National Kidney Foundation, Inc. This is a US Government Work. There are no restrictions on its use.*

INDEX WORDS: Access to care; awareness; chronic kidney disease; health insurance.

The burden of chronic kidney disease (CKD) in the United States is high, and CKD is a strong predictor of cardiovascular risk. Moreover, CKD often is progressive, and more than 110,000 patients start maintenance dialysis therapy every year, at considerable expense.¹ The societal burden of CKD is

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compounded by a high prevalence of low CKD awareness, particularly in people at earlier stages of disease.^{2,3} The low level of awareness implies that the health care system is unsuccessful in effectively identifying or engaging most patients with underlying CKD to implement measures in earlier stages that could slow disease progression or reduce cardiovascular risk.^{4,5} In this regard, 44% of patients who started maintenance dialysis therapy in 2008 received no established care by a nephrologist before the initiation of dialysis therapy.¹ Determining the predictors of CKD awareness could allow for the development of strategies to mitigate the burden and potentially increase the number of patients who are adequately treated to reduce CKD progression or cardiovascular risk.

In this context, understanding barriers to health care is critical to understanding the effect that awareness may have on CKD-related outcomes. Access to health care is the timely use of personal health services to improve disease-related outcomes. In 2004, the Chronic Kidney Disease Initiative identified 19 barriers to improving CKD treatment. Among these were noninsurance, underinsurance, unstructured medical care systems, lack of patient awareness of the risks associated with CKD, and lack of coordination

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among care providers.⁶ In 2009, a total of 50.7 million Americans were uninsured, a number that does not include the underinsured.⁷ The understanding of access to health care for individuals with kidney disease has been limited mainly to the dialysis population and does not extend to earlier stages, for which awareness and disease prevention strategies should be implemented. Recent data suggest that race or insurance status influence poor access to care and higher risk of incident end-stage renal disease and later initiation of dialysis therapy.⁸⁻¹⁰ However, understanding is limited regarding the difficulty obtaining access to care, types of provider, or difficulty paying for care in the population with or at risk of CKD.

The Kidney Early Evaluation Program (KEEP) cohort provides an opportunity to study the relationships between potential barriers to care, including insurance coverage, awareness of CKD, and patient perception of difficulty obtaining care. For participants with evidence of CKD, we hypothesized that the availability of health insurance coverage would be associated with greater CKD awareness and lower reported difficulty obtaining health care.

METHODS

Study Participants and Procedures

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.¹¹ Data from volunteers who participated in KEEP screenings from 2000 through 2010 were examined, and 29,144 adult participants with CKD (defined as estimated glomerular filtration rate [eGFR] <60 mL/min/1.73 m² or albumin-creatinine ratio [ACR] >30 mg/g) were identified. Participants who reported receiving dialysis therapy or having undergone kidney transplant were excluded, as were those with missing CKD awareness status.

Data for demographics, clinical conditions and risk factors, CKD awareness, health insurance and prescription drug coverage, and difficulty obtaining care were obtained from the KEEP questionnaire completed by participants at the time of screening. Blood glucose concentration and semiquantitative ascertainment of albuminuria were ascertained by point-of-care testing on the day of screening. Hemoglobin, lipid panel, and serum creatinine were measured for all participants; serum calcium, phosphorus, and parathyroid hormone were measured for participants with eGFR <60 mL/min/1.73 m²; and glycosylated hemoglobin was measured for participants with self-reported diabetes or point-of-care measurement of blood glucose consistent with diabetes (fasting glucose \geq 126 mg/dL or random glucose \geq 200 mg/dL).

Participants with CKD were considered to be aware of CKD if they answered "yes" to either of the following 2 questions: (1) Have you ever been told by a doctor or a health care professional that you have kidney disease? or (2) Have you ever been told by a doctor or a health care professional that you have protein or blood in your urine? Possible responses were "yes," "no," or "not answered."

Definitions

GFR was estimated using the CKD Epidemiology Collaboration (CKD-EPI) equation.¹² ACR was determined using urine dipstick

and was categorized as <30, 30-300, or >300 mg/g. CKD stages were defined as follows: stage 1, eGFR \geq 90 mL/min/1.73 m² and ACR \geq 30 mg/g; stage 2, eGFR of 60-89 mL/min/1.73 m² and ACR \geq 30 mg/g; stage 3, eGFR of 30-59 mL/min/1.73 m²; stage 4, eGFR of 15-29 mL/min/1.73 m²; and stage 5, eGFR <15 mL/min/ 1.73 m². Diabetes was defined as history of diabetes (self-report or retinopathy), use of medications to treat diabetes, or fasting blood glucose level \geq 126 mg/dL or nonfasting blood glucose level \geq 200 mg/dL in the absence of self-report or medication use. Hypertension was defined as self-report, use of medication to treat hypertension, or systolic blood pressure ≥130 mm Hg or diastolic blood pressure ≥80 mm Hg. History of cardiovascular disease was defined as self-reported history of heart attack, heart angioplasty, bypass surgery, heart failure, abnormal heart rhythm, or stroke. Dyslipidemia was defined as total cholesterol level >200 mg/dL or triglyceride level >150 mg/dL.

Health insurance status was classified as yes or no and categorized further as public insurance (Medicare, Medicaid, and/or veterans benefits only), private insurance (health maintenance organization, preferred provider organization, and/or other private insurance only), mixed (at least one public and one private insurance type), and none. Difficulty obtaining care was based on patient self-report and categorized as extremely, moderately, somewhat, or not difficult.

Statistical Analysis

Participant characteristics by CKD awareness status were described using proportions for categorical variables and mean \pm standard deviation for continuous data. The χ^2 test or analysis of variance was used to test the differences in characteristics between participants with and without CKD awareness. The collinearity between health insurance coverage, prescription drug coverage, and difficulty obtaining care was tested, and no evidence of collinearity was found. Logistic regression was used to describe the association of CKD awareness (outcome) with health insurance coverage, prescription drug coverage, and self-reported difficulty obtaining care as predictors. An unadjusted model was built and 3 additional models were constructed adjusting for various risk factors, including demographics (age, sex, race/ethnicity, and highest education level), severity of CKD (CKD stage and albuminuria category), comorbid conditions (diabetes, hypertension, hyperlipidemia, and current smoking), body size, self-assessment of health, and laboratory data (hemoglobin and total cholesterol). Additional analysis was performed by stratifying data based on diabetic status and in the subgroup of participants with eGFR <60 mL/min/ 1.73 m². Sensitivity analyses were performed by repeating all analyses in the subgroup of participants who reported "yes" to only the question "Have you ever been told by a doctor or a health care professional that you have kidney disease?" Additional sensitivity analyses were undertaken by excluding data from individuals with missing data to examine measures of access to care, awareness of comorbid conditions, and selfassessment of health in participants aware and unaware of CKD. All statistical analyses were performed with SAS, version 9.1 (www.sas.com).

RESULTS

Participant Characteristics

Of 29,144 participants with CKD, 6,751 (23%) reported CKD awareness, defined by a "yes" response to either of the 2 relevant questions. The prevalence of CKD awareness stratified by eGFR

Table 1. Awareness of CKD Stratified by Albuminuria and eGFR Using Answe	ers to Both Questions Testing CKD Awareness
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eGFR	All		ACR = 0-29 mg/g		ACR = 30-299 mg/g		ACR ≥ 300 mg/g		Missing	
	No.	CKD Aware	No.	CKD Aware	No.	CKD Aware	No.	CKD Aware	No.	CKD Aware
All	29,144	6,751 (23)	13,629	2,801 (21)	12,685	3,177 (25)	1,496	633 (42)	1,334	140 (10)
≥90	4,590	965 (21)	0	0 (0)	4,322	891 (21)	268	74 (28)	0	0 (0)
60-89	5,453	1,275 (23)	0	0 (0)	5,022	1,138 (23)	431	137 (32)	0	0 (0)
45-59	12,941	2,448 (19)	9,991	1,786 (18)	1,809	497 (27)	248	107 (43)	893	58 (6)
30-44	4,892	1,415 (29)	3,201	844 (26)	1,102	402 (36)	262	123 (47)	327	46 (14)
15-29	1,105	541 (49)	424	167 (39)	380	213 (56)	202	134 (66)	99	27 (27)
<15	163	107 (66)	13	4 (31)	50	36 (72)	85	58 (68)	15	9 (60)

Note: Unless otherwise indicated, values are number (percentage). Participants were defined as being aware of CKD if they answered "yes" to: (1) "Have you ever been told by a doctor or a health care professional that you have kidney disease?" or (2) "Have you ever been told by a doctor or a health care professional that you have protein or blood in your urine?"

Abbreviations and definitions: ACR, albumin-creatinine ratio; CKD, chronic kidney disease; eGFR, estimated glomerular filtration rate (in mL/min/1.73 m²; factor for conversion to mL/s/1.73 m², ×0.01667).

and ACR is listed in Table 1. Regarding only the first of the 2 awareness questions, 3,022 participants with CKD (10%) answered "yes" to the question "Have you ever been told by a health care professional that you have kidney disease?"; the distribution stratified by eGFR and ACR is listed in Table 2. The prevalence of awareness increased across lower eGFR values and increasing albuminuria levels.

Characteristics of participants who were aware and unaware of CKD status, as defined by a "yes" answer to either of the 2 questions, are listed in Table 3. Unaware participants were older and more likely to be African American, with a lower education level and higher eGFR. They were less likely to have albuminuria, diabetes, hyperlipidemia, or cardiovascular disease. Systolic blood pressure and all laboratory measurements except total and lowdensity lipoprotein cholesterol values were significantly different in aware and unaware participants. However, none of the differences in blood pressure or laboratory variables was clinically meaningful.

CKD Awareness and Measures of Health Care Access and Self-assessment of Health: Unadjusted Analyses

The unadjusted associations between awareness of CKD and measures of health care access and self-assessment of health are listed in Table 4. By CKD awareness status, there were small but statistically significant differences in proportions of participants who reported having health insurance coverage and in types of health insurance. Of participants who were aware of having CKD, 81% reported having health insurance, and 83% of those who were unaware reported having health insurance. Most had been seen by a physician within the last year (93% of aware and 91% of unaware participants). Participants who were unaware of having

eGFR	All		ACR = 0-29 mg/g		ACR = 30-299 mg/g		ACR ≥300 mg/g		Missing	
	No.	CKD Aware	No.	CKD Aware	No.	CKD Aware	No.	CKD Aware	No.	CKD Aware
All	28,923	3,022 (10)	13,531	1,371 (10)	12,580	1,173 (9)	1,482	372 (25)	1,330	106 (8)
≥90	4,565	234 (5)	0	0 (0)	4,300	203 (5)	265	31 (12)	0	0 (0)
60-89	5,402	365 (7)	0	0 (0)	4,975	318 (6)	427	47 (11)	0	0 (0)
45-59	12,849	1,021(8)	9,920	727 (7)	1,789	203 (11)	247	51 (21)	893	40 (4)
30-44	4,849	862 (18)	3,177	501 (16)	1,089	245 (22)	259	82 (32)	324	34 (10)
15-29	1,096	443 (40)	421	139 (33)	378	174 (46)	199	107 (54)	98	23 (23)
<15	162	97 (60)	13	4 (31)	49	30 (61)	85	54 (64)	15	9 (60)

Table 2. Awareness of CKD Stratified by Albuminuria and eGFR Using Answer to One Question Testing CKD Awareness

Note: Unless otherwise indicated, values are number (percentage). Participants were defined as being aware of CKD if they answered "yes" to "Have you ever been told by a doctor or a health care professional that you have kidney disease?"

Abbreviations and definitions: ACR, albumin-creatinine ratio; CKD, chronic kidney disease; eGFR, estimated glomerular filtration rate (in mL/min/1.73 m²; factor for conversion to mL/s/1.73 m², ×0.01667).

	CF	KD	
	Aware	Unaware	Р
No	6 751	22 393	
Romographic characteristics	0,701	22,000	
	62.2 ± 14.5	64.0 ± 14.7	<0.001
Age (y) Mon	22.0	21.5	0.001
Baco/othnicity	55.9	51.5	<0.003
White ^a	57.6	51.0	<0.001
African American ^a	57.0	20.0	
Hispania	24.2	30.2	
Asian	5.8	3.0	
Asian	0.5	7.7	
Other Lisbest advestion	7.9	1.2	<0.001
	E Z	7.0	< 0.001
	5.7	7.0	
Some nigh school	9.9	11.9	
High school graduate	28.1	29.7	
Some college	26.0	23.5	
College graduate	17.7	16.0	
Postgraduate or protessional	11.6	10.7	
Missing	0.99	1.3	
CKD stage			<0.001
1	14.3	16.2	0.001
2	18.9	18.7	
3	57.2	62 3	
4	80	2.5	
5	1.6	0.25	
Serum creatinine (mg/dL)	1.34 ± 0.74	1.16 ± 0.45	<0.001
eGFR (mL/min/1.73 m ²)	58.8 ± 25.4	63.2 ± 23.7	< 0.001
Albuminuria			<0.001
< 30 mg/g	41 4	48.4	<0.001
<00 mg/g 30-300 mg/g	41.4	40.4	
>300 mg/g	97.1	30	
2 500 Mg/g Missing	0. 1	5.3	
Wissing	2.1	3.5	
Comorbid conditions/risk factors			
Diabetes	51.5	42.1	< 0.001
Hypertension	86.4	82.6	< 0.001
Hyperlipidemia	75.1	51.2	< 0.001
Cardiovascular disease	42.4	31.8	< 0.001
Current smoker	8.2	8.3	<0.001
Clinical/laboratory measures			
Systolic blood pressure (mm Hg)	137.9 + 21.0	139 1 + 21 7	<0.001
Diastolic blood pressure (mm Hg)	78.9 + 12.6	78.9 + 12.6	0.9
Body mass index (kg/m ²)	310 ± 72	30.3 ± 6.8	< 0.001
Plasma glucose (mg/dl)	131.9 ± 65.3	128 4 + 65 0	<0.001
Hemoglobin (g/dL)	13.3 + 1.6	13 4 + 1 6	< 0.01
Total cholesterol (mg/dL)	192.8 ± 47.0	103 9 + 44 2	< 0.1
DL cholesterol (mg/dL)	102.0 ± 47.0 100.1 ± 27.0	101 / + 26 7	0.1
Serum calcium (mg/dL)	0 50 + 0 60	0 67 + 0 51	U.2 ~0.001
Sorum phoephorus (mg/dL)	3.33 ± 0.00	3.07 ± 0.01	<0.001
Sorum DTH (ng/mL) ^{b,e}	3.73 ± 0.03 72.5 (47.5 ± 110.0)		<0.001
Chucosylated homoglobin (%) ^{b,f}	73.3(47.3, 112.0) 7.47 ± 1.76	7 26 + 1 66	<0.001 0.02
Giyoosylated Herrioglobili (%)	1.41 - 1.10	1.00 - 1.00	0.03

Table 3. Characteristics of KEEP Participants Aware and Unaware of CKD

Note: Data are presented as mean \pm standard deviation for continuous variables and percentage for categorical variables. Conversion factors for units: serum creatinine in mg/dL to μ mol/L, ×88.4; eGFR in mL/min/1.73 m² to mL/s/1.73 m², ×0.01667; glucose in mg/dL to mmol/L, ×0.05551; hemoglobin in g/dL to g/L, ×10; cholesterol in mg/dL to mmol/L, ×0.02586; calcium in mg/dL to mmol/L, ×0.2495; phosphorus in mg/dL to mmol/L, ×0.3229. No conversion necessary for PTH in pg/mL and ng/L.

Abbreviations: CKD, chronic kidney disease; eGFR, estimated glomerular filtration rate; KEEP, Kidney Early Evaluation Program; LDL, low-density lipoprotein; PTH, parathyroid hormone.

^aNon-Hispanic.

^bSerum calcium, phosphorus, and PTH were measured in participants with eGFR <60 mL/min/1.73 m², and glycosylated hemoglobin, in participants with diabetes.

^cn = 11,137.

^dn = 11,147.

 $e_n = 10,773$. Median (interquartile range).

^fn = 3,416.

		СКД		
	Aware	Unaware	Р	
Health insurance			<0.001	
Missing	3.5	4.2		
Yes	80.6	82.5		
No	15.9	13.3		
Type of health insurance ^a			<0.001	
Missing or none	19.4	17.5		
Medicare	45.4	47.1		
Medicaid	3.2	2.7		
HMO	7.7	8.4		
PPO	8.1	4.7		
Veterans benefits	0.93	0.96		
Private	4.0	5.2		
Other/unknown	11.3	13.5		
Prescription drug coverage			< 0.001	
Missing	12.1	38.8		
Yes	69.0	48.6		
No	18.9	12.6		
Last physician visit			< 0.001	
Missing	0.6	1.4		
Within the last year	93.1	90.7		
1-2 y ago	4.2	5.1		
>2 y ago	2.0	2.8		
Difficulty obtaining care			< 0.001	
Missing	8.8	36.7		
Extremely difficult	5.4	2.6		
Moderately difficult	5.2	3.0		
Somewhat difficult	9.3	5.1		
Not very difficult	19.0	13.4		
Not difficult	52.4	39.2		
Awareness of comorbid conditions				
Diabetes	97.6	95.5	< 0.001	
Hypertension	93.1	88.9	< 0.001	
Hyperlipidemia	63.1	55.4	< 0.001	
Self-assessment of health			< 0.001	
Missing	8.4	36.4		
Excellent	2.4	2.9		
Very good	49.5	42.2		
Good	32.2	16.0		
Fair	77	26		

Table 4.	Access to Care, Awarer	ness of Comorbid Con	ditions
and	Self-assessment of Hea	lth in KEEP Participan	its

Note: Values shown are percentages.

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

^aInsurance type was selected in the order listed and was otherwise not mutually exclusive.

CKD were also more likely to be unaware of having diabetes, hypertension, or hyperlipidemia. Data regarding prescription drug coverage, difficulty obtaining care, and self-assessment of health were more likely to be missing for participants who were unaware of having CKD.

CKD Awareness and Measures of Health Care Access: Adjusted Analyses

We found no significant relationship between availability of health insurance or prescription drug coverage and odds of CKD awareness (Table 5). Furthermore, we found no association between type of health insurance (public, private, mixed, or none) and odds of CKD awareness (Table 6). However, there was a significant association between the reported difficulty obtaining medical care and the odds of CKD awareness. Participants who reported that obtaining medical care was extremely or somewhat difficult were more likely to be aware of having CKD (Tables 5 and 6). CKD awareness was significantly more likely in diabetic participants who reported extreme difficulty obtaining care and in nondiabetic participants who reported some difficulty obtaining care. When analysis was restricted to participants with eGFR <60mL/min/1.73 m², CKD awareness was more likely in those who reported moderate difficulty obtaining care (Table 7).

None of the 2-way interactions examined was statistically significant (health insurance coverage, prescription drug coverage, and difficulty obtaining care with each other and each of these with diabetes, hypertension, and hyperlipidemia). The same trends were observed in our sensitivity analysis, in which the definition of having CKD was limited to the question "Have you ever been told by a doctor or a health care professional that you have kidney disease?" Similar trends were noted when analyses were restricted to individuals with complete data available for all key variables: health insurance coverage, type of health insurance, prescription drug coverage, difficulty obtaining care, and self-assessment of health. Results were similar except that the unadjusted analyses showed no statistically significant difference in proportions of participants who reported prescription drug coverage by CKD awareness status.

DISCUSSION

Identifying barriers to health care access for people with kidney disease may have an important role in influencing awareness of CKD and CKDrelated outcomes. In this report from the KEEP population, we report very low rates of CKD awareness across a range of eGFRs. We found no independent association between health insurance status and awareness, but found that KEEP participants who were aware of CKD reported greater difficulty obtaining care.

Lack of health insurance and underinsurance have been suggested as factors that prevent adequate care of patients with kidney disease, and these factors are associated with late nephrology referral.^{6,13} Given

	Unadjusted	Model 1 ^ª	Model 2 ^b	Model 3 ^c				
No.	18,895	18,660	17,729	17,502				
No health insurance	1.07 (0.93-1.22)	0.95 (0.82-1.09)	0.92 (0.79-1.07)	0.93 (0.79-1.08)				
No prescription drug coverage	0.90 (0.80-1.00)	0.90 (0.80-1.01)	0.93 (0.82-1.05)	0.93 (0.83-1.05)				
Difficulty obtaining care ^d								
Extremely difficult	1.58 (1.34-1.85)	1.43 (1.21-1.70)	1.24 (1.04-1.49)	1.25 (1.04-1.49)				
Moderately difficult	1.27 (1.09-1.47)	1.22 (1.04-1.42)	1.11 (0.94-1.30)	1.11 (0.94-1.30)				
Somewhat difficult	1.40 (1.25-1.57)	1.30 (1.15-1.47)	1.19 (1.05-1.35)	1.19 (1.05-1.36)				
Not very difficult	1.08 (1.00-1.17)	1.06 (0.98-1.15)	1.03 (0.95-1.12)	1.03 (0.94-1.12)				

Table 5. Odds Ratios of CKD Awareness by Self-reported Access to Care

Note: Except where indicated, values shown are odds ratio (95% confidence interval). Data for patients with missing data for CKD awareness, health insurance, prescription drug coverage, or difficulty obtaining care were not included in any of the models.

Abbreviation: CKD, chronic kidney disease.

^aAdjusted for demographics (age, sex, race/ethnicity, and highest education) and CKD severity (CKD stage and albuminuria)

^bAdjusted for variables in model 1 and comorbid conditions (diabetes, hypertension, hyperlipidemia, and current smoking), body mass index, and self-assessment of health.

^cAdjusted for variables in model 2 and laboratory data (hemoglobin and total cholesterol).

^dReference is not difficult.

these associations, we hypothesized that availability of health insurance coverage would allow greater access to care, which in turn would be associated with increased CKD awareness. However, we were unable to show any such association with availability of health insurance coverage, type of coverage (public, private, or mixed), or additional availability of prescription drug coverage. KEEP requires participants to actively decide to participate in the screening, and the KEEP cohort may be more actively engaged in seeking health care irrespective of health insurance status. Consistent with this idea, most KEEP participants report receiving medical care within the past year, and this active health care–seeking behavior may mitigate differences stemming from differences in insurance coverage. Also, it may be that with the present health care system, simply having insurance does not lead to more access to quality care or to enhanced health education. There have been recent advances in support for educational programs in advanced kidney disease to promote awareness, understanding, and effective self-care. However, resources are limited for people who may be at risk or who have evidence of early CKD.¹⁴ Additionally, barriers to delivering effective kidney disease education extend beyond the availability of health insurance coverage

	Unadjusted	Model 1 ^a	Model 2 ^b	Model 3 ^c
No.	18,895	18,660	17,729	17,502
Health insurance ^d		·	·	
Private only	1.27 (1.17-1.39)	1.00 (0.91-1.10)	1.05 (0.94-1.16)	1.05 (0.95-1.17)
Mixed	1.19 (1.09-1.30)	1.21 (1.11-1.33)	1.20 (1.09-1.32)	1.19 (1.09-1.31)
Unknown	1.06 (0.90-1.24)	0.89 (0.75-1.05)	0.94 (0.79-1.12)	0.96 (0.80-1.15)
None	1.19 (1.03-1.37)	0.95 (0.81-1.11)	0.95 (0.81-1.11)	0.95 (0.81-1.12)
No prescription drug coverage	0.92 (0.83-1.03)	0.91 (0.81-1.02)	0.94 (0.83-1.06)	0.95 (0.84-1.07)
Difficulty obtaining care ^e				
Extremely difficult	1.59 (1.35-1.87)	1.45 (1.22-1.71)	1.25 (1.05-1.50)	1.25 (1.05-1.50)
Moderately difficult	1.28 (1.10-1.49)	1.23 (1.05-1.44)	1.12 (0.95-1.31)	1.12 (0.95-1.32)
Somewhat difficult	1.42 (1.26-1.59)	1.32 (1.17-1.49)	1.21 (1.07-1.37)	1.21 (1.06-1.37)
Not very difficult	1.09 (1.01-1.18)	1.07 (0.98-1.16)	1.04 (0.96-1.13)	1.04 (0.95-1.13)

Table 6. Odds Ratios of CKD Awareness by Type of Health Insurance

Note: Except where indicated, values shown are odds ratio (95% confidence interval). Data for patients with missing data for CKD awareness, health insurance, prescription drug coverage, or difficulty obtaining care were not included in any model.

Abbreviation: CKD, chronic kidney disease.

^aAdjusted for demographics (age, sex, race/ethnicity, and highest education) and CKD severity (CKD stage and albuminuria).

^bAdjusted for variables in model 1 and comorbid conditions (diabetes, hypertension, hyperlipidemia, and current smoking), body mass index, and self-assessment of health.

^cAdjusted for variables in model 2 and laboratory data (hemoglobin and total cholesterol).

^dReference is public only.

^eReference is not difficult.

	Unadjusted	Model 1 ^a	Model 2 ^b	Model 3 ^c
No.	12,351	12,116	11,495	11,357
No health insurance	1.34 (1.12-1.60)	1.03 (0.84-1.25)	1.02 (0.83-1.25)	1.03 (0.83-1.26)
No prescription drug coverage	0.91 (0.80-1.05)	0.90 (0.78-1.03)	0.91 (0.78-1.05)	0.91 (0.79-1.06)
Difficulty obtaining care ^d	· ,		. ,	, , , , , , , , , , , , , , , , , , ,
Extremely difficult	1.53 (1.21-1.92)	1.24 (0.97-1.59)	1.11 (0.85-1.44)	1.10 (0.85-1.44)
Moderately difficult	1.48 (1.22-1.79)	1.42 (1.16-1.74)	1.34 (1.09-1.66)	1.35 (1.09-1.67)
Somewhat difficult	1.36 (1.17-1.58)	1.23 (1.05-1.45)	1.12 (0.94-1.32)	1.13 (0.95-1.33)
Not very difficult	1.05 (0.95-1.15)	1.02 (0.92-1.13)	0.97 (0.87-1.07)	0.96 (0.86-1.07)

Table 7. Odds Ratios of CKD Awareness by Access to Care in KEEP Participants with eGFR <60 mL/min/1.73 m²

Note: Except where indicated, values shown are odds ratio (95% confidence interval). Data for patients with missing data for CKD awareness, health insurance, prescription drug coverage, or difficulty obtaining care were not included in any of the models.

Abbreviations: CKD, chronic kidney disease; eGFR, estimated glomerular filtration rate; KEEP, Kidney Early Evaluation Program.

^aAdjusted for demographics (age, sex, race/ethnicity, and highest education) and CKD severity (CKD stage and albuminuria).

^bAdjusted for variables in model 1 and comorbid conditions (diabetes, hypertension, hyperlipidemia, and current smoking), body mass index, and self-assessment of health.

°Adjusted for variables in model 2 and laboratory data (hemoglobin and total cholesterol).

^dReference is not difficult.

and include those imposed by language differences or lack of health literacy.

The association of health care access or insurance coverage with CKD awareness has been evaluated in prior studies.^{2,15,16} More than 85% of participants in the Jackson Heart Study had insurance coverage, but like in our cohort; there was no demonstrable association between availability of health insurance and CKD awareness.¹⁵ Similar findings also were reported² from the National Health and Nutrition Examination Survey (NHANES) 1999-2004; however, there was a trend toward greater awareness in participants who had a routine site for primary care (8.1% vs 2.3%; P = 0.06). Thus, access to routine primary care may be a more important determinant of CKD awareness than health insurance coverage. This would be consistent with the finding that awareness of hypertension has been reported to be associated with number of health care visits by the patient in the past year.¹⁷

In contrast to the lack of association with health insurance coverage, KEEP participants who were aware of CKD reported greater difficulty obtaining health care. Of note, the response to the question regarding ease of access to care reflects perceived and not actual difficulty obtaining care. Data examining the association between perceived and actual engagement in care in CKD populations are limited. The survey instrument used in KEEP screenings does not allow us to elucidate the underlying reasons for the association between CKD awareness and perceived difficulty obtaining care. Patients who were aware of CKD had more advanced CKD and a greater burden of comorbid conditions. Perhaps these patients require and thus expect more engagement with medical care for both chronic and acute issues, and they may perceive more difficulty meeting these expectations of care. In addition, our findings could suggest that people who know they have kidney disease come to a KEEP screening because they feel as though they have poor access to care through the existing mechanisms of obtaining care in their communities. The reported extreme difficulty may be due to inadequate communication with their physicians or they may be seeking a second opinion, which may have prompted a KEEP visit. Patients also may be seeking more care through KEEP when they know (are aware) about their disease status. These observations suggest that the KEEP cohort represents a self-referred high-risk population, and this may limit the generalizability of our findings to the entire CKD population.

Our study has a number of strengths distinct from other studies of CKD cohorts. KEEP is a national community-based program serving high-risk individuals who voluntarily participate in a screening program, and it provides a large sample size across a broad range of eGFRs. However, our study is not without limitations and hence the findings may not be generalizable to all patients with CKD. As discussed, KEEP participants are self-selected and show greater health care-seeking behavior. This may be a reason for our inability to show a difference in CKD awareness by health insurance coverage and for a greater perception of difficulty obtaining care in participants aware of CKD. Both eGFR and albuminuria were measured only once, raising concern about misclassification bias. Moreover, a significant proportion of participants labeled as having CKD had mild impairments in eGFR and/or microalbuminuria. For both these reasons, some participants categorized as having CKD may not have the disease, and this in turn may have led us to underestimate CKD awareness. However, the approach here is consistent with other large cohort studies, was applied systematically to all participants, and is less likely to be differential by awareness. For some of the measures of interest, the proportion of missing data was higher than desired, possibly introducing selection bias into the results because the missing data may be related to other patient characteristics of interest. To address these potential biases, additional sensitivity analyses were conducted, excluding participants with missing data for key predictors. Finally, experience is limited regarding measures of perception of access to care and its relationship to other care processes or clinical outcomes. Our large study contributes to understanding the performance of this easily administered question.

In summary, we found that most KEEP participants with evidence of CKD were not aware of having CKD, especially those at earlier stages. Awareness was not related to presence or type of health insurance coverage or the additional availability of prescription medication coverage. We found that participants who were aware of having CKD were more likely to report greater difficulty obtaining access to care. This perceived difficulty in access to medical care with CKD awareness should be explored in future studies.

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