Participant Follow-up in the Kidney Early Evaluation Program (KEEP) After Initial Detection

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Background: Chronic kidney disease (CKD) detection in a targeted at-risk population was reported in the National Kidney Foundation Kidney Early Evaluation Program (KEEP). This study assessed follow-up within 3 months of detection to determine whether participants reported seeing a physician, kinds of care addressed, and interventions.

Methods: KEEP is a free community-based health-screening program to raise kidney disease awareness and detect CKD for early disease intervention. Participants receive laboratory results and educational materials about kidney disease risks and treatment options. Physicians receive laboratory results for their participating KEEP patients and clinical practice guidelines for CKD care.

Results: Between August 2000 and December 2006, a total of 72,395 KEEP participants received follow-up forms. Forms were sent to all participants; the response rate was 28.4%. Responders were more likely to be older, women, white, living in the western United States, with high school education or higher, with decreasing kidney function by means of estimated glomerular filtration rate, and with hypertension, diabetes, or history of cardiovascular disease. Of respondents, 71% reported seeing physicians in follow-up. Those with evidence of CKD were 24% more likely to report seeing a physician than those without CKD. Follow-up with physicians was more likely with decreasing kidney function levels, increasing albuminuria, and more advanced CKD stage.

Conclusion: The KEEP detection program with disease education appears to motivate the targeted population to seek physician care for findings noted. Longer term follow-up is needed to determine whether detection and physician follow-up lead to changes in care and outcomes that may affect the increased risk of death, end-stage renal disease, or cardiovascular events.

Am J Kidney Dis 51(S2):S69-S76.

INDEX WORDS: Chronic kidney disease; detection; follow-up.

Chronic kidney disease (CKD) has received increased attention since the introduction of the definition and classification system from the National Kidney Foundation (NKF) CKD guidelines in February 2002.[1] Several investigators estimated the size of the noninstitutionalized CKD population to be between 11.5% and 14%, judging from estimated glomerular filtration rates (eGFRs) and evidence of microalbuminuria from the National Health and Nutrition Examination Survey in the United States between 1988 and 1994 and 1999 and 2004.[2-4] Approximately 20 million adults in the United States are estimated to have evidence of increased albumin-creatinine ratio (ACR; $\geq$30 mg/g) and decreased eGFR ($<$60 mL/min/1.73 m^2 [$<$1.00 mL/s/1.73 m^2]); however, only about 100,000 reach end-stage renal disease each year.[2,5,6] All-cause and cardiovascular death appear to be more likely outcomes for patients with CKD than reaching end-stage renal disease.[7]

CKD detection efforts have been developed throughout the world, but few are as large as the NKF Kidney Early Evaluation Program (KEEP),[8-11] which includes follow-up to determine whether participants seek medical care after the initial screening event. KEEP targets adults with self-reported diabetes, hypertension, or a family history of these diseases or kidney disease. Upon completion of the screening program, participants receive information about laboratory results and measurements of blood pressure, body mass index, blood glucose, hemoglobin, serum creatinine, eGFR, and evidence of proteinuria. However, little information is available regarding KEEP participants' follow-up care relative to the

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Received November 26, 2007. Accepted in revised form December 26, 2007.

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0272-6386/08/5104-0109$34.00/0
doi:10.1053/j.ajkd.2007.12.011

frequency of and reasons for physician visits. We analyzed KEEP participants from 2000 to 2006, evaluating the likelihood of following up with physicians in the 3 months after participating in the screening program to determine factors that influence the decision to visit a physician, reasons for the visit, and care interventions.

METHODS

Subjects

As described elsewhere in this supplement,[12] eligible KEEP participants were 18 years or older with self-reported diabetes or hypertension or a first-degree relative with diabetes, hypertension, or kidney disease. We included only eligible KEEP participants from August 2000 through December 31, 2006, from 47 NKF affiliates and 1,608 screening programs in 49 states and the District of Columbia. The KEEP cohort in this study, excluding individuals with missing data values, consists of 73,460 eligible KEEP participants. Participants receive health screening reports within a month of completing the screening program. Within the next month, a follow-up survey form is sent to any participant who was identified with at least 1 abnormal test result or preexisting comorbid condition. The primary goal of the follow-up survey form is to encourage participants to seek medical consultation and care regarding the screening test results.

Definitions

Diabetes was defined as self-reported history of diabetes or retinopathy, receiving oral medication or insulin for diabetes, or increased blood glucose, defined as glucose level of 126 mg/dL or greater (≥7.0 mmol/L) if fasting or 200 mg/dL or greater (≥11.1 mmol/L) if nonfasting. Hypertension was defined as self-reported history of high blood pressure, receiving medication for high blood pressure, or increased blood pressure,[13] defined as systolic blood pressure of 130 mm Hg or greater or diastolic blood pressure of 80 mm Hg or greater for persons with a history of diabetes or CKD, otherwise systolic blood pressure of 140 mm Hg or greater or diastolic blood pressure of 90 mm Hg or greater. Cardiovascular disease was defined as self-reported heart attack, heart bypass surgery, heart angioplasty, stroke, heart failure, abnormal heart rhythm, or peripheral vascular disease (applicable only to the pre–May 2005 form). Anemia was defined as per the World Health Organization, as hemoglobin level less than 13 g/dL (<130 g/L) for men and less than 12 g/dL (<120 g/L) for women. eGFR was calculated using the isotope dilution mass spectometry–traceable 4-variable Modification of Diet in Renal Disease Study equation,[14] and serum creatinine was calibrated to the Cleveland Clinic Research Laboratory.[15] eGFR values were grouped as less than 30, 30 to less than 40, 40 to less than 50, 50 to less than 60, 60 to less than 70, 70 to less than 80, 80 to less than 90, and 90 mL/min/1.73 m^2 or greater (<0.50, 0.50 to <0.67, 0.67 to <0.83, 0.83 to <1.00, 1.00 to <1.17, 1.17 to <1.33, 1.33 to <1.50, and ≥1.50 mL/s/1.73 m^2). ACR was calculated from urine samples and recorded as less than 30, 30 to 300, or greater than 300 mg/g. CKD was defined as CKD stages 1 to 5: stage 1, eGFR greater than 90 mL/min/1.73 m^2 (>1.50 mL/s/1.73 m^2) and ACR of 30 mg/g or greater; stage 2, eGFR of 60 to 89 mL/min/1.73 m^2 (1.00 to 1.48 mL/s/1.73m^2) and ACR of 30 mg/g or greater; stage 3, eGFR of 30 to 59 mL/min/1.73 m^2 (0.50 to 0.98 mL/s/1.73 m^2); stage 4, eGFR of 15 to 29 mL/min/1.73 m^2 (0.25 to 0.48 mL/s/1.73 m^2); and stage 5, eGFR less than 15 mL/min/1.73 m^2 (<0.25 mL/s/1.73 m^2). Obesity was defined as body mass index of 30 kg/m^2 or greater.

Analysis

Follow-up response rate was calculated by dividing the numerator (number of participants who returned follow-up forms and answered the question about seeing a physician about the screening result) by the denominator (number of participants who received follow-up forms). The percentage of participants who returned follow-up forms and reported seeing a physician was compared by using individual health condition and CKD progression indicators. The χ^2 test was used to determine *P* values for these comparisons. Multivariable logistic regressions were used for calculating odds ratios of returning follow-up forms and reporting physician visits about the screening results, respectively. Predictor variables included age, sex, race, region, education, smoking status, health insurance access, diabetes, hypertension, self-reported cardiovascular disease, obesity, anemia, and levels of eGFR. *P* less than 0.05 is considered statistically significant.

RESULTS

Of 73,460 eligible KEEP participants, 72,395 received follow-up forms. Of these, 20,541 participants returned the follow-up forms and reported seeing a physician about the screening results, a response rate of 28.4% (Table 1). For persons with an eGFR less than 60 mL/min/1.73 m^2 (<1.00 mL/s/1.73 m^2), the response rate was 43.0%, accounting for about one quarter (24.7%; 5,066 of 20,541) of participants who returned follow-up forms. Older age, female sex, white race, residing in the West, nonsmoking, high school or higher education, having insurance, and having hypertension, body mass index less than 30 kg/m^2, anemia, and lower eGFR (<60 mL/min/1.73 m^2 [<1.00 mL/s/1.73 m^2]) were significant predictors for returning follow-up forms (Table 2). For example, persons with an eGFR less than 60 mL/min/1.73 m^2 (<1.00 mL/s/1.73 m^2) have a 48% to 71% greater likelihood of returning follow-up forms. Persons with high school education or higher have a 67% greater likelihood of returning follow-up forms. We performed the same analysis on the 2006 cohort and found that except for eGFR level, all listed

Table 1. Characteristics of Participants Who Did and Did Not Return Follow-up Forms

Characteristics	All	Returned Forms		*P*
		No	Yes	
Total	72,395	51,854 (100)	20,541 (100)	
Age (y)				<0.001
18-30	5,703	4,799 (9.25)	904 (4.40)	
31-45	16,114	12,895 (24.87)	3,219 (15.67)	
46-60	25,538	18,604 (35.88)	6,934 (33.76)	
61-75	18,937	11,889 (22.93)	7,048 (34.31)	
>75	6,103	3,667 (7.07)	2,436 (11.86)	
Sex*				<0.001
Women	49,468	34,967 (67.5)	14,501 (70.63)	
Men	22,866	16,837 (32.50)	6,029 (29.37)	
Race*				<0.001
White	32,855	21,270 (42.07)	11,585 (57.35)	
African American	24,351	18,458 (36.5)	5,893 (29.17)	
Other	13,558	10,836 (21.43)	2,722 (13.43)	
Region*				<0.001
Northeast	16,590	12,009 (23.17)	4,581 (22..31)	
Midwest	11,645	7,982 (15.40)	3,663 (17.84)	
South	35,693	25,933 (50.03)	9,760 (47.52)	
West	8,442	5,909 (11.4)	2,533 (12.33)	
Screening period				<0.001
2000-2004	37,171	26,229 (50.58)	10,942 (53.27)	
2005-2006	35,224	25,625 (49.42)	9,599 (46.73)	
Current smoker*	8,290	6,537 (13.45)	1,753 (8.99)	<0.001
High school education or above*	60,144	42,202 (82.77)	17,942 (88.45)	<0.001
Insurance coverage*	56,759	39,558 (79.67)	17,201 (86.98)	<0.001
Diabetes*†	20,440	14,059 (27.12)	6,381 (31.07)	<0.001
Hypertension*‡	50,158	34,580 (66.71)	15,578 (75.85)	<0.001
Self-reported cardiovascular disease	14,360	9,636 (18.58)	4,724 (23.00)	<0.001
Obesity*§	31,889	23,127 (45.41)	8,762 (43.21)	<0.001
Anemia*‖	8,276	5,707 (11.61)	2,569 (12.88)	<0.001
Estimated glomerular filtration rate* (mL/min/1.73 m^2)				<0.001
<30	632	348 (0.72)	284 (1.44)	
30-<40	1,326	691 (1.42)	635 (3.21)	
40-<50	3,188	1,747 (3.60)	1,441 (7.29)	
50-<60	6,631	3,925 (8.08)	2,706 (13.69)	
60-<70	10,492	7,183 (14.80)	3,309 (16.74)	
70-<80	13,251	9,617 (19.81)	3,634 (18.38)	
80-<90	11,130	8,321 (17.14)	2,809 (14.21)	
≥90	21,669	16,717 (34.43)	4,952 (25.05)	

Note: Values expressed as number (percent) unless noted otherwise. Of participants who returned follow-up forms, only those who did not answer whether they had seen a physician about screening results were excluded. To convert estimated glomerular filtration rate in mL/min/1.73 m^2 to mL/s/1.73 m^2, multiply by 0.01667.

*Excludes missing values.

†Diabetes defined as self-reported history of diabetes, receiving medication for diabetes, or blood glucose level of 126 mg/dL or greater (≥7.0 mmol/L) fasting or 200 mg/dL or greater (≥11.1 mmol/L) nonfasting.

‡Hypertension defined as self-reported history of hypertension, receiving medication for hypertension, or increased blood pressure (Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure[13]): systolic blood pressure of 130 mm Hg or greater or diastolic blood pressure of 80 mm Hg or greater if diabetes or chronic kidney disease, otherwise systolic blood pressure of 140 mm Hg or greater or diastolic blood pressure of 90 mm Hg or greater.

§Body mass index of 30 kg/m^2 or greater.

‖As defined by the World Health Organization, a hemoglobin level less than 13 g/dL (<130 g/L) for men and less than 12 g/dL (<120 g/L) for women.

Table 2. Predictors of Returning Follow-up Forms

Characteristics	All Participants		2006 Participants	
	OR (95% CI) of Returning Forms	*P*	OR (95% CI) of Returning Forms	*P*
Age (y)				
18-30	0.59 (0.54-0.65)	<0.001	0.61 (0.49-0.75)	<0.001
31-45	0.75 (0.72-0.80)	<0.001	0.74 (0.65-0.84)	<0.001
46-60	1		1	
61-75	1.42 (1.36-1.49)	<0.001	1.29 (1.17-1.43)	<0.001
>75	1.33 (1.24-1.43)	<0.001	1.28 (1.11-1.49)	<0.001
Sex				
Women	1		1	
Men	0.85 (0.81-0.88)	<0.001	0.80 (0.73-0.87)	<0.001
Race				
White	1.46 (1.40-1.53)	<0.001	1.50 (1.36-1.65)	<0.001
African American	1		1	
Other	0.85 (0.80-0.90)	<0.001	0.87 (0.75-1.01)	0.07
Region				
South	0.80 (0.75-0.86)	<0.001	0.84 (0.74-0.96)	0.01
Northeast	0.76 (0.71-0.82)	<0.001	0.71 (0.61-0.82)	<0.001
Midwest	0.98 (0.91-1.06)	0.6	1.01 (0.87-1.18)	0.9
West	1		1	
Current smoker	0.78 (0.74-0.83)	<0.001	0.74 (0.63-0.86)	<0.001
≥High school education	1.67 (1.57-1.77)	<0.001	1.75 (1.54-1.99)	<0.001
Insurance coverage	1.16 (1.10-1.23)	<0.001	1.20 (1.06-1.35)	0.004
Diabetes*	1.04 (1.00-1.08)	0.09	1.05 (0.96-1.20)	0.3
Hypertension†	1.17 (1.11-1.22)	<0.001	1.16 (1.04-1.28)	0.006
Self-reported cardiovascular disease	1.02 (0.97-1.07)	0.4	1.02 (0.93-1.12)	0.7
Obesity‡	0.91 (0.87-0.94)	<0.001	0.82 (0.75-0.89)	<0.001
Anemia§	1.07 (1.01-1.14)	0.02	1.03 (0.91-1.17)	0.6
Estimated glomerular filtration rate (mL/min/1.73 m^2)				
<30	1.62 (1.35-1.94)	<0.001	3.64 (2.44-5.42)	<0.001
30-<40	1.71 (1.50-1.95)	<0.001	3.63 (2.72-4.84)	<0.001
40-<50	1.69 (1.55-1.85)	<0.001	3.49 (2.88-4.24)	<0.001
50-<60	1.48 (1.38-1.58)	<0.001	3.03 (2.60-3.53)	<0.001
60-<70	1.08 (1.02-1.15)	0.01	1.29 (1.13-1.48)	0.002
70-<80	0.95 (0.89-1.00)	0.05	1.04 (0.92-1.18)	0.5
80-<90	0.95 (0.90-1.01)	0.1	1.01 (0.88-1.16)	0.9
≥90	1		1	

Note: To convert estimated glomerular filtration rate in mL/min/1.73 m^2 to mL/s/1.73 m^2, multiply by 0.01667.

Abbreviations: OR, odds ratio; CI, confidence interval.

*Diabetes defined as self-reported history of diabetes, receiving medication for diabetes, or blood glucose level of 126 mg/dL or greater (≥7.0 mmol/L) fasting or 200 mg/dL or greater (≥11.1 mmol/L) nonfasting.

†Hypertension defined as self-reported history of hypertension, receiving medication for hypertension, or increased blood pressure (Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure[13]): systolic blood pressure of 130 mm Hg or greater or diastolic blood pressure of 80 mm Hg or greater if diabetes or chronic kidney disease, otherwise systolic blood pressure of 140 mm Hg or greater or diastolic blood pressure of 90 mm Hg or greater.

‡Body mass index of 30 kg/m^2 or greater.

§As defined by the World Health Organization, a hemoglobin level less than 13 g/dL (<130 g/L) for men and less than 12 g/dL (<120 g/L) for women.

predictors showed similar predictive values. In the 2006 KEEP cohort, eGFR less than 60 mL/min/1.73 m^2 (<1.00 mL/s/1.73 m^2) had a much greater effect on predicting return of follow-up forms (odds ratio from 3.0 for eGFR of 50 to <60 mL/min/1.73 m^2 [0.83 to <1.00 mL/s/1.73 m^2] to 3.6 for eGFR < 30 mL/min/1.73 m^2 [<0.50 mL/s/1.73 m^2]).

Table 3. Percentage of Kidney Early Evaluation Program Participants Who Returned Follow-up Forms and Reported Seeing a Physician about Screening Results

Characteristics	Participants Who Saw a Physician		*P*
	No. of Participants	%	
Diabetes*			<0.001
No	14,158	66.68	
Yes	6,381	80.66	
Hypertension†			<0.001
No	4,961	55.27	
Yes	15,578	76.04	
Self-reported cardiovascular disease			<0.001
No	15,817	68.91	
Yes	4,724	78.13	
Anemia‡			<0.001
No	17,383	70.03	
Yes	2,569	77.62	
Estimated glomerular filtration rate (mL/min/1.73 m^2)			<0.001
<30	284	92.61	
30-<40	635	84.41	
40-<50	1,441	83.28	
50-<60	2,706	78.68	
60-<70	3,309	70.60	
70-<80	3,634	69.48	
80-<90	2,809	66.11	
90-<100	2,230	64.71	
≥100	2,722	63.92	
Microalbuminuria (mg/L)			<0.001
≤10	10,192	66.58	
11-≤30	5,804	72.85	
31-≤80	1,647	79.60	
≥81	1,479	85.26	
Albumin-creatinine ratio (mg/g)			<0.001
<30	15,823	68.98	
30-<300	2,030	83.10	
≥300	307	89.25	
Chronic kidney disease			<0.001
Yes	6,397	81.26	
No	11,625	65.49	

Note: To convert estimated glomerular filtration rate in mL/min/1.73 m^2 to mL/s/1.73 m^2, multiply by 0.01667.

*Diabetes defined as self-reported history of diabetes, receiving medication for diabetes, or blood glucose level of 126 mg/dL or greater (≥7.0 mmol/L) fasting or 200 mg/dL or greater (≥11.1 mmol/L) nonfasting.

†Hypertension defined as self-reported history of hypertension, receiving medication for hypertension, or increased blood pressure (Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure[13]): systolic blood pressure of 130 mm Hg or greater or diastolic blood pressure of 80 mm Hg or greater if diabetes or chronic kidney disease, otherwise systolic blood pressure of 140 mm Hg or greater or diastolic blood pressure of 90 mm Hg or greater.

‡As defined by the World Health Organization, a hemoglobin level less than 13 g/dL (<130 g/L) for men and less than 12 g/dL (<120 g/L) for women.

Of the 20,541 participants who returned follow-up forms, 14,590 (71%) reported seeing a physician about their screening results, 5,951 reported not seeing a physician, and 661 did not answer the question. Greater percentages of participants with diabetes, hypertension, cardiovascular disease, or anemia or with evidence of CKD visited physicians about their screening results (Table 3). Using the multivariable logistic model, older age, female sex, African American race, living in a region other than the West, currently not a smoker, and obesity are signifi-

cant predictors of visiting a physician regarding screening results (Table 4). Of these significant predicting factors, evidence of CKD seems to be the most important. For example, compared with participants with an eGFR of 90 mL/min/1.73 m^2 or greater ($\geq$1.50 mL/s/1.73 m^2), those with an eGFR between 30 and 59 mL/min/1.73 m^2 (0.50 and 0.98 mL/s/1.73 m^2) had a 37% to 58% greater likelihood of seeing a physician; and those with an eGFR less than 30 mL/min/1.73 m^2 ($<$0.50 mL/s/1.73 m^2) were 2.8 times more likely to see a physician.

Of the 3,340 participants who learned they had hypertension, 51.3% were monitoring blood pressure, 16.6% adjusted their diets, and 49.9% received prescription medicine (Table 5). Of the 1,599 participants who learned they had diabetes, 50.6% were monitoring blood glucose levels, 34.3% adjusted their diets, 40.7% received prescription medicine, and 9.9% were prescribed insulin. Of the 528 persons who learned they had anemia, 32.8% were prescribed over-the-counter medication, 19.7% received prescription medicine, and 9.3% were prescribed injections.

DISCUSSION

Of the 72,395 individuals who met KEEP criteria between August 2000 and December 31, 2006, a total of 20,541 (28.4%) returned a follow-up form with questions about visiting their physicians after the detection program. Of participants with eGFR less than 60 mL/min/1.73 m^2 ($<$1.00 mL/s/1.73 m^2), 43% returned the follow-up questionnaire overall, with gradual improvement reaching 48.5% in 2006. Predictors of returning follow-up forms varied by age, sex, race, US region, educational level, insurance status, comorbid conditions, and level of kidney function by means of eGFR. When the cohort was divided based on follow-up calling efforts by KEEP program staff (2000 to 2005 versus 2006) between a general approach to encourage all screened individuals to see a physician for medical care and a targeted effort directed at participants with an eGFR less than 60 mL/min/1.73 m^2 ($<$1.00 mL/s/1.73 m^2), data showed a considerable difference in the likelihood of physician follow-up. Efforts targeted toward participants with evidence of moderate and severe CKD (eGFR $<$ 60 mL/min/1.73 m^2 [$<$1.00 mL/s/1.73 m^2]) were 2 to 3 times more effective.

Table 4. Predictors of Reporting Seeing a Physician About Screening Results

Characteristics	OR (95% CI) of Seeing a Physician	*P*
Age (y)		
18-30	0.63 (0.54-0.75)	<0.001
31-45	0.90 (0.81-0.99)	0.03
46-60	1.00	
61-75	1.41 (1.29-1.54)	<0.001
>75	1.66 (1.45-1.91)	<0.001
Sex		
Women	1.00	
Men	0.84 (0.78-0.91)	<0.001
Race		
White	0.76 (0.70-0.83)	<0.001
African American	1.00	
Other	0.82 (0.73-0.93)	0.001
Region		
South	1.19 (1.06-1.33)	0.003
Northeast	1.25 (1.11-1.42)	<0.001
Midwest	1.23 (1.08-1.40)	0.002
West	1.00	
Current smoker	0.89 (0.79-1.00)	0.04
≥High school education	0.95 (0.85-1.07)	0.4
Insurance coverage	1.90 (1.72-2.10)	<0.001
Diabetes*	1.57 (1.44-1.70)	<0.001
Hypertension†	1.73 (1.59-1.88)	<0.001
Self-reported cardiovascular disease	1.21 (1.11-1.32)	<0.001
Obesity‡	1.08 (1.00-1.16)	0.04
Anemia§	1.11 (0.99-1.24)	0.07
Estimated glomerular filtration rate (mL/min per 1.73 m^2)		
<30	3.81 (2.29-6.31)	<0.001
30-<40	1.58 (1.23-2.04)	<0.001
40-<50	1.65 (1.39-1.96)	<0.001
50-<60	1.37 (1.21-1.56)	<0.001
60-<70	1.04 (0.94-1.16)	0.5
70-<80	1.05 (0.94-1.16)	0.4
80-<90	0.93 (0.83-1.04)	0.2
≥90	1.00	

Note: n = 17,853. To convert estimated glomerular filtration rate in mL/min/1.73 m^2 to mL/s/1.73 m^2, multiply by 0.01667.

Abbreviations: OR, odds ratio; CI, confidence interval.

*Diabetes defined as self-reported history of diabetes, receiving medication for diabetes, or blood glucose level of 126 mg/dL or greater (≥7.0 mmol/L) fasting or 200 mg/dL or greater (≥11.1 mmol/L) nonfasting.

†Hypertension defined as self-reported history of hypertension, receiving medication for hypertension, or increased blood pressure (Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure[13]): systolic blood pressure of 130 mm Hg or greater or diastolic blood pressure of 80 mm Hg or greater if diabetes or chronic kidney disease, otherwise systolic blood pressure of 140 mm Hg or greater or diastolic blood pressure of 90 mm Hg or greater.

‡Body mass index of 30 kg/m^2 or greater.

§As defined by the World Health Organization, a hemoglobin level less than 13 g/dL (<130 g/L) for men and less than 12 g/dL (<120 g/L) for women.

Table 5. Medical Interventions for Kidney Early Evaluation Program Participants Addressing Diseases

Diabetes (n = 1,599)		Hypertension (n = 3,340)		Anemia (n = 528)	
Intervention	%	Intervention	%	Intervention	%
Monitor blood glucose	50.6	Monitor blood pressure	51.3	Over-the-counter medication	32.8
Diet adjustment	34.3	Diet adjustment	16.6	Prescription medication	19.7
Drug therapy	40.7	Drug therapy	49.9	Injection	9.3
Insulin	9.9	Other	14.3	Other anemia treatment	26.1
Other	14.9				

This suggests that the health-screening program supported by a targeted educational plan with increasing vigilance in follow-up of participants with evidence of more advanced CKD can lead to increased participant access to the medical system.

Of KEEP participants who returned their follow-up forms, 71% indicated that they saw their physicians after the KEEP event. When categorized by evidence of CKD, 24% more participants with CKD reported seeing a physician than participants without evidence of CKD. Participants with decreased kidney function and increased urine albumin levels were more likely to report visiting physicians after the KEEP event. Predictors of increased likelihood of reporting a physician visit were age, sex, race, geographic region, insurance status, and decreased kidney function indicated by using eGFR. For participants with medical insurance, the chance of reporting physician follow-up increased by 90%, confirming the importance of access to the health care system. For participants with an eGFR less than 30 mL/min/1.73 m^2 ($<$0.50 mL/s/1.73 m^2), the likelihood was 3.7 times greater than for those with an eGFR greater than 60 mL/min/1.73 m^2 ($<$1.00 mL/s/1.73 m^2), suggesting that targeted groups were accessing the health care system.

Participants' indicated reasons for physician visits provide insight into how they leverage the information obtained from the detection program. Of those with increased blood pressure at the screening, two thirds indicated that they saw their physicians for that finding. Of those with evidence of kidney damage, 50% saw their physicians for that finding. Although follow-up data are limited to 28% of people who participated in the program, they provide important observations regarding activities in the immediate 3-month follow-up period. Because the main purpose of KEEP is to engage the population at risk of kidney disease to participate in the program and seek further medical care, the program appears to be meeting its objective. Receiving health information at the end of the program and consulting with a health care professional to review health status and risk factors appears to motivate participants to engage the health care system. Educational materials that participants receive include information about kidney disease, risk factors, and lifestyle changes, such as weight loss, blood pressure control, and, for those with diabetes, blood glucose control. Kidney disease treatments as defined in clinical practice guidelines also are reviewed, and participants are encouraged to discuss them with their physicians. The targeted nature of follow-up activities for participants with evidence of an eGFR less than 60 mL/min/1.73 m^2 ($<$1.00 mL/s/1.73 m^2) likely explains the increased odds of participants with the lowest eGFRs seeing their physician. The educational effort also helps inform at-risk participants with hypertension and diabetes.

Whether the health-screening program and subsequent follow-up physician visits changed outcomes for these participants compared with those who did not follow up with physician visits is unclear from the data. Long-term strategies to follow up individuals with evidence of mild to moderate CKD should be designed and implemented.

In this evaluation of the KEEP cohort regarding participants who provide follow-up information, the response rate was close to 30% and considerably greater in the targeted low-eGFR population. The short-term follow-up should be expanded to determine whether longer term health status and medical care are changed for program participants and whether providers change the care of similar patients in their practices.

Generalization of our results is limited by the low response rate in returning follow-up forms,

with significant differences in age, sex, race, smoking history, education, and some health conditions between participants who returned and did not return follow-up forms. Results based on the group that returned follow-up forms thus might be biased. Results for medical interventions (Table 5) also are limited. Because we did not collect medical intervention data at baseline, we cannot conclude any influence on changes in medical intervention by the findings of KEEP.

The KEEP detection program appears to successfully identify individuals at high risk of CKD and motivate participants with evidence of kidney damage to seek physician care in the 3 months after the screening event. Additional long-term assessment of participants regarding their subsequent care and outcomes is needed.

ACKNOWLEDGEMENTS

Support: The Kidney Early Evaluation Program is a program of the National Kidney Foundation Inc and is supported by Amgen, Abbott, Genzyme, Ortho Biotech Products LP, and Novartis, with additional support provided by Siemens Medical Solutions Diagnostics, Lifescan, Suplena, and OceanSpray Cranberries.

Financial Disclosure: Dr Collins has received research support from Amgen. Dr Vassalotti reports having received grant support from the Centers for Disease Control and Prevention, but has no conflicts of interest with the subject of this article. Dr Li and Mr Chen have no conflicts of interest.

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