

The Kidney Education Outreach Program's Community-Based Screenings: Participants' Demographics and Screening Results

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Abstract

Objective: To outline the Kidney Education Outreach Program (KEOP) screening protocol, to describe the context in which these chronic kidney disease (CKD) screenings were administered, and to report the characteristics and screening results for participants from October 2005 to September 2008.

Methods: A cohort of 1,742 people participated in targeted, free, community-based CKD screenings. Screenings included a self-report questionnaire regarding sociodemographic information, lifestyle behaviors, and personal and family health history. This survey was followed by urine dipstick testing for proteinuria and microalbuminuria.

Results: Medical histories were provided by 1,694 individuals: 1,522 through the complete questionnaire and 172 through an abbreviated questionnaire that differed principally in lack of information on family history of disease. Urine samples were collected from 1,706 participants. The mean age of screening participants was 54 years old; 70% were female, 50% were African American, and 13% were Latino. More than 40% of subjects were obese. Roughly one-quarter (23%) had been diagnosed with diabetes mellitus and about half (47%) had been diagnosed with hypertension. Twenty-four percent reported a family history of kidney disease. While 60% of the participants tested positive for microalbuminuria, less than 4% of these persons had ever been told they had kidney disease.

Limitations: Lack of confirmatory testing with a serum creatinine (and estimated glomerular filtration rate) or, alternatively, with a 24-hour urine collection for creatinine clearance and protein excretion; no standardized follow-up for screened participants.

Discussion: The KEOP targeted screenings disclosed a high prevalence of known risk factors for CKD—diabetes mellitus, hypertension, obesity, advanced age, and family history of kidney disease. However, despite these factors, less than 4% of screened participants were aware of a diagnosis of CKD.

Keywords: chronic kidney disease; screening; Kidney Education Outreach Program (KEOP)

Chronic kidney disease (CKD) is defined by the National Kidney Foundation as a progressive loss of kidney function that can be identified by abnormal protein excretion in the urine and/or elevations in serum creatinine. CKD is a national public health problem whose prevalence continues to rise.^{1,2} More than 26 million adults have early stage CKD and another 400,000 people are in the latter stage of the disease, often referred to as end-stage kidney disease (ESKD).^{3,4} The disease burden is particularly prominent in North Carolina: approximately 940,000 (11%) of North Carolinians have

early stage CKD, and North Carolina ranks 9th in the nation for statewide prevalence of ESKD (n=11,000).^{5,6}

Unfortunately, CKD awareness is low among at-risk persons as well as among primary care physicians.⁷⁻⁹ Treatment of CKD across all five stages, and its comorbid diseases (diabetes, hypertension, and cardiovascular disease), is very costly.¹⁰ North Carolina's cumulative CKD-related health expenditures for 2007 were estimated to be around five billion dollars.¹¹ A 2008 report by the North Carolina Institute of Medicine Task Force on Chronic

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Kidney Disease acknowledged that CKD is a pervasive, expensive, and personally debilitating health problem for North Carolinians. The Task Force recommended the use of community-based awareness programs complemented by targeted screening for uninsured persons with diabetes mellitus, hypertension, heart disease, or any family history of kidney disease as important strategies to help reduce the burden of CKD.¹² Screening populations at high risk for CKD is essential in order to achieve consistent implementation of early therapeutic interventions that stop or slow the progression of the disease.¹³

Six years of national screenings administered by the National Kidney Foundation's Kidney Early Education Program (NKF-KEEP) included 2,495 North Carolina participants and served as the impetus for the University of North Carolina Kidney Center (UNCKC) to initiate the Kidney Education Outreach Program (KEOP) in 2005.¹⁴ With the goal of raising awareness among North Carolina residents and primary care physicians about the major risk factors for CKD and the importance of early diagnosis and intervention, the KEOP has three primary components: (1) focus groups to ascertain perceptions about CKD that inform subsequent awareness activities, (2) interactive community conversations augmented by community-based media campaigns that use local citizens as spokespersons, and (3) free CKD screenings that target at-risk persons. Essential community-based partnerships with organizations, agencies, and lay leaders characterize the KEOP and help the program achieve sustainability and credibility through local ownership.^{15,16}

North Carolina's highest ESKD prevalence rates are in rural counties.⁶ Seventeen of these counties were selected as initial KEOP target counties. From October 2005 through September 2008, 35 screenings were held in six of these counties (Anson, Bertie, Edgecombe, Greene, Martin, and Montgomery) and in eight additional counties (Cabarrus, Davidson, Guilford, Hertford, Mecklenburg, Orange, Richmond, and Stanly) that invited the KEOP to participate in local health fairs or other community activities. The purpose of this article is to describe the KEOP screening protocol, the context in which these screenings were administered, and the characteristics and screening results of the KEOP's October 2005 through September 2008 participants.

Methods

Pre-screening Awareness Activities

Because lay person and primary care physician awareness about CKD is low, free KEOP screenings were preceded by several months of community-based activities that comprised interactive information sessions and local media campaigns that used local citizens as spokespersons. Focus groups were used to assess a community's preconceptions about CKD and explored whether residents perceived barriers to obtaining preventive or primary care. These preliminary activities emphasize active learning, are

conducted in conjunction with local lay leaders, and have three foci: (1) to emphasize the primary risk factors for CKD: diabetes mellitus, hypertension, heart disease, and a family history of CKD; (2) to promote the value of being screened before clinical symptoms are apparent; and (3) to encourage at-risk residents to ask their primary care provider: "Hey Doc, How Are My Kidneys?"^{17,18} Participation in these activities is voluntary, but high-risk populations are targeted through announcements and partnerships with local departments of health and social services, senior citizen councils, and faith-based organizations. Community partners host the information sessions to ensure locations that are familiar and accessible to residents.

Screening Protocol

Sites for the screenings included churches, hospitals, community centers, community colleges, senior citizen centers, and correctional institutions. Screenings performed after November 2007 continued to be hosted by local partners but were administered on the KEOP's mobile outreach unit. Any person age 18 years or older who could provide a urine sample and complete a questionnaire was eligible for screening. All screening activities and procedures were approved by the Office of Human Research Ethics at the University of North Carolina at Chapel Hill.

KEOP screenings were conducted by UNCKC staff members (physicians, nurses, educators, social workers, research technicians) and trained volunteers (medical students, citizens). After providing informed consent, participants completed a version of the University of North Carolina Kidney Center Screening Questionnaire. Participants completed either the 49-item document that asked participants to self-report information regarding sociodemographic information (e.g., age, education, race/ethnicity), lifestyle behaviors (e.g., tobacco use, alcohol consumption, exercise habits), and personal and family health history or an abbreviated, 19-item questionnaire that focused on key sociodemographic and health questions. The abbreviated survey was administered to participants who resided outside the host county. All questionnaires were read to participants to ensure standardization of documentation and to avoid potential discomfort and/or inaccurate reporting related to functional literacy issues.^{19,20}

After completing either the full or abbreviated questionnaire, participants provided a spot urine specimen which was tested for proteinuria by dipstick (Chemstrip 10 MD Urine Test Strip [Roche Diagnostics]) and for microalbuminuria (Chemstrip Micral [Roche Diagnostics]). Proteinuria dipstick testing was performed for the entirety of the screening period; microalbuminuria testing began in July 2006, after the first 104 individuals were screened. On-site, risk for kidney disease was assessed with results from the urine tests. A dipstick value of one or greater for proteinuria (30 mg/dl or greater) and/or detection of microalbuminuria of ≥ 20 mg/l were considered abnormal.

At the completion of the screening, participants were given two copies of their test results and met individually with a UNCKC staff member for a review of their results. All individuals screened were encouraged to share their results with their primary care physicians. Individuals with abnormal test results were advised to follow up with a physician in one to six months, depending on the level of proteinuria and microalbuminuria detected. All screening result forms included a toll-free telephone number to ensure participants and physicians had access to KEOP staff to answer any questions about the screening or individual results. Participants who did not have a health care provider and/or health insurance were given a list of local clinics and primary care providers available to see such participants for follow-up care, including free clinics, federally-qualified health centers, or community health centers. Participants were also given educational materials such as pamphlets and brochures that explained the relationships between CKD, diabetes mellitus, and hypertension, as well as materials that promote active and healthy lifestyle choices.

Statistical Analyses

Statistical analyses were generated using the Stata statistical program, version 9.2 (StataCorp, College Station, TX, 2007). Descriptive analyses were used to characterize the screening population by sociodemographic data, health status, family history, and lifestyle behaviors. Mean values and prevalence rates were examined using Fisher's exact tests for all categorical variables and t-test for all continuous variables.

Results

Participants

From October 2005 through September 2008, 1,742 participants were screened through the KEOP. Medical histories were provided by 1,694 individuals: 1,522 through the complete questionnaire and 172 through an abbreviated questionnaire that differed principally in lack of information on family history of disease. Urine samples were collected from 1,706 participants. Forty-eight participants declined to complete a survey but consented for urinalysis. The screenings were performed in 14 North Carolina counties. By promoting the free screenings among at-risk populations, these targeted outreach activities captured a population with a higher than average risk for CKD.

The mean age of the screened population was 54 years, with almost 40% of participants aged 60 years or older. The vast majority of screened participants were female, and approximately half were African American. Fewer than 12 years of education had been completed by 20% of the participants. Of the 1,522 participants that completed the full questionnaire, 35% had smoked 100 cigarettes in their lifetime, and 8% had been diagnosed with some form of heart disease. Forty-two percent of the 1,694 participants who completed the surveys qualified as obese (BMI > 30kg/m²)

and nearly one-half and one-quarter of those screened had already been diagnosed with hypertension or diabetes mellitus, respectively. Family history of kidney disease was reported in 24% of screenings, while family histories of diabetes mellitus and hypertension were identified at far higher rates—66% and 78% respectively (see Table 1).

A large majority of the participants reported having some form of health insurance. Of the 1,694 participants who completed questionnaires (both the full and the abbreviated versions), only 53 (3.1%) answered "yes" to the question "Have you ever been told by a doctor that you have kidney

Table 1.
Characteristics of the UNC Kidney Center KEOP Screening Population as of October 1, 2008

Characteristics	Overall (N=1,694)
Mean age, (Std)	54 (16.2)
Female	70.1%
Race/Ethnicity	
African American	49.5%
White	35.5%
Latino	12.8%
Native American	0.6%
Asian	0.5%
Other	1.0%
Less than high school education	20.7%
Smoke 100 cigarettes in life ^a	35.6%
Mean body mass index, (Std)	30 (14.4)
Health insurance	83.4%
Diabetes mellitus	22.6%
Heart disease ^a	8.4%
Hypertension	47.1%
Obese ^b	42.3%
Kidney disease ^a	3.1%
Family history of hypertension ^a	78.4%
Family history of diabetes mellitus ^a	66.4%
Family history of kidney disease ^a	23.7%

a. Data not captured for 172 participants who completed the abbreviated survey.

b. Obesity defined as BMI > 30kg/m².

disease?" (1,621 answered "no," eight answered "I don't know," and 12 did not provide an answer) (see Table 1). Notably, only 3% of the participants that tested positive for proteinuria and 4% of those that tested positive for microalbuminuria responded "yes" to this question.

Performance of Screening with Dipstick for Proteinuria and Microalbuminuria

Urine was collected from 1,706 participants—dipstick testing for proteinuria was performed on 1,706 samples, and

microalbuminuria testing was performed on 1,497 samples. With dipstick testing for proteinuria, 194 (11%) samples were considered positive screens with values of one or higher. Microalbuminuria testing, using a level of 20 mg/l or higher as a positive screen, was considered positive for 902 (60%) of the urine samples. The vast majority of positive microalbuminuria tests were in subjects with 20 mg/l of microalbuminuria; less than 10% of these subjects tested positive for dipstick proteinuria (see Table 2).

Performance of Screening with Dipstick Among Diabetic and Hypertensive Participants

Of the 194 participants that screened positive for dipstick proteinuria, 37% were self-identified diabetics, and 61% gave a history of hypertension. Among the 902 participants that tested positive for microalbuminuria, diagnoses of both diabetes mellitus and hypertension were more likely to be present in positive screens. Specifically, 68% of self-reported diabetics had positive microalbuminuria screens, compared to a 58% rate of positive screens in non-diabetics ($p=0.006$). Similarly, participants with diagnosed hypertension had higher rates of positive microalbuminuria screens compared to participants without hypertension diagnoses, 64% vs. 57% ($p=0.002$) (see Tables 2 and 3

for further details on screening population characteristics). The level of diagnosed diabetes mellitus among those who screened positive was likely affected by how diabetic status was determined in this study. Participants were only categorized as diabetic if they had been diagnosed by their physicians. Participants who reported that they were "borderline" or "almost" diabetic did not qualify as a "yes" to the specific survey item, "Have you ever been told by a doctor that you have diabetes or that your sugar is high?" which may explain the low prevalence of diagnosed diabetes mellitus among the screened population.

Discussion

CKD is associated with premature mortality, decreased quality of life, and increased health care expenditures.¹² This growing public health problem, which now affects roughly 17% of the US adult population and over 900,000 North Carolinians, is well suited for population-based screening. The disease can often be identified early and progression can be halted or slowed with appropriate therapies, especially when implemented early in the disease when clinical symptoms are not yet apparent.

Not surprisingly, the KEOP's targeted screenings disclosed a high prevalence of known risk factors for CKD

Table 2.
Microalbuminuria Screen Results by Characteristics of the UNC Kidney Center KEOP Screening Population as of October 1, 2008 (N=1,497)

Characteristics	Normoalbuminuria (n=595)	Microalbuminuria ^a (n=902)	P-value ^b
Mean age, (Std)	55 (15.8)	54 (16.4)	0.303
Female	73.7%	66.3%	0.003
Race/ Ethnicity			
African American	43.0%	53.4%	0.003
White	39.2%	31.1%	
Latino	15.6%	13.3%	
Native American	0.9%	0.5%	
Asian	0.5%	0.7%	
Other	0.9%	1.1%	
Smoke 100 cigarettes in life ^c	35.6%	38.3%	0.317
Mean body mass index, (Std)	29 (6.8)	31 (17.7)	0.003
Diabetes mellitus	19.3%	26.5%	0.002
Heart disease ^c	6.1%	10.5%	0.007
Hypertension	43.7%	51.2%	0.006
Obese ^d	36.2%	46.5%	<0.001
Family history of hypertension ^c	76.3%	78.9%	0.291
Family history of diabetes mellitus ^c	66.5%	68.1%	0.580
Family history of kidney disease ^c	27.1%	24.0%	0.206

a. Microalbuminuria defined as urine albumin concentration >20mg/l (using semi-quantitative micral strips).

b. P-values reported are from Fishers exact test for all categorical variables and from t-tests for all continuous variables.

c. Data not captured for 172 participants who completed the short survey.

d. Obesity defined as BMI>30kg/m².

Table 3.
Detection of Kidney Disease in the KEOP by Two Screening Modalities

Screening Test	Negative Screen		Positive Screen		
	Negative	Trace	1+	2+	3+
Dipstick for proteinuria ^a					
N=1,706	n=1,106 64.8%	n=406 23.8%	n=171 10.0%	n=13 0.8%	n=10 0.6%
	n=1,512 (88.6%)		n=194 (11.4%)		
Microalbuminuria ^b	Negative		20 mg/l	50 mg/l	100 mg/l
n=1,497	n=595 39.7%		n=644 43.0%	n=178 11.9%	n=80 5.3%
	n=595 (39.7%)		n=902 (60.3%)		

a. For dipstick testing, trace denotes < 30 mg/dl, 1+ denotes 30-100 mg/dl, 2+ denotes 100-500 mg/dl, and 3+ denotes > 500 mg/dl.

b. 1,706 participants gave urine samples, of which 209 were not tested for microalbuminuria.

among the screened population, including diabetes mellitus, hypertension, obesity, advanced age, and family history of kidney disease. However, despite this confluence of risk factors, less than 4% of screened participants (53 of 1,694) were aware of a diagnosis of CKD. This result agrees with low awareness of CKD in the general population. Only 3% of participants in NKF-KEEP reported a history of CKD at screening despite 16% having an estimated glomerular filtration rate (eGFR) of less than 60 ml/min/1.73 m².²¹ In the National Health and Nutrition Examination Survey population, less than 25% of subjects with moderately to severely decreased kidney function (CKD stages 3 and 4, eGFR 15-59 ml/min/1.73 m²) were aware of CKD.³ Given that more than half of the screened KEOP participants had detectable microalbuminuria, we expect that further diagnostic testing (for example, with serum creatinine or 24-hour urine creatinine measurements) will reveal kidney disease in greater than the 4% classified as having CKD.

The strength of the data presented here is that, in a relatively large and high-risk sample, community-based screening proved feasible. This type of community screening is not meant to diagnose disease, *per se*, but rather to identify individuals at high risk for disease and facilitate a more thorough workup for such individuals. Increased awareness of CKD and its associated risk factors is an associated benefit of community screening as well. Ideally, screening for CKD should include a detailed history accompanied by urine and blood testing; however, all of these components may not always be obtainable. The microalbuminuria performance in KEOP suggests that a fast, on-site urine screening test can identify individuals who would benefit from further evaluation. The low number of positive dipstick screens suggests that microalbuminuria should be preferentially used over dipstick proteinuria, if possible. We expect that there will be false positive results from the microalbuminuria dipstick testing, just as we are confident that there are false negative results with proteinuria testing. Given that the response to a positive screen in the KEOP and other screening activities is referral to a primary care

provider, which imposes negligible risk and has the potential for tremendous benefit, we recommend the more sensitive test of microalbuminuria (notably, the NKF-KEEP screenings use this method as well).

A major limitation of these data is the lack of confirmatory testing with a serum creatinine (and estimated GFR) or, alternatively, with a 24-hour urine collection for creatinine clearance and protein excretion. The purpose of the KEOP is to identify subjects in need of further evaluation and not to validate specific screening tools. Subjects who did have positive urine screening tests (by dipstick or microalbuminuria) were referred to appropriate local health care providers, who likely did confirmatory testing. We do not have those results, however, and therefore can only speculate, as we have done here, as to how the screening tools in KEOP performed. It must be emphasized that CKD, by definition, is a chronic disease and can never be diagnosed by a single evaluation. Therefore, inclusion of serum creatinine testing at such screenings would not obviate the need for referral to a health care provider and at least three months of follow-up to truly diagnose CKD.¹

Another limitation is that the screenings were done on a generally high-risk group, and therefore our results may not be applicable to the general population. However, CKD screenings may be more justifiable, in terms of cost and participation, in high-risk groups such as older persons and persons with diabetes mellitus and hypertension.¹³ Implementation of health strategies, such as blood pressure control, avoidance of nephrotoxins, and dietary salt restriction, will likely have the greatest yield among such high-risk groups in terms of reducing the burden of CKD, and in terms of slowing and possibly halting progression to ESKD.

Still, we feel that the most crucial limitation of screening activities such as ours (and the original KEEP screenings upon which our activities were based) is the lack of standardized follow-up for the screened participants. This is a practical matter, as we can only provide information for formal primary care or nephrology evaluation and are not equipped to actually perform such evaluations. The NKF-

KEEP now provides the opportunity for participants to return on an approximately yearly basis for repeat evaluation. Yet this return for repeat testing does not entirely capture the optimal outcome from its screening, which is for a participant to become educated about disease risk and seek out a relationship with a local health care provider to further evaluate this risk. We plan, in the future, to institute a follow-up mechanism in the KEOP that not only ascertains whether screened participants seek local care after their screenings, but also which factor or factors in the screening (urine results, screening questions, discussion with staff) prompted this behavior.

Overall, results from the first 36 months of the KEOP reveal the feasibility of a targeted screening program to identify a

significant number of individuals in need of further diagnostic evaluation for CKD. The program serves as a model that other communities, both at state and community levels, can follow in the fight to reduce the burden of CKD. **NCMJ**

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