

Sustainable Community-Based CKD Screening Methods Employed by the National Kidney Foundation's Kidney Early Evaluation Program (KEEP)

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This year, 2011, the National Kidney Foundation's (NKF) Kidney Early Evaluation Program (KEEP) celebrates its 11th anniversary, approaching 3,500 cumulative screening events conducted by 48 affiliates and reaching more than 165,000 people in communities across the country. KEEP serves as the largest and most comprehensive and sustained multi-center community-based chronic kidney disease (CKD) screening program in the United States. While focused on CKD, KEEP also functions as a unique means of screening for and discovering obesity, diabetes, hypertension, and cardiovascular disease. The NKF's approach to social marketing (Fig 1), patient education, and advocacy combined with KEEP's data capabilities, longitudinal tracking, and feedback to clinicians have made the program the nation's leading effort to screen for and intervene in chronic diseases. KEEP's structure as an outreach effort, coupled with a sense of activism in recent years regarding primary prevention of chronic disease, has enabled sustained growth and international expansion.

HISTORY

Since KEEP's national launch in August 2000, the NKF and its local Division and Affiliate offices have been screening high-risk individuals for CKD. KEEP

targets people 18 years and older who have a history of diabetes or hypertension or who have a family history of these conditions or of kidney disease. The NKF had pilot tested the program, screening 889 high-risk people in 21 cities from April through October 1997. The pilot program was an adaptation of a screening program developed by the NKF of Indiana in 1991, called the Computerized Assessment of Risk and Education (CARE). This effort, provided in collaboration with the Diabetes Research and Training Center, was multidisciplinary, using health professionals and social workers to reach out to the families of dialysis patients. As KEEP grew, avoiding direct medical intervention simplified the central institutional review board process and promoted rapid implementation of decisions by the KEEP Steering Committee. Lack of need for adverse-event reporting to regulatory agencies eliminated the bureaucratic paperwork and overhead of a randomized trial. KEEP thus is a health screening program that provides early CKD detection and raises public awareness of CKD and its risk factors.

Figure 2 shows the KEEP organizational structure. Leadership from the KEEP Steering Committee (with regular teleconferences and face-to-face meetings) and commitment from the NKF have been critical to the success of the program. KEEP became sustainable because it had the advantage of working with a fully functional NKF Division and Affiliate infrastructure. Screening logistics and volunteer networking, including media access and other promotional avenues, were established by every local affiliate before KEEP was launched. As a result, KEEP boosted the profile of each NKF office in the community. This allowed the KEEP Steering Committee to concentrate on dealing with common components of the program, such as funding, questionnaire forms, laboratory vendors, data management systems, and call-center functionality. This practical division of resources and workloads among the academic KEEP Steering Committee, the NKF, and the NKF Divisions and Affiliates created a solid foundation. Excellent leadership from the KEEP Steering Committee and unwavering commitment from the NKF helped enormously in the development of this program.

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0272-6386/\$36.00

doi:10.1053/j.ajkd.2010.11.010

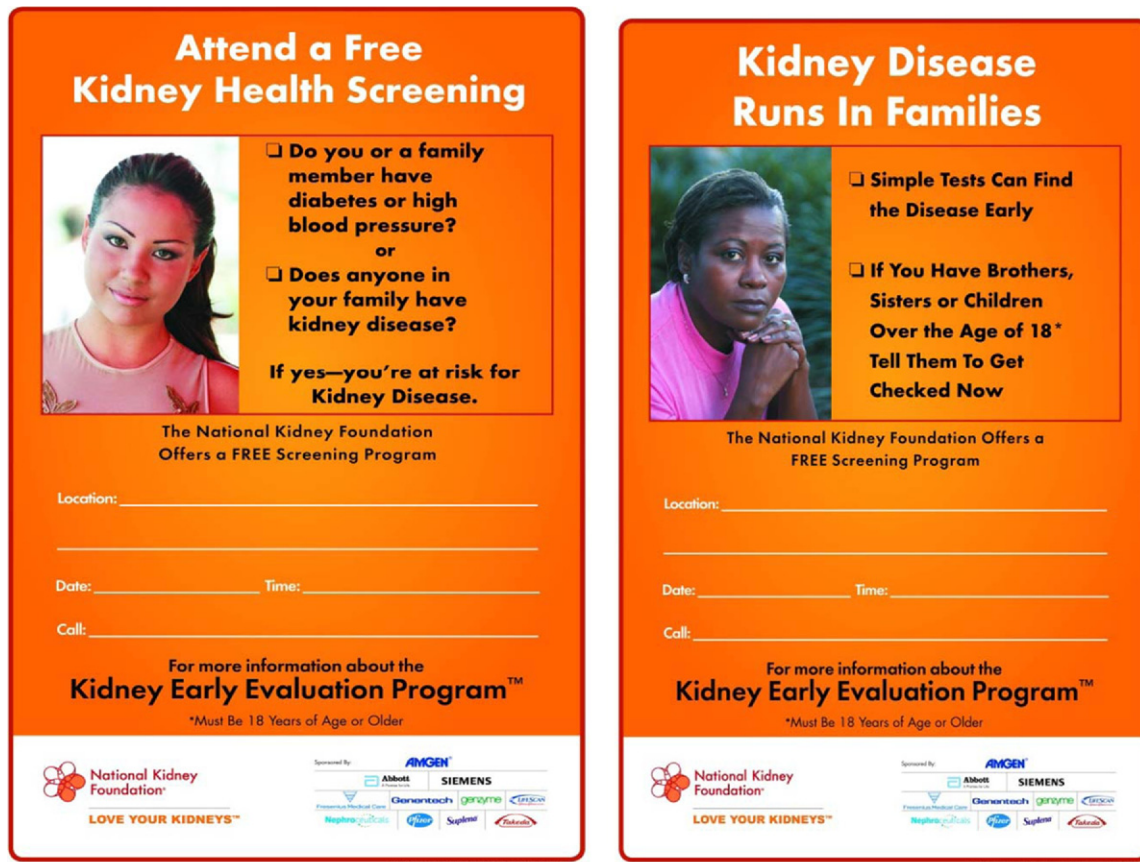


Figure 1. Example of advertisements for Kidney Early Evaluation Program community screening events.

SCREENING EVENTS

In its present form, KEEP is a voluntary free community-based health screening program designed to identify and educate individuals at increased risk of kidney disease. The screening effort, organized by local NKF affiliates, targets risk factors for and the presence of common chronic diseases, including obesity, hypertension, diabetes, CKD, and cardiovascular disease.^{1,2} It aims to raise awareness early, when appropriate intervention may delay or prevent disease progression and related health complications. Local

multimedia promotional efforts based on successful social marketing techniques target people at risk and motivate them to participate in screening events. The screenings are held in nonmedical noninstitutional community-based locations, such as churches and social centers. The evaluation process consists of a series of 6 stations (Table 1) staffed by local volunteer clinicians and physicians. Participants provide informed consent for the screening and the deidentified health information data merge for research purposes, then complete a comprehensive health questionnaire. Participants also indicate whether they agree to have their clinical assessment and laboratory results sent to

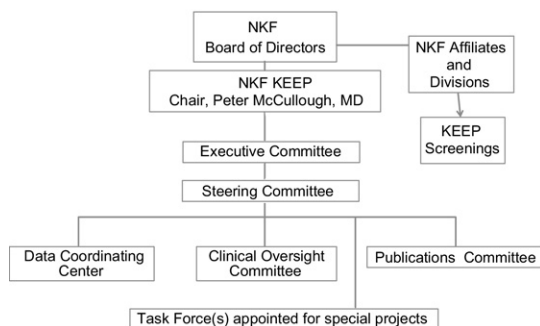


Figure 2. National Kidney Foundation (NKF) Kidney Early Evaluation Program (KEEP) organizational chart.

Table 1. Kidney Early Evaluation Program Screening Stations

| Station | Activity ^a |
|---------|-------------------------------------|
| 1 | Registration |
| 2 | Consent and screening questionnaire |
| 3 | Physical measurements |
| 4 | Urine and blood testing |
| 5 | Clinician consultation |
| 6 | Screening review |

^aApproximately 45 minutes' total screening time.

Box 1. Kidney Early Evaluation Program Test Performed

| On-Site (point-of-care) Tests | Central Laboratory Tests |
|-------------------------------|---|
| Measurements | Serum creatinine |
| Height and weight | Estimated glomerular filtration rate ^a |
| Waist circumference | Hemoglobin |
| Blood pressure | Lipid panel |
| Blood | Hemoglobin A _{1c} |
| Blood glucose | Parathyroid hormone |
| Urine | Calcium |
| Albumin-creatinine ratio | Phosphorus |

^aCurrently using the 4-variable Modification of Diet in Renal Disease Study equation.

their primary care physicians. Measurements include height, weight, blood pressure, waist circumference, and body mass index. A diagnostic panel of urine and blood tests is used to assess evidence and risk-factor control of diabetes, dyslipidemia, CKD, anemia, CKD mineral and bone disorder, and kidney damage.³ The following tests also are performed (Box 1):

- Urine albumin-creatinine ratio (milligrams per gram).
- Fasting or random blood glucose (milligrams per deciliter).
- Serum creatinine (milligrams per deciliter).
- Estimated glomerular filtration rate (milliliters per minute per 1.73 m²); the 4-variable Modification of Diet in Renal Disease (MDRD) Study equation was used through 2010, the MDRD Study and the CKD Epidemiology Collaboration (CKD-EPI) equations were used in 2010, and the CKD-EPI equation will be used after 2010.
- Hemoglobin (grams per deciliter).
- Lipid profile: total cholesterol, triglycerides, high-density lipoprotein cholesterol, low-density lipoprotein cholesterol (milligrams per deciliter).
- Hemoglobin A_{1c} for participants with self-reported diabetes or onsite blood glucose test results indicative of diabetes (percent).

Additional tests are performed for participants with estimated glomerular filtration rate <60 mL/min/1.73 m²:

- Intact parathyroid hormone (picograms per milliliter).
- Calcium (milligrams per deciliter).
- Phosphorus (milligrams per deciliter).

All participants debrief with a physician, physician assistant, or nurse practitioner to review risk factors and on-site test results, including an initial diagnosis of hypertension, diabetes, or CKD.⁴ The use of point-of-care testing has been critical, raising awareness of and interest in the findings and “priming” participants

for the final report to follow in the mail. Laboratory results are reviewed within 72 hours for critical values by NKF medical personnel, and participants with abnormal test results are contacted directly by NKF Call Center staff (Fig 3). Laboratory reports with comprehensive review of all screening results, including physical measurements, and lay explanations are sent to participants after the screening. If appropriate consent is obtained, treating physicians also receive a report with detailed actions suggested by Clinical Practice Guidelines. For participants with CKD, additional reflexive information is given to treating physicians regarding complications, anemia, and CKD mineral and bone disorder.

About 1 month after screening results are sent, follow-up questionnaires are sent to gauge the effectiveness of the screening. The most important follow-up question is whether the KEEP screening prompted participants, especially those with abnormal test results, to see their physicians. For participants who saw their physicians, other questions address what tests were discussed and whether interventions or treatments were recommended or prescribed. Participants who do not return the questionnaire receive a follow-up telephone call to discuss the questions. Call Center staff members confirm receipt of screening data, review results, and encourage use of printed and online NKF resources. Call Center staff also encourage participants to have any abnormal results reviewed and repeated by their health care providers to ensure follow-up of critical laboratory values. This postscreening follow-up is intended to increase awareness of CKD and make the clinical findings actionable for participants and their physicians.



Figure 3. National Kidney Foundation Call Center work flow steps after Kidney Early Evaluation Program screenings.

LONGITUDINAL PROGRAM

A longitudinal component of the KEEP process, launched in June 2008, involves annual rescreenings for changes in risk factors, disease states, and evaluation of CKD progression.⁵ From the KEEP database, electronic triggers call for outbound targeted invitations to prior participants, asking them to return to the KEEP community screening site for a repeat examination. Return participants are identified on arrival and are asked to complete a questionnaire developed to assess interval changes in CKD risk factors and other medical events. Approximately 30% of KEEP participants are now engaged in longitudinal assessment, which is critical for evaluation of the program and continual refinement of KEEP interventional methods.

DATA METHODS

The KEEP Data Coordinating Center is a centralized data center established in 2002 at the Minneapolis Medical Research Foundation, Minneapolis, MN, for managing data collection processes, maintaining data consistency and quality, and conducting epidemiologic research on the high-CKD-risk KEEP populations. The Data Coordinating Center uses Windows-based database systems and optical character recognition applications to facilitate on-line data entry and survey form scanning, manages data and database systems for maintaining data integrity and participant confidentiality, and implements management tools for performing data quality assurance and control. The KEEP Annual Data Report is a principal product of the program, providing epidemiologic data by region, ethnicity, and major socioeconomic strata. The KEEP Annual Data Report is published as a supplement to the *American Journal of Kidney Diseases* to coincide with NKF Spring Clinical Meetings and World Kidney Day. KEEP Annual Data Reports from previous years⁶⁻¹² are available, along with PowerPoint slides of the figures, on CD and on the NKF (www.kidney.org/news/keep/index.cfm) and AJKD (www.ajkd.org/content/supplements) websites.

GLOBAL EXPANSION OF KEEP

KEEP is recognized by the Centers for Disease Control and Prevention as a model of "Best Practice" in chronic disease screening. Recognized around the world for its effectiveness in identifying at-risk patients, KEEP is being replicated or emulated in several countries.¹³⁻¹⁵ In the United States, KEEP has enabled the NKF to identify and help address health disparities at the community level. Free to participants and conducted in English and Spanish, KEEP successfully reaches people most at risk, provides timely reporting

of their clinical status, and offers access to health care for those most in need.

KEEP has influenced the medical community and other kidney-related organizations worldwide. For example, the World Kidney Day committee requested a presentation regarding the world epidemic of hypertension and kidney disease, showcasing KEEP as an example of efforts to curtail this epidemic.¹⁶⁻²¹ A global CKD screening movement began, and the Kidney Disease Prevention Network was established. The first meeting, held in September 2009, included representatives from numerous countries currently conducting CKD detection programs. The mutual goal set by the World Health Organization and the Pan American Health Organization is to develop best practices for risk factors and CKD detection, including social marketing, data collection and analysis, patient and professional follow-up, government collaboration, and cost-effectiveness.

SUMMARY

KEEP clearly shows that targeted screening for kidney disease has a high yield for identifying people in the community at increased risk and detecting individuals with decreased kidney function.^{1,2,17} More importantly, KEEP is a screening and awareness program for the common soil of major chronic conditions, including obesity, diabetes, hypertension, CKD, and cardiovascular disease. The importance of early intervention in these chronic disease states has gained widespread recognition, helping KEEP grow in the past decade into an international program. Additionally, the versatility of the KEEP database enables researchers to work with the KEEP Steering Committee to conduct population-based epidemiologic analyses.²² From this information, the NKF and the global public health community can identify the need for future educational programs and match content to specific target audiences.

The goal of KEEP is not just to identify and measure illness parameters, but also to increase awareness of kidney disease risk and complications in physicians and patients to optimally influence care measures and clinical outcomes. The model for KEEP has emphasized volunteerism, community involvement, simplicity, multidisciplinary oversight, attention to safety, assiduous results reporting, repeated follow-up, and continuous improvement. These tenets, coupled with a focus on primary prevention, have produced the nation's only sustainable chronic disease screening program, which serves as a model for other national and global attempts aimed at controlling chronic illness.

ACKNOWLEDGEMENTS

The authors thank Chronic Disease Research Group colleagues Shane Nygaard, BA, for manuscript preparation and Nan Booth, MSW, MPH, ELS, for manuscript editing.

Support: The KEEP is a program of the NKF Inc and is supported by Amgen, Abbott, Siemens, Astellas, Fresenius Medical Care, Genzyme, LifeScan, Nephroceuticals, and Pfizer. Dr Whaley-Connell is supported by the Veteran's Affairs Career Development Award-2.

Financial Disclosure: Dr Collins has consulted with Amgen. The remaining authors declare that they have no relevant financial interests.

REFERENCES

1. Brown WW, Peters RM, Ohmit SE, et al. Early detection of kidney disease in community settings: the Kidney Early Evaluation Program (KEEP). *Am J Kidney Dis.* 2003;42:22-35.
2. Brown WW, Collins A, Chen SC, et al. Identification of persons at high risk for kidney disease via targeted screening: the NKF Kidney Early Evaluation Program. *Kidney Int Suppl.* 2003;83:S50-S55.
3. El Achkar TM, Ohmit SE, McCullough PA, et al. Higher prevalence of anemia with diabetes mellitus in moderate kidney insufficiency: the Kidney Early Evaluation Program. *Kidney Int.* 2005;67:1483-1488.
4. McGill JB, Brown WW, Chen SC, Collins AJ, Gannon MR. Kidney Early Evaluation Program (KEEP). Findings from a community screening program. *Diabetes Educ.* 2004;30:196-202, 206.
5. Vassalotti JA, Li S, McCullough PA, Bakris GL. Kidney Early Evaluation Program: a community-based screening approach to address disparities in chronic kidney disease. *Semin Nephrol.* 2010;30:66-73.
6. McCullough PA, Vassalotti JA, Collins AJ, Chen SC, Bakris GL. National Kidney Foundation's Kidney Early Evaluation Program (KEEP) Annual Data Report 2009: executive summary. *Am J Kidney Dis.* 2010;55(3) (suppl 2):S1-S3.
7. Bakris GL, McCullough PA, Collins AJ. Executive summary: Kidney Early Evaluation Program (KEEP) 2008 Annual Data Report. *Am J Kidney Dis.* 2009;53(4) (suppl 4):S1-S2.
8. Bakris G, Collins AJ. Executive summary: Kidney Early Evaluation Program (KEEP) 2007 Annual Data Report [erratum in *Am J Kidney Dis.* 2008;51(5):872-874]. *Am J Kidney Dis.* 2008;51(4) (suppl 2):S1-S2.
9. National Kidney Foundation. Kidney Early Evaluation Program Annual Data Report 2006. *Am J Kidney Dis.* 2007;49(3) (suppl 3):S1-S160.
10. National Kidney Foundation. Kidney Early Evaluation Program Annual Data Report 2005. *Am J Kidney Dis.* 2005;46(5) (suppl 3):S1-S158.
11. National Kidney Foundation. Kidney Early Evaluation Program Annual Data Report 2004. *Am J Kidney Dis.* 2005;45(3) (suppl 2):S1-S135.
12. National Kidney Foundation. Kidney Early Evaluation Program Annual Data Report 2003. *Am J Kidney Dis.* 2003;42(3) (suppl 4):S1-S60.
13. Mathew TH, Corso O, Ludlow M, et al. Screening for chronic kidney disease in Australia: a pilot study in the community and workplace. *Kidney Int Suppl.* 2010;116:S9-S16.
14. Obrador GT, García-García G, Villa AR, et al. Prevalence of chronic kidney disease in the Kidney Early Evaluation Program (KEEP) México and comparison with KEEP US. *Kidney Int Suppl.* 2010;116:S2-S8.
15. Takahashi S, Kazuyoshi O, Yanai M. The Kidney Early Evaluation Program (KEEP) in Japan: results from the initial screening period. *Kidney Int Suppl.* 2010;116:S17-S23.
16. McCullough PA, Jurkovitz CT, Pergola PE, et al. Independent components of chronic kidney disease as a cardiovascular risk state: results from the Kidney Early Evaluation Program (KEEP). *Arch Intern Med.* 2007;167:1122-1129.
17. Jurkovitz CT, Qiu Y, Wang C, Gilbertson DT, Brown WW. The Kidney Early Evaluation Program (KEEP): program design and demographic characteristics of the population. *Am J Kidney Dis.* 2008;51(suppl 2):S3-S12.
18. Rao MV, Qiu Y, Wang C, Bakris G. Hypertension and CKD: Kidney Early Evaluation Program (KEEP) and National Health and Nutrition Examination Survey (NHANES), 1999-2004. *Am J Kidney Dis.* 2008;51(suppl 2):S30-S37.
19. McCullough PA, Li S, Jurkovitz CT, et al. CKD and cardiovascular disease in screened high-risk volunteer and general populations: the Kidney Early Evaluation Program (KEEP) and National Health and Nutrition Examination Survey (NHANES) 1999-2004. *Am J Kidney Dis.* 2008;51(suppl 2):S38-S45.
20. Sarafidis PA, Li S, Chen SC, et al. Hypertension awareness, treatment, and control in chronic kidney disease. *Am J Med.* 2008;121:332-340.
21. Bakris GL, Ritz E. The message for World Kidney Day 2009: hypertension and kidney disease: a marriage that should be prevented. *Am J Nephrol.* 2009;30:95-98.
22. McCullough PA, Li S, Jurkovitz CT, et al. Chronic kidney disease, prevalence of premature cardiovascular disease, and relationship to short-term mortality. *Am Heart J.* 2008;156:277-283.