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Educational programs improve the preparation for dialysis and survival of patients with chronic kidney disease

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Preparation for end-stage renal disease (ESRD) is widely acknowledged to be suboptimal in the United States. We sought to determine whether participation in a kidney disease screening and education program resulted in improved ESRD preparation and survival in 595 adults who developed ESRD after participating in the National Kidney Foundation Kidney Early Evaluation Program (KEEP), a community-based screening and education program. Non-KEEP patients were selected from a national ESRD registry and matched to KEEP participants based on demographic and clinical characteristics. The main outcomes were pre-ESRD nephrologist care, placement of permanent vascular access, use of peritoneal dialysis, pre-emptive transplant wait listing, transplantation, and mortality after ESRD. Participation in KEEP was associated with significantly higher rates of pre-ESRD nephrologist care (76.0% vs. 69.3%), peritoneal dialysis (10.3% vs. 6.4%), pre-emptive transplant wait listing (24.2% vs. 17.1%), and transplantation (9.7% vs. 6.4%) but not with higher rates of permanent vascular access (23.4% vs. 20.1%). Participation in KEEP was associated with a lower risk for mortality (hazard ratio 0.80), but this was not statistically significant after adjusting for ESRD preparation. Thus, participation in a voluntary community kidney disease screening and education program was associated with higher rates of ESRD preparation and survival.

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Preparation for end-stage renal disease (ESRD), a condition affecting more than 600,000 Americans, is widely acknowledged to be suboptimal.^{1,2} Despite dissemination of practice guidelines for chronic kidney disease (CKD) and a Medicare benefit supporting pre-ESRD education, many patients experience care that falls short of recommendations. For example, more than 80% of patients who start hemodialysis do so with a central venous catheter rather than an arteriovenous fistula or graft.³ Approximately 30–60% of potentially eligible patients do not receive information about peritoneal dialysis, a type of home dialysis, or transplantation before ESRD;^{4–6} as a result, fewer than 10% of patients receive these treatment modalities at the onset of ESRD.³ Suboptimal preparation for ESRD contributes to high mortality in the first year after dialysis initiation and excess costs.⁷

Suboptimal preparation for ESRD reflects deficiencies in one or more processes of care: identification of patients at high risk of progression, education about ESRD treatment options, and timely referral, evaluation, and surgery for dialysis access placement and transplantation. Several lines of evidence, including two small trials, suggest that education programs for patients with advanced CKD increase uptake of peritoneal dialysis and may improve survival.^{8–11} Unfortunately, low awareness of CKD, including among patients with advanced CKD,¹² may limit the impact of these programs. Screening for CKD is one approach to increase awareness; however, universal or even targeted CKD screening programs remain controversial owing to the lack of evidence of benefit.¹³ Yet, most studies of CKD screening have not considered the potential effects that screening may have on ESRD preparation and outcomes nor have any studies to our knowledge assessed the effects of a combined CKD screening and education program.

We assessed ESRD preparation and survival among participants in the Kidney Early Evaluation Program (KEEP),

a national community-based kidney disease screening and education program, and matched non-KEEP patients from a national registry of individuals who developed ESRD between 2005 and 2010. We hypothesized that KEEP participants would have higher rates of preparation for ESRD, and that a more favorable profile of ESRD preparation among KEEP participants would largely explain ESRD mortality differences between KEEP participants and matched non-KEEP patients.

RESULTS

Participant characteristics

KEEP participants who progressed to ESRD had a mean age of 63.2 ± 13.9 years, 47.2% were men, 42.2% were white, and 57.5% had diabetes. Before matching, there were notable imbalances between KEEP participants and non-KEEP patients with ESRD (Table 1). For example, KEEP participants were more likely to be non-white and female individuals and less likely to have functional status limitations (standardized differences $>10\%$). After matching, there were no measured characteristics that were significantly imbalanced (Table 1 and (Supplementary Table 1 online)).

ESRD preparation

KEEP participants were more likely to see a nephrologist before ESRD (76.0% vs. 69.3%, $P < 0.01$), more likely to use peritoneal dialysis versus hemodialysis (10.3% vs. 6.4%, $P < 0.01$), more likely to be placed on the transplant waiting list before ESRD (24.2% vs. 17.1%, $P < 0.01$), and more likely to undergo transplantation (9.7% vs. 6.4%, $P < 0.01$), although they were not more likely to undergo pre-emptive transplantation (1.7% vs. 1.5%, $P = 0.7$) (Table 2). KEEP participants were slightly more likely to use an arteriovenous fistula or graft (23.4% vs. 20.1%, $P = 0.09$) at the first outpatient dialysis and slightly more likely to have a mature or maturing arteriovenous fistula or graft at the first outpatient dialysis (44.0% vs. 39.6%, $P = 0.06$), but these differences were not statistically significant.

ESRD mortality

Over a median follow-up of 1.6 years after the onset of ESRD, there were 175 deaths among KEEP participants and 1037 deaths among non-KEEP patients (hazard ratio, 0.80; 95% confidence interval: 0.68–0.94) (Table 3). The association between KEEP participation and mortality was similar when we included all adults with ESRD and adjusted for variables

Table 1 | Baseline characteristics of KEEP participants with ESRD and non-KEEP patients before and after matching

	Before matching			After matching		
	Non-KEEP	KEEP	Standardized difference	Non-KEEP	KEEP	Standardized difference
<i>N</i>	290,252	595		2975	595	
Mean age (years)	62.3	63.2	6.1	63.2	63.2	0.0
<i>Race</i>						
White race (%)	58.3	42.2	−32.6	43.0	42.2	−0.8
Black race (%)	35.6	43.2	15.6	42.8	43.2	0.8
Other race (%)	6.1	14.6	28.2	14.2	14.6	1.1
Hispanic ethnicity (%)	11.8	9.1	−8.9	9.8	9.1	−2.5
Male (%)	55.7	47.2	−17.1	47.8	47.2	−1.2
Full- or part-time employment (%)	11.4	11.9	1.6	11.2	11.9	2.3
<i>Incidence year</i>						
2005 (%)	9.7	6.7	−11.0	7.3	6.9	−1.6
2006 (%)	17.7	18.4	1.8	18.8	19	0.5
2007 (%)	17.8	14.9	−7.8	15.2	15	−0.6
2008 (%)	17.9	17.7	−0.5	17.2	17.3	0.3
2009 (%)	18.5	25.1	16.0	24.5	24.5	0.0
2010 (%)	18.4	17.1	−3.4	17.0	17.3	0.8
Medicaid coverage (%)	7.4	7.1	−1.2	7.1	7.1	0.0
Diabetes (%)	52.9	57.5	9.3	60.1	57.5	−5.3
Coronary artery disease (%)	19.4	17.5	−4.9	17.2	17.5	0.8
Peripheral arterial disease (%)	12.6	9.8	−8.9	9.4	9.8	1.4
Stroke (%)	9.3	10.4	3.7	10.7	10.4	−1.0
Congestive heart failure (%)	31.5	28.9	−5.7	29.0	28.9	−0.2
Chronic lung disease (%)	8.4	6.1	−8.9	5.6	6.1	2.1
Cancer (%)	7.1	6.4	−2.8	5.8	6.4	2.5
Unable to walk (%)	6.7	2.7	−19.0	2.2	2.7	3.2
Unable to transfer (%)	3.4	1.2	−14.7	0.9	1.2	2.9
Needs assistance in activities of daily living (%)	11	7.7	−11.4	7.3	7.7	1.5
Morbid obesity (%)	9.0	9.0	0	9.4	9.0	−1.4
Alcohol dependence (%)	1.7	0.7	−9.6	0.7	0.7	−0.4
Drug dependence (%)	1.6	0.5	−10.4	0.5	0.5	−0.6

Abbreviations: ESRD, end-stage renal disease; KEEP, Kidney Early Evaluation Program.

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