AJKD
Original Investigation

Effects of a Nationwide Predialysis Educational Program on Modality Choice, Vascular Access, and Patient Outcomes

Eduardo Lacson Jr, MD, MPH, Weiling Wang, MS, Cari DeVries, Keith Leste, MA, Raymond M. Hakim, MD, PhD, Michael Lazarus, MD, and Joseph Pulliam, MD

Background: Patients' education about transplant, hemodialysis (HD), peritoneal dialysis (PD), and conservative care often is provided by nephrologists as needed and occurs as time allows.

Study Design: Quality improvement report.

Setting & Participants: Attendees of a national treatment options program (TOPs) who initiated long-term dialysis therapy (median, 3.4 months) at Fresenius Medical Care, North America facilities throughout 2008 were compared with period-prevalent incident patients receiving usual care.

Quality Improvement Plan: Standardized predialysis treatment options education.

Outcomes: Rates of opting for PD modality, arteriovenous HD access at initiation, and early (90-day) mortality risk.

Measurements: Logistic regression (for choice of PD and HD access type) and Cox models (for early mortality) were constructed, including a 1:1 matched cohort. A post hoc sensitivity analysis also compared a propensity score–matched cohort.

Results: 3,165 TOPs attendees (10.5% of 30,217 incident patients admitted between January 1 and December 31, 2008), were younger, more likely to be white, and had slightly larger body surface area. The unadjusted OR for TOPs attendees for selecting PD therapy was 8.45 (95% CI, 7.63-9.37) with a case-mix plus laboratory–adjusted OR of 5.13 (95% CI, 3.58-7.35). For patients who opted for in-center HD therapy, the OR was 2.14 (95% CI, 1.96-2.33) and adjusted OR was 2.06 (95% CI, 1.88-2.26) for starting with a fistula or graft. The unadjusted early mortality HR was 0.51 (95% CI, 0.43-0.60) and case-mix plus laboratory–adjusted adjusted HR was 0.61 (95% CI, 0.50-0.74) for TOPs attendees (all outcomes, $P < 0.001$). These results were consistent in the 1:1 matched analysis and propensity score–matched analysis.

Limitations: It is possible that physicians who referred to these programs were more likely to prescribe PD therapy or place arteriovenous accesses. Motivated, treatment-adherent patients (who would have better outcomes) may have self-selected to attend education sessions.

Conclusion: Attending an options class predialysis was associated with more frequent selection of home dialysis, fewer tunneled HD catheters, and lower mortality risk during the first 90 days of dialysis therapy.
Am J Kidney Dis. 58(2):235-242.

INDEX WORDS: Dialysis; education; end-stage renal disease (ESRD); chronic kidney disease (CKD); quality improvement.

Editorial, p. 160

The decrease in incidence and prevalence of home dialysis in the United States during the past 20 years has been discussed in a recent in-depth review.[1] This decrease has occurred despite data showing improving outcomes,[1,2] higher patient satisfaction,[3] lower overall cost with peritoneal dialysis (PD) therapy,[4] and a perception by US nephrologists that home therapy is underused.[5] Some factors that may explain this decrease include a lack of nephrology fellowship home dialysis training, the availability of many easily accessed outpatient hemodialysis (HD) facilities, physician reimbursement disincentives, and inadequate patient education about home dialysis therapies.[1] However, it is difficult to link cause with effect.

Nevertheless, the importance of providing predialysis treatment options education to patients and their families has been stressed in many recent publications[6-10] and is believed to be the vital first step to increase the percentage of US patients receiving home dialysis. With this vision, Fresenius Medical Care, North America (FMCNA), operating more than 1,700 facilities and providing dialysis to 124,000 patients (~35% of all US dialysis patients), conceptualized a quality improvement initiative to educate predialysis patients. In August 2006, a nationwide treatment options education program (TOPs) was initiated to provide unbiased treatment options education to patients with chronic kidney disease (CKD) and their

From Fresenius Medical Care, North America, Waltham, MA.

Received November 30, 2010. Accepted in revised form April 1, 2011. Originally published online June 13, 2011.

Address correspondence to Eduardo Lacson Jr, MD, MPH, Clinical Sciences, Epidemiology, and Research, Fresenius Medical Care, North America, 920 Winter St, Waltham, MA 02451-1457. E-mail: elacsonj@fmc-na.com

0272-6386/$36.00
doi:10.1053/j.ajkd.2011.04.015

families about kidney transplant, in-center HD, home dialysis (PD and home HD), and conservative therapy.

METHODS

Program Structure

Three months before program initiation, FMCNA management selected TOPs leaders and class locations. These personnel were responsible for organizing and conducting a minimum of 1 class per month, as well all data entry and submission. TOPs leaders were trained before program initiation, stressing the need for balanced and nonbiased presentations. Monthly conference calls were conducted to review questions and reinforce training.

In the next year and a half, more than 300 TOPs leaders eventually were required to establish the program throughout all geographic areas within FMCNA. Fifty-five percent of TOPs leaders were home program nurses, 13% were full-time TOPs leaders, and the other 32% included social workers, dieticians, and facility clinical managers. Patient teaching materials were selected regionally in consultation with local nephrologists from standardized readily available materials. The TOPs is intended to be a multiple-touch program with initial education completed in a single group class session, then, with patient consent, followed up by contact at 30, 90, and 180 days thereafter to: (1) review treatment options; (2) inquire about each patient's kidney function/status and, if appropriate, dialysis access planning; and (3) provide feedback to the referring physician. Details about the program are included in Item S1 (available as online supplementary material).

Physician Notification

Program structure and intent were communicated to local nephrologists in person and in writing in each of FMCNA's 300 geographic areas. Class times and locations were altered based on physician input. In addition, each physician had the opportunity to review the content. However, only minor changes in format occurred because the material typically was copyright protected (see Item S1). Reminders of upcoming classes and locations were provided regularly to nephrology offices.

Data Collection

During each class, TOPs leaders presented patients with a Health Information Portability and Accountability Act (HIPAA)-compliant form to permit follow-up contact and data were collected, including demographic information and the physician's name. A ranking of modality preference was obtained immediately after the class; however, laboratory data, medications, comorbid conditions, or medical history during this predialysis period was not obtained.

TOPs leaders entered data electronically in the TOPs database after class sessions. Attendee demographics were matched monthly between the TOPs database and FMCNA admissions to determine initial dialysis modality and first dialysis date according to Centers for Medicare & Medicaid Services Form 2728. The time between attending a class and starting dialysis therapy was not predictable. Because of the database size, individual review of patient comorbid conditions was beyond the scope of this study. It was impossible to determine which TOPs participants had received a preemptive kidney transplant or were in the process of a transplant workup because no accessible information was available to the investigators for this particular modality.

By 2008, TOPs had reached a national scope, such that it was possible to conduct a focused outcome analysis. In 2008, demographic characteristics were collected from incident patients at the time of admission to FMCNA to include age, sex, race, diagnosis of diabetes mellitus (DM), location (based on the FMCNA area designation), dialysis access type, and body surface area (BSA; calculated from height and the mean of postdialysis weight within the first 30 days). Each new patient's first-ever monthly laboratory results for key indicators (albumin, hemoglobin, phosphorus, and weekly standardized Kt/V) were collated. Dialysis modality was recorded at baseline. Before dialysis therapy initiation, TOPs attendees were identified and compared with the rest of the incident patients. Primary outcomes of interest included modality selection and percentage of catheters at baseline for patients who opted for HD therapy and 90-day mortality (combined end point of death and withdrawal from dialysis therapy). Secondary outcomes included a sustainability evaluation at 90 days for the prevalence of PD therapy and vascular access type.

Statistical Analyses

Descriptive information was compared using t tests or χ^2 tests when appropriate. For the subset of incident patients admitted to FMCNA in 2008, Kaplan-Meier survival curves were constructed to illustrate differences in survival between cohorts. The log-rank test was used to test for significant differences in 90-day survival between cohorts. Logistic regression models were constructed to determine whether TOPs attendance led to significant differences in the odds ratio (OR) for choosing PD therapy and noncatheter access (ie, permanent arteriovenous fistula or graft) for patients who opted for HD therapy. These models included unadjusted, case-mix–adjusted (ie, for age, sex, race, DM, number of comorbidity diagnoses, and BSA), and finally, the case-mix plus laboratory–adjusted (ie, adding albumin, hemoglobin, and phosphorus values) versions. Weekly Kt/V was excluded as a laboratory adjuster because it was not different between cohorts. Finally, Cox proportional hazard models were constructed to determine hazard ratios (HRs) for mortality, similarly presented in 3 ways: unadjusted, case-mix adjusted, and case-mix plus laboratory adjusted. To diminish potential selection bias, all analyses were repeated in a 1:1 matched cohort based on age, sex, race, presence or absence of physician-diagnosed DM, and geographic area. We were able to match 2,800 TOPs attendees from the original cohort of 3,165 patients (88%) with 2,800 controls from 27,052 control patients. In the matched analysis, only BSA and number of comorbid conditions were unbalanced and used for additional case-mix adjustment.

Finally, post hoc, 2 sensitivity analyses were performed: (1) the primary analyses were repeated in a combined propensity score plus area–matched cohort of patients, for which propensity score was obtained from a logistic regression model that included determinant variables for age, sex, race, presence or absence of DM, BSA, number of comorbidity diagnoses, and albumin, hemoglobin, and phosphorus values (all case-mix and laboratory variables used in primary analyses were used in the second-stage adjusted models in the propensity score–matched cohort); and (2) a mixed-effects model for both choice of PD therapy and HD access type were constructed, adding insurance status at dialysis therapy initiation (coded as Medicare, commercial, or other) as a fixed effect and dialysis facility as a random effect. Analyses were performed using SAS, version 9.2 or higher (SAS Institute, Inc; www.sas.com).

RESULTS

Modality Preferences and Subsequent Modality Selection

The TOPs started in August 2006, and through December 2008, a total of 20,057 patients with CKD attended a TOPs class; 18,230 (90.8%) attendees were referred by nephrologists; 464 (2.3%), by primary

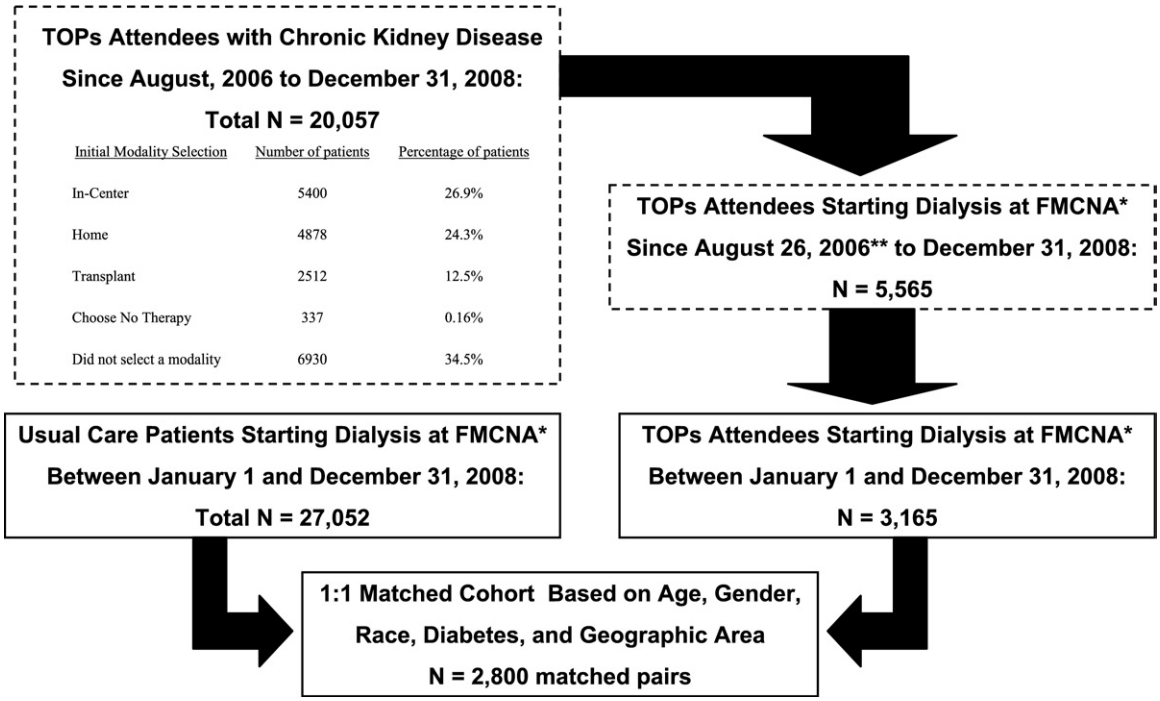

Figure 1. Population flow chart with results of an immediate posteducation session survey of which treatment modality the attendees would choose for end-stage renal disease at that time. The primary analyses compared incident patients followed up with usual care against treatment options program (TOPs) attendees from patients who initiated dialysis therapy between January 1 and December 31, 2008, first including all patients and then in a 1:1 matched cohort sample. *FMCNA, Fresenius Medical Care, North America; **the first known TOPs attendee initiated dialysis therapy on this date.

care physicians; 70 (0.03%), by a physician other than nephrologist or primary care physician; and 1,293 (6.4%), by a nonphysician or were self-referred. Attendees were asked to provide their modality preference at the conclusion of the session, with results shown in Fig 1. Home therapy was selected as the first treatment choice for 24.3% of patients, 26.9% selected in-center HD therapy, and 34.5% of attendees were undecided. Kidney transplant was the first choice in 12.5% of patients.

Between August 2006 and December 2008, a total of 5,565 (27.7%) of 20,057 TOPs-educated patients started dialysis therapy in an FMCNA facility. During that same period, ~75,000 patients who did not receive TOPs education initiated dialysis therapy in an FMCNA facility. Twenty-five percent of TOPs-educated patients began any home dialysis therapy, whereas 3.3% of patients who did not attend TOPs started home dialysis therapy, although the home modality was predominantly PD.

Focused Outcome Analysis

By 2008, TOPs had reached a national scope such that it was possible to conduct a focused outcome analysis. All new in-center HD and home PD patients admitted within 15 days of their first-ever dialysis treatment were identified as either TOPs educated or non–TOPs educated. Home HD patients were not included because there were too few to provide meaningful analysis. Demographic information, BSA, vascular access type, dialysis modality, and first-monthly laboratory results after starting dialysis therapy were collected. Mortality (combined end point of death and withdrawal from dialysis therapy) was tracked for the first 90 days of dialysis therapy.

Characteristics of the subset of 30,217 incident patients admitted between January 1 and December 31, 2008, are listed in Table 1. TOPs attendees were younger (62.2 vs 63.0 years; $P = 0.008$), more likely to be white (72% vs 65%; $P < 0.001$), and had slightly larger BSA (1.89 vs 1.87 m^2; $P < 0.001$) at baseline. TOPs attendees' first session occurred at a mean of 5.5 ± 5.8 (median, 3.4) months before the initiation of dialysis therapy, which was maintained in the matched cohort sample.

Table 1 also lists characteristics of 2,800 TOPs patients we were able to match to 2,800 non-TOPs patients based on age, sex, race, DM, and geographic location. Overall, matched TOPs attendees had slightly higher albumin, hemoglobin, and phosphorus levels during their first 30 days of dialysis therapy. Importantly, >24% of patients who attended TOPs in the original cohort and the matched cohort consistently opted for PD therapy compared with ≤4% of non–

Table 1. Characteristics of Incident Patients

Characteristics	All	TOPs	Non-TOPs	Matched TOPs	Matched Controls
No. of patients	30,217	3,165	27,052	2,800	2,800
Peritoneal dialysis (%)	5.9	24.5	3.7	24.0	4.0
Age (y)	62.9 ± 15.4	62.2[a] ± 14.7	63.0 ± 15.5	63.4 ± 13.6	63.5 ± 13.5
Men (%)	56.5	54.7	56.7	56.6	56.6
Race (%)					
White	65.4	72.5[b]	64.6	76.2	76.2
Black	29.2	23.3	30.0	21.4	21.4
Other	5.3	4.2	5.4	2.4	2.4
Diabetes (%)	54.2	53.2	54.3	54.4	54.4
BSA (m^2)	1.87 ± 0.27	1.89[a] ± 0.28	1.87 ± 0.27	1.90[a] ± 0.27	1.87 ± 0.28
No. of comorbid conditions	3.9 ± 5.0	3.7[c] ± 4.9	3.9 ± 5.0	3.7[a] ± 4.9	4.2 ± 5.2
Vascular access (%)					
Any catheter	77.4	63.4[b]	78.7	63.2[b]	75.8
Graft	4.1	5.9	3.9	5.6	4.2
Fistula	14.5	27.4	13.3	27.8	15.3
Other/unknown	4.0	3.3	4.0	3.3	4.7
Albumin (g/dL)	3.46 ± 0.53	3.62 ± 0.52[b]	3.44 ± 0.53	3.62 ± 0.51[b]	3.45 ± 0.56
Hemoglobin (g/dL)	10.22 ± 1.35	10.36 ± 1.39[b]	10.20 ± 1.35	10.36 ± 1.40[a]	10.28 ± 1.40
Phosphorus (mg/dL)	4.75 ± 1.48	4.93 ± 1.47[b]	4.73 ± 1.48	4.92 ± 1.47[b]	4.73 ± 1.49
Weekly stdKt/V	2.22 ± 0.33	2.21 ± 0.35	2.22 ± 0.33	2.22 ± 0.35	2.22 ± 0.32

Note: Patients were admitted to Fresenius Medical Care, North America between January 1 and December 31, 2008. Values are shown as mean ± standard deviation or percentage. Vascular access percentages were determined based on patients who opted for hemodialysis therapy. The 1:1 matched cohorts of patients were selected from the larger group of TOPs and non-TOPs patients. Conversion factors for units: albumin and hemoglobin in g/dL to g/L, ×10.

Abbreviations: BSA, body surface area; TOPs, treatment options program; stdKt/V, standardized Kt/V.

[a]$P < 0.01$; [b]$P < 0.001$; [c]$P = 0.01$ comparing TOPs and non-TOPs patients.

TOPs attendees, similar to the overall program data reviewed from 2006-2008. Logistic regression models to determine selection of PD as the modality of first choice indicated an unadjusted OR for TOPs attendees of 8.45 (95% confidence interval [CI], 7.63-9.37) relative to non-TOPs patients, with a case-mix plus laboratory–adjusted OR of 5.13 (95% CI, 3.58-7.35). For patients who opted for in-center HD therapy, the relative risk for having a fistula or graft on initiating dialysis therapy was 2.14 (95% CI, 1.96-2.33), and the case-mix plus laboratory–adjusted OR was 2.06 (95% CI, 1.88-2.26), all $P < 0.001$. Results were similar in the matched cohort of patients, as listed in Table 2. The sensitivity analysis incorporating insurance status and dialysis facility to the case-mix plus laboratory–adjusted models also had similar results (data not shown).

Patient survival at 90 days was significantly better for TOPs attendees, whether comparing the entire cohort or the matched cohort of patients, as shown in Fig 2. HRs for death were lower for TOPs attendees and remained so even after adjustment for case-mix and laboratory values (reference, non-TOPs patients), shown in Fig 3. The unadjusted HR was 0.51 (95% CI, 0.43-0.60), and case-mix plus laboratory–adjusted HR was 0.61 (95% CI, 0.50-0.74) for TOPs attendees, with all $P < 0.001$. These results were confirmed in the 1:1 matched analysis. Post hoc sensitivity analyses comparing cohorts matched by propensity score and area had ~500 fewer patients in each arm, but results

Table 2. Odds Ratios Comparing Modality Choice and Vascular Access Type for Incident Patients

Baseline Outcomes	All TOPs Patients	Matched TOPs Cohort[a]
Peritoneal dialysis		
Unadjusted	8.45 (7.63-9.37)	7.51 (6.10-9.24)
Case-mix adjusted	5.51 (3.85-7.88)	8.37 (3.54-19.78)
Case-mix + laboratory adjusted	5.13 (3.58-7.35)	7.73 (3.26-18.32)
Noncatheter access		
Unadjusted	2.14 (1.96-2.33)	1.82 (1.61-2.06)
Case-mix adjusted	2.17 (1.99-2.37)	1.83 (1.61-2.07)
Case-mix + laboratory adjusted	2.06 (1.88-2.26)	1.73 (1.51-1.97)

Note: Values shown are odds ratios (95% confidence intervals); reference groups are non-TOPs attendees (odds ratio, 1.00); All values significant at $P < 0.001$. The matched column is a subgroup of 1:1 matched (by age, sex, race, diabetes, and area) cohort sample.

Abbreviation: TOPs, treatment options program.

[a]For the matched cohort, factors used for case-mix adjustment were body surface area and number of comorbidity diagnoses.

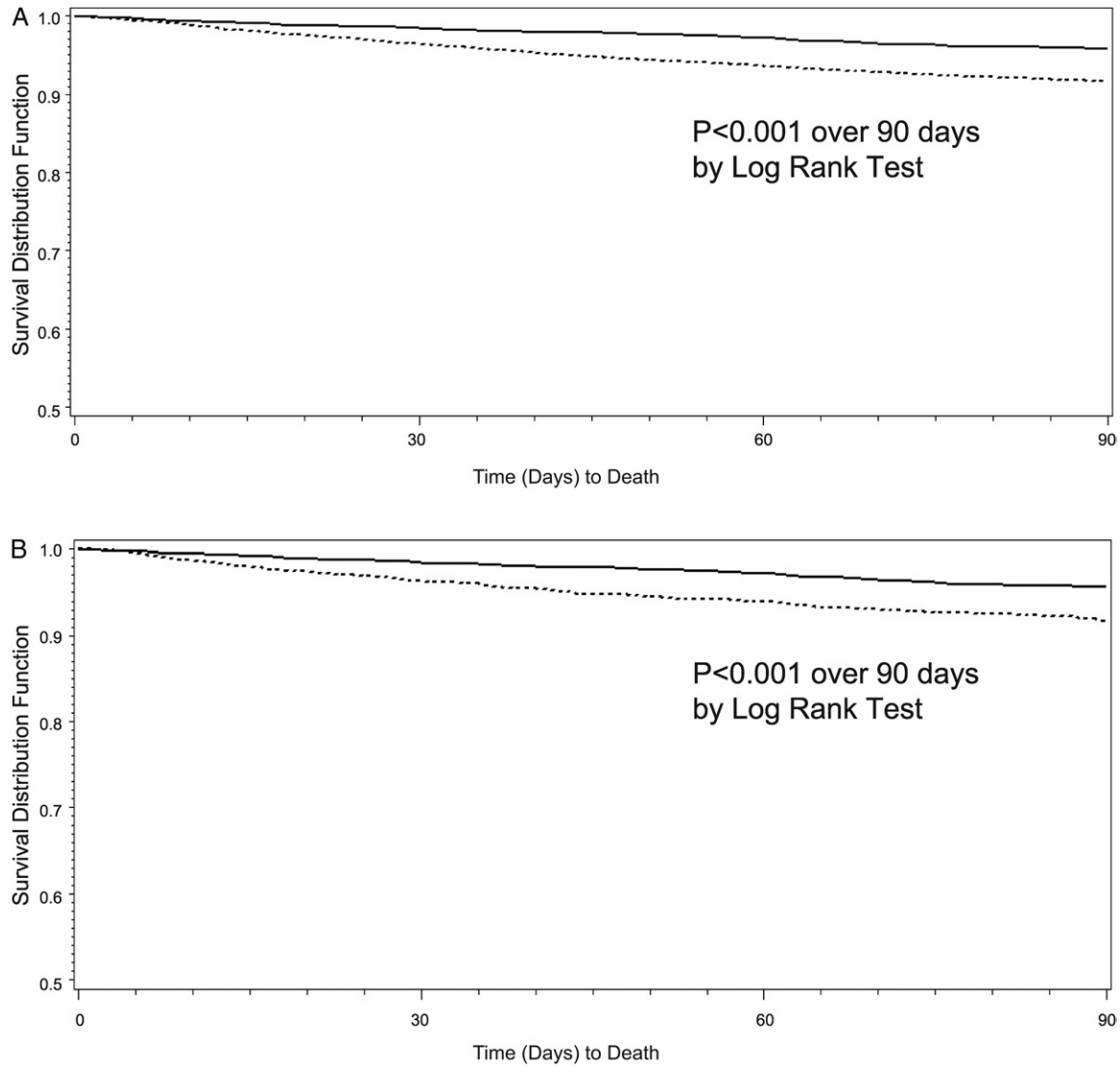

Figure 2. Kaplan-Meier survival curves comparing treatment options program (TOPs; solid line) and non-TOPs (broken line) patients in the overall cohort ([A] 27,052 non-TOPs and 3,165 TOPs patients) and cohort matched 1:1 by age, sex, race, and diabetes, and area ([B] 2,800 non-TOPs and 2,800 TOPs patients).

were consistent with the original analysis, with a case-mix plus laboratory–adjusted mortality HR for TOPs attendees of 0.60 (95% CI, 0.47-0.78), with $P < 0.001$. The case-mix plus laboratory–adjusted OR for avoidance of catheter use similarly was 1.97 (95% CI, 1.73-2.25), whereas the OR for choosing PD modality was 4.49 (95% CI, 2.26-8.93), both $P < 0.001$.

From 25,007 incident patients who survived their first 90 days on dialysis therapy, the distribution of modality as of the 91st day is shown in Fig 4. Of note, 675 (92.8%) TOPs attendees who initially chose PD were still on PD therapy, with 3 patients (0.4%) shifting to home HD therapy. In addition, 116 (5.4%) of 2,154 TOPs attendees who initially started on in-center HD therapy switched to PD therapy on or before their 90th day. In contrast, only 430 (2.0%) of 21,207 surviving non-TOPs patients who initiated in-center HD therapy switched to PD therapy on or before their 90th day ($P < 0.001$). TOPs attendees' unadjusted OR was 7.79 (95% CI, 7.00-8.67) for being on PD therapy at day 90, decreasing to 4.69 (95% CI, 3.24-6.79) after case-mix plus laboratory adjustment, both $P < 0.001$.

Of the subgroup of patients who started HD therapy using a tunneled HD catheter, 13.1% (n = 178) of 1,355 TOPs patients had the catheter converted to a graft or fistula compared with 10.2% (1,673) of 16,424 non-TOPs HD patients. Of 2,090 TOPs attendees treated using HD as of day 90, a total of 1,220 (58.4%) were dialyzed using catheters (includes patients for whom noncatheter accesses failed), whereas the corresponding percentage from the 20,838 non-

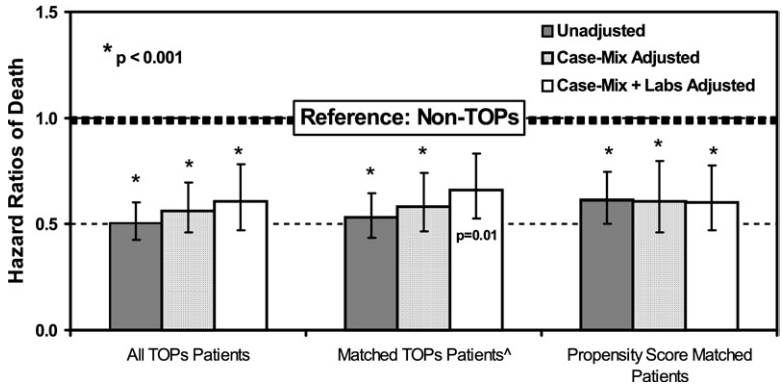

Figure 3. Cox proportional hazard models for mortality in incident patients during their first 90 days, comparing treatment options program (TOPs) and non-TOPs attendees (including the sensitivity analysis in a propensity score–matched cohort with fewer patients). Relative risk of mortality is shown; non-TOPs attendees make up the reference group. ^Additional case-mix adjustment for body surface area and number of comorbid conditions.

TOPs patients on HD therapy as of day 90 was 71.9% (n = 14,989; $P < 0.001$). The unadjusted relative risk for having a permanent access by day 90 was 2.02 (95% CI, 1.84-2.22) for TOPs attendees, with an OR of 1.92 (95% CI, 1.74-2.11) after case-mix plus laboratory adjustment, both $P < 0.001$.

DISCUSSION

To our knowledge, this is the largest report of the structure, implementation, epidemiology, and outcomes of a nationwide predialysis education program. It also is the largest of its kind to link short-term dialysis therapy outcomes with attendance of the program before the onset of end-stage renal disease (ESRD). One of every 4 patients who attended the TOPs session selected a home therapy (PD) as the initial modality and more TOPs attendees shifted from in-center HD to PD therapy within the first 90 days of dialysis therapy compared with non-TOPs patients.

The impact of predialysis education on increasing the number of patients planning to choose home therapies has been tested in a single-center randomized clinical trial.[11] Furthermore, similarly increased use of PD, lower catheter rate, and lower mortality were achieved using a predialysis multidisciplinary education program in Taiwan.[12] Better mortality has been observed for longer than our 90-day observation period in these prior studies.[9,12] This report builds on such experience and supports providing widely-based predialysis patients with CKD and family members with an opportunity to attend sessions offering ESRD therapy options education.

As shown by the National Pre-ESRD Education Initiative,[13,14] predialysis education results in a 2- to

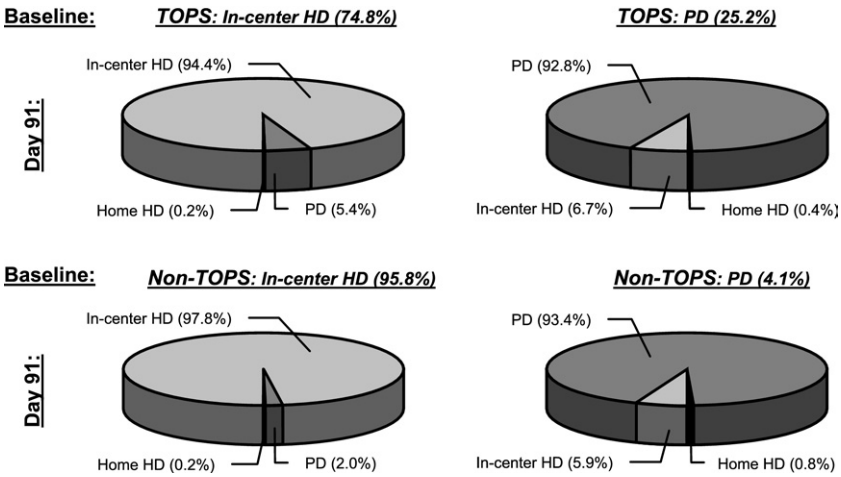

Figure 4. Modality distribution at the end of 90 days comparing treatment options program (TOPs; top charts) and non-TOPs attendees (bottom charts) for active patients as of day 91. The charts on the right-hand side indicate modality after 90 days for those who initially choose in-center hemodialysis (HD) therapy, whereas those on the left-hand side indicate results for those who in initially opted for peritoneal dialysis (PD) therapy. For comparison, baseline values are given in the text above each chart.

3-fold increase in the incidence rate of patients initiating dialysis on home therapy compared with the US home therapy incidence. The home therapy incidence rate we observed was 6 times higher for TOPs patients than for non-TOPs patients. Although 25% of TOPs patients starting on a home therapy is a marked increase over the 4% incidence of non-TOPs patients, it is important to put this increase in perspective and recognize the extensive literature showing that more than half (and in some reports, more than three quarters) of all patients are suitable candidates for home therapy.[15-17] Certainly, there is ample opportunity to expand the percentage of patients receiving home therapy.

American nephrologists consider patient choice as the critical element in choosing a dialysis modality.[5] The need to educate patients and give them the opportunity to be involved in making appropriate choices is obvious and occurs, yet even in patients seen by nephrologists, patient knowledge about ESRD therapeutic options is not extensive.[6] Nephrologists must understand the possible barriers between the knowledge provided to patients and what patients recall. Certainly, physician time constraints combined with the complex and fragmented care to patients with CKD represent 2 of these barriers.[6]

TOPs is not a solution to the fragmentation of CKD care, but an attempt to provide dialysis treatment option education classes for patients and families across a large geographic area. The observed increase in incident home patients was predicted, but the magnitude of the increase, coupled with a decrease in incident HD catheters and a decrease in the first-90-day mortality, was not anticipated.

Everyone involved with dialysis care is focused on decreasing first-90-day mortality and the number of incident patients with HD catheters. It would appear that patient education before dialysis therapy might provide a way to positively influence these 2 vexing issues. As TOPs moves forward, we will focus on expanding the educational offering with regular follow-up to address undecided patients and provide information about dialysis access and dietary information.

There are limitations to the present study. From the onset, the intent was to make options education available to a large number of pre-ESRD patients by creating a sustainable program across a large dialysis organization. Data collection did not include CKD stage, laboratory results, predialysis medical intervention, and distance from the patients' home to the dialysis center, and the interval between the TOPs education session and the start of dialysis therapy was not recorded for non-FMCNA patients. Although transplant education was provided during TOPs, there was no mechanism to track patients who may have undergone a pre-emptive transplant or patients who did not initiate dialysis therapy at FMCNA. Given the observational design of the study, we cannot prove causation, hence the link between pre-education and choice of home dialysis modality, albeit strong, remains circumstantial. It is possible that physicians (>90% nephrologists) who referred patients to these programs had a bias for home therapy, provided more timely referral for arteriovenous fistulas or grafts, and provided overall better care. It also is possible that patients who agreed to come to pre-ESRD education sessions were more likely to select home dialysis therapy and would more likely agree to an early arteriovenous fistula and adhere to medical regimens. Lack of information about pre-ESRD care beyond TOPs education may have confounded the associated dialysis outcomes. Finally, we reported only first-90-day survival and have not yet calculated if the survival advantage will carry on during longer follow-up, if it is due to the selection of healthier motivated patients or a lower rate of HD catheters, or if the information obtained helped motivate patients to maximize therapy and improve their health status.

In summary, this study shows that attending a standardized treatment options class predialysis, along with periodic follow-up, was associated with more frequent selection of home dialysis therapy, fewer tunneled HD catheters, and lower mortality risk during the first 90 days of dialysis therapy. In the setting of the new Medicare prospective payment system, there are potential benefits for the dialysis provider because option education appears to be a key determinant for the sustainability and growth of home therapy, decrease in HD catheter use, and improvement in early mortality.[18] Independent of this particular program, results here support the notion that providing treatment option education to patients before the start of dialysis therapy needs to be a priority for all involved with dialysis care.

ACKNOWLEDGEMENTS

We thank the FMCNA staff who have and continue to participate in TOPs and Carol McKenna and Allison Baginski for assistance with figure preparation.

Support: All authors are full-time employees of FMCNA.

Financial Disclosure: The authors declare that they have no other relevant financial interests.

SUPPLEMENTARY MATERIAL

Item S1: Additional information for TOPs.

Note: The supplementary material accompanying this article (doi:10.1053/j.ajkd.2011.04.015) is available at www.ajkd.org.

REFERENCES

1. Khawar O, Kalantar-Zadeh K, Lo WK, Johnson D, Mehrotra R. Is the declining use of long-term peritoneal dialysis justified by outcome data? *Clin J Am Soc Nephrol.* 2007;2:1317-1328.
2. Mehrotra R, Kermah D, Fried L, et al. Chronic peritoneal dialysis in the United States: declining utilization despite improving outcomes. *J Am Soc Nephrol.* 2007;18:2781-2788.
3. Rubin HR, Fink NE, Plantinga LC, Sadler JH, Kliger AS, Powe NR. Patient ratings of dialysis care with peritoneal dialysis vs. hemodialysis. *JAMA*. 2004;291:697-703.
4. Shih YC, Guo A, Just PM, Mujais S. Impact of initial dialysis modality and modality switches on Medicare expenditures of end-stage renal disease patients. *Kidney Int.* 2005;68:319-329.
5. Mendelssohn DC, Mullaney SR, Jung B, et al. What do American nephrologists think about dialysis modality selection? *Am J Kidney Dis*. 2001;37:22-29.
6. Finkelstein FO, Story K, Firanek C, et al. Perceived knowledge among patients cared for by nephrologists about chronic kidney disease and end-stage renal disease therapies. *Kidney Int.* 2008;74:1178-1184.
7. Golper TA. Predialysis nephrology care improves dialysis outcomes: now what? Or chapter two. *Clin J Am Soc Nephrol*. 2007;2:143-145.
8. Robinson K. Does pre-ESRD education make a difference: the patients' perspective. *Dial Transplant.* 2001;30:564-567.
9. Devins GM, Medelssohn DC, Barre PE, et al. Predialysis psychoeducational intervention extends survival in CKD: a 20-year follow-up. *Am J Kidney Dis.* 2005;46:1088-1098.
10. Devins FM, Mendelssohn DC, Barre PE, et al. Predialysis psychoeducational intervention and coping styles influence time to dialysis in chronic kidney disease. *Am J Kidney Dis.* 2003;42:693-703.
11. Manns BJ, Taub K, Vanderstraeten C, et al. The impact of education on chronic kidney disease patients' plans to initiate with self-care dialysis: a randomized clinical trial. *Kidney Int.* 2005;68:1777-1783.
12. Wu W, Wang SY, Hsu KH, et al. Multidisciplinary predialysis education decreases the incidence of dialysis and reduces mortality—a controlled cohort study based on NKF/DOQI guidelines. *Nephrol Dial Transplant.* 2009;24:3426-3433.
13. Golper TA, Vonesh ER, Wolfson M, Baudoin M, Schreiber MJ. The impact of pre-ESRD education on dialysis modality selection [ASN abstract 1223]. *J Am Soc Nephrol.* 2000;11:231A.
14. Golper TA, Vonesh ER, Mujais S, Baudoin M, Schreiber MJ. Factors associated with modality selection: results from the national pre-ESRD education initiative [ASN abstract 1224]. *J Am Soc Nephrol*. 2000;11:232A.
15. Oliver MJ, Quinn RR, Richardson EP, et al. Home care assistance and the utilization of peritoneal dialysis. *Kidney Int*. 2007;71:673-678.
16. Jager KJ, Korevaar JC, Dekker FW, et al. The effect of contraindications and patient preference on dialysis modality selection in ESRD patients in The Netherlands. *Am J Kidney Dis*. 2004;43:891-899.
17. Mendelssohn DC, Mujais SK, Soroka SD, et al. A prospective evaluation of renal replacement therapy modality eligibility. *Nephrol Dial Transplant.* 2009;24:555-561.
18. Lacson E, Hakim RM. The 2011 ESRD prospective payment system: perspectives from Fresenius Medical Care, a large dialysis organization. *Am J Kidney Dis*. 2011;57:547-549.