

# Effect of an In-Hospital Chronic Kidney Disease Education Program among Patients with Unplanned Urgent-Start Dialysis

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## Summary

**Background and objectives** The effect of in-hospital education on the adoption of home dialysis (peritoneal dialysis [PD] and home hemodialysis [HHD]) after an unplanned dialysis start is unknown.

**Design, setting, participants, & measurements** Clinical demographics of consecutive patients acutely initiating hemodialysis (HD) from January 2005 to December 2009 were abstracted using institutional electronic records. All patients received multimedia chronic kidney disease education by the same advanced care nurse practitioner before discharge from the hospital. Clinical characteristics of patients choosing home dialysis or staying on in-center HD were compared.

**Results** Between 2005 and 2009, 228 patients acutely started renal replacement therapy (RRT) at the center. Seventy-one patients chose home dialysis (49 patients adopted PD and 22 adopted HHD), 132 chose to remain on in-center HD, and 25 died before discharge from the hospital. Patients adopting home dialysis tended to be younger than in-center HD patients ( $55 \pm 18$  [home dialysis] versus  $59 \pm 16$  [in center] years;  $P = 0.09$ ) and were similar in gender distribution (49% [home dialysis] versus 56% [in center] male;  $P = 0.2$ ). Patients adopting home dialysis were more likely to have a failed kidney transplant (24% [home dialysis] versus 12% [in center];  $P = 0.045$ ) and less likely to have ischemic nephropathy (9% [home dialysis] versus 21% [in center];  $P = 0.03$ ). The distribution of comorbid conditions was different between patients adopting home dialysis and in-center HD.

**Conclusions** Home dialysis is feasible after urgent dialysis start. Education should be promoted among patient experiencing acute-start dialysis.

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## Introduction

A recent study suggests that 80% of patients with end-stage renal disease (ESRD) are candidates for home dialysis (1). However, the prevalence of home dialysis remains low in the United States and in Europe, with 7.5% to 15% of patients on peritoneal dialysis (PD) and 0.6% to 2% on home hemodialysis (HHD) (2,3). Patient-centered education among chronic kidney disease (CKD) patients has been shown to increase patients' intention to initiate self-care dialysis (4). However, the effect of such education on the adoption of home dialysis after an unplanned urgent-start dialysis is unknown. At our center, we provide in-hospital education to all individuals starting dialysis with the aim of enhancing adoption of home dialysis (5).

The primary objective of our study was to describe the effect of in-hospital CKD education among acute dialysis starters on the adoption of home dialysis (PD or HHD). We also aimed to determine the feasibility of adopting home dialysis after an unplanned RRT

initiation and to compare characteristics of patients adopting home dialysis and patients remaining on in-center hemodialysis (HD).

## Materials and Methods

### Design and Definitions

This is a retrospective observational cohort study with prospectively collected data. Institutional research ethics board approval was obtained. All information obtained was crossreferenced and validated twice with electronic and paper charts. Included patients consisted of all consecutive hospitalized patients requiring acute dialysis start from January 2005 to December 2009 at the University Health Network. All patients included in the study had no formal CKD education before dialysis initiation and were all seen by the same advanced nephrology nurse practitioner to receive education on renal replacement therapy (RRT) options.

Patient demographics such as age, sex, etiology of ESRD, comorbid conditions, social support, and ne-

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phrology care (at least one outpatient visit with a nephrologist before starting RRT) before dialysis initiation were prospectively collected into a computerized clinical database. The outcome of patients as of December 2009 (alive, dead, transfer to another center, or recovery of renal function) was also documented. Subjects who died before discharge from the hospitalization during which dialysis was initiated were excluded from analysis. The effect of the educational program was assessed by determining the adopted dialysis modality at the time of discharge from the hospital. Characteristics between patients choosing home dialysis (PD or HHD) and in-center HD were also compared.

### Education Program

Our center has a “home dialysis first” policy. Since 2005, all competent patients acutely starting dialysis as an inpatient received education on dialysis modalities and were encouraged to adopt home dialysis. An advanced nurse practitioner equally familiar with PD and HHD provided multimedia education on the different dialysis modalities using manuals, flipcharts, pamphlets, and DVDs. The same advanced nurse practitioner provided in-hospital education over three to five appointments. Efforts were made to include family members and caregivers during at least one education session. If a meeting with the family was not possible, the advanced nurse practitioner contacted the family by phone at least once. The primary objective of our education program was to assess and to match patients’ values, abilities, lifestyle, and their renal replacement modality needs. A discharge renal replacement modality was then determined. The benefits and barriers of all RRTs including home dialysis, in-center HD, and renal transplantation were discussed. Patients also had the opportunity to visit the home dialysis (PD and HHD) units and had the chance to meet with other patients performing all modalities of RRT. Given that patients were informed about kidney transplantation, they were all encouraged to meet with our transplantation coordinator. The patients were offered PD or HHD unless they had any contraindication(s) to a specific modality.

In our center, there were few relative contraindications to the adoption of HHD, but these include dementia, unstable psychiatric illness, unsuitable vascular access, and inappropriate home situation. The advanced nurse practitioner and the treating physicians determined contraindications for PD. Contraindications consisted of multiple abdominal surgeries, colostomy, intra-abdominal infection, and nonadherent behavior. Our criteria were described in a recent publication (6). Before the implementation of our in-hospital program, no formal education was provided to our acute-start dialysis patients, resulting in 87% of patients with unplanned dialysis start remaining on in-center HD (unpublished data).

Once the dialysis modality was determined, all efforts were made to accommodate our patients’ choice. We have a dedicated HD training unit; therefore, there was no delay in initiation of HHD training during the hospitalization. A PD catheter coordinator assisted in timely PD catheter insertion, and PD training usually started 1 week after catheter insertion.

### Statistical Analyses

Continuous variables were expressed as mean  $\pm$  SD or median with interquartile ranges. Categorical variables were expressed as percentage or number. All continuous data were compared using a Mann–Whitney test, whereas dichotomous data were compared using Pearson  $\chi^2$  analysis. Logistic regression modeling was done to determine the factors associated with the adoption of home dialysis. Variables with  $P < 0.2$  were included in our model, and goodness of fit was evaluated with the Hosmer–Lemeshow statistics. Unadjusted survival was assessed among patients adopting home dialysis and patients staying on in-center HD from the time of discharge from the hospitalization in which dialysis was initiated until December 2009. Patients not surviving the hospitalization of RRT initiation were excluded from analysis. All  $P$  values were two-tailed, and values less than 0.05 were considered significant. All analyses were performed using SPSS-16 (SPSS, Chicago, IL).

### Results

Between January 1, 2005 and December 31, 2009, 232 patients acutely initiated in-center HD during a hospitalization and received education by an advanced nurse practitioner. Four patients had incomplete data; therefore, 228 patients were included in the analysis presented here. Among these patients, 71 (31%) chose home dialysis (49 patients adopted PD and 22 adopted HHD) and 132 patients stayed on in-center HD (Figure 1). Twenty-five patients died before being discharged from the hospital and were not included in our analysis. During the same time period, a total of 473 patients required initiation of dialysis; therefore, the cohort presented here represented 49% of all dialysis starts at our center. Baseline characteristics of patients are summarized in Table 1. Patients adopting home dialysis tended to be younger than in-center HD patients ( $55 \pm 18$  [home dialysis] versus  $59 \pm 16$  [in center] years;  $P = 0.09$ ). Patients adopting home dialysis were more likely to have a failed kidney transplant and less likely to have ischemic nephropathy. Comorbidities were different between the two groups of patients (Table 1). To facilitate discharge, additional social support was required by 19 patients (14%) adopting in-center HD. In contrast, three patients (6%) adopting PD and none choosing HHD re-

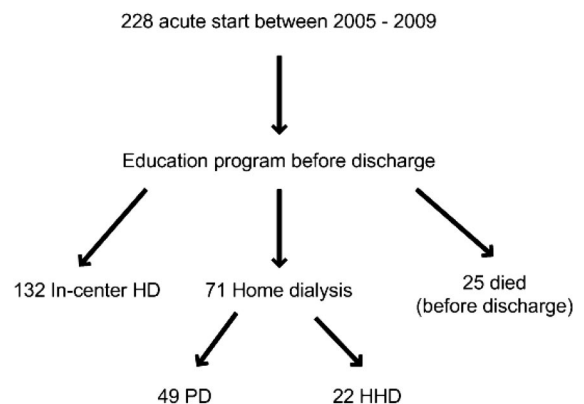


Figure 1. | Patients’ flow through the study.

**Table 1. Baseline characteristics of patients**

	Home Dialysis (n = 71)	In-Center HD (n = 132)	P
Age at start of the modality, years	55 ± 18	59 ± 16	0.09
Gender, male, %	49	56	0.2
Etiology of ESRD, %			
diabetes	17	19	NS
GN	14	6	0.07
HTN	4	5	NS
failed transplant	24	12	0.045
drug toxicity	6	5	NS
ischemic nephropathy	9	21	0.029
multiple myeloma	3	5	NS
hepatorenal syndrome	0	5	NS
other	17	14	NS
unknown	7	8	NS
Comorbidities, %			
hypertension	85	73	0.08
dyslipidemia	37	39	0.9
diabetes	41	47	0.5
malignancy	7	9	0.6
CHF	20	12	0.2
PVD	7	18	0.04
CVD	21	9	0.03
CABG	10	7	0.4
MI	18	9	0.07
Contraindications to PD, %	0	28	<0.001
Followed by nephrologists before dialysis start, %	49	34	0.03

HTN, hypertension; CHF, cardiac heart failure; PVD, peripheral vascular disease; CVD, cerebrovascular disease; CABG, coronary artery bypass graft; MI, myocardial infarction.

quired additional social support. Table 2 shows the laboratory values of patients acutely starting dialysis. There was no difference in laboratory measures and their estimated GFR at the time of dialysis initiation between patients adopting home dialysis or remaining on in-center HD. Within 3 months of discharge from the hospital, all patients assigned to HHD remained on the chosen modal-

ity. During the same time frame after discharge, five PD patients (10%) switched to in-center HD.

In our cohort of acute dialysis starters, 80 patients (39%) were known by nephrologists before dialysis initiation. Patients known by nephrologists before the start of RRT were more likely to adopt home dialysis (49% of all patients adopting home dialysis *versus* 34% of patients choosing in-center HD; *P* = 0.03). The distribution of ESRD etiologies among these patients is listed in Table 3.

Table 4 summarizes the outcome of patients at the end of the follow-up period. The follow-up was similar between home dialysis (2.6 ± 1.3 years) and in-center HD (2.4 ± 1.3 years) patients. Patients adopting home dialysis were less likely to be transferred to another center (4% [home dialysis] *versus* 24% [in-center HD]). The age at death was similar between both groups. Figure 2 shows the unadjusted survival of our cohort. The unadjusted 5-year survival rate among discharged patients was similar between home dialysis and in-center HD patients (73% [home dialysis] *versus* 71% [in-center HD], log-rank test, *P* = 0.5).

Multivariable analysis identified that younger age at dialysis initiation ( $\beta$  = 0.022, 95% confidence interval [CI] 1.001 to 1.044, *P* = 0.04) and higher albumin level ( $\beta$  = -0.059, 95% CI 0.889 to 0.998, *P* = 0.04) were associated with adoption of home dialysis.

**Discussion**

We describe our experience with in-hospital education among patients acutely initiating dialysis. To our knowledge, this is the first study to assess strategies to enhance the adoption of home dialysis (PD or HHD) after an unplanned urgent RRT initiation. Our results illustrate that (1) home dialysis adoption is feasible after providing in-hospital dialysis education to those acutely starting dialysis, (2) the benefits of education are not restricted to patients who had previously attended CKD clinics, and (3) patients adopting home dialysis are different from patients remaining on in-center HD.

Before the implementation of our educational program for acute dialysis starters, 87% of patients starting dialysis acutely as an in-patient remained on in-center HD at the time of discharge. After implementation of our program, 65% of acute starters chose in-center HD and 35% adopted home dialysis, suggesting that acute educational intervention may influence dialysis modality selection.

**Table 2. Laboratory values at time of urgent dialysis initiation**

	Home Dialysis (n = 71)	In-Center HD (n = 132)	P
Creatinine, μmol/L	637 [404 to 727]	630 [405 to 750]	0.9
Estimated GFR, ml/min <sup>a</sup>	9.9 [6.7 to 13.1]	10.2 [5.8 to 13.5]	0.8
Urea, mmol/L	32 [25 to 39]	32 [21 to 41]	0.9
Calcium, mmol/L	2.26 [2.13 to 2.40]	2.21 [2.08 to 2.40]	0.2
Phosphorus, mmol/L	1.83 [1.41 to 2.24]	1.90 [1.36 to 2.27]	0.5
Parathyroid hormone, pmol/L	36 [14 to 46]	40 [9 to 49]	0.7
Hemoglobin, g/L	94 [82 to 106]	92 [81 to 101]	0.6
Bicarbonate, mmol/L	20 [17 to 24]	20 [17 to 25]	0.9
Albumin, g/L	33 [29 to 38]	31 [27 to 35]	0.2

Values expressed as median [interquartile range].  
<sup>a</sup>Estimated GFR obtained using the four-variable Modification of Diet in Renal Disease formula (19).

**Table 3. Distribution of ESRD etiology among acute starters known by nephrologists**

Etiology, %	Acute Starters ( <i>n</i> = 80)
Diabetes	15
GN	10
HTN	3
Failed transplant	40
Drug toxicity	6
Ischemic nephropathy	1
Other	15
Unknown	10

The purpose of CKD education is to provide an informed transition to RRT and to help patients cope with barriers associated with starting a form of RRT (7–9). After receiving CKD education, patients are more likely to identify advantages of self-care dialysis (autonomy and lifestyle benefits) (10). Manns and colleagues conducted a randomized controlled trial of predialysis patients to determine the effect of education on patients' intention to initiate dialysis with self-care dialysis (4). Patients included in the study were randomized to a patient-centered education (educational booklets, video, and interactive educational session on self-care dialysis) or standard care with education with a multidisciplinary predialysis team. At the end of the study, 82% of the intervention group intended to start self-care dialysis compared with 50% in the standard care group ( $P = 0.015$ ). Similar findings are reflected by another retrospective study that indicated that 55% of patients enrolled in a predialysis education program chose self-care dialysis (11).

Differences between patients choosing home dialysis or remaining on in-center HD were identified. There was a trend toward younger patients adopting home dialysis. Our results are consistent with previous studies comparing patients on in-center HD and PD showing that PD patients are more likely to be younger and have less comorbidities and a different distribution of ESRD etiologies (12,13). Few studies have compared patients adopting in-center HD *versus* home HD (14). It is interesting to note that additional support was required for patients choosing in-center HD, which may be a marker of frailty rather than a direct reflection of choice of renal replacement modality. Whether the more favorable patient characteristics trans-

late to higher technique success rate within this subgroup of patients requires further examination.

A potential management gap was identified in our cohort of patients acutely initiating dialysis. Thirty-nine percent of patients were seen at least once by a nephrologist before they urgently initiated dialysis. These results were similar to data previously described in a retrospective study in the United Kingdom (15) that identified risk factors associated with acute-start dialysis in patients who were known by a renal service. These investigators found that delayed initial discussion about RRT, late referral for RRT counseling, late referral for access creation, older age, and sicker patients were some of the contributing factors leading to acute unplanned dialysis despite receiving care from nephrologists. These findings are also consistent with other studies suggesting that patients with late referral to nephrology or lack of education on dialysis modalities were more likely to need a temporary access for their first dialysis (16,17). It is interesting to see that patients with failed kidney transplant and patients with glomerulonephritis represented 55% of our acute dialysis starters known by nephrologists. A possible explanation for this finding might be denial of the impending need for RRT among patients or care providers or the refusal to commit to a dialysis modality choice. Future work is required to identify the risk factors explaining why these patients are most vulnerable to needing urgent unplanned dialysis.

Patients undergoing unplanned dialysis initiation tended to have worse survival in other studies (18). In our cohort of patients, the unadjusted 5-year survival was 70%. This rate is relatively favorable and may partly be explained by selection bias. Furthermore, patients dying during the initial hospitalization in which RRT was urgently initiated were censored from the analysis. Finally, vital status of patients transferred to other centers was not available, potentially underestimating the mortality rate among in-center HD patients.

Our study is limited by its observational nature. Only the modality chosen at the time of discharge was available. No information was available once patients were transferred to another center. These patients could have decided to adopt home dialysis thereafter. This particular situation would contribute to an underestimation of the potential benefits of in-hospital education. Furthermore, we cannot confirm the causality between the educational program

**Table 4. Clinical outcomes**

	Home Dialysis ( <i>n</i> = 71)	In-Center HD ( <i>n</i> = 132)	<i>P</i>
Outcome as of December 31, 2009, %			0.004
dead	25	21	
recovery of renal function after discharge	2		
transfer to another center	4	24	
Dialysis follow-up			
patients alive as of 2009, years			
mean $\pm$ SD	2.6 $\pm$ 1.3	2.4 $\pm$ 1.3	NS
median [IQR]	2.76 [1.42 to 3.42]	2.25 [1.25 to 3.58]	NS
all patients included in the study, years			
mean $\pm$ SD	2.3 $\pm$ 1.3	1.9 $\pm$ 1.4	NS
median [IQR]	2.58 [1.25 to 3.17]	1.79 [0.67 to 2.80]	NS
Age at death, years	66 $\pm$ 17	70 $\pm$ 11	NS

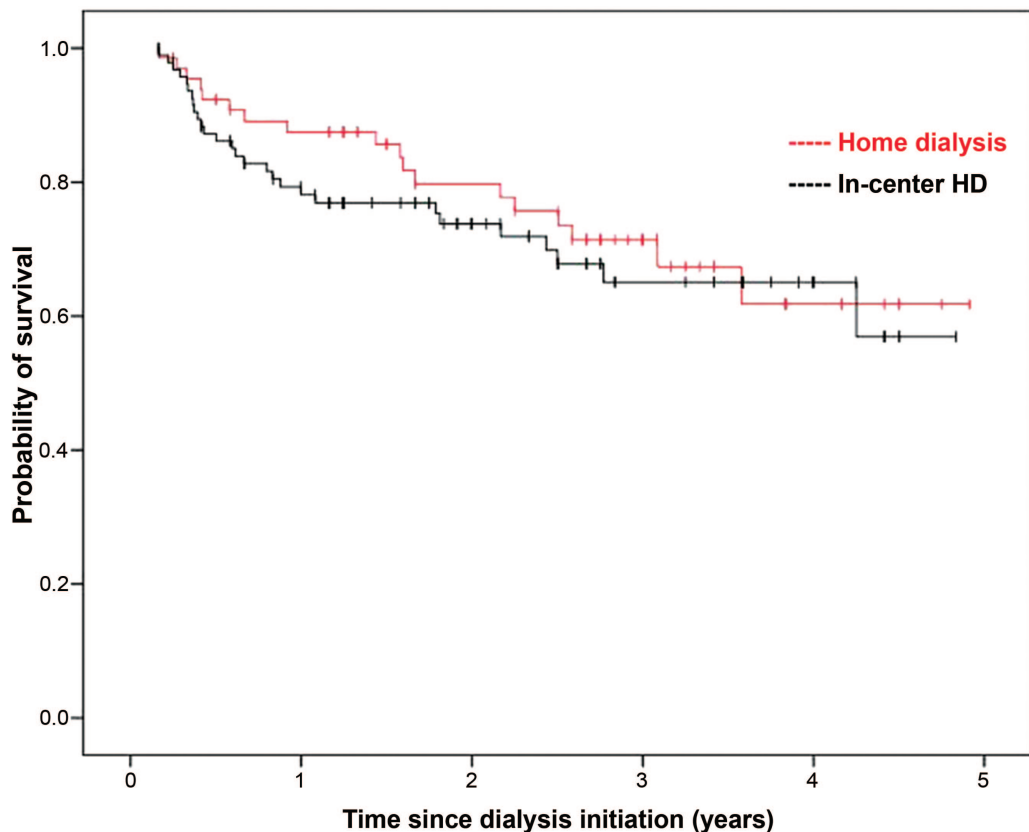


Figure 2. | Time to death since dialysis initiation (in years) in patients treated with home dialysis (PD and HHD) and in-center HD.

and the adoption of home dialysis. However, the fact that 35% of all acute starters adopted home dialysis after the implementation of our in-hospital education program (*versus* 13% before the program) gives credit to the benefit of such educational initiatives. We do not have complete information regarding hemodynamic stability in all patients during their acute dialysis sessions. Finally, little information was documented regarding the amount of modality education among patients followed by nephrologists before dialysis initiation, which is a form of co-intervention and is a potential limitation of the study presented here.

In conclusion, in-hospital education and home dialysis is feasible among acute dialysis starters and appears to be responsible for more of these patients choosing home dialysis. We identified a potential management gap among a subset of our patients urgently starting dialysis. Additional strategies are required to facilitate patients transferring to their dialytic modality of choice in a timely manner. Prospective evaluation of clinical outcomes of unplanned *versus* planned dialysis starters warrants further investigation.

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#### Disclosures

None.

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