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

Jean-Philippe Rioux, Harpaul Cheema, Joanne M. Bargman, Diane Watson, and Christopher T. Chan

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 ± 18 [home dialysis] versus 59 ± 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.

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-
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 ± 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 χ² 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 statistic. 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.](image-url)
required 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 adopting home dialysis or remaining on in-center HD were on the chosen modality. 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 2. Laboratory values at time of urgent dialysis initiation

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

Values expressed as median [interquartile range].
\(\ast\)Estimated GFR obtained using the four-variable Modification of Diet in Renal Disease formula (19).

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 choosing 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 2 shows the laboratory values at the time of urgent dialysis initiation.

Table 3. Baseline characteristics of patients

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

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

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.
Whether the more favorable patient characteristics trans-
reflection of choice of renal replacement modality.
HD, which may be a marker of frailty rather than a direct

Studies have compared patients adopting in-center HD
and a different distribution of ESRD etiologies (12,13). Few
are more likely to be younger and have less comorbidities
remaining on in-center HD were identified. There was a

Another retrospective study that indicated that 55% of pa-
care group (\(n = 132\)) vs 50% in the standard
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 glomerulone-
phritis 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 ex-
plained by selection bias. Furthermore, patients dying dur-
ing 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 avail-
able, 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 trans-
ferred 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

The purpose of CKD education is to provide an in-
formed 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 iden-
tify advantages of self-care dialysis (autonomy and life-
style benefits) (10). Manns and colleagues conducted a
randomized controlled trial of predialysis patients to de-
termine 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 edu-
cation (educational booklets, video, and interactive educa-
tional 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 pa-
tients 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 addi-
tional 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 co-
hort of patients acutely initiating dialysis. Thirty-nine per-
cent 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 fac-
tors 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
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benefits of in-hospital education. Furthermore, we cannot
confirm the causality between the educational program

<table>
<thead>
<tr>
<th>Etiology, %</th>
<th>Acute Starters (n = 80)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes</td>
<td>15</td>
</tr>
<tr>
<td>CN</td>
<td>10</td>
</tr>
<tr>
<td>HTN</td>
<td>3</td>
</tr>
<tr>
<td>Failed transplant</td>
<td>40</td>
</tr>
<tr>
<td>Drug toxicity</td>
<td>6</td>
</tr>
<tr>
<td>Ischemic nephropathy</td>
<td>1</td>
</tr>
<tr>
<td>Other</td>
<td>15</td>
</tr>
<tr>
<td>Unknown</td>
<td>10</td>
</tr>
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</table>

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

Acknowledgments
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Disclosures
None.

References


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