with similar—if not better—outcomes for patients with end-stage renal disease (1–4). Despite those benefits, PD and HHD are both used in less than 10% of the world's prevalent dialysis population (5,6). The underutilization of these therapies is connected to several barriers to home-based, self-care therapy. Unique to PD are the challenges related to higher rates of treatment-related technique failure (TF) (7) as a result of any or a combination of infectious complications, mechanical complications, inadequate solute clearance, ultrafiltration failure, and psychosocial problems (8).

Faced with patients who are eligible for both PD and HHD, and with the technical challenges of HHD, our center has consistently adopted a “PD first” strategy, using PD as an incident dialysis modality, followed by ongoing support and encouragement to transition to HHD for patients after PD TF (9). In the present report, our primary objective was to determine whether systematic differences in demographic, comorbid, and psychosocial characteristics can be observed between patients with PD TF who have transferred to either FHD or HHD.

METHODS

This retrospective observational cohort study included all patients who experienced PD TF at our center between 2000 and 2010. Patients who died or underwent transplantation while receiving PD were excluded. Demographic data and comorbidities were collected using an electronic clinical database that is maintained for all chronic kidney disease patients at our institution. The Davies comorbidity index was used to quantify comorbidities (10). Causes of PD TF were categorized as infection-related, ultrafiltration failure (based on clinical evaluation), decreased small-solute clearance, or other. Psychosocial data, including languages spoken, immigration status, and living arrangements, were collected using structured one-on-one patient interviews conducted by the home dialysis nurses. Distance from the facility was calculated using Web-based software that compared the postal code of the facility with each patient's residence postal code. Approval was obtained from the local institutional research ethics board.

Continuous variables are described as mean and standard deviation or median and interquartile range, as appropriate. Categorical variables are described as frequencies or percentages. Mann–Whitney and Fischer exact tests were used, as appropriate, to compare demographic, clinical, biochemical, and psychosocial characteristics for patients with PD TF who transitioned to either FHD or HHD. Values of p less than 0.05 were considered

Use of Home Hemodialysis After Peritoneal Dialysis Technique Failure

Compared with facility-based hemodialysis (FHD), home-based renal replacement therapies (RRTs), including peritoneal dialysis (PD) and home hemodialysis (HHD), are more cost effective, might be associated with improved patient satisfaction, and are associated

statistically significant. All analyses were performed using PASW 18 (SPSS Inc., Chicago, IL, USA).

RESULTS

Of the 75 patients who experienced PD TF at our center during the study period, 12 (16%) transitioned to HHD, and 63 (84%) transitioned to FHD. Patients using FHD received 4-hour FHD treatments 3 times weekly. Of the HHD patients, 7 underwent 4-hour HHD treatments on alternate days of the week, and 5 underwent 8-hour nocturnal HHD treatments on alternate nights of the week.

Table 1 summarizes the demographic data for the patient cohort. No difference in the adoption of HHD compared with FHD occurred over time during the study (dividing the study period into two periods). There was no difference in the sex distribution between the two groups. However, the median age of patients who initiated HHD at the time of PD TF was significantly younger than that of patients who initiated FHD. There was no difference between study groups with regard to the duration of PD before TF. The median distance from patient residence to our center was greater among the HHD patients. A higher proportion of patients who experienced TF because of peritonitis were transitioned to FHD compared with HHD.

Table 2 summarizes comorbidity data. We observed a trend toward a greater mean comorbidity score among FHD patients than among HHD patients, but the difference did not reach statistical significance. Further supporting that trend, we also observed a trend toward a greater likelihood of being listed for a deceased donor graft among HHD patients than among FHD patients (41.7% vs 17.5%, $p = 0.06$).

Table 3 summarizes differences in psychosocial characteristics between the FHD and HHD patients. Overall, FHD and HHD patients showed no differences in the proportion of patients who lived alone, in immigration status, or in whether English was a second language or not the primary language spoken.

DISCUSSION

A change in therapy to any form of home-based RRT requires the acquisition of new skills and knowledge, and increased treatment-related responsibilities that many patients and their caregivers are reluctant to undertake (9). Compared with patients on FHD, patients on PD have experienced the benefits and challenges of home-based RRT and may be more poised to transition to HHD. Moreover, as happens at many centers, the PD and HHD programs at our center are

TABLE 1
Demographic Data for the Study Patients

Variable	Hemodialysis location Home	Facility	<i>p</i> Value
Patients (<i>n</i>)	12	63	—
Male sex [<i>n</i> (%)]	6 (50)	30 (49)	1
Age at PD failure (years)			
Mean	47.7	60.3	0.005
95% CI	41.9–53.3	56.3–64.3	
Duration on PD (years)			
Mean	2.8	2.3	0.5
95% CI	1.5–4.0	1.7–2.9	
Distance to center (km)			
Mean	32.9	19.1	0.05
95% CI	12.5–53.4	13.0–25.2	
Year of transition			0.08
2000–2005	5	12	
2006–2010	7	51	
Cause of PD technique failure [<i>n</i> (%)]			
Infection-related	2 (17)	29 (56)	0.02
Inadequate UF or solute clearance	6 (50)	9 (17)	
Other	4 (33)	14 (27)	

PD = peritoneal dialysis; CI = confidence interval; UF = ultrafiltration.

TABLE 2
Comorbidity Data

Variable	Hemodialysis location Home	Facility	<i>p</i> Value
Comorbidity score			
Mean	0.5	0.8	0.2
95% CI	0.0–1.1	0.6–1.0	
CAD	0	13	—
CVD	2	8	—
Cancer	1	8	—
Diabetes mellitus	3	22	—
Deceased donor transplant listing	5	11	0.06

CI = confidence interval; CAD = coronary artery disease; CVD = cerebrovascular disease.

administered by the same multidisciplinary health care team, which may have been crucial in facilitating the high rate of transition to HHD (17%) compared with the national average of less than 1% among all Canadian patients experiencing PD TF during the same time period (Canadian Organ Replacement Register. Unpublished data).

TABLE 3
Psychosocial Data

Variable	Hemodialysis location		<i>p</i> Value
	Home	Facility	
ESL	9	30	0.1
Primary language English	7	37	1
Immigrant	9	45	1
Lives alone	2	10	1

ESL = English as a second language.

The present study builds on a study by Wong *et al.* (11) that demonstrated successful initiation of HHD in 8 patients after PD TF. In the present study, the control group of patients who were treated with FHD after PD TF provided us with an opportunity to describe the barriers to HHD and other barriers that may be unique to a population of patients previously treated with home-based RRT. Those barriers include distance from residence to the center (12), time spent on PD, living alone (13), age (12), comorbidities (14), listing for deceased-donor kidney transplantation, and psychosocial characteristics (English as a second language, primary spoken language, and immigration). We found that younger age, fewer comorbidities, and greater distance from the HD facility were predictive of HHD use (compared with FHD use) after PD TF. We also found that infection-related TF was negatively associated with likelihood of HHD use after TF, which may relate to suboptimal PD technique among a group of patients who were either self-identified or identified by the team as having challenges with self-care therapy.

As in our study, age has previously been described as a predictor for the selection of in-center rather than home-based RRT (12,13). Older patients may be viewed by health care providers as being less able to perform home dialysis, possibly because of perceived motivational difficulties, poor physical and mental capacity, need for extra physical effort, and comorbidities (15). Other studies have suggested that older patients require more training to learn HHD (15).

We assessed listing for deceased-donor kidney transplantation as a proxy for comorbidities, because very ill patients are often ineligible for transplantation listing. In earlier work, the presence of cerebrovascular disease, peripheral vascular disease, hypertension, coronary artery disease, congestive heart failure, and left ventricular hypertrophy have been linked to the selection of FHD over PD (12,13,16).

One interesting finding of the present study is that living alone did not correlate with the selection of FHD

over HHD. Previous studies comparing the selection of FHD and PD indicate that living alone is an independent predictor of FHD selection (12,13,15). That difference may relate to the fact that our population had already been performing dialysis at home, which may have excluded a large number of patients who would not have been comfortable performing PD alone.

Our observation that living farther from the dialysis center encouraged selection of HHD after PD TF is supported by one other study, which showed an association between distance from center and home-based RRT (17,18), but is refuted by a different study (19).

The limitations of the present study include its single-center and observational nature. Furthermore, we were not able to compile an exhaustive list of variables because of missing data. Parameters such as income and educational level may have been of interest. For any given patient, the decision to choose FHD or HHD is complex and multifactorial; it depends both on patient (or caregiver) preference and on a multidisciplinary assessment of eligibility to perform HHD by the home dialysis staff.

Notwithstanding its limitations, our study demonstrates that HHD remains a feasible option among patients experiencing PD TF. Empowering a patient to remain on a home-based RRT after PD TF may improve outcomes and quality of life, while also being more cost-effective; however, this approach requires further prospective study (20–24). Moreover, given that most patients in our study were transitioned to FHD after PD TF, we have to continue working to reach a better understanding of the barriers to the use of HHD after PD TF from multiple perspectives—including those of the patient, the provider, and the health care system.

DISCLOSURES

JP holds an unrestricted educational award from Baxter Healthcare Canada; has received speaking honoraria from Hemosphere USA, Amgen Canada, and Baxter Healthcare International; and has received consultancy and advisory board fees from Baxter Healthcare Canada and Shire Canada. PAM has served as an advisor to Baxter Healthcare, Fresenius Medical Care, and Gambro Lundia. The remaining authors have no financial conflicts of interest to declare.

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