



Quantifying Missed Opportunities for Recruitment to Home Dialysis Therapies

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Abstract

Background: Despite the recognized benefits of home therapies for patients and the health care system, most individuals with kidney failure in Canada continue to be initiated on in-center hemodialysis. To optimize recruitment to home therapies, there is a need for programs to better understand the extent to which potential candidates are not successfully initiated on these therapies.

Objective: We aimed to quantify missed opportunities to recruit patients to home therapies and explore where in the modality selection process this occurs.

Design: Retrospective observational study.

Setting: British Columbia, Canada.

Patients: All patients aged >18 years who started chronic dialysis in British Columbia between January 01, 2015, and December 31, 2017. The sample was further restricted to include patients who received at least 3 months of predialysis care. All patients were followed for a minimum of 12 months from the start of dialysis to capture any transition to home therapies.

Methods: Cases were defined as a “missed opportunity” if a patient had chosen a home therapy, or remained undecided about their preferred modality, and ultimately received in-center hemodialysis as their destination therapy. These cases were assessed for: (1) documentation of a contraindication to home therapies; and (2) the type of dialysis education received. Differences in characteristics among patients classified as an appropriate outcome or a missed opportunity were examined using Wilcoxon rank-sum test or χ^2 test, as appropriate.

Results: Of the 1845 patients who started chronic dialysis during the study period, 635 (34%) were initiated on a home therapy. A total of 320 (17.3%) missed opportunities were identified, with 165 (8.9%) having initially chosen a home therapy and 155 (8.4%) being undecided about their preferred modality. Compared with patients who chose and initiated or transitioned to a home therapy, those identified as a missed opportunity tended to be older with a higher prevalence of cardiovascular disease. A contraindication to both peritoneal dialysis and home hemodialysis was documented in 8 “missed opportunity” patients. General modality orientation was provided to most (71%) patients who had initially chosen a home therapy but who ultimately received in-center hemodialysis. These patients received less home therapy-specific education compared with patients who chose and subsequently started a home therapy (20% vs 35%, $P < .001$).

Limitations: Contraindications to home therapies were potentially under-ascertained, and the nature of contraindications was not systematically captured.

Conclusions: Even within a mature home therapy program, we discovered a substantial number of missed opportunities to recruit patients to home therapies. Better characterization of modality contraindications and enhanced education that is specific to home therapies may be of benefit. Mapping the recruitment pathway in this way can define the magnitude of missed opportunities and identify areas that could be optimized. This is to be encouraged, as even small incremental improvements in the uptake of home therapies could lead to better patient outcomes and contribute to significant cost savings for the health care system.

Trial Registration: Not applicable as this was a qualitative study.

Abrégé

Contexte: Les avantages de la dialyse à domicile pour les patients et le système de santé sont reconnus. Pourtant, la majorité des personnes atteintes d'insuffisance rénale au Canada continue de recevoir des traitements d'hémodialyse en centre. Pour recruter davantage de patients sur les thérapies à domicile, il est nécessaire d'instaurer des programmes qui permettent d'établir dans quelle mesure les candidats potentiels n'y sont pas initiés avec succès.

Objectif: Nous souhaitons quantifier les occasions manquées de recruter des patients pour les modalités à domicile et déterminer où ces occasions manquées se produisent dans le processus de sélection de la modalité.



Conception: Étude de cohorte rétrospective

Cadre: Colombie-Britannique (Canada).

Sujets: Tous les adultes ayant amorcé des traitements de dialyse chronique en Colombie-Britannique entre le 1er janvier 2015 et le 31 décembre 2017. L'échantillon a été davantage restreint pour inclure les patients ayant reçu au moins trois mois de soins pré-dialyse. Le suivi s'est étalé sur un minimum de douze mois à compter de l'amorce de la dialyse afin de capter toute transition vers une modalité à domicile.

Méthodologie: Les cas ont été définis comme une « occasion manquée » si la personne avait d'emblée choisi une modalité à domicile ou si elle était demeurée indécise quant à sa modalité préférée et avait finalement reçu des traitements d'hémodialyse en centre de façon permanente. Les occasions manquées ont été examinées pour: i) une contre-indication aux thérapies à domicile et; ii) le type de formation reçue pour la dialyse. L'évaluation des différences dans les caractéristiques des patients, selon que leur cas était classé comme un résultat favorable ou une occasion manquée, a été effectuée à l'aide du test de Wilcoxon ou du test du Chi-carré.

Résultats: Des 1 845 patients ayant débuté des traitements de dialyse chronique au cours de la période étudiée, 635 (34 %) avaient amorcé la dialyse à domicile. En tout, 320 cas (17,3 %) ont été classés comme « occasions manquées », soit 165 patients (8,9 %) ayant d'emblée choisi une thérapie à domicile et 155 (8,4 %) indécis quant à leur modalité préférée. Comparativement aux patients qui avaient choisi et amorcé un traitement à domicile ou qui avaient fait une transition (hémodialyse en centre vers une modalité à domicile), les patients classés « occasion manquée » tendaient à être plus âgés avec une prévalence plus élevée de maladies cardiovasculaires. Une contre-indication à la fois à la dialyse péritonéale et à l'hémodialyse à domicile était documentée pour huit patients classés « occasion manquée ». Une orientation générale sur la modalité avait été fournie à la majorité des patients (71 %) qui avaient initialement choisi une thérapie à domicile, mais qui avaient finalement reçu une hémodialyse en centre. Ces patients avaient reçu moins d'information spécifique aux modalités pratiquées à domicile que les patients qui avaient d'emblée choisi et poursuivi leurs traitements à domicile (20 % contre 35 %, $p < 0,001$).

Limites: Les contre-indications aux modalités à domicile pourraient avoir été sous-évaluées et leur nature n'était pas systématiquement prise en compte.

Conclusion: Un nombre significatif d'occasions manquées de recruter des patients pour les modalités de dialyse à domicile a été observé, bien que le programme étudié soit solidement établi. Une meilleure caractérisation des contre-indications à ces modalités et davantage de formation spécifique à ces thérapies pourraient s'avérer bénéfiques. De plus, une cartographie du processus de recrutement pourrait contribuer à mieux définir l'ampleur des occasions manquées et à cerner les domaines susceptibles d'être optimisés. Cette démarche est à encourager, car toute amélioration progressive dans l'adoption des thérapies à domicile, aussi infime soit-elle, est susceptible d'améliorer les résultats des patients et de générer des économies importantes pour le système de santé.

Enregistrement de l'essai: Sans objet, il s'agit d'une étude qualitative.

Keywords

end-stage kidney disease, home hemodialysis, home therapies, modality selection, peritoneal dialysis

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Introduction

Home-based dialysis therapies for patients with end-stage kidney disease place an emphasis on improving quality of life and encouraging autonomy for patients while sustaining cost-efficient treatment in the home environment.^{1,2} In light of these benefits, kidney programs across Canada have adopted a “home first” approach, where home

therapies are actively promoted as the default choice over in-center hemodialysis (HD).² Despite a concerted effort to promote home therapies, more than 70% of Canadian incident dialysis patients start on in-center HD.^{3,4} To continue to foster the growth of home therapies, it is important to understand the reasons why a patient may not be recruited to either peritoneal dialysis (PD) or home HD. Although conceptual models have been proposed in the literature to

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delineate the steps involved, and thus guide the implementation of care pathways in renal programs, there is a paucity of contemporary real-world data describing the modality selection pathway.⁵

One way to investigate this is to map the patient journey from predialysis nephrology care to dialysis initiation and identify where along that journey an individual may be lost from the recruitment pathway to home therapies. The province of British Columbia (BC) is uniquely positioned to address this question. The entire spectrum of care for patients requiring renal replacement therapy is coordinated by BC Renal, a provincial network of administrators and health care providers.^{6,7} The provincial predialysis care model uses a multidisciplinary team approach to guide patients through a standardized predialysis pathway to manage their chronic kidney disease and prepare for transition to renal replacement therapy if ever needed.⁶ The latter involves informing the patient about all modalities through educational sessions, an integrated assessment of candidacy where feasible, and a “home first” approach for dialysis.^{6,7} Delivery of clinical care is captured in real time using a province-wide clinical information system, which includes specific modules for dialysis modality selection, orientation, and education in kidney replacement therapies.⁸ Finally, BC has a mature home therapy program with an incidence of home therapies that is higher than the national average.^{1,6}

In this retrospective observational study, we sought to quantify “missed opportunities” for the recruitment of patients to home therapies from multidisciplinary kidney clinics. To address this question, we analyzed a large cohort of incident dialysis patients in BC over a 3-year period and investigated their journey from initially choosing their preferred dialysis modality during predialysis care through to starting their destination dialysis therapy.

Methods

Design, Setting, and Participants

This was a retrospective observational study of adult patients (aged >18 years) who initiated chronic dialysis in BC between January 1, 2015, and December 31, 2017. We defined chronic dialysis as kidney failure requiring dialysis for ≥ 90 days or <90 days for reasons other than recovery of kidney function. We restricted the sample to those patients who had a minimum of 3 months of predialysis nephrology care, to allow an appropriate time window for modality selection and education (Figure 1). We excluded patients who received a kidney transplant within the first 90 days of starting dialysis and patients who transferred to BC from another Canadian province. The observation period was extended to December 31, 2018, so that all patients had a minimum of 12-month follow-up from dialysis initiation to capturing a transition to a home therapy.

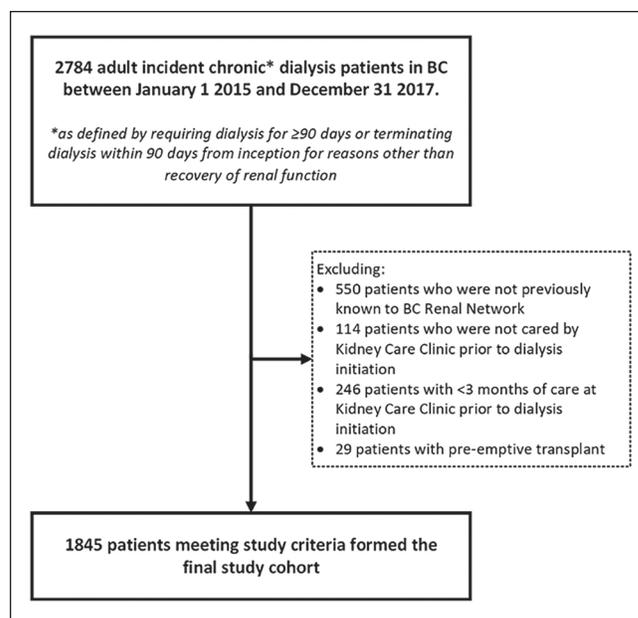


Figure 1. Cohort derivation.

Data Sources

BC Renal is a branch of the Provincial Health Services Authority and is responsible for the coordination and delivery of care to patients with kidney disease in the province. The Patient Records and Outcome Management Information System (PROMIS) is a province-wide registry of all patients attending multidisciplinary kidney clinics and those receiving kidney replacement therapy.^{6,9} Under the governance of BC Renal, this integrated clinical information system supports all aspects of care from individual patient management to outcome-based planning and policy development.⁸ The PROMIS is an Oracle-based Web-accessible program that facilitates capture of clinical information in real time during patient encounters along with comprehensive laboratory data, the latter via interfacing with laboratory systems across the province.⁹

Variable Definitions

We employed a cross-classification of patients’ initial modality selection and their destination chronic dialysis therapy to identify “missed opportunities” for recruitment into a home therapy. A missed opportunity was defined as any instance where a patient was initiated and maintained on in-center HD but, during their predialysis care, had stated a preference for PD and/or home HD, or had yet to decide on a modality. A patient was deemed not suitable for a home therapy if there was a contraindication to *both* PD and home HD recorded in PROMIS; however, the specific nature of contraindications was not routinely captured in the database. Two types of modality education were available to patients attending

Table 1. Characteristics of Patients Who Initiated Chronic Dialysis in British Columbia Between January 01, 2015, and December 31, 2017.

	Overall	Dialysis type at chronic dialysis initiation		
		In-center HD (initiation as out-patient)	In-center HD (initiation as in-patient)	Home therapies
Number of patients	1845	543 (29.4%)	667 (36.2%)	635 (34.4%)
Age, median [IQR], y	69 [59-77]	69 [60-78]	71 [62-78]	66 [55-74]
Male, No. (%)	1197 (65)	355 (65)	418 (63)	424 (67)
Race/Ethnicity, No. (%)				
Caucasian	1057 (57)	299 (55)	409 (61)	349 (55)
Asian Oriental	257 (14)	86 (16)	52 (8)	119 (19)
South or East Asian	347 (19)	97 (18)	130 (19)	120 (19)
Indigenous	75 (4)	24 (4)	31 (5)	20 (3)
Other	109 (6)	37 (7)	45 (7)	27 (4)
Diabetes, No. (%)	1161 (63)	326 (60)	467 (70)	368 (58)
Cardiovascular disease, No. (%)	1058 (57)	304 (56)	471 (71)	283 (45)
Duration of predialysis care at Kidney Care	30.2	32.6	27.6	29.8
Clinic, median [IQR], mo	[12.9-60.4]	[14.8-65.9]	[11.0-54.1]	[13.2-60.7]
Estimated glomerular filtration rate, mean (SD), mL/min/1.73 m ²	9.5 (4.4)	8.6 (3.0)	10.2 (5.9)	9.5 (3.6)

Note. HD = hemodialysis; IQR = interquartile range.

multidisciplinary kidney care clinics: (1) general orientation, which introduces the patient to the concept of renal replacement therapy and provides information on all modality options, and (2) modality-specific education, including home therapy initiation, management, and technique.^{10,11}

Statistical Methods

Continuous variables are reported as mean and standard deviation (SD), or median and interquartile range (IQR), depending on the underlying distribution. Categorical variables are reported as frequency (percentage). Differences in characteristics among patients classified as an appropriate outcome or a missed opportunity were examined using Wilcoxon rank-sum test or χ^2 as appropriate. All tests were 2-sided with $P < .05$ considered statistically significant. Analyses were performed in SAS software, version 9.4 (SAS Institute Inc., Cary, North Carolina).

Results

Study Population

A total of 1845 incident dialysis patients were included in the cohort. Table 1 describes their demographic and clinical characteristics, overall and stratified by initial dialysis modality. Patients had a median (IQR) age of 69 (59-77) years, and the majority (65%) were men. As expected, there was a high prevalence of diabetes (63%) and cardiovascular disease (57%). The mean (SD) estimated glomerular filtration rate at dialysis initiation was 9.5 (4.4) mL/min/1.73 m². The median (IQR) for duration of predialysis care was 30.2 (12.9-60.4) months. Approximately one-third of patients were initiated on PD or

home HD. A significant proportion of patients ($n = 667$, 36%) commenced HD acutely in hospital. These patients tended to be older with a higher burden of diabetes and cardiovascular disease and shorter duration of predialysis care.

Modality Selection and Chronic Dialysis Therapy

Figure 2 shows the cross-classification of patients' chosen dialysis modality and their destination therapy. Those who chose PD were the most likely to initiate a home therapy, with the vast majority starting PD while also noting that a small number of patients ($n = 6$) transitioned to home HD. Among those who initially chose home HD, approximately half (45%) received the therapy. A total of 320 (17.3%) missed opportunities for recruitment to home therapies were identified. This included 165 (8.9%) patients who had chosen either PD ($n = 138$, 7.5%) or home HD ($n = 27$, 1.5%), and 155 (8.4%) patients who were undecided about their preferred modality, all of whom were ultimately maintained on in-center HD. Interestingly, among 722 patients who chose in-center HD as their preferred modality, 63 (9%) initiated a home therapy. Among 215 patients who were undecided about their preferred modality, 56 (27%) ultimately started a home therapy. Patients who chose a home therapy and started a home therapy ("appropriate outcome") tended to be younger and were less likely to have diabetes or cardiovascular disease and in predialysis care longer, compared with patients classified as a missed opportunity (Table 2).

Suitability for Home Therapies

Of the 320 missed opportunities, 8 patients (2.5%) had a documented contraindication to both PD and home HD, such

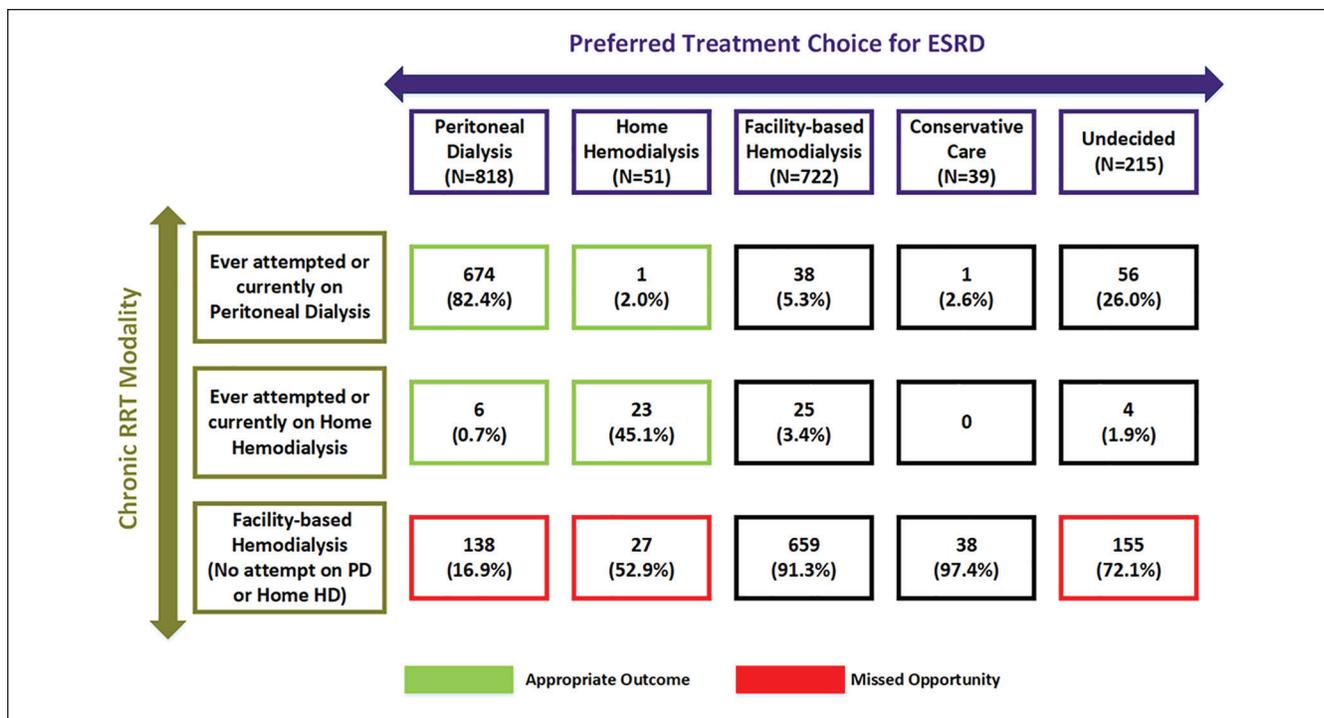


Figure 2. Cross-classification of patients' chosen dialysis modality and their destination modality. Note. PD = peritoneal dialysis; HD = hemodialysis.

Table 2. Characteristics of Patients by Cross-classification of Patients' Chosen Dialysis Modality and Their Final Maintenance Modality.

	Appropriate outcome	Missed opportunity	P value
Number of Patients	704	320	
Age, median [IQR], y	66 [56-74]	71 [61-77]	<.001
Male, No. (%)	477 (68)	206 (64)	.29
Race/Ethnicity, No. (%)			.02
Caucasian	405 (58)	199 (62)	
Asian Oriental	127 (18)	34 (11)	
South or East Asian	122 (17)	53 (16)	
Indigenous	21 (3)	15 (5)	
Other	29 (4)	19 (6)	
Diabetes, No. (%)	418 (59)	199 (62)	.39
Cardiovascular disease, No. (%)	340 (48)	207 (65)	<.001
Duration of pre-dialysis care at Kidney Care	31.1	24.8	.03
Clinic, median [IQR], mo	[13.5-62.0]	[10.6-51.5]	
Estimated glomerular filtration rate (mL/min/1.73 m ²), median [IQR]	9 [7-11]	9 [7-13]	.07

Note. IQR = interquartile range.

that 312 patients were either suitable or potentially suitable for a home therapy (Figure 3).

Modality Education

There were differences in the types of modality education received among patients classified as an appropriate outcome and a missed opportunity ($P < .001$). Among missed opportunity patients who had chosen a home therapy but without a documented contraindication to both home

therapies, most (71%) received general modality orientation, whereas just 20% received more specific home therapy education (Figure 3). This is in contrast to patients who chose and started a home therapy, of whom 35% received specific education in home therapies. Data regarding education were not available for a substantial number of patients who started in-center HD having initially been undecided about their modality (Figure 3). General orientation and home therapy-specific education were delivered to 31% and 9% of these patients, respectively.

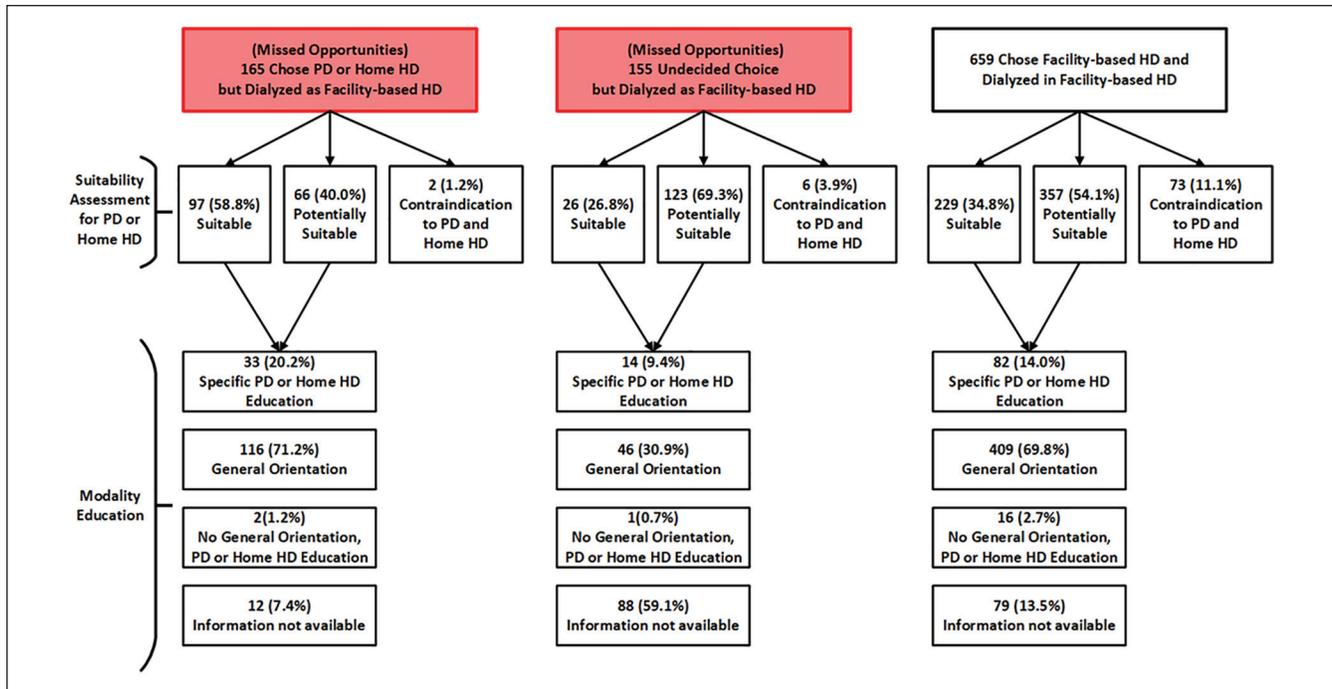


Figure 3. Suitability for home therapies and the type of modality education received.

Discussion

Our study shows that, even in the setting of a mature home therapy program with multidisciplinary predialysis care, there can be a significant number of potentially suitable patients with advanced kidney disease who are not recruited to a home therapy. Although this may seem intuitive, the true extent of the problem is not well documented in the literature. To our knowledge, this is the first study to quantify missed opportunities for recruitment to home therapies from multiple centers and using contemporary data from a centralized clinical information system. By mapping the patient's journey from predialysis care through to dialysis initiation, we were able to identify points along that pathway where our processes could be optimized. In particular, we discovered a mismatch between patients who did not have a clear contraindication to both PD and home HD, and the number of patients who received dedicated education in home therapies. While it should be acknowledged that many factors go into a patient's modality decision, our findings demonstrate the need for kidney programs to evaluate their current processes for recruitment to home therapies with the aim of identifying steps in the pathway that require further interrogation and/or quality improvement initiatives.

Patients with end-stage kidney disease can experience direct benefits from home therapies through increased autonomy, the capability to influence their care, and being in a home setting.¹⁰⁻¹² Interestingly, we observed instances where patients chose in-center HD during their predialysis care, but who were subsequently transitioned to a home therapy. This

demonstrates that patients are malleable in their thought processes toward modality selection, and that the door to home therapies should remain open for all patients, even if their initial inclination was toward in-center HD. Further support for this comes from a recent survey of incident HD patients, of whom 47% felt that their modality decision was not entirely their own choice.^{13,14} It could be argued that the recruitment of even a small proportion of these patients to a home therapy could have a significant beneficial impact on patients and the health care system alike. A comprehensive cost-effectiveness analysis comparing home-based with facility-based dialysis found that home-based options are associated with reduced cost to the health care system, lower travel costs, reduced need for relocation from rural communities, and higher maintenance of workforce productivity.^{4,10,11} When compared with in-center HD, both PD and home HD were associated with lower dialysis lifetime costs to the system with savings of >\$36 000 and >\$75 000 respectively.¹⁰ In BC, home therapies are generally estimated to cost approximately \$45 000 to \$50 000 per patient per year, whereas in-center dialysis costs between \$65 000 and \$90 000 per patient per year.¹¹ Even recruitment of a small proportion of these missed opportunities could therefore contribute to large cost savings.^{10,11}

The pathways that a patient may take from the time of initial modality selection to their maintenance dialysis therapy have not been comprehensively described in the literature, nor is a single process universally applicable in all jurisdictions. A conceptual 6-step model has been proposed

as a way to guide programs when evaluating the recruitment of patients to home therapies.⁵ Within a “home first” renal program, all patients are expected to be screened for suitability for home-based therapies and any barriers resolved where possible. Previous studies found that 17% to 37% of those aged 55 to 62 years and 20% of those aged >75 years had a contraindication to a home therapy.^{15,16} While acknowledging that contraindications may have been under-captured in this study, less than 5% of the overall cohort had a clear contraindication to both PD and home HD. One of the challenges in comparing studies is the heterogeneity in what constitutes a contraindication to home dialysis. Depending on the experience and culture of a given program, a barrier to home therapies may or may not be perceived as insurmountable. For instance, the home therapy program in BC has for many years been pushing the boundary for inclusion of patients into the program, including the provision of support services and specialized nursing staff.⁶ The adoption of streamlined definitions of absolute and relative contraindications would facilitate a more meaningful comparison of home therapy incidence rates between different programs.

In addition to the general orientation provided to patients and their families regarding kidney replacement therapy options, there is evidence that providing patients with specific home-based education increases the likelihood of them choosing a home therapy.^{14,17} These focused education sessions provide an avenue to discuss common patient-perceived barriers, alleviate fears and anxieties, and facilitate the transition to the home environment.¹⁸ Therefore, patients who are deemed suitable for a home therapy should be offered further dedicated education to fully inform their modality decision.¹⁷⁻²⁰ Our study found that the majority of potentially suitable patients did not receive specific education in home therapies. A more detailed assessment of these cases will be needed to identify root causes for this finding, along with interventions to target improvement in this step of the recruitment process. Furthermore, a significant number of the excluded patients ($n = 910$) would have started acute HD without receiving prior modality education due to limited or no exposure to the predialysis pathway. These suboptimal starts would benefit from a structured education program to provide the opportunity to learn about their home dialysis options and aid in transition. Novel patient-centered methods to promote home therapies have been explored in the literature, including transition nurses, transition guides, and patient navigators.^{6,19-23} While such multifaceted approaches to education could enhance recruitment to home therapies, individual programs need a means of quantifying the effect of any specific intervention that is undertaken.^{11,19-23} This starts with having a complete understanding of the current process of recruitment.

Our study has a number of limitations inherent to the secondary utilization of administrative data. Although the clinical information system automatically captures clinical data

from several data sources, there remains a need for manual data entry from clinical staff which is subject to inaccuracy and incomplete information. This may have contributed to the lower than expected frequency of education/orientation received by patients and the lower frequency of contraindications observed compared with other programs. Unfortunately, we were unable to interrogate the nature of these contraindications. Health authorities within the province of BC are likely to exhibit variability in their approach to education and assessments for home therapies, which would not be accounted for when the data are assessed at the aggregate level. Furthermore, there remains a level of subjectivity from their clinical team as to the which patients are provided specific home therapy education after completing the general orientation. This may be based on nontraditional barriers or due to a clinical gestalt but remain important factors to capture when attempting to standardize future practice. We only included patients who had a minimum of 3 months of predialysis care, and this time window may not represent an adequate amount of time for patients to reach an informed decision regarding their modality preference. One study found a significant increase in mortality in those referred for predialysis care within 3 months of their dialysis start (40% vs 27% in 1 year), and several others have found that even longer pre-dialysis durations (upward of 1 year) lead to multiple benefits.^{24,25} Our study found that the median predialysis duration was lower among the missed opportunities group, which may suggest that longer predialysis care might be an important factor. We had chosen 3 months as this has been the local experience as a reasonable time window for expedited dialysis education prior to start. These limitations are balanced by several strengths. The continuously updated clinical information system provided real-time data captured from clinical encounters. The sample size was large and representative of the provincial incident dialysis population across the full spectrum of age and ethnicity.

Conclusion

This provincial study found a significant number of missed opportunities to recruit patients to home-based dialysis therapies despite the availability of standardized predialysis care and a “home first” renal program. By first understanding the magnitude and scope of these missed opportunities, programs may be in a stronger position to prioritize resource allocation and interventions, such as better characterizing suitability for home therapies and ensuring that all suitable patients receive home therapy-specific education. We suggest that renal programs in other jurisdictions apply a similar approach to map their existing recruitment pathway and identify areas that could be optimized, as even small incremental improvements may lead to better patient outcomes and contribute to significant cost savings for the health care system.

Ethics Approval and Consent to Participate

This work was undertaken as part of a quality improvement initiative under the auspices of the provincial Home Therapies Committee of BC Renal and was therefore not subject to review by a research ethics board.

Consent for Publication

All authors have consented for publication.

Availability of Data and Materials

All relevant data are presented in the manuscript.

Declaration of Conflicting Interests

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