Canadian Society of Nephrology/ Société canadienne de néphrologie CSN/SCN
CANADIAN JOURNAL OF KIDNEY HEALTH AND DISEASE
Journal canadien de la santé et de la maladie rénale

Quality Assurance and Improvement in Nephrology-Original Clinical Research Quantitative

Canadian Journal of Kidney Health and Disease
Volume 7: 1–10

DOI: 10.1177/2054358120977391
journals.sagepub.com/home/cjk
SAGE

An Environmental Scan and Evaluation of Home Dialysis Quality Indicators Currently Used in Canada

Lisa Dubrofsky[1], Ali Ibrahim[2], Karthik Tennankore[3], Krishna Poinen[4], Sachin Shah[5], and Samuel A. Silver[6]

Abstract

Background: Quality indicators are important tools to measure and ultimately improve the quality of care provided. Performance measurement may be particularly helpful to grow disciplines that are underutilized and cost-effective, such as home dialysis (peritoneal dialysis and home hemodialysis).
Objective: To identify and catalog home dialysis quality indicators currently used in Canada, as well as to evaluate these indicators as a starting point for future collaboration and standardization of quality indicators across Canada.
Design: An environmental scan of quality indicators from provincial organizations, quality organizations, and stakeholders.
Setting: Sixteen-member pan-Canadian panel with expertise in both nephrology and quality improvement.
Patients: Our environmental scan included indicators relevant to patients on home dialysis.
Measurements: We classified existing indicators based on the Institute of Medicine (IOM) and Donabedian frameworks.
Methods: To evaluate the indicators, a 6-person subcommittee conducted a modified version of the Delphi consensus technique based on the American College of Physicians/Agency for Healthcare Research and Quality criteria. We shared these consensus ratings with the entire 16-member panel for further examination. We rated items from 1 to 9 on 6 domains (1-3 does not meet criteria to 7-9 meets criteria) as well as a global final rating (1-3 unnecessary to 7-9 necessary) to distinguish high-quality from low-quality indicators.
Results: Overall, we identified 40 quality indicators across 7 provinces, with 22 (55%) rated as "necessary" to distinguish high quality from poor quality care. Ten indicators were measured by more than 1 province, and 5 of these indicators were rated as necessary (home dialysis prevalence, home dialysis incidence, anemia target achievement, rates of peritonitis associated with peritoneal dialysis, and home dialysis attrition). None of these indicators captured the IOM domains of timely, patient-centered, or equitable care.
Limitations: The environmental scan is a nonexhaustive list of quality indicators in Canada. The panel also lacked representation from patients, administrators, and allied health professionals.
Conclusions: These results provide Canadian home dialysis programs with a starting point on how to measure quality of care along with the current gaps. This work is an initial and necessary step toward future collaboration and standardization of quality indicators across Canada, so that home dialysis programs can access a smaller number of highly rated balanced indicators to motivate and support patient-centered quality improvement initiatives.

Abrégé

Contexte: Les indicateurs de la qualité sont des outils essentiels pour mesurer et, ultimement, améliorer la qualité des soins prodigués aux patients. La mesure de la performance peut s'avérer particulièrement utile pour développer des disciplines rentables et sous-utilisées comme la dialyse à domicile (dialyse péritonéale et hémodialyse à domicile).
Objectif: Inventorier et classer les indicateurs de qualité de la dialyse à domicile présentement en usage au Canada, et les évaluer comme point de départ d'une future collaboration et normalisation des indicateurs de qualité à travers le Canada.
Type d'étude: Une analyse contextuelle des indicateurs de qualité des organisations provinciales, des organismes de gestion de la qualité et des différents intervenants.
Cadre: Un comité pancanadien composé de 16 personnes détenant une expertise en néphrologie et en amélioration de la qualité.
Sujets: L'analyse contextuelle incluait des indicateurs pertinents pour des patients dialysés à domicile.

Mesures: Nous avons classé les indicateurs existants en nous basant sur les cadres de référence Donabedian et de l'Institute of Medicine (IOM).
Méthodologie: Un sous-comité de six personnes a employé une version modifiée de la méthode Delphi basée sur les critères de l'*American College of Physicians/Agency for Healthcare Research and Quality* pour évaluer les indicateurs. Nous avons partagé les évaluations consensuelles à l'ensemble des 16 membres du comité pour un examen plus approfondi. Pour distinguer les indicateurs de haute qualité des indicateurs de faible qualité, les différents éléments ont été classés de 1 à 9 pour six domaines (où 1-3 correspondaient à « ne répond pas aux critères » et 7-9 à « répond aux critères ») et une note finale globale (où 1-3 = inutile et 7-9 = nécessaire) leur a été attribuée.
Résultats: En tout, 40 indicateurs de la qualité ont été identifiés dans sept provinces, dont 22 (55 %) ont été jugés « nécessaires » pour distinguer les indicateurs de haute qualité des indicateurs de mauvaise qualité. Dix indicateurs ont été mesurés par plus d'une province, et cinq ont été jugés nécessaires (prévalence et incidence de la dialyse à domicile, atteinte de la cible pour l'anémie, taux de péritonites associées à la dialyse péritonéale et attrition de la dialyse à domicile). Aucun de ces indicateurs ne couvrait les domaines de l'IOM relatifs aux soins en temps opportun, aux soins axés sur le patient et aux soins équitables.
Limites: Cette analyse contextuelle constitue une liste non exhaustive des indicateurs de qualité au Canada. De plus, le comité manquait de représentation parmi les patients, les administrateurs et les professionnels paramédicaux.
Conclusion: Ces résultats fournissent aux programmes canadiens de dialyse à domicile un point de départ sur la façon de mesurer la qualité des soins, de même qu'un portrait des lacunes actuelles. Ces travaux constituent la première étape nécessaire vers une future collaboration et normalisation des indicateurs de la qualité des soins à travers le Canada, afin que ces programmes disposent d'un nombre restreint d'indicateurs équilibrés et de grande qualité pour motiver et soutenir des initiatives d'amélioration de la qualité axées sur le patient.

Keywords
home dialysis, peritoneal dialysis, home hemodialysis, quality indicators, quality improvement, measuring quality

Received May 7, 2020. Accepted for publication October 29, 2020.

Introduction

The increasing burden of end-stage kidney disease (ESKD) has brought heightened interest in home dialysis modalities, including peritoneal dialysis (PD) and home hemodialysis (HHD).[1] Home-based dialysis therapies may be relatively underutilized in Canada, with reported prevalence rates of 17% for PD and 3% for HHD.[2] Both PD and HHD have also been shown to be equally effective and less costly relative to in-center hemodialysis in the Canadian health care context.[2] Therefore, growing high-quality home dialysis programs have become a national priority. One strategy to enable high-quality health care is through quality indicator measurement, which is then utilized by the applicable stakeholders to improve health care delivery for patients with ESKD interested in home dialysis.

Multiple frameworks for defining health care quality exist. The Institute of Medicine (IOM) identifies domains of health care quality as safe (free from harm), effective (using best available evidence), efficient (limits waste), timely (available when needed), patient-centered (focused on the patient), and equitable (equally available).[3] While the IOM domains are helpful in defining health care quality, the Donabedian framework is often used to describe how health care is delivered. In the Donabedian framework, the 3 components of health care quality are structure (the setting in which care occurs), process (the care that is done to the patient), and outcome (how the care ultimately affects the patient).[4] In addition to covering these elements of health care quality, it is also recommended that quality of care indicators be evidence-based, precisely specified, and feasible for subsequent quality improvement activities.[5]

[1]Division of Nephrology, Sunnybrook Health Sciences Centre, University of Toronto, ON, Canada
[2]Division of Nephrology, Department of Medicine, University Health Network, University of Toronto, ON, Canada
[3]Division of Nephrology, Department of Medicine, Dalhousie University & Nova Scotia Health Authority, Halifax, Canada
[4]Division of Nephrology, Department of Medicine, University of British Columbia, Vancouver, Canada
[5]Division of Nephrology, Department of Medicine, University of Saskatchewan, Saskatoon, Canada
[6]Division of Nephrology, Kingston Health Sciences Center, Queen's University, ON, Canada

Corresponding Author:
Samuel A. Silver, Division of Nephrology, Kingston Health Sciences Center, Queen's University, 76 Stuart Street, 3-Burr 21-3-039, Kingston, ON, Canada K7L 2V7.
Email: samuel.silver@queensu.ca

In Canada, it is unclear what home dialysis quality indicators exist and the degree that they characterize the different domains of health care quality. Overlap and repetition is also very likely given that health care is a provincial jurisdiction. Therefore, we sought to identify and catalog (by the IOM and Donabedian frameworks) home dialysis quality indicators currently used in Canada, as well as to evaluate these indicators based on the American College of Physicians/Agency for Healthcare Research and Quality criteria.[5,6] Our aim is to provide a pan-Canadian resource of existing quality indicators in home dialysis to inform improvement initiatives, as well as serve as a starting point for future collaboration and standardization of quality indicators across Canada.

Methods

Indicator Identification and Categorization

We collected publicly available quality indicators currently in use by nephrology programs across the country (including British Columbia, Alberta, Saskatchewan, Manitoba, Quebec, Ontario, and the Atlantic Provinces). For indicators not publicly available, we contacted provincial data leads, division heads, and home dialysis content experts. We stopped the environmental scan once we achieved representation from all the aforementioned provinces.

We combined similar indicators into a single measure and characterized each indicator according to the IOM and Donabedian frameworks of health care quality; we also included balancing indicators so as to capture measures that look at potential adverse effects of home dialysis (eg, infectious complication).[7]

Indicator Evaluation

We rated the identified indicators using a modified version of the American College of Physicians/Agency for Healthcare Research and Quality performance measure review criteria, which included the following dimensions (Supplemental Table 1)[5,6,8]:

- Importance: The metric will lead to measurable and meaningful improvement or there is a clear performance gap.
- Evidence-base: The metric is based on high-quality and high-quantity evidence.
- Measure specifications: The metric can be clearly defined (ie, numerator and denominator) and reliably captured.
- Feasibility and applicability: The metric is under the influence of health care providers and/or the health care system, with data collection and improvement activities both feasible and acceptable.

Based on these dimension ratings, each indicator then received a final global rating rather than an average score based on its overall ability to distinguish good quality from poor quality.[6]

Modified Delphi Process

We then used a modified version of the Delphi consensus technique to evaluate the identified quality indicators, based on the RAND method and the above American College of Physicians/Agency for Healthcare Research and Quality performance measure review criteria.[9] This process involved a structured approach through which the expertise and knowledge of a group of individuals was systematically obtained and interspersed by opinion feedback. We used multiple stages of the modified Delphi technique, including individual rating, consensus meeting, and final ranking to allow for optimal, unbiased expression of opinions. This format is an established technique for developing and evaluating quality indicators in health care.[8,10-16]

First, we made the identified home dialysis quality indicators available to 6 members (home dialysis subcommittee) of a 16-member volunteer national quality indicator committee. The 16-member committee included representatives from 7 of 10 provinces, with most possessing advanced training in quality improvement. Each member of the home dialysis subcommittee then individually reviewed the quality indicators identified in the environmental scan in advance of a teleconference in which the indicators and their preliminary ratings were discussed. Through group discussion, the 6 panelists provided initial group ratings on whether the indicator met criteria within each of the American College of Physicians/Agency for Healthcare Research and Quality dimensions using a 9-point scale where 1 to 3 indicated "does not meet criteria," 4 to 6 "meets some criteria," and 7 to 9 "meets criteria." For the global rating, we considered quality indicators as "necessary" if the median rating was 7, 8, or 9 and there was no disagreement by any member. We considered indicators as "unnecessary" if the median rating was 1, 2, or 3 and there was no disagreement by any member. We considered all other indicators as "supplemental."

Next, we shared the group ratings with each home dialysis subcommittee member to compare with their initial rating and provide feedback as needed. Any disagreements prompted further discussion until we achieved consensus. These consensus ratings were then shared with the entire 16-member committee, with further discussion of any ratings that differed by $\geq$3 points. The final ratings were approved by the full 16-member committee prior to publication. Formal research ethics board review was not required by Queen's University based on the Tri-Council Policy Statement for ethical human research, as the focus of the study involved quality indicators and not human participants.

Results

Our environmental scan revealed 40 home dialysis quality indicators across 7 provinces in Canada (Table 1). IOM

Table 1. Environmental Scan of Current Canadian Nephrology Quality Indicators.

Institute of Medicine domains of quality	Donabedian framework of health care quality			
	Structure	Process	Outcome	Balancing
Safe			--Home dialysis technique/ treatment survival (1)	--Number of hospital admissions per year (2) --Number of hospital days per year (1) --PD peritonitis rates (6) --PD catheter exit site infections (1) --Home hemodialysis access infections (2)
Effective		--Home hemodialysis access type (1) --PD catheter outcomes, stratified by insertion technique (1) --eGFR at PD start (1)	--Home dialysis patients achieving targets for solute removal, hemoglobin, phosphate, and PTH (2)	--Attrition due to technique failure, transplant and death (7)
Efficient	--Presence of home dialysis quality improvement team (1)	--% of assessed patients who are eligible for home dialysis (1) --% of offered patients who choose home dialysis (1) --Number of home dialysis referrals (3) --eGFR at time of home dialysis referral (1) --Number of PD catheter insertions (1) --Number of patients started on hemodialysis while waiting for a PD catheter (1) --eGFR at PD catheter insertion (1)	--Home dialysis prevalence (5) --Home dialysis incidence (6) --Home dialysis as first modality (1)	--Home dialysis training failures and reasons (1) --Home dialysis exit at 6 and 12 months and reasons (1) --Home dialysis training time (1) --PD catheter removal rates and reasons (2)
Timely		--Time from PD catheter surgery referral to surgical clinic (1) --Time from surgical clinic visit to catheter insertion (1)	--Home dialysis incidence within 6 months of chronic dialysis initiation (3)	
Patient-centered	--Presence of predialysis educator (1) --Presence of a multidisciplinary PD team (1)	--Transitions from PD to home hemodialysis (1)	--Home dialysis as preferred modality choice (1) --Quality of life on home dialysis (1)	
Equitable		--% of patients assessed for home dialysis (1) --% of eligible patients who are offered home dialysis (1) --Number of patients on assisted PD (1)		

Note. The denominator is 7 provinces (territories excluded and Atlantic provinces combined) and the table indicates the number of provinces currently using the listed indicator. PD = peritoneal dialysis; eGFR = estimated glomerular filtration rate; PTH = parathyroid hormone.

domains covered included safety (n = 6, 15%), effective (n = 8, 20%), efficient (n = 15, 38%), timely (n = 3, 7%), patient-centered (n = 5, 13%), and equitable (n = 3, 7%). Donabedian categories covered included structure (n = 3, 7%), process (n = 16, 40%), outcome (n = 11, 28%), and balancing (n = 10, 25%).

We found little overlap in the quality indicators being measured among provinces. Only 10 indicators were measured by multiple provinces, with only 4 indicators measured by most of the provinces (home dialysis prevalence, home dialysis incidence, rates of PD peritonitis, and home dialysis attrition). These common indicators focused on safe (n = 3), effective (n = 2), and efficient (n = 4) care and were primarily outcome (n = 4) and balancing measures (n = 5). The only patient-reported outcome/experience measure (PROM or PREM) identified was quality of life, consistently assessed by only a single province.

With respect to overall ability to distinguish good quality from poor quality (ie, necessary versus unnecessary for improvement), we rated 22 (55%) indicators as "necessary," 11 (27%) as "supplemental," and 7 (18%) as "unnecessary" (Table 2). The 22 "necessary" indicators focused on safe (n = 3, 14%), effective (n = 4, 18%), efficient (n = 7, 32%), timely (n = 2, 9%), patient-centered (n = 4, 18%), and equitable (n = 2, 9%) care and consisted of 2 (9%) structure measures, 8 (36%) process measures, 7 (32%) outcome measures, and 5 (23%) balancing measures.

Four common themes emerged during the rating process. First, the strength of evidence for most indicators was moderate, with only 10 indicators receiving ratings of 7 to 9. Second, most indicators could be precisely defined and specified, but definitions often varied between provinces. For example, some provinces measure "home dialysis incidence within 6 months of chronic initiation of dialysis," whereas others use different time frames, exclusions, and risk adjustments. Third, feasibility of data collection varied across the indicators due to differing provincial infrastructure and electronic medical record (EMR) capabilities. This theme was particularly problematic for indicators that relied on patient or health care staff perspectives (eg, quality of life, reasons for home dialysis attrition). Last, the panel rated most indicators (n = 23, 58%) as usable for quality improvement (ie, under the influence of health care providers and/or the health care system, with data collection and improvement activities both feasible and acceptable). Notable exceptions included measures not necessarily attributable to nephrology, such as rehospitalizations.

Of the 10 indicators measured by multiple provinces, the panel rated 5 as "necessary." These included home dialysis prevalence, home dialysis incidence, anemia target achievement, rates of PD peritonitis, and home dialysis attrition. None of these indicators captured the IOM domains of timely, patient-centered, or equitable care.

Discussion

In an environmental scan of home dialysis quality indicators across Canada, we identified 40 unique indicators. Our pan-Canadian panel with experience in both home dialysis and quality improvement rated just over half of these indicators as "necessary" to distinguish good quality from poor quality care based on the American College of Physicians/Agency for Healthcare Research and Quality criteria. However, we observed little overlap of indicators across provinces and only 5 indicators used by multiple provinces received global ratings $\geq$7. In addition, we noted several of the IOM domains of quality had little representation, specifically measures of timely, patient-centered, and equitable care. These results provide Canadian home dialysis programs with a starting point on how to measure quality of care, which we envision as an initial step toward future collaboration and standardization of quality indicators across Canada.

There is little published data on quality indicators in home dialysis. A recent review by the American Society of Nephrology (ASN) Quality Committee identified 60 national indicators for all aspects of kidney disease (except transplantation), of which only 3 specifically pertained to home dialysis (PD adequacy, PD catheter success rate, and PD catheter exit site infection rate).[8] Of their 60 indicators, the panel rated 29 (49%) as metrics with high validity using a similar approach as our group. These findings are consistent with our data for Canadian home dialysis indicators, showing approximately 50% of current indicators are highly rated. Also consistent with the ASN results are the identification of some common themes that affect quality of care measures. These included indicators based on questionable evidence and measures without a performance gap (ie, so-called "topped-out" measures).[17] Examples of "topped-out" home dialysis measures included dialysis adequacy and achievement of anemia targets. Given the large number of home dialysis indicators observed, it is important to continually assess measures to ensure they are based on the most current evidence and performance gaps exist.

Our work extends these lessons by also categorizing existing home dialysis indicators by the IOM and Donabedian frameworks, which highlights gaps and opportunities for new measure development. Most highly rated indicators used by multiple provinces focus on outcome or balancing measures in the domains of safe, effective, and efficient care. Notably missing are structure (the setting in which care occurs) and process (the care that is done to the patient) measures, along with measures of timely, patient-centered, and equitable care. As a first step, some of the identified indicators could be modified to measure other IOM domains (eg, by adding a time component to the definition).

Besides providing home dialysis programs with a starting point on how to measure quality of care, we believe the observed variation in such a large number of indicators combined with little overlap in the highly rated indicators suggests

Table 2. Quality Indicators Rated by the American College of Physicians/Agency for Healthcare Research and Quality Performance Measure Criteria Using a Modified Delphi Technique.

Indicator type	Targets important improvements	Strong level of evidence	Performance gap exists	Precisely defined and specified	Feasible to collect	Usable for QI	Final rating	Notes
Structure								
Presence of predialysis educator	9	6	5	9	9	9	8	--Lends itself more to a process measure (eg, did education occur by a certain point in time)
Presence of multidisciplinary PD team	8	7	6	7	8	8	7	--May act as a surrogate for program size
Presence of home dialysis QI team	8	6	8	5	5	7	6	
Process								
% of patients assessed for home dialysis	8	3	8	7	3	7	7	--Important to specify the denominator (eg, all MCKC patients or just patients deemed eligible for home dialysis)
% of assessed patients who are eligible for home dialysis	7	4	7	7	3	8	7	--Would need appropriate risk adjustment
% of eligible patients who are offered home dialysis	7	5	2	3	3	5	2	--May not be a performance gap and may need to be adjusted for upcoming transplant
% offered patients who choose home dialysis	8	4	7	7	7	7	8	--Consider recording reasons why home dialysis is not chosen
No. of home dialysis referrals	7	3	7	1	7	7	6	--Fine as a local measure, but need to know denominator (eg, entire population or only eligible for home dialysis for it to be useful)
eGFR at time of home dialysis referral	4	1	4	5	3	4	4	
Time from PD catheter surgery referral to surgical clinic	8	6	7	8	8	8	8	
Time from surgical clinic visit to catheter insertion	8	7	7	8	8	8	8	
No. of PD catheter insertions	6	5	8	9	7	6	6	
No. of patients started on HD while waiting for a PD catheter	6	5	7	9	6	6	6	
PD catheter outcomes, stratified by insertion technique	7	5	7	8	8	7	7	
eGFR at PD catheter insertion	8	6	7	3	3	5	3	--Hard to account for random fluctuations in eGFR
eGFR at PD start	8	6	7	3	6	4	3	
No. of patients on assisted PD	7	7	8	8	8	7	7	--Lends itself more to a structural measure (eg, does the program have an assisted PD program)
No. of transitions from PD to home HD	5	6	6	4	6	6	5	
Home HD by access type	7	7	7	7	7	7	7	
Outcome								
Home dialysis prevalence	8	6	7	6	7	7	7	--Would need appropriate risk adjustment
Home dialysis incidence	8	6	8	5	6	8	7	--Any measure or time frame is sufficient, as long as simply defined
Home dialysis incidence within 6 months of chronic dialysis initiation	7	5	7	6	6	6	6	--The exact time frame is less important than having some measure of incidence that is followed over time
Home dialysis as first modality	8	5	7	6	7	7	7	--Better measure for PD, as unclear how to count training time for home HD patients

(continued)

Table 2. (continued)

Indicator type	Targets important improvements	Strong level of evidence	Performance gap exists	Precisely defined and specified	Feasible to collect	Usable for QI	Final rating	Notes
Home dialysis as preferred modality choice	8	5	7	4	5	7	7	--Patient-centered metric; need to specify if home dialysis has to be the patient's first modality or home dialysis at any time is sufficient (latter is simpler and preferred)
Home dialysis technique/treatment survival	8	8	8	8	7	7	7	--Would need appropriate risk adjustment --Could be used to compare centers --Local centers should then determine reasons for technique failure
% of home dialysis patients meeting solute removal targets	5	4	5	7	6	5	3	--Small performance gap --Lots of additional effort for patients and staff
% of home dialysis patients meeting anemia targets	7	7	6	7	8	7	7	--Not much variation between centers --May be better specified at the program level, including CKD and all patients on dialysis
% of home dialysis patients meeting phosphate targets	5	3	7	7	7	6	3	
% of home dialysis patients meeting PTH targets	5	3	7	2	7	6	2	
Quality of life	8	7	6	7	4	5	7	--Provinces needs to provide programs with both a system to measure and pathways to act on issues identified
Balancing								
Home dialysis training time	6	5	7	6	6	6	6	--Not patient-centered, but monitoring may have financial implications for program
Home dialysis training failures	7	6	7	5	7	7	7	--If adopted, local programs need to track reasons for failures
Home dialysis exits at 6 and 12 mo	8	7	7	7	5	7	7	--Selected time frame should be based on the program's economic breakeven point
Home dialysis attrition due to technique failure, transplant, death	8	6	9	6	7	7	7	--Very challenging to identify granular reasons and solutions
No. of hospital admissions per year	6	5	5	6	4	4	4	--Most reasons for admission are not related to dialysis, which makes them challenging to reduce
No. of hospital days per year	6	5	5	4	3	3	3	
PD peritonitis rates	7	7	6	7	7	7	7	--May be difficult for high-performing program to improve further (ie, measure could be topped out)
PD catheter exit site infections	5	7	6	4	7	7	7	--Lower rate than peritonitis limits its importance
PD catheter removals rates	6	5	6	8	6	5	5	
Home HD access infections	6	6	6	5	5	6	6	--Smaller population than PD --Should differentiate between exit site infections and bacteremia

Note. Each domain was rated on a 9-point scale where 1 to 3 indicated "does not meet criteria," 4 to 6 "meets some criteria," and 7 to 9 "meets criteria." After considering and rating each of these domains, the panelists then rated the overall measure (1-3 = unnecessary, 4-6 = supplemental, 7-9 = necessary). PD = peritoneal dialysis; eGFR = estimated glomerular filtration rate; CKD = chronic kidney disease; HD = hemodialysis; PTH = parathyroid hormone.

Table 3. First Step Toward Development of a Balanced Quality Indicator Scorecard for Home Dialysis.

Institute of Medicine domains of quality	Donabedian framework of health care quality			
	Structure	Process	Outcome	Balancing
Safe			--Home dialysis technique/ treatment survival (*definition, numerator, denominator, risk adjustment, and minimum acceptable target need to be specified*)	--Infectious complications, such as rates of peritoneal dialysis peritonitis or home HD vascular access infections
Effective				--Home dialysis attrition, including transplant and death (*standard template to document major reasons for attrition is needed*)
Efficient		--% offered patients who choose home dialysis (*numerator, denominator, risk adjustment, and minimum acceptable target need to be specified*)	--Home dialysis incidence (*time frame, numerator, denominator, risk adjustment, and minimum acceptable target need to be specified*)	
Timely		**--Time from dialysis access order to insertion** **--Time to transition patients from in-center HD to home dialysis modality**		
Patient-centered	--Presence of a multidisciplinary home dialysis team (*specific staffing components, full-time equivalents, and responsibilities need to be clearly defined*)		**--Patient-reported outcome and experience measures**	
Equitable	**--Presence of programs to support home dialysis access to underserved populations (eg, elderly, rural, obese)**			

Note. Several highly rated indicators from the environmental scan have been populated (in regular font), with indicator gaps (in bold) and additional work needed to complete the scorecard (in italics). HD = hemodialysis.

an opportunity exists for collaboration and standardization of quality indicators across Canada. Important considerations would include ensuring the selected indicators could be precisely defined and specified across provinces given different data infrastructures and EMRs, along with consensus on the included indicators and criteria for adding and removing indicators. Collaboration may also help programs to define and validate new indicators that have not been highly rated by demonstrating that adopting these measures into quality improvement initiatives lead to improvements in care. In this way, we may reduce measurement costs, data collection burden, and ensure that we are not "re-inventing the wheel" to solve similar problems.

Accordingly, we have proposed initial steps toward development of a balanced quality indicator scorecard for home dialysis (Table 3). This scorecard is intended to help programs focus on a small number of prioritized indicators across all domains of quality and stimulate further discussion. It should also be recognized that for many measures (particularly process measures), it may be preferable to stratify by home modality given the different barriers to success. The scorecard incorporates all aspects of the IOM and Donabedian

frameworks, as well as highly rated indicators already in use by multiple provinces. These latter indicators include home dialysis incidence (which changes quicker than home dialysis prevalence), rates of PD peritonitis (under infectious complications), and home dialysis attrition. We have also included the presence of a multidisciplinary home dialysis team as a structural measure given its association with persistent use of PD at 1 year[18]; however, the staffing components, full-time equivalents, and responsibilities of the multidisciplinary team remain to be determined. A process measure is also needed to capture efforts at home dialysis uptake, for which the proportion of offered patients who choose home dialysis was highly rated; although any quality indicator that captures this construct would be acceptable. For process measures (especially those related to education and decision-making), it is important to ensure that they accurately capture whether the process has been provided as intended (ie, fidelity). Otherwise, the measure could be susceptible to "gaming."[19] Newly developed indicators are required to measure timely, patient-centered, and equitable care, and our suggestions are meant to elicit further discussion of how to routinely measure these in a manner that is useful for quality improvement initiatives and not overly burdensome to staff. In particular, a standardized approach is required to capture patient-reported outcome and experience measures (PROMs and PREMs) in a manner that is not overly burdensome to patients and staff, as well as being amenable to quality improvement interventions. The omission in available PROMs and PREMs was also noted by the ASN Quality Committee,[8] emphasizing the importance of this work.

Strengths of this work include the structured approach to indicator categorization and evaluation, using the IOM and Donabedian frameworks along with the American College of Physicians/Agency for Healthcare Research and Quality criteria. Our panel also included members representing most regions of Canada to ensure relevance and feasibility of the indicators across different health care contexts, in addition to advanced training and real-life expertise in home dialysis and/or quality improvement to ensure applicability to frontline improvement efforts.

Our work does have some limitations. First, the environmental scan is a nonexhaustive list of quality indicators currently being used at the local and provincial levels. However, we did collect indicators from across the country, except for the 3 territories. Second, we did not examine how indicators were operationalized (ie, numerator, denominator, risk adjustment), as the focus of this work was on the indicator construct. Operational definitions for quality indicators must be clarified before implementation.[5] For example, the process measure "time from surgical clinic to catheter insertion" requires a clear definition to avoid interpretation being affected by purposeful "early" referrals with planned catheter deferral or unintentional "late" referrals." Third, the differences between process and outcome measures can be subjective, especially for evidence-based surrogate outcomes (eg, vascular access, anemia).[19] Fourth, there is some degree of overlap in which IOM domains different indicators should be categorized. (eg, eGFR at time of home dialysis referral could be considered as a marker of efficient or timely access to care). Similarly, if home dialysis prevalence is stratified by geography, then this could measure equity. We classified indicators based on the description provided, but what really determines the IOM domain is how the indicator is used to drive frontline improvement efforts. Fifth, the evaluation of indicators was not anonymous, and so there is the potential for bias through the bandwagon effect.[20] Sixth, the panel was composed of 15 physicians and 1 nurse practitioner, and so the results may not represent the views of other important stakeholders in home dialysis quality, such as patients, administrators, and allied health professionals.

Conclusions

In summary, we identified 40 home dialysis quality indicators currently being measured across Canada. Of the 22 indicators rated as "necessary" to distinguish good quality from poor quality care, 10 were measured by multiple provinces (4 by the majority of provinces) and only 5 of these received global ratings ≥ 7. Furthermore, we noted that most home dialysis quality indicators focus on safe, effective, and efficient care, with gaps in assessment of timely, patient-centered, and equitable care. This work is intended to jump start discussions on the consolidation and standardization of quality indicator measurement and reporting in Canada. Future work will require stakeholder engagement to review data capabilities, operational definitions, risk adjustment, and targets, along with the development of new indicators to fill the identified gaps. Input from nephrology providers trained and committed to working in quality improvement will also be required to ensure candidate indicators remain useful to frontline staff. For example, selected indicators should inform the development of measurement sets and driver diagrams to guide improvement initiatives (ie, home dialysis educator $\rightarrow$ % educated $\rightarrow$ home dialysis incidence). In this way, Canadian home dialysis programs can begin to move beyond measuring 40 indicators of varying validity toward measuring a smaller number of balanced indicators that motivate and support patient-centered quality improvement initiatives.

Ethics Approval and Consent to Participate

No ethics approval or consent was required.

Consent for Publication

All authors approved the final version of this manuscript.

Availability of Data and Materials

The data and material are available from corresponding author upon reasonable request.

Acknowledgments

The authors value the support and guidance from Adeera Levin throughout the design and execution of this work. The other 10 volunteer

quality committee members include William Beaubien-Souligny, Daniel Blum, Tamara Glavinovic, Claire Harris, Jay Hingwala, Amber Molnar, Priya Mysore, Alison Thomas, Amanda Vinson, and Seychelle Yohanna. S.A.S. is supported by a Kidney Research Scientist Core Education and National Training (KRESCENT) Program New Investigator Award (co-funded by the Kidney Foundation of Canada, Canadian Society of Nephrology, and Canadian Institutes of Health Research).

Declaration of Conflicting Interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: S.A.S. has received speaking fees from Sanofi Canada. KT has participated in advisory boards for Otsuka, AstraZeneca, Baxter and Janssen and received unrestricted investigator-initiated grant funding for research from Otsuka and Astellas. The remaining authors have no conflicts of interest relevant to this study. All authors approved the final version of the submitted manuscript. We certify that neither this manuscript nor one with substantially similar content has been published or is being considered for publication elsewhere.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

ORCID iDs

Krishna Poinen https://orcid.org/0000-0002-0118-0280
Sachin Shah https://orcid.org/0000-0003-2809-1023
Samuel A. Silver https://orcid.org/0000-0002-1843-6131

Supplemental Material

Supplemental material for this article is available online.

References

1. Li PK, Cheung WL, Lui SL, et al. Increasing home based dialysis therapies to tackle dialysis burden around the world: a position statement on dialysis economics from the 2nd Congress of the International Society for Hemodialysis. *Nephrology (Carlton)*. 2011;16(1):53-56.
2. Sinclair A, Cimon K, Loncar M, et al. Dialysis modalities for the treatment of end-stage kidney disease: a health technology assessment. Ottawa, ON: Canadian Agency for Drugs and Technologies in Health; 2017.
3. Institute of Medicine, Committee on Quality of Health Care in America. Crossing the quality chasm: a new health system for the 21st century. Washington, DC: National Academies Press; 2001.
4. Donabedian A. The quality of care: how can it be assessed? *JAMA*. 1988;260(12):1743-1748.
5. Stelfox HT, Straus SE. Measuring quality of care: considering measurement frameworks and needs assessment to guide quality indicator development. *J Clin Epidemiol*. 2013;66(12):1320-1327.
6. MacLean CH, Kerr EA, Qaseem A. Time out—charting a path for improving performance measurement. *N Engl J Med*. 2018;378(19):1757-1761.
7. Institute for Healthcare Improvement. Science of improvement: establishing measures. http://www.ihi.org/resources/Pages/HowtoImprove/ScienceofImprovementEstablishingMeasures.aspx. Published 2019. Accessed August 14, 2019.
8. Mendu ML, Tummalapalli SL, Lentine KL, et al. Measuring quality in kidney care: an evaluation of existing quality metrics and approach to facilitating improvements in care delivery. *J Am Soc Nephrol*. 2020;31(3):602-614.
9. Fink A, Kosecoff J, Chassin M, Brook RH. Consensus methods: characteristics and guidelines for use. *Am J Public Health*. 1984;74(9):979-983.
10. Guttmann A, Razzaq A, Lindsay P, Zagorski B, Anderson GM. Development of measures of the quality of emergency department care for children using a structured panel process. *Pediatrics*. 2006;118(1):114-123.
11. Kroger E, Tourigny A, Morin D, et al. Selecting process quality indicators for the integrated care of vulnerable older adults affected by cognitive impairment or dementia. *BMC Health Serv Res*. 2007;7:195.
12. Lindsay P, Schull M, Bronskill S, Anderson G. The development of indicators to measure the quality of clinical care in emergency departments following a modified-Delphi approach. *Acad Emerg Med*. 2002;9(11):1131-1139.
13. Greenberg A, Angus H, Sullivan T, Brown AD. Development of a set of strategy-based system-level cancer care performance indicators in Ontario, Canada. *Int J Qual Health Care*. 2005;17(2):107-114.
14. Bell CM, Brener SS, Comrie R, Anderson GM, Bronskill SE. Quality measures for medication continuity in long-term care facilities, using a structured panel process. *Drugs Aging*. 2012;29(4):319-327.
15. Morris AM, Brener S, Dresser L, et al. Use of a structured panel process to define quality metrics for antimicrobial stewardship programs. *Infect Control Hosp Epidemiol*. 2012;33(5):500-506.
16. Jeffs L, Law MP, Straus S, Cardoso R, Lyons RF, Bell C. Defining quality outcomes for complex-care patients transitioning across the continuum using a structured panel process. *BMJ Qual Saf*. 2013;22(12):1014-1024.
17. Weiner D, Watnick S. The ESRD quality incentive program—can we bridge the chasm. *J Am Soc Nephrol*. 2017;28(6):1697-1706.
18. Pravoverov LV, Zheng S, Parikh R, et al. Trends associated with large-scale expansion of peritoneal dialysis within an integrated care delivery model. *JAMA Intern Med*. 2019;179:1537-1542.
19. Chassin MR, Loeb JM, Schmaltz SP, Wachter RM. Accountability measures—using measurement to promote quality improvement. *N Engl J Med*. 2010;363(7):683-688.
20. Hsu C-C, Brian SA. The Delphi technique: making sense of consensus. *Pract Assess Res Eval*. 2007;12:10.