The START Project: Final Report

Alberta Health Services
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Kidney Health Strategic Clinical Network™

START
Starting dialysis on Time At home on the Right Therapy

Authors

Prepared for the Kidney Health Strategic Clinical Network ™ by:

Dr. Rob Quinn MD PhD FRCPC
Nephrologist and Associate Professor
University of Calgary
Co-chair, START Project

Farah Mohamed BHSc JD
Practice Lead, START Project
Kidney Health Strategic Clinical Network™ (KH SCN™)

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Foreward

On behalf of the Kidney Health Strategic Clinical Network™ (KH SCN™) Leadership Team, we are pleased to share the final results of the **S**tarting dialysis on **T**ime, **A**t Home, on the **R**ight **T**herapy (START) Project.

The START Project was developed by the KH SCN™ in partnership with Alberta Kidney Care (AKC) to address the increasing demand for dialysis in Alberta. The START Project focused on implementing best practice guidelines to optimize the use of peritoneal dialysis (PD) therapy, as well as reduce the inappropriate early initiation of dialysis in patients with end-stage kidney disease (ESKD).

This work would not have been possible without the engagement and support from front-line staff, managers, the START Working Group, AKC Leadership and others who have championed the START Project. We especially thank the project leads, Dr. Rob Quinn, Dr. Rob Pauly, and Tracy Schwartz, as well as Farah Mohamed, the START Practice Lead, for their significant contributions to the START Project. Their support and perseverance made this project possible and successful.

We also thank our patients and their families who, through their resilience, manage a challenging chronic disease on a daily basis. In doing so, our patients and families inspire us to improve their care.

Finally, we congratulate the front-line staff and management who received the **2018 Alberta Health Services' President's Excellence Award for excellence in Quality Improvement**. This award recognizes their successful efforts to safely and effectively improve the use of home dialysis therapies and improve appropriateness of timing of dialysis initiation.

While we have made improvements over the course of the START Project, we believe further uptake of peritoneal dialysis can be achieved if additional process and practice changes are implemented. The START Project was the beginning of a culture change toward continuous quality improvement, and has equipped the teams with the tools necessary to continue to identify and address local and provincial barriers to adopting best practices. The teams' enthusiasm and quality improvement efforts should be celebrated and supported.

The KH SCN™ will continue to work with AKC and the Alberta Health Services (AHS') Quality, Safety and Outcomes Improvement Executive Committee (QSO) in an effort to sustain and further improve peritoneal dialysis outcomes.

Sincerely,

Dr. Nairne Scott-Douglas
Senior Medical Director
Kidney Health Strategic Clinical Network
Alberta Health Services
nairne.scott-douglas@ahs.ca

Louise Morrin
Senior Provincial Director
Kidney Health Strategic Clinical Network
Alberta Health Services
louise.morrin@ahs.ca

Acknowledgements

Kidney Health Strategic Clinical Network™ Leadership
Dr. Marni Armstrong
Dr. Scott Klarenbach
Anita Kozinski
Dr. Braden Manns
Louise Morrin
Dr. Neesh Pannu
Dr. Nairne Scott-Douglas
Terry Smith

START Project Co-Chairs and Core Team
Farah Mohamed
Dr. Robert Pauly
Dr. Rob Quinn
Tracy Schwartz

START Project Working Group
Marilyn Bartoshyk
Jeanette Bigford*
Tony Chacon*
Suzanne Gergely*
Kathryn Iwaasa
Stephanie Lord*
Rhonda Macneil*
Janice McKenzie*
Rhonda Reimer*
Frances Reintjes*
Kin Tam*
Tracy Zeiler*

**indicates Working Group member is also an Alberta Kidney Care Champion*

Alberta Kidney Care Leadership
Carol Easton
Dr. Kailash Jindal
Dr. Dan Muruve
Cathy Osborne
Janice Stewart
Sandi Vanderzee

Alberta Kidney Care Champions
Rachel Atwood
Colleen Astle
Mary Beauchamp
Cheryl Carleton
Shuang Chen
Alanna Colosimo
Lisa Davies
Sherri deBoer
Donna Dooley
Renee Eggert
Danielle Fox
Stephanie Fox
Owen Gaskill
Jeri Grieco
Doris Hauser
Janis Heal
Sharla Herauf
Laurie Hermann
Sarah Hu
Glenna Hummel
Janice James
Kiran Jassi
Deborah Johnson
Susanne Jorgensen

Alberta Kidney Care Champions
continued …

Beverly Joseph
Rene King
Lindsay Kreway
Victoria Kriszan
Kristal Larsen
Stefanie Latreille Banville
Andrea Luca
Donna Mallach
Shonna Mccormack
Mikaela Muir
Andrea Neves
Julie Nhan
Valerie O'Leary
Krista Parkinson
Myrna Poettcker
Dorota Pogorzelski
Tracy Resler
Bernice Reurink
Julie Rhodes
Lisa Ryan
Joanne Selin
Janice Thompson
Jennifer Wamsley
Jennifer Wintringham
Maria Yee
Sylvia Zuidema

University of Calgary
Alix Clarke
Adriane Lewin

Abbreviations

AHS	Alberta Health Services
AKC	Alberta Kidney Care
AKI	Acute Kidney Injury
CANN-NET	Canadian Kidney Knowledge Translation and Generation Network
CMAJ	Canadian Medical Association Journal
CSN	Canadian Society of Nephrology
DMAR™ System	Dialysis, Measurement, Analysis, and Reporting System
eGFR	Estimated glomerular filtration rate
ESKD	End stage kidney disease
GNCH	Grey Nuns Community Hospital (Edmonton)
HD	Hemodialysis
Historical Period	October 1, 2015 to September 30, 2016
KH SCN™	Kidney Health Strategic Clinical Network™
NARP	Northern Alberta Renal Program
PD	Peritoneal dialysis
Project Period	October 1, 2016 to March 31, 2018
QSO	Quality, Safety and Outcomes Improvement Executive Committee
RAH	Royal Alexandra Hospital (Edmonton)
SARP	Southern Alberta Renal Program
START	Starting dialysis on Time, At Home, on the Right Therapy
UAH	University of Alberta Hospital (Edmonton)

Executive Summary

Most patients with kidney failure are treated with hemodialysis (HD), despite the fact that peritoneal dialysis (PD) is an equivalent therapy with respect to important clinical outcomes and is much less expensive to provide. Although clinical practice guidelines suggest patients should not initiate dialysis until their kidney function falls below a certain threshold, many patients also start dialysis earlier than is recommended.

The Kidney Health Strategic Clinical Network™ (KH SCN™) developed the Starting dialysis on Time, At Home, on the Right Therapy (START) Project in partnership with Alberta Kidney Care (AKC) to address the increasing demand for dialysis by (a) optimizing the use of PD therapy and (b) reducing the inappropriate, early initiation of dialysis in patients with end stage kidney disease (ESKD).

In order to measure progress on these goals, the following primary outcomes were established:

1. **To achieve a 5% absolute increase in the proportion of patients who receive PD within 180 days of starting dialysis province-wide; and**

2. **To achieve a 5% absolute reduction in the proportion of outpatients who initiate dialysis with an eGFR > 9.5 ml/min/1.73m^2.**

Between October 1, 2016 and March 31, 2018 (the “Project Period”), a structured review process was implemented as part of the patient pathway to ensure all new dialysis patients were:

- identified and assessed for PD eligibility;
- educated about treatment options and offered PD if they were eligible;
- supported to make an informed modality decision; and
- successfully initiated on their chosen therapy.

The patented Dialysis, Measurement, Analysis, and Reporting System (DMAR™ System) was used to capture high-quality data tied to the process of modality selection and dialysis initiation, creating a foundation for local improvements and evidence-based change management. Provincial and local program metrics were reported quarterly, providing

reliable and timely data that allowed for improved clinical decision making, audit and feedback. The data collection process was also standardized provincially, ensuring that we could benchmark provincial programs with one another to identify and address areas of variability. The quality improvement process was supported by an innovation collaborative comprising three learning sessions, modelled on The Breakthrough Series: The Institute for Healthcare Improvement's (IHI) Collaborative Model for Achieving Breakthrough Improvement.

With respect to the first primary outcome, the percentage of patients province-wide who received PD within the first 180 days of starting dialysis increased from 25% to 32% ($p<0.001$) during the Project Period, surpassing our target, with 6 out of 7 participating sites showing growth.

With respect to the second primary outcome, the proportion of outpatients in Alberta initiating dialysis earlier than guidelines suggest, we observed a 3% decrease from 16% to 13% ($p=0.17$). Provincially, we are working toward the target level for the START Project. Some sites, including Lethbridge, Edmonton – Royal Alexandra Hospital (RAH), and Edmonton – University of Alberta Hospital (UAH) have already exceeded this target.

Based on the preliminary results of the project, the KH SCN™ has received funding to continue the START Project through March 2019 while the KH SCN™ Leadership plans for an eventual transition from project funding to annualized support. In order to support the transition and long-term sustainability of the initiative into renal operations, a collaborative effort between the KH SCN™ and AKC Leadership teams, this report will be supplemented with an economic evaluation of the START Project toward the end of 2018.

Privacy Statement

In accordance with Alberta Health Services' (AHS') privacy standards, we have a duty to disclose health information with the highest degree of anonymity possible and in a limited manner. In order to comply with this standard, we only report program and site-specific data as aggregate health information. If cell or sample sizes are less than 10 patients, we are required to suppress those statistics to minimize the risk of identifying individual patients. Where this is the case, relevant information is communicated directly to the sites, programs and staff involved in the care of the affected patients.

Disclosures

The Dialysis, Measurement, Analysis, and Reporting (DMAR)^{TM} System is an innovative web-based application that facilitates the collection of prospective high-quality data about the care of patients with kidney disease.

Dr. Rob Quinn is the co-inventor of the DMAR^{TM} System, and is the co-owner of the intellectual property associated with it. He has not received any financial compensation for his involvement in the Starting dialysis on Time, At Home, on the Right Therapy (START) Project and has donated his time, in-kind to support the project.

The DMAR^{TM} System is owned by Oliver Medical Management Inc. Dr. Quinn does not receive any remuneration from Oliver Medical Management Inc.

Funding

The START Project was primarily funded by an award for strategic investments and innovation in healthcare, through the Alberta Health Services' (AHS') Strategic Clinical Networks. Other sources of support included funds from the University of Calgary, Cumming School of Medicine (Division of Nephrology), in-kind support from Alberta Kidney Care (AKC) and in-kind support from Dr. Rob Quinn for data review and analysis.

Background

Rationale

The demand for dialysis therapies in Alberta has increased at a rate of 4.5% per year, placing significant capacity and financial pressures on Alberta's renal programs. There are more than 2200 patients in Alberta who currently receive dialysis for end stage kidney disease, and approximately 600 new patients initiate dialysis therapy annually.[1]

Most patients with kidney failure are treated with hemodialysis (HD), despite the fact that peritoneal dialysis (PD) is an equivalent therapy with respect to important clinical outcomes[2] and is much less expensive to provide. Even accounting for modality failure and modality switching, PD is the lowest cost modality. The total annual health care cost differential for a patient with chronic kidney disease treated with PD versus HD ranges from $39,000 to $57,000 less per patient (depending on whether a patient receives HD in hospital or at a satellite location).[3,4,5] PD also reduces patients' travel expenses, increases leisure and work time, and may improve quality of life for some.[6] Prior to the introduction of the Starting dialysis on Time, At Home, on the Right Therapy (START) Project, the proportion of patients receiving dialysis therapy and who were treated with PD ranged from 11%to 22% across Alberta.[1]

In addition to the choice of dialysis therapy, the timing of dialysis initiation is another important consideration. Clinical practice guidelines indicate that patients should not initiate dialysis until their kidney function falls below a threshold estimated glomerular filtration rate (eGFR, a measure of kidney function) and they develop symptoms from

[1] Kidney Health Strategic Clinical Network. Prevalence of Severe Kidney Disease and Use of Dialysis and Transplantation across Alberta from 2004 – 2013. (Annual Kidney Care Report). 2015.
[2] Yeates K, Zhu N, Vonesh E, et al. Hemodialysis and peritoneal dialysis are associated with similar outcomes for end-stage renal disease treatment in Canada. Nephrol Dial Transplant. 2012; 27(9): 3568-3575
[3] Klarenbach SW, Tonelli M, Chui B, Manns BJ. Economic evaluation of dialysis therapies. Nat Rev Nephrol. 2014 Nov; 10(11): 644-652.
[4] Lee H, et al. Cost analysis of ongoing care of patients with end-stage renal disease: the impact of dialysis modality and dialysis access. Am J Kidney Disease. 2002; 40: 611-622
[5] Total annual health care costs consider costs associated with outpatient dialysis care, inpatient dialysis care, outpatient non-dialysis care and physician claims.
[6] Ginieri Coccossis M, Theofilou P, Synodinou, C, et al. Quality of life, mental health and health beliefs in haemodialysis and peritoneal dialysis patients: Investigating differences in early and later years of current treatment. BMC Nephrol. 2008; 9(14):

kidney failure.[7] Based on randomized controlled trial data, early initiation of dialysis does not improve patient outcomes.[10] Following the guidelines leads to an average economic benefit of $18,000 per patient for the health system.[8,9] Prior to the introduction of the START Project, the most recent Alberta-specific data from 2013 suggested that 23% of patients with kidney failure were starting dialysis earlier than recommended.[1]

Together, these data highlighted an opportunity to address the increasing demand for dialysis by implementing strategies to increase the safe and effective use of PD and reduce inappropriate, early initiation of dialysis in patients with kidney failure.

Project Development

The START Project is built on two prior initiatives that directly addressed and supported the KH SCN™'s goals:

1. **Calgary Zone Pilot Project to increase the safe and effective use of PD:** The first initiative introduced a novel system of standardizing and optimizing the process of dialysis treatment selection. Multidisciplinary meetings were implemented to ensure that all patients with kidney failure were identified, assessed for PD eligibility, offered dialysis treatment options, and allowed to make an informed choice about their dialysis treatment. The DMAR™ System, was used to support and document this process, facilitating the collection of prospective, high-quality data about the process of dialysis treatment selection. The DMAR™ System was required to support this process, as the variables related to optimizing the process of dialysis treatment selection were not consistently documented as part of clinical practice, either in the form of a paper chart or electronically.

   During the first year of the pilot, the percentage of new patients who received PD within 180 days of starting dialysis increased to 35%. The project team identified several gaps in care and implemented interventions to address these gaps.

[7] Nesrallah GE, Mustafa RA, Clark WF, et al. Canadian Society of Nephrology 2014 clinical practice guidelines for timing the initiation of chronic dialysis. CMAJ. Feb 4, 2014; 186(2): 112-117
[8] Manns BJ, Quinn RR. Early dialysis of no benefit to the patient or the health care system. Am J Kidney Dis. 2011 May; 57(5): 649-50.
[9] Harris A, Cooper BA, Li JJ, et al. Cost-effectiveness of initiating dialysis early: A randomized controlled trial. Am J Kidney Dis. 2011 May; 57(5): 707-715

Following the implementation of these interventions, the percentage of new patients who received PD increased to 53%. During this time period, no change in PD utilization was observed in any other areas of the province.

2. **Implementation of the Canadian Kidney Knowledge Translation and Generation Network (CANN-NET) and the Canadian Society of Nephrology (CSN) Guidelines:** The IDEAL Study, a randomized controlled trial, showed that starting dialysis early in patients with chronic kidney disease was associated with increased costs, but was not associated with improved patient outcomes.[10] The results of this study prompted the CANN-NET and the CSN to establish a committee to review and revise national guidelines for the timing of dialysis initiation. These guidelines were subsequently published in the Canadian Medical Association Journal (CMAJ).[7] The CANN-NET developed several knowledge translation tools aimed at providers and patients based on the guidelines, and have been testing these knowledge translation tools across Canada.

   As part of the START Project, we adopted these knowledge translation tools and modified the DMAR™ System to monitor outcomes related to the implementation of these guidelines and tools, with the goal of reducing inappropriate early dialysis initiation.

[10] Cooper, BA, Branley P, Bulfone L, et al. A randomized, controlled trial of early versus late initiation of dialysis. *N Engl J Med*. 2010; 363(7): 609-619.

Methods

The START Project was rolled out in three phases as described below.

Phase 1: Creation of infrastructure to support collection of high-quality data tied to the process of modality selection and dialysis initiation. Based on the success of the Calgary Zone Pilot Project, the KH SCN™ chose to scale the structured approach to the assessment and documentation of modality selection across the province. In order to do so, the following tasks were completed between March 2016 and the end of October 2016:

1. **Preparation of business case, privacy impact assessment, and data sharing agreements:** These documents were prepared in order to secure funding for the START Project, to allow for the implementation and roll-out of the DMAR™ System province wide, and to support the analysis of the data collected.

2. **Installation and testing of the DMAR™ System**: Once the appropriate agreements were in place, we installed and tested the DMAR™ System in the AHS environment so that it could be used provincially.

3. **Implementation of a standardized process for modality selection and data collection**: Multidisciplinary teams at participating sites across Alberta were trained to organize and lead multidisciplinary meetings where all new dialysis patients were identified and tracked on a roster. Teams ensured that all new dialysis starts in their programs were identified, assessed to determine their eligibility for PD, educated about their treatment options, offered PD if they were eligible, supported to make an informed modality decision, and successfully initiated on their chosen therapy. Patients remained on the meeting roster and were discussed at each multidisciplinary meeting until they had completed the process described above. Staff were also trained to document this process and the relevant variables in a standardized and objective manner using the DMAR™ System. This ensured that all sites collected data on a common platform with a consistent coding schema to permit objective comparisons across sites and programs.

Phase 2: Structured review of all new dialysis patients and reporting of metrics tied to the process of modality selection and dialysis initiation. In October 2016, the START Project went live and data capture began. From October 1, 2016 through March 31, 2018 (the "Project Period"), multidisciplinary meetings were conducted as described above. All data were reviewed centrally for consistency in coding, accuracy, and completeness. Any queries were communicated in real-time to the user who entered the data and were addressed prior to the analysis and reporting of data. This rigorous oversight is a unique feature of the DMAR™ System and ensured a high-quality dataset that served as the foundation of the reporting process.

Phase 3: Support of quality improvement (QI) process using a modified innovation collaborative, modelled on The Breakthrough Series: The Institute for Healthcare Improvement's (IHI) Collaborative Model for Achieving Breakthrough Improvement: In order to support the quality improvement (QI) process, the START Project Core Team implemented an innovation collaborative comprising three learning sessions (June 2017, December 2017 and March 2018). These learning sessions, modelled on the IHI Collaborative Model for Achieving Breakthrough Improvement[11], brought front-line teams together from across the province to work toward improving the use of PD and encouraging adherence to the guidelines for the appropriate timing of dialysis initiation at their respective sites.

Participating teams were provided with site-specific reports tied to the process of modality selection and dialysis initiation on a quarterly basis. This system of audit and feedback allowed front-line staff to identify local barriers to increasing the safe and effective use of PD and ensuring timely initiation of dialysis. Data were mapped to steps in the process of care that drove the outcomes of interest, allowing sites to identify local gaps and opportunities to improve. The teams developed action plans and implemented local interventions to address these gaps. They used balanced scorecards as a performance measurement tool to track their performance on primary outcomes common to all sites, as well as secondary outcomes specific to their local context. Ongoing data collection for the duration of the START Project allowed teams to determine if their interventions were effective on an iterative basis at each subsequent learning session, and to revisit their interventions if required (the "Plan-Do-Study-Act Cycle"). The forum also provided sites with the opportunity to share local practices and learn from one another.

[11] Institute for Healthcare Improvement (IHI). Innovation Series 2003 – The Breakthrough Series: IHI's Collaborative Model for Achieving Breakthrough Improvement (2003).

Defining Project Outcomes

Primary Outcomes (Key Performance Indicators)

The primary goals of the START Project were to improve the use of PD and to reduce the inappropriate early initiation of dialysis. In order to measure progress on these goals, the following Key Performance Indicators were established:

1. **To achieve a 5% absolute increase in the proportion of patients who receive PD within 180 days of starting dialysis province-wide.** There are two metrics which are traditionally used to describe the use of PD in a patient population: prevalence and incidence.

   PD incidence (also called *incident PD utilization*) describes how many new patients start PD during a defined period of time. PD prevalence (also called *PD utilization*) is a complex metric that describes how many total patients are on PD at a defined point in time, regardless of when they started PD. PD prevalence is determined by the number of patients who start PD (PD incidence); the time they spend on PD; and the loss of patients from PD due to death, kidney transplantation, transfer to HD (technique failure), or other causes.

   With approximately 2200 patients receiving dialysis in Alberta, it would take several years of a sustained increase in the incidence of PD to move PD prevalence by a few percentage points. In addition, a typical program can lose as much as half of the PD population by 2 years due to technique failure, death, transplantation, and other causes. To maintain a constant PD population, these losses must be replaced. Further, while some causes of loss from PD therapy are undesirable (such as death or transfer to HD), other causes of loss are desirable. As an example, PD loss due to kidney transplantation means that patients are transitioned to a more effective and less costly alternative, which should be promoted. For these reasons, simply tracking PD prevalence is an insensitive and potentially misleading metric that doesn't accurately reflect a program's efforts to increase the number of patients who receive PD. Reporting individual causes of loss is more informative from a quality improvement perspective.

Increasing the number of patients who start PD therapy (PD incidence) is the single largest, modifiable determinant of PD prevalence, **and this was the focus of the START Project.** While some patients may receive PD as their first treatment, many patients who are ultimately treated with PD may take as long as 180 days to receive it. This is particularly true in programs where there are a large number of patients who start dialysis urgently, in the hospital. Some hospitals have the capacity to treat urgent starts with PD. However, many patients who express an interest in PD will be treated initially with HD and will require time to be converted to PD. They are assessed for eligibility, receive education about their treatment options, make an informed choice, and have a PD catheter placed. Once the PD catheter is healed, they are trained and start therapy.

2. **To achieve a 5% absolute reduction in the proportion of outpatients who initiate dialysis with an eGFR > 9.5 ml/min/1.73m^2.** Estimated glomerular filtration rate (eGFR) is a measure of kidney function. During the development of performance indicators for timing of dialysis initiation, stakeholders felt that guidance should be given as to the eGFR below which dialysis should be considered if a patient develops symptoms of kidney failure. The target chosen was based on the results from the IDEAL Study.[10] In the IDEAL Study, the target eGFR level, reflected the mean level of kidney function at dialysis initiation in patients randomized to the intent-to-defer strategy (9.8 ml/min/1.73m^2). Renal function was measured using the Cockroft-Gault equation.

   In Alberta, the CKD-EPI equation is used to calculate eGFR and is routinely reported by labs. In order to convert to our measure of eGFR, we looked to a re-analysis of the IDEAL participants.[12] CKD-EPI ranged from 0.3 ml/min/1.73m^2 to 3.6 ml/min/1.73m^2 lower than the estimate by Cockroft-Gault. In order to be conservative, we selected 9.5 ml/min/1.73m^2 [(9.8 ml/min/1.73m^2) – (0.3 ml/min/1.73m^2)] as the eGFR threshold.

   The inclusion of patients with acute kidney injury (AKI) introduces problems for the calculation of eGFR because serum creatinine is not in steady state. Prior data showed that this artificially inflates eGFR and skews results in patients who start

[12] Wong MG, Pollock CA, Cooper BA, et al. Association between GFR estimated by multiple methods at dialysis commencement and patient survival. CJASN. 2014; 9(1): 135-42.

dialysis in hospital, as they often have AKI. Therefore, the START Project focused on eGFR in elective, outpatient starts (who have a stable eGFR) for our key performance indicator for timing of dialysis initiation. This is a more accurate reflection of decision-making and is potentially modifiable.

Secondary Outcomes

The secondary outcomes for the START Project are as follows:

1. **To provide actionable, detailed metrics pertaining to the 6 steps in the process of modality selection and dialysis initiation.** In order to understand drivers of incident PD utilization in a local program, we reported the percentage of patients who made it through 6 steps required to start a patient on PD and benchmarked performance across sites in Alberta. Specifically, we reported the number of patients making it through each step and the percentage of patients moving from one step to the next. Based on prior experience, we were able to provide targets for each of these metrics from high-performing programs. Participating teams were able to review these metrics in order to identify ways to optimize each step. By optimizing these 6 steps, a dialysis program can increase the number of patients who are treated with PD.[13] The 6 metrics are:

    1. Proportion (%) of patients assessed to determine their eligibility for PD;
    2. Proportion (%) of assessed patients deemed eligible for PD;
    3. Proportion (%) of eligible patients offered PD;
    4. Proportion (%) of offered patients who chose PD;
    5. Proportion (%) of patients who chose PD who received PD therapy as their first dialysis modality; and
    6. Proportion (%) of patients who chose PD who received PD within 180 days of starting dialysis.

    In many other jurisdictions, a “PD first” policy has been implemented. This means that eligible patients must use PD as their first form of dialysis therapy, and are not provided with a choice. Based on prior experience, we have been able to increase the use of PD without removing patient choice if we ensure that everyone is identified, assessed for PD eligibility, and all potential candidates are offered the

[13] Blake PG, Quinn, RR, Oliver, MJ. Peritoneal dialysis and the process of modality selection. Perit Dial Int. 2013 May-Jun; 33(3); 233-241.

therapy. In a high-performing program, we expect all patients to be identified and more than 90% to be assessed for PD eligibility. Typically, 10% of patients either die before they can be assessed, transfer out of the program, recover kidney function, or refuse to be assessed. Approximately 80% of assessed patients will be eligible for PD and 100% should be offered it, if eligible.[13]

We also tracked choice rates to ensure that patients are provided with balanced information about their treatment options. We know from literature estimates and previous work that approximately 50%-60% of eligible patients will choose PD when offered it.[13] Higher choice rates suggest a promotional or even coercive process, while lower choice rates suggest that the presentation of treatment options may be biased against PD.

Finally, in patients who choose PD, we need to ensure that they receive a functioning PD catheter, are trained to perform PD at home, and are able to initiate PD successfully. Typically, 90% of patients who choose PD will successfully transition to the therapy within 180 days of starting dialysis.

2. **To standardize the assessment for PD eligibility and improve shared patient-provider decision making.** As part of the structured process to determine whether a patient is eligible for PD, patients underwent a standardized assessment that was documented using the DMAR™ System. The process of documenting the assessment required that programs standardize their approach, ensuring that every patient was identified, assessed for PD eligibility, and that all potential candidates were offered the therapy. Adhering to this process improves shared patient-provider decision making about dialysis modality.

   In order to measure this outcome, we monitored the completion of a multidisciplinary assessment on all patients, and the percentage of patients who were offered PD as a treatment option.

3. **To measure the proportion of patients receiving a standardized assessment to establish PD eligibility and education about their treatment choices and timing of education**. In many other jurisdictions (for example, jurisdictions that implement a “PD first” policy), patients are not educated about their treatment options. This is a barrier to increasing the use of PD.

To measure this outcome, we monitored the completion of a standardized, multidisciplinary assessment on all patients and the percentage of patients who were eligible for PD.

4. **To report complications associated with incident PD utilization, including rates of hospitalization, technique failure, and death.** To ensure there were no unintended consequences associated with interventions to increase PD utilization, we monitored rates of hospital admissions, number of days in hospital, and the risk of technique failure and death in all patients starting dialysis.

5. **To monitor the presence of symptoms of kidney failure at dialysis initiation and the reasons for dialysis initiation.** Starting in August 2017, participating teams began standardizing the documentation of variables related to the timing of dialysis initiation in outpatients, including symptoms present at the time of dialysis initiation and the reason for dialysis initiation. These data provided granular information regarding the circumstances under which outpatients started dialysis and allowed teams to use this information to improve the provision of care to their patients.

Historical Data: Data Sources and Baseline Estimates

Alberta Kidney Care (AKC) [formerly the Northern and Southern Alberta Renal Programs or “NARP” and “SARP”] provided historical data about the timing of dialysis initiation, as well as incident and prevalent PD utilization. These historical data were used to establish the baseline for the primary outcomes (Key Performance Indicators) identified as part of the START Project. Note that each program uses its own system of data collection and, in some cases, the data were obtained via chart review as the data were not available in existing electronic systems.

The historical period includes the 12-month period prior to implementation of the START Project (October 1, 2015 to September 30, 2016; the “Historical Period”). Data were not available from AKC in order to establish a baseline for the secondary outcomes, as these data were not collected in a robust manner prior to beginning the START Project.

The cohort of patients included all new patients who commenced dialysis during the Historical Period at each of the 7 participating sites [Calgary, Lethbridge, Medicine Hat, Edmonton [including University of Alberta Hospital (UAH) Grey Nuns Community Hospital (GNCH), and Royal Alexandra Hospital (RAH)], and Red Deer]. These patients included:

- Any patient with ESKD, in the opinion of their nephrologist, who initiated dialysis;
- Any patient with AKI who required dialysis for at least 28 days;
- Any patient who received a single outpatient dialysis treatment; and
- Any patient with a failed transplant who initiated dialysis.

The cohort did not include patients who transferred into a program from another center who was already established on dialysis.

AKC provided raw data to the START Project, which were analyzed by the project team.

START Project: Results

Defining the Patient Population

With the support of AKC, all seven chronic kidney disease clinics in Alberta participated in the START Project [Calgary, Lethbridge, Medicine Hat, Edmonton (including UAH, GNCH and RAH), and Red Deer].

All patients who commenced dialysis between October 1, 2016 and March 31, 2018 (the "Project Period") in Alberta were screened for inclusion in our cohort. Inclusion and exclusion criteria were applied to isolate a cohort that provided usable information regarding the drivers of incident PD utilization and the timing of dialysis initiation.

The **Inclusion Criteria** were:

1. Any patient with ESKD, in the opinion of their nephrologist, who initiated dialysis in a participating site;
2. Any patient with AKI requiring dialysis for at least 28 days;
3. Any patient receiving a single outpatient dialysis treatment; and
4. Failed transplants initiating dialysis.

The **Exclusion Criteria** were:

1. Patients who were inappropriately registered and did not meet criteria for registration in the program (n=22);
2. Transient patients who were from another program and started dialysis with the intent of returning to their home program (n=17);
3. Pre-emptive transplants were monitored, but were excluded for the calculation of dialysis-specific metrics (n=21);
4. Transfers into program were excluded because they are prevalent patients who have already been on dialysis for a period of time (n=78); and
5. Baseline assessment pending: these patients are excluded from the analysis until their baseline assessments are completed, at which point they may be added to future cohorts for analysis (n=46).

Patient Characteristics

A total of 1123 patients were identified in Alberta between October 1, 2016 and March 31, 2018 (the "Project Period"). After applying our inclusion and exclusion criteria, the final cohort for analysis and reporting consisted of 939 patients (see Table 1 below).

	Calgary	Lethbridge	Medicine Hat	Red Deer	GNCH	RAH	UAH	Edmonton*	Alberta
Registered patients	**396**	**78**	**34**	**116**	**77**	**130**	**292**	**499**	**1123**
Excluded patients (%)	3 (0.8)	1 (1.3)	1 (2.9)	10 (8.6)	3 (3.9)	1 (0.8)	3 (1)	7 (1.4)	**22 (2)**
Transient (%)	12 (3.1)	0	2 (6.1)	0	1 (1.4)	0	2 (0.7)	3 (0.6)	**17 (1.5)**
Pre-emptive transplants (%)	13 (3.4)	0	0	0	1 (1.4)	0	7 (2.4)	8 (1.6)	**21 (1.9)**
Transfers (%)	28 (7.3)	11 (14.3)	7 (22.6)	7 (6.6)	8 (11)	7 (5.4)	10 (3.5)	25 (5.1)	**78 (7.2)**
Baseline assessment pending (%)	22 (5.5)	3 (4.5)	1 (4.2)	11 (11.1)	0	3 (2.5)	6 (2.2)	9 (2)	**46 (4.5)**
Final cohort	**318**	**63**	**23**	**88**	**64**	**119**	**264**	**447**	**939**

Table 1: Inclusion and exclusion criteria for new patients who started dialysis in Alberta during the Project Period, and creation of final cohort for analysis and reporting.

*Edmonton includes GNCH, RAH, UAH.

Table 2, on the following page, illustrates the baseline characteristics of patients at the time of dialysis initiation. The mean age was 59 years, ranging from 57 years at GNCH to 67 years in Lethbridge. Provincially, 53% of patients started dialysis as inpatients, ranging from 42% at GNCH to 65% in Medicine Hat. Patients in Medicine Hat were the most likely to have received pre-dialysis care (91%). These data are only presented for the duration of the project, as AKC was not able to provide this data for the historical period.

It's important to note that the smaller size of the population in some sites, like Medicine Hat and Lethbridge, limit the conclusions we can draw at these sites.

	Calgary	Lethbridge	Medicine Hat	Red Deer	GNCH	RAH	UAH	Edmonton*	Alberta
Patients by site, total	**318**	**63**	**23**	**88**	**64**	**119**	**264**	**447**	**939**
Age, mean (STD)	60.3 (14.9)	67.4 (15.2)	66.7 (11.8)	61.7 (15.2)	56.5 (14.8)	57.3 (15.9)	56.5 (15.2)	56.7 (15.3)	**59.4 (15.3)**
Age, median (IQR)	62 (51, 71)	69 (58, 79)	69 (56, 75)	62 (54.5, 72.5)	58 (49.5, 66)	60 (44, 69)	57.5 (47, 68)	58 (47, 69)	**61 (50, 71)**
BMI, mean (STD)	28.5 (8)	30.2 (10.6)	31.7 (6.4)	30.1 (8.7)	30.1 (7.9)	27.3 (6.6)	29.3 (8.3)	28.9 (7.9)	**29 (8.2)**
BMI, median (IQR)	27.5 (23.2, 32)	27.8 (24.8, 33.	32.7 (25.4, 34)	28.8 (25.4, 33.	28 (24.5, 34.9)	26.5 (22.8, 29.	28.1 (23.3, 32.	27.7 (23.4, 32.	**27.9 (23.6, 32.**
Male (%)	200 (63)	35 (56)	15 (65)	55 (63)	39 (61)	70 (59)	179 (68)	288 (64)	**593 (63)**
Diabetes (%)	184 (58)	37 (59)	12 (52)	44 (50)	38 (59)	64 (54)	120 (45)	222 (50)	**499 (53)**
Coronary Artery Disease (%)	90 (28)	12 (19)	7 (30)	23 (26)	8 (13)	22 (19)	40 (15)	70 (16)	**202 (22)**
Congestive Heart Failure (%)	70 (22)	13 (21)	9 (39)	13 (15)	8 (13)	16 (13)	19 (7)	43 (10)	**148 (16)**
Cerebrovascular Disease (%)	35 (11)	7 (11)	5 (22)	7 (8)	3 (5)	13 (11)	16 (6)	32 (7)	**86 (9)**
Peripheral Vascular Disease (%)	33 (10)	6 (10)	3 (13)	6 (7)	3 (5)	9 (8)	23 (9)	35 (8)	**83 (9)**
Cancer (%)	50 (16)	17 (27)	4 (17)	10 (11)	7 (11)	11 (9)	31 (12)	49 (11)	**130 (14)**
Started dialysis as inpatient (%)	171 (54)	34 (54)	15 (65)	57 (65)	27 (42)	72 (61)	118 (45)	217 (49)	**494 (53)**
Started dialysis in ICU (%)	24 (8)	8 (13)	5 (22)	11 (13)	4 (6)	18 (15)	29 (11)	51 (11)	**99 (11)**
Predialysis care, any (%)	268 (84)	45 (71)	21 (91)	62 (71)	50 (78)	94 (79)	208 (79)	352 (79)	**748 (80)**
Predialysis care, at least 4 months (%)	245 (77)	36 (57)	18 (78)	56 (64)	47 (73)	81 (68)	191 (72)	319 (71)	**674 (72)**
Predialysis care, at least 12 months (%)	214 (67)	31 (49)	15 (65)	41 (47)	33 (52)	54 (45)	152 (58)	239 (54)	**540 (58)**

Table 2: Characteristics of new patients who started dialysis in Alberta during the Project Period.

* Edmonton includes GNCH, RAH and UAH.

Primary Outcomes (Key Performance Indicators)

For all outcomes below, time periods for the data are as follows:

Historical Period (12 months): October 1, 2015 to September 30, 2016

Project Period (18 months): October 1, 2016 to March 31, 2018

1. **PD: proportion of patients who receive PD within 180 days of starting dialysis**

	Calgary	Lethbridge	Medicine Hat	Red Deer	GNCH*	RAH*	UAH*	Edmonton†	Alberta
Total patients, Historical	**230**	**51**	**15**	**64**	N/A	N/A	N/A	**322**	**682**
Total patients, Project	**318**	**63**	**23**	**88**	**64**	**119**	**264**	**447**	**939**
Patients, started dialysis using PD (%), Historical	46 (20)	4 (8)	2 (13)	9 (14)	N/A	N/A	N/A	75 (23)	**136 (20)**
Patients, started dialysis using PD (%), Project	115 (36)	6 (10)	2 (9)	10 (11)	20 (31)	23 (19)	76 (29)	119 (27)	**252 (27)**
Patients, received PD within 180 days of starting dialysis (%), Historical	61 (27)	6 (12)	2 (13)	12 (19)	N/A	N/A	N/A	90 (28)	**171 (25)**
Patients, received PD within 180 days of starting dialysis (%), Project	138 (43)	9 (14)	2 (9)	22 (25)	23 (36)	25 (21)	80 (30)	128 (29)	**299 (32)**

Table 3: Proportion of patients who started dialysis on PD, and who received PD within 180 days of starting dialysis, during the Project Period as compared to the Historical Period.

*† AKC was not able to provide data for the Historical Period on a site-by-site basis for GNCH, RAH and UAH. Edmonton includes GNCH, RAH and UAH.

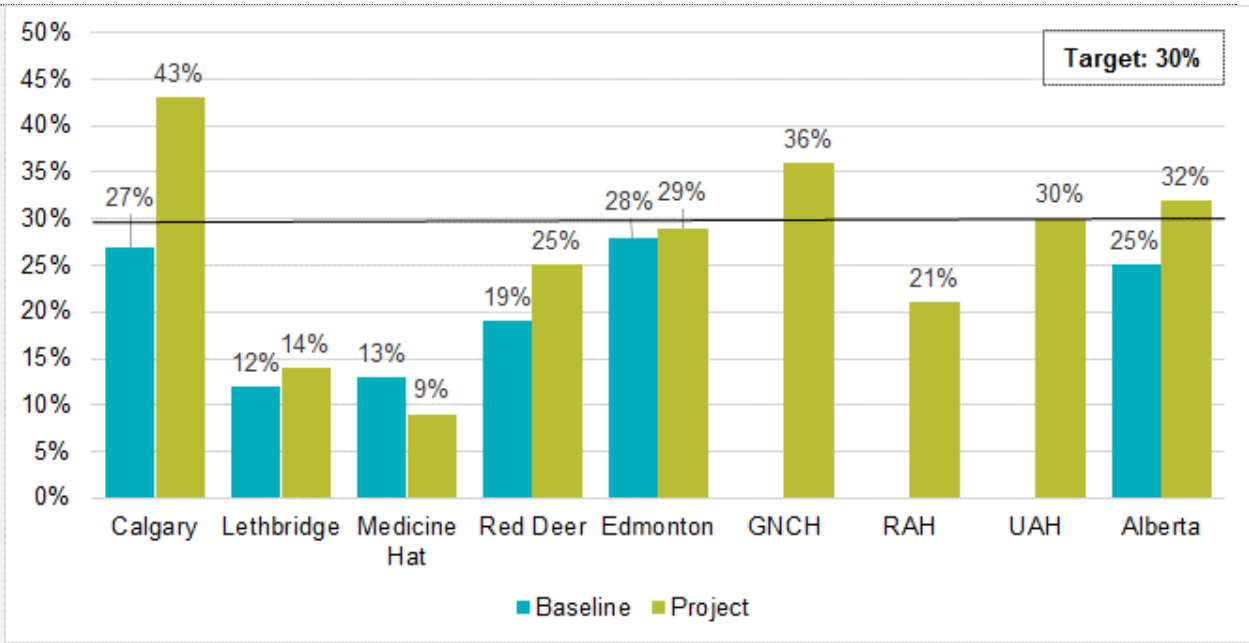

Figure 1: Proportion of patients who received PD within 180 days of starting dialysis, during the Project Period as compared to the Historical Period.

*† AKC was not able to provide data for the Historical Period on a site-by-site basis for GNCH, RAH and UAH. Edmonton includes GNCH, RAH and UAH.

During the Historical Period, 682 patients initiated chronic dialysis therapy in Alberta. Twenty percent (20%) of patients received PD as their initial form of therapy and 25% of patients received PD within 180 days of starting dialysis (see Table 3 and Figure 1).

The goal of the START project was to increase the proportion of new patients being treated with PD within 180 days after initiating dialysis by 5%. Based on the historical information provided by each program, the provincial target for the START Project was to increase the proportion of patients who receive PD within 180 days of starting dialysis to 30%.

The target set for the START Project was exceeded, increasing the proportion of patients who received PD within 180 days of starting dialysis to 32% provincially (p<0.003). This ranged from 9% in Medicine Hat to 43% in Calgary, with 4 out of 5 sites showing growth (see Table 3).

Note that the data for having received PD within 180 days of starting dialysis during this historical period is only provided for Edmonton on a program-wide basis, as AKC was not able to provide this data on a site-by-site basis (for GNCH, RAH and UAH).

2. Timing of Dialysis Initiation: proportion of outpatients who initiated dialysis with an eGFR > 9.5 ml/min/1.73m^2

	Calgary	Lethbridge	Medicine Hat	Red Deer	GNCH*	RAH*	UAH*	Edmonton†	Alberta
Total outpatients, Historical	**101**	**28**	**11**	**23**	N/A	N/A	N/A	**154**	**317**
Total outpatients, Project	**147**	**29**	**8**	**31**	**37**	**47**	**146**	**230**	**445**
Outpatients, Mean eGFR (STD), Historical	7.3 (3)	5.7 (1.5)	9.6 (3.2)	7.6 (2.5)	N/A	N/A	N/A	7.4 (2.5)	**7.3 (2.7)**
Outpatients, Mean eGFR (STD), Project	7.6 (2.2)	7 (1.7)	8.8 (2.4)	8.3 (4.5)	7.9 (2.6)	6.6 (2.1)	6.8 (2.1)	6.9 (2.2)	**7.3 (2.5)**
Outpatients, eGFR > 9.5 ml/min/1.73m^2 (%), Historical	15 (15)	0	5 (46)	5 (22)	N/A	N/A	N/A	26 (17)	51 (16)
Outpatients, eGFR > 9.5 ml/min/1.73m^2 (%), Project	21 (14)	2 (7)	4 (50)	9 (29)	7 (19)	3 (6)	10 (7)	20 (9)	56 (13)

Table 4: Mean eGFR of outpatients and proportion of outpatients who initiate dialysis with an eGFR > 9.5 ml/min/1.73m^2, during the Project Period as compared to the Historical Period.

*†AKC was not able to provide data for the Historical Period on a site-by-site basis for GNCH, RAH and UAH. Edmonton includes GNCH, RAH and UAH.

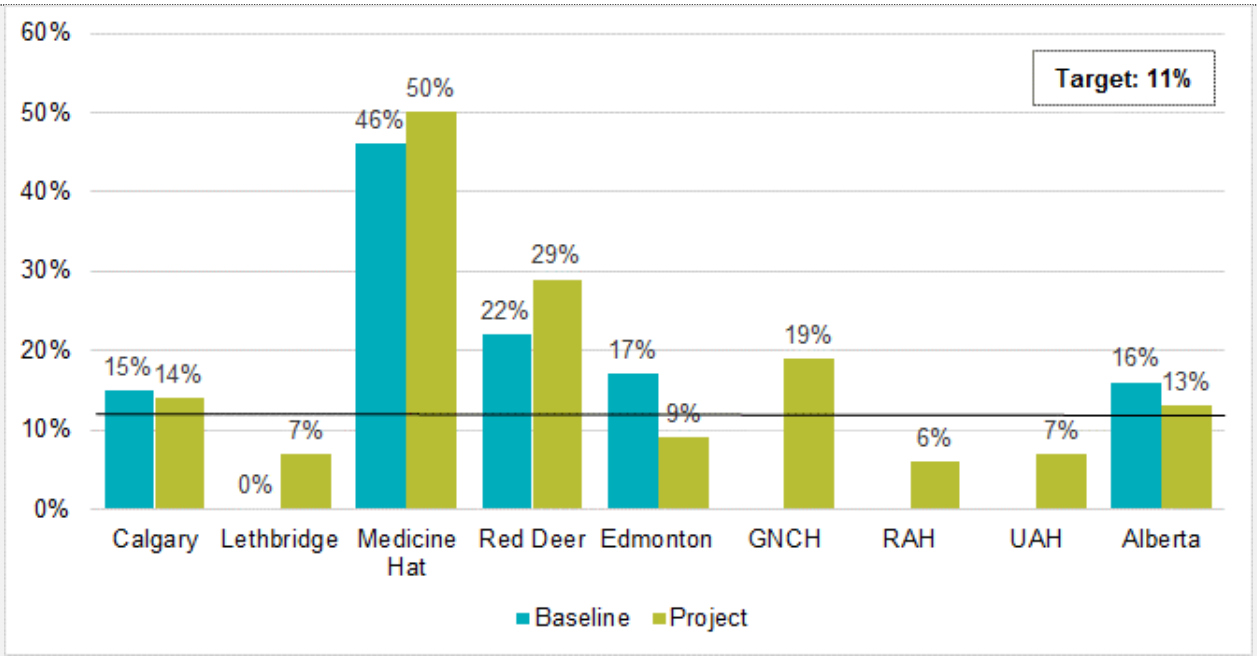

Figure 2: Proportion of outpatients initiating dialysis with an eGFR >9.5 ml/min/1.73m^2, during the Project Period as compared to the Historical Period.

*†AKC was not able to provide data for the Historical Period on a site-by-site basis for GNCH, RAH and UAH. Edmonton includes GNCH, RAH and UAH.

During the Historical Period, 317 outpatients initiated chronic dialysis therapy in Alberta. The mean eGFR of outpatients who started dialysis during the Historical Period, provincially, was 7.3 ml/min/1.73m^2 and 16% of outpatients started with an eGFR above target (see Table 4, above). This number was lower than anticipated based on information available at the time the project was developed, making for a fairly aggressive target.

Based on data from the Historical Period, the provincial target for the START Project was to reduce the proportion of outpatients who initiated dialysis with an eGFR > 9.5 ml/min/1.73m^2 to 11%.

The mean eGFR of outpatients at the time of dialysis initiation during the Project Period remained near the mean eGFR established by the historical data, at 7.6 ml/min/1.73m^2 (p=0.36). Thirteen percent (13%) of outpatients initiated dialysis with an eGFR above the target of 9.5 ml/min/1.73m^2 during the Project Period, a drop of 3% from the Historical Period (p=0.17).

Provincially, we are working toward the target level for the START Project. Some sites, including Lethbridge, RAH and UAH have already exceeded this target. Edmonton, as a program, has also exceeded this target. There is noticeable variability in the percentage of outpatients starting dialysis above the target eGFR, ranging from 6% at RAH to 50% in Medicine Hat.

Secondary Outcomes

Prior to the implementation of the START Project and the DMAR™ System, the metrics selected as secondary outcomes were not monitored or recorded in Alberta as part of standard patient care or data collection. Therefore, data were not available from AKC during the Historical Period in order to establish a baseline for the secondary outcomes.

The START Project created a systematic infrastructure to collect these variables, which allowed Alberta's renal programs to monitor and understand drivers of incident PD utilization and optimize their performance to maximize the safe and effective use of PD. As there is no comparator group, these variables are descriptive.

1. **To provide actionable, detailed metrics pertaining to the 6 steps in the process of modality selection and dialysis initiation.**

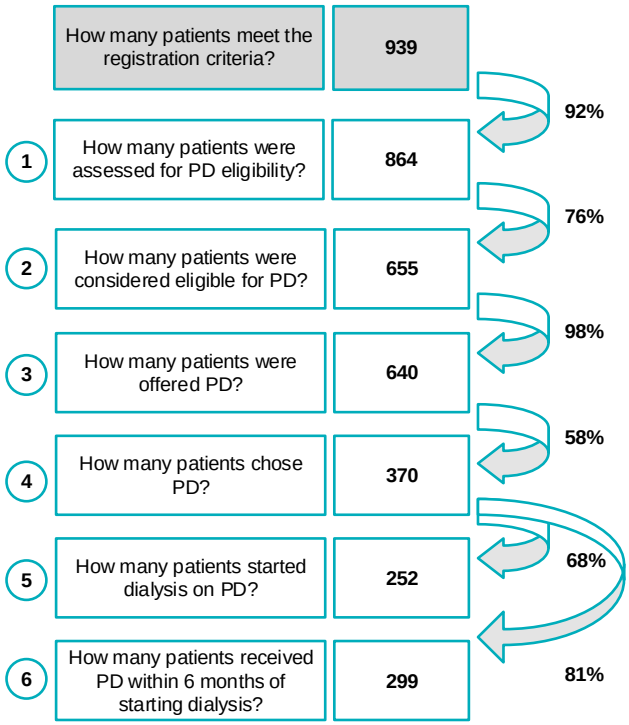

Figure 3: Flowchart illustrating the progression of patients through the six-step process required to start a patient on PD in Alberta, during the Project Period (Percentages refer to the percentage of patients making it from one step to the next.)

	Calgary	Lethbridge	Medicine Hat	Red Deer	GNCH	RAH	UAH	Edmonton*	Alberta
Patients, total registered	**318**	**63**	**23**	**88**	**64**	**119**	**264**	**447**	**939**
Assessed for PD, %	92%	81%	87%	89%	92%	94%	96%	95%	**92%**
Eligible for PD, %	86%	78%	30%	54%	78%	70%	76%	75%	**76%**
Offered PD, %	98%	100%	100%	100%	98%	96%	97%	97%	**98%**
Chose PD, %	63%	28%	50%	67%	78%	48%	55%	57%	**58%**
Chose PD and started on PD, %	75%	55%	67%	36%	57%	64%	73%	68%	**68%**
Chose PD and received PD within 180 days of starting dialysis, %	90%	82%	67%	79%	66%	69%	77%	73%	**81%**

Table 5: Table illustrating the progression of patients through the six-step process required to start a patient on PD in Alberta, during the Project Period (Percentages refer to the percentage of patients making it from one step to the next.)

*Edmonton includes GNCH, RAH and UAH.

Table 5, above, illustrates the percentage of patients who progress through the six-step process required to start a patient on PD across Alberta, and benchmarks the percentages across the provincial dialysis programs. A 1% change in any step of the process will impact the increase in incident PD utilization equally. A program that performs well at each step will have a high percentage of new patients starting dialysis and receiving dialysis within 180 days of initiating dialysis therapy.

2. To standardize the assessment for PD eligibility and improve shared patient-provider decision making.

In Alberta, 92% of new dialysis patients were assessed for PD eligibility (baseline data is not available as a comparison). This ranged from 81% of patients being assessed in Lethbridge to 96% of patients being assessed at UAH (see Table 5, above).

The reasons patients were not assessed for eligibility were largely beyond the control of the programs and included: recovery of kidney function, dying before they could be assessed, refusing assessment, and transferring out of the program before they could be assessed. These factors were largely not modifiable.

Patients who were deemed eligible for dialysis were offered PD as a treatment option in 98% of cases, ranging from 97% of patients at UAH to 100% of patients in Lethbridge, Medicine Hat and Red Deer. Eighty-one percent (81%) of patients province-wide who had chosen PD, received PD within 180 days of starting dialysis, ranging from 66% of patients at RAH to 90% of patients in Calgary.

3. **To measure the proportion of patients receiving a standardized assessment to establish PD eligibility and education about their treatment choices and timing of education**.

   As a proxy for the percentage of patients who receive modality assessments and education on modality treatment options, we reported the percentage of patients who were assessed. As mentioned above, 92% of new dialysis patients in Alberta were assessed for PD eligibility and educated on modality treatment options. This ranged from 81% of patients being assessed in Lethbridge to 96% of patients being assessed at UAH.

   The reasons patients were not assessed for eligibility were largely beyond the control of the programs and included: recovery of kidney function, dying before they could be assessed, refusing assessment, and transferring out of the program before they could be assessed.

4. **To report complications associated with incident PD utilization, including rates of hospitalization, technique failure, and death.**

   To ensure there were no unintended consequences associated with efforts to increase PD utilization, we monitored rates of hospital admissions, number of days in hospital, and the risk of technique failure and death in all patients starting dialysis.

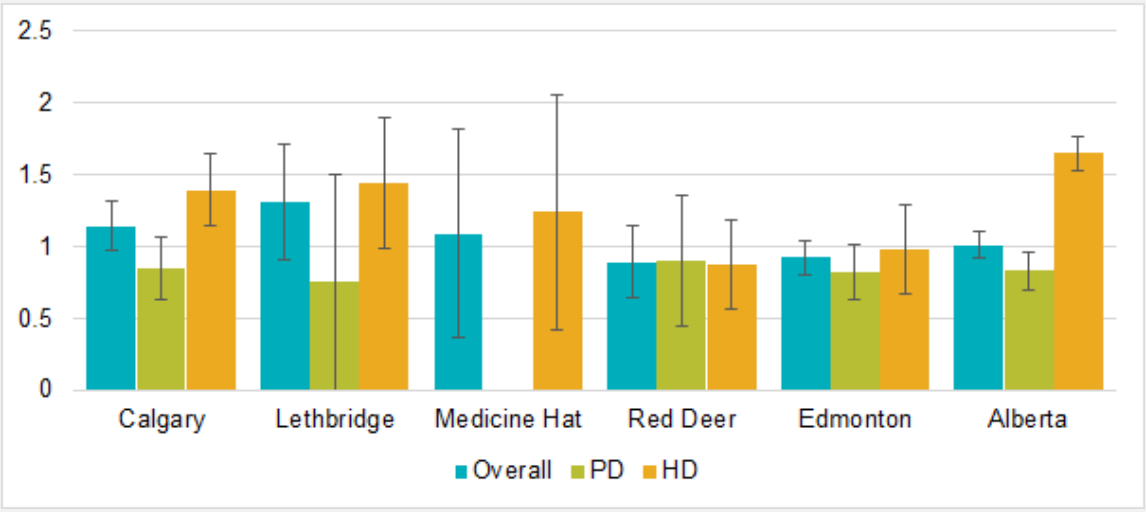

Figure 4: Number of hospital admissions per year, overall and by modality, during the Project Period (95% CI) in patients who received outpatient dialysis.

*Edmonton include GNCH, RAH and UAH.

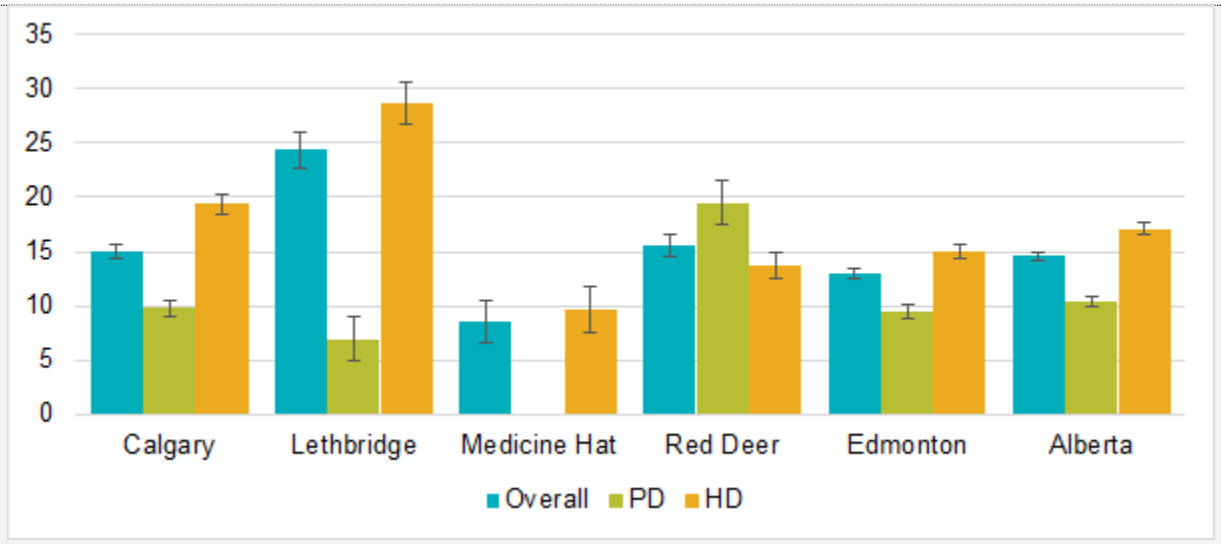

Figure 4: Number of hospital days per year, overall and by modality, during the Project Period (95% CI).

*Edmonton includes GNCH, RAH and UAH.

	Alberta
PD Patients, with 6 months of potential follow up	**193**
Causes of Loss	
Permanent technique failure (%)	20 (10%)
Death (%)	2 (1%)
Transplant (%)	3 (2%)
Recovery (%)	3 (2%)
Palliative (%)	2 (1%)
Transfer (%)	2 (1%)

Table 6: Causes of loss from PD, provincially, in patients with 6-months of potential follow-up, during the Project Period

Provincially, the rate of hospitalization in patients who received PD within 180 days of starting dialysis was much lower than the rate of hospitalizations in HD patients. The number of hospitalizations per year in patients who received PD within 180 days on average was 0.83 [95% CI (0.71, 0.97)] as compared to 1.12 hospitalizations per year in HD patients [95% CI (1.01, 1.24)]. The number of days spent in hospital per year was also much lower, with PD patients spending only 10.4 days per year in hospital [95% CI (9.9, 10.9)] compared to HD patients spending 17.1 days per year in hospital [95% CI (16.6-17.6)] (see Figures 3 and 4, above).

The hospitalization rates are in line with literature estimates and there is no signal of harm.

We also monitored causes of loss from PD therapy, which include the risk of technique failure and death. For these measures, we followed patients who started PD at least 6 months before the end of the reporting cycle so that we could adequately observe these patients for any unintended consequences. Provincially, the rates of technique failure in PD patients are low, with only 10% of patients experiencing permanent technique failure. The rate of mortality in PD patients during the Project Period is also low (2%) and likely reflects the health status of PD patients, who are generally healthier and younger than HD patients.

While it will be important to continue monitoring patients for the risk of unintended consequences associated with the START Project, the outcomes to date do not

indicate any reason to be concerned and certainly no increased risk of harm as compared to HD patients.

5. To monitor the presence of symptoms of kidney failure at dialysis initiation and the reasons for dialysis initiation.

	Calgary	Lethbridge	Medicine* Hat	Red Deer	GNCH	RAH	UAH	Edmonton†	Alberta
Reason for dialysis initiation									
Threshold eGFR (%)	1 (8)	-		1 (50)	3 (100)	-	1 (33)	4 (67)	6 (25)
Severe Acidosis (%)	0	-		0	0	-	0	0	0
Volume Overload (%)	7 (54)	-		1 (50)	1 (33)	-	2 (67)	3 (50)	11 (46)
Severe Hyperkalemia (%)	2 (15)	-		0	0	-	0	0	2 (8)
Electrolyte Disturbances (%)	0	-		0	0	-	0	0	0
Uremic Signs (%)	1 (8)	-		0	0	-	0	0	1 (4)
Uremic Symptoms (%)	6 (46)	-		2 (100)	2 (67)	-	3 (100)	5 (83)	16 (67)
Other: No documented uremic symptoms (%)	1 (8)	-		0	0	-	0	0	1 (4)

Table 7: Reasons for dialysis initiation in patients who started dialysis with an eGFR > 9.5 ml/min/1.73m^2, after August 1, 2017 (*Note: Patients may have more than one reason for starting dialysis with an eGFR above threshold).*

*For Medicine Hat, the cell was less than 10 patients. Therefore we are required to suppress these statistics to minimize the risk of identifying patients.

†Edmonton includes GNCH, RAH and UAH.

Of the outpatients in Alberta who initiated dialysis between August 1, 2017 and March 31, 2018, 12% started dialysis with an eGFR > 9.5 ml/min/1.73m^2. Of these patients (above threshold). The most common reasons for initiating dialysis with an eGFR above threshold was the presence of uremic symptoms. For only one patient, it was unknown whether or not there were any uremic symptoms present at the time they started dialysis. See Table 7, above.

Reflections & Site Specific Recommendations

Patient Population

More than 1,100 patients started dialysis in Alberta between October 1, 2016 and March 31, 2018. After removing prevalent patients that transferred into Alberta dialysis programs, a total of 939 new dialysis patients were included in this final report (see Table 1).

Lethbridge and Medicine Hat served the oldest patient population, while the youngest patients were in Edmonton. The frequency of comorbid conditions tracked fairly closely with age, 80% of patients Alberta-wide had some exposure to predialysis care, and 53% of patients started dialysis while admitted to an acute care hospital (see Table 2).

Calgary (Registered Patients: 318)

Summary

Overall, 43% of patients in Calgary received PD within 180 days of starting dialysis over the reporting period. This high incident rate reflected the fact that 92% of patients were assessed, 86% of patients were deemed eligible for PD, and nearly all eligible patients were offered the therapy. Of those who were offered it, the choice rate was on the high end of expected at 63%. Three-quarters of patients who chose PD started on it as a first therapy and 90% received it within 180 days of starting.

The proportion of outpatient dialysis starts that initiated dialysis with an eGFR above 9.5 ml/min/1.73m^2 was relatively low at 14%. While this was higher than the START Project target of 11%, the target was set based on the assumption that the number of patients starting dialysis with an eGFR above 9.5 ml/min/1.73m^2 would be much higher than observed and highlights the need for accurate measurement to confirm performance, prior to initiating interventions to fix them. The mean eGFR at initiation of dialysis in outpatients was 7.6 ml/min/1.73m^2.

Recommendations

In Calgary, the local team has worked and continues to work to ensure that acute, inpatient starts are educated about their treatment options and provided a choice of therapy. If patients choose PD, they are working to make sure it is a realistic option and to streamline the process of getting a catheter placed, transitioning patients from hospital

to home, and facilitating training for independent dialysis. During the START Project, this resulted in a rate of PD use by 180 days in inpatient starts that was nearly double the provincial average (24% in Calgary compared to 13% provincially). However, only 40% of patients who eventually decided to do PD started on PD as a first therapy if they started in hospital, suggesting there is room for improvement. While this may not increase PD use by 180 days, it may lead to an earlier transition to therapy, which may make the process more efficient, less costly, and avoid unnecessary procedures due to starting patients on something other than their intended therapy. There do not appear to be any major modifiable barriers to PD use and efforts should likely shift to maintain the observed gains, improving the patient experience, and fine-tuning process, without the expectation that PD use will increase dramatically beyond current levels.

Lethbridge (Registered Patients: 63)

Summary

Overall, 14% of patients in Lethbridge received PD within 180 days of starting dialysis over the reporting period. This incident rate reflected the fact that only 81% of patients were assessed, 78% of patients were deemed eligible for PD, and all eligible patients were offered the therapy. Of those who were offered PD, the choice rate was the lowest observed in the province at 28%. Just over half of patients who chose PD started on PD as a first therapy and 82% received it within 180 days of starting dialysis.

The proportion of outpatient dialysis starts that initiated dialysis with an eGFR above 9.5 ml/min/1.73m^2 was low at 7% and already on target for the START Project. The mean eGFR at dialysis initiation in outpatients was 7.0 ml/min/1.73m^2.

Recommendations

A closer look at the above metrics reveal that, despite the low proportion of patients assessed for PD compared to other sites, the reasons were not modifiable in all but one patient. The patients who were not assessed died, recovered kidney function, transferred out of the program, or refused to participate in the assessment, except for one patient who transferred to a satellite unit and modality education was not completed. Having a process in place to educate patients located at remote units will be important. The low choice rate, reflected by the fact that only 28% of patients offered PD will go on to choose PD and have a PD catheter placed should be the focus in Lethbridge moving forward. This metric is typically affected by the manner in which PD is presented and the timing of

the offer. When home dialysis options are viewed positively and patients make an informed decision, choice rates are typically between 50%-60%. To put this in perspective, increasing the choice rate from 28% to 60% would increase incident PD use from 14% to 31%, if all other metrics remained constant.

Medicine Hat (Registered Patients: 23)

Summary

Overall, 9% of patients in Medicine Hat received PD within 180 days of starting dialysis over the reporting period. This incident rate reflected the fact that 87% of patients were assessed, only 30% of patients were deemed eligible for PD, and all eligible patients were offered the therapy. Of those who were offered PD, the choice rate was 50%. Fifty-five percent (55%) of patients who chose PD started on it as a first therapy and 67% received it within 180 days of starting.

The proportion of outpatient dialysis starts that initiated dialysis with an eGFR above 9.5 ml/min/1.73m^2 was low at 50% and above the target for the START Project. However, this is based on a small sample size and is difficult to interpret, as a consequence. The mean eGFR at dialysis initiation in outpatients was 8.8 ml/min/1.73m^2.

Recommendations

The low eligibility rate is the most obvious barrier to increasing PD use in Medicine Hat (30% vs. 76% provincially). While they serve an older population, many sites with similar patient populations have historically had much higher eligibility rates. A closer look at eligibility shows that the rate of contraindications to PD was high in Medicine Hat (45% of patients compared to provincial average of 17%). However, even after removing those with contraindications, eligibility rates were low [6 out of 11 patients without contraindications ultimately deemed eligible for PD (55% compared to 91% provincially)], although the numbers were small. While contraindications appear to be non-modifiable, what a team at one site considers a contraindication may not be the same as a team at another site. A careful review of the contraindications at Medicine Hat may be helpful and determine whether this is simply a chance finding in a relatively small population, or if it represents an opportunity to revisit eligibility criteria and expand the pool of potential PD patients. The eligibility rate among those who do not have contraindications is historically a measure of how “aggressive” teams are at offering PD to patients. While there are certainly patients who do not have contraindications, but who have a

constellation of barriers that make them poor home candidates, typically sites with high PD utilization are liberal in who they offer the therapy and about 85%-90% of such patients are deemed eligible. The potential impact of increasing eligibility rates is large – if eligibility increased to 80%, incident PD use would rise from 9% to 23%, if all other metrics remained the same.

Red Deer (Registered Patients: 88)

Summary

Overall, 25% of patients in Red Deer received PD within 180 days of starting dialysis over the reporting period. This incident rate reflected the fact that 89% of patients were assessed, 54% of patients were deemed eligible for PD, and all eligible patients were offered the therapy. Of those who were offered PD, the choice rate was 67%. Only 36% of patients who chose PD started on it as a first therapy, but 79% of them received it within 180 days of starting.

The proportion of outpatient dialysis starts that initiated dialysis with an eGFR above 9.5 ml/min/1.73m^2 was 29% and above the provincial average of 13%. The exact explanation is not yet clear and may reflect physician practice, difficulties accessing resources that prompt pre-emptive starts, or other issues that influence decisions regarding the timing of starts. With increasing numbers, we can begin to examine if there are physician level differences in practice and what the drivers of these differences are. The mean eGFR at dialysis initiation in outpatients was 8.4 ml/min/1.73m^2.

Recommendations

In Red Deer, the major modifiable barrier to increasing PD utilization was the low eligibility rate. Again, while the proportion of patient with a contraindication to therapy was higher compared to the provincial average (32% in Red Deer compared to 17% provincially), a critical review of contraindicated patients is likely to be helpful. In those patients who did not have a contraindication to therapy, about 79% were deemed eligible for PD – a rate that is lower than expected when compared against sites with high PD use. Again, this reflects how aggressively programs offer PD to patients and may be another potential area to address or examine in more detail. This can reflect hesitancy on the part of physicians, the PD nursing staff, or patients to consider home therapies. Our ability to predict who will do well at baseline is limited and to date, there is no signal that being more liberal in the offer of PD to patients leads to higher rates of technique failure or

complications. If eligibility rates increased to 80% from the current 54%, the incident rate in Red Deer would increase from 25% to 38% if all other metrics remained the same.

The other area that should be highlighted is the low likelihood of starting PD as a first therapy in those who ultimately choose PD. Only 36% of patients who choose PD when given the option will receive it as a first therapy compared to 68% provincially. That number improves to 79% at 6 months after dialysis start compared to 81% provincially. This typically reflects one of several issues – first, programs with a high number of urgent, acute starts often have lower rates of PD as a first therapy unless they have developed acute PD start programs. In addition, the inability to secure timely PD catheter placement can make it challenging to get patients on PD as a first therapy and access to PD training can be a contributor, although training capacity hasn't been an issue to date. The team in Red Deer has made great strides at addressing the issue of surgical support for catheter placement.

Grey Nun's Community Hospital [GNCH (Registered Patients: 64)]

Summary

Overall, 36% of patients at GNCH received PD within 180 days of starting dialysis over the reporting period. This incident rate reflected the fact that 92% of patients were assessed, 78% of patients were deemed eligible for PD, and nearly all eligible patients were offered the therapy. Of those who were offered it, the choice rate was 78% and higher than the provincial average of 58%. A total of 57% of patients who chose PD started on it as a first therapy and 66% received it within 180 days of starting.

The proportion of outpatient dialysis starts that initiated dialysis with an eGFR greater than 9.5 ml/min/1.73m^2 was 19% and above target for the START Project. However, this is based on a sample size of only 37 patients and is difficult to interpret, as a consequence. The mean eGFR at dialysis initiation in outpatients was 7.9 ml/min/1.73m^2.

Recommendations

The choice rate at GNCH is higher than expected. This may reflect a promotional approach to modality discussions. The inability to get patients who have chosen PD onto therapy is the most obvious barrier to increasing PD use (66% vs. 81% provincially). Delays in PD training have been raised locally as a potential explanation for this observation, although PD catheter dysfunction is also a consideration that should be

explored. The ability to move this metric to the provincial average would have the impact of increasing incident PD use from 36% to 44%, if all other metrics stayed the same.

Royal Alexandra Hospital [RAH (Registered Patients: 119)]

Summary

Overall, 21% of patients received PD within 180 days of starting dialysis over the reporting period. This incident rate reflected the fact that 94% of patients were assessed, 76% of patients were deemed eligible for PD, and nearly all eligible patients were offered the therapy. Of those who were offered it, the choice rate was only 48% (lower than the provincial average of 58%). Sixty-four percent (64%) of patients who chose PD started on it as a first therapy and 69% received it within 180 days of starting.

The proportion of outpatient dialysis starts that initiated dialysis with an eGFR above 9.5 ml/min/1.73m^2 was only 7% and better than the target for the START Project. The mean eGFR at dialysis initiation in outpatients was 6.6 ml/min/1.73m^2.

Recommendations

The choice rate is lower than expected. The inability to get patients who have chosen PD onto therapy within 180 days is a barrier to increasing PD use locally (69% at RAH compared to 81% provincially). If one follows patients beyond 180 days at this site, they do eventually get 81% of patients who choose PD on the therapy, but this lags sites with higher PD use where it is closer to 90% who eventually get on. Delays in PD training have also been raised locally as a potential explanation for this observation, but PD catheter dysfunction is another potential explanation that should be explored. The ability to move this metric to the provincial average would have the impact of increasing incident PD use from 21% to 27%, if all other metrics stayed the same.

University of Alberta Hospital [UAH (Registered Patients: 264)]

Summary

Overall, 30% of patients received PD within 180 days of starting dialysis over the reporting period. This incident rate reflected the fact that 96% of patients were assessed, 76% of patients were deemed eligible for PD, and nearly all eligible patients were offered the therapy. Of those who were offered PD, the choice rate was 55% and higher than the provincial average of 58%. Seventy-three percent (73%) of patients who chose PD

started on it as a first therapy and that number increased only marginally to 77% by 180 days after the initiation of dialysis.

The proportion of outpatient dialysis starts that initiated dialysis with an eGFR above 9.5 ml/min/1.73m^2 was 9% and better than the target for the START Project. The mean eGFR at dialysis initiation in outpatients was 6.8 ml/min/1.73m^2.

Recommendations

Converting patients who express a wish to do PD and getting them on therapy in a timely way is the only identified barrier to increased PD utilization, based on high-level metrics. The proportion who choose PD and start on PD was in line with other high-performing sites, but the added bump that is observed in the first six months at other sites doesn't happen locally. Delays in training have been identified as the likely culprit and indeed, if patients were followed beyond 180 days, 89% eventually received PD. Of note, only 2.5% of patients starting in hospital start on PD, as compared to 11% at sites with higher PD use, and this likely reflects a local policy that discourages inpatient PD starts. There is no organized, urgent PD start program. Nearly all new PD starts occurred in outpatients. The last consideration is again, the possibility that PD catheter dysfunction is a barrier to getting people on therapy – this should be excluded.

Impact

The START Project aligns with AHS' Organizational Priorities and is an excellent example of a health care team-based approach that addresses capacity, financial pressures and improves the patient experience and clinical outcomes of individuals with kidney disease in our province. While improvements have been made during the course of the initiative, we believe further uptake of PD can be achieved if additional process and practice changes are implemented, supported by high-quality data collection. The ability to capture high-quality information is a distinct advantage with the START Project. It allows accurate identification of gaps in care, benchmarking of institutions against one another, and the tailoring of interventions to problem areas. In addition, it allows the evaluation of interventions to determine if they are having the desired impact on the areas targeted. Accurate measurement does not, by itself, lead to change, but it is a necessary first step and provides the foundation for quality improvement work. The KH SCN™ continues to work with the AKC to support sustained, and hopefully further improved, PD outcomes.

The Impact on AHS' Organizational Priorities is described below:

Priority: Improving patient experiences, promoting a "Patient First" strategy

Dialysis has a significant impact on a patient's quality of life and is a large time commitment. Canadian guidelines suggest deferring dialysis initiation until a patient's eGFR is at or below the threshold eGFR (9.5 ml/min/1.73m^2) and the patient displays symptoms of kidney failure. In addition, most patients wish to defer dialysis initiation until it is absolutely necessary. During the course of the START Project, more outpatients started dialysis in accordance with Canadian guidelines, with only 13% of patients starting dialysis earlier than guidelines suggest based on their eGFR, compared to 16% starting earlier than guidelines suggest in the year prior to the START Project.

Some jurisdictions have implemented a "PD first" policy to increase PD utilization. This means that patients must do PD as their first form of therapy if they are medically able to do so and are not provided with a choice regarding their dialysis modality. In our experience, cleaning up the processes of care and standardizing our approach to the identification and assessment of patients to ensure all eligible patients are offered PD leads to increased PD use, without restricting patient choice. During the START Project, the percentage of patients who received PD within 180 days of starting dialysis increased 7% across the province, from 25% at baseline to 32% by the end of the project period

(p<0.001), with 4 of 5 sites showing growth. The greatest increase was seen in Calgary, increasing from 27% at baseline to 43% by the end of the Project Period. The next step is to continue to use high-quality information, tied to the processes of care to identify gaps in care that could lead to further improvements if addressed.

Priority: Enhancing care in the community

Increasing the percentage of patients who receive PD within 180 days of starting dialysis increases the time patients spend at home or in their own communities, and shifts care from the dialysis unit to the patient's home. It also reduces the time patients need to travel to receive care at a dialysis facility. As noted above, the proportion of new patients being treated in their homes has increased by 7% province-wide since the introduction of the START Project.

Priority: Improving system flow

Improving access to PD for eligible, interested patients and increasing PD uptake can relieve capacity pressure for in-centre HD. Patients that may have previously received in-centre HD have the opportunity to dialyze in the community, which increases space available for patients who are not eligible for PD, or who do not choose to receive PD. This will delay the need for capital spending to expand in-centre HD services.

Priority: Ensuring a quality and safety focus in patient care

Dialysis is a life-saving therapy. Therefore, patients cannot defer dialysis therapy once their kidney failure reaches a critical level. We collect high-quality data regarding patient outcomes (hospitalization, technique failure, death, rates of invasive procedures) that were previously not available, to ensure that there are no unintended consequences to the interventions designed to address our priority areas. The outcomes observed to date do not indicate any reason to be concerned and certainly, no increased risk of harm as compared to HD patients.

Priority: Integrating research, innovation and analytics in delivery of care

The START Project integrates a novel approach to improving the use of dialysis therapy by using a provincially standardized data collection for all new dialysis patients. The complimentary DMAR™ System allows teams to capture high-quality data tied to the process of modality selection and dialysis initiation, creating a foundation for local improvements and evidence-based change management. Regular audit and feedback

through the use of quarterly, quality improvement reports allows programs to understand the complex process of starting a patient on dialysis and identify opportunities for improvement and implementing practice changes specific to their local environment.

The DMAR™ System uses a patented method that allows for clinical-trial quality data collection in everyday practice. These high-quality data can then be leveraged for the purpose of research, innovation, and quality improvement. To date, nearly 30 peer-reviewed articles have been published with data collected using the DMAR™ System. Data collected using the DMAR™ System has also allowed us to identify gaps in care, has provided clinical insights that led to clinical trials, and continues to support innovation in the dialysis space.

Priority: Ensuring Integration with Connect Care

Going forward, we plan to integrate data collection efforts into *Connect Care* and use our learnings from the START project to help design better and more streamlined documentation at point-of-care that can be efficiently leveraged for the purpose of quality improvement and reporting.

Sustainability

Based on the preliminary results of the project to December 2017, the KH SCN™ received funding to continue the START Project through March 2019 while leadership plans for an eventual transition from project funding to annual support. In order to support the transition and long-term sustainability of the initiative into renal operations, in collaboration with the KH SCN™ and AKC Leadership teams, this report will be supplemented with an economic evaluation of START toward the end of 2018.

In the years ahead, our focus is to support teams in maintaining the practice changes relating to the process of modality selection and dialysis initiation, and where potential exists, continuing to strive for further improved uptake of PD. To support these efforts, we make recommendations in the following section with respect to maintaining practice changes realized through the START Project, and striving for further improved uptake of PD.

Recommendations for Sustainability

Based on the results of the START Project, the KH SCN leadership team makes the following recommendations:

Recommendation 1: Continue to use the structured review and multidisciplinary assessment for all new starts, and document modality selection and the decision-making process using the DMAR™ System.

Multidisciplinary team meetings are required as part of standard patient care and provide an important forum for conducting a structured review of all new dialysis starts. These meetings ensure that all new dialysis patients are:

- identified and assessed for PD eligibility;
- educated about treatment options and offered PD if they are eligible;
- supported to make an informed modality decision; and
- successfully initiated on their chosen therapy.

The details of this structured assessment process and the relevant variables should continue to be documented in a standardized manner using the DMAR™- System so that the effectiveness of the program can be monitored. This ensures that data are collected

provincially on a common platform with a consistent coding schema to permit objective comparisons and reporting across sites and programs.

Operational support and support from champions including KH SCN™ Leadership, AKC Leadership, front-line staff, managers and physicians, is required to ensure that data collection, data review and analysis can continue.

Over the coming months the KH SCN Leadership Team will be working with the START Co-Chairs and the AKC Leadership team to optimize and streamline data capture.

Recommendation 2: Continue to provide ongoing reporting and expert interpretation support to inform the quality improvement process.

The documentation of variables of modality selection and dialysis initiation using the DMAR™ System enabled the KH SCN™ to provide participating teams with site-specific reports tied to the process of modality selection and dialysis initiation on a quarterly basis. This system of audit and feedback assisted front-line staff in identifying local barriers to increasing the safe and effective use of PD and ensuring timely initiation of dialysis.

These site-specific reports should continue to be provided to sites on a regular basis (at least every 6 months) to enable teams to review their metrics, to maintain their performance on the primary outcomes of the START Project, and to identify local gaps in care and opportunities to improve.

Support from clinical champions, the KH SCN™ Leadership, the AKC Leadership, quality improvement committees, managers, and physicians is required to facilitate the above recommendation.

Recommendation 3: Continue to support an effective quality improvement process to utilize reports and achieve further improvement in uptake and maintenance of PD.

In order to support quality improvement processes and the use of audit and feedback reports to achieve further improvement in uptake of PD, teams must be supported with resources and expertise to:

- use data from their reports to identify gaps and unwanted variations in care;
- develop tailored solutions to address gaps and variations; and
- evaluate the impact of their solutions by continuing to implement methods learned during the innovation collaborative learning sessions modelled on the IHI Collaborative Model for Achieving Breakthrough Improvement (including continued use of quality improvement tools and processes, balanced scorecards as a performance measurement tools and the "Plan-Do-Study-Act Cycle").

Continued support for the START Project will help facilitate the development of indicators of high value nephrology care and the creation of audit and feedback quality improvement reports for physicians. These reports will include indicators that support audit and feedback and inform physician practice changes, complementing the quality improvement process and supporting further improvement in uptake and maintenance of PD.

Operational support, as well as support from champions including KH SCN™, AKC, quality improvement committees, front-line staff and managers and physicians, is required to support teams to engage in an effective quality improvement process.

Conclusions

Through the START Project, we have developed a greater understanding of how to optimize the safe and effective use of PD in a provincial context and improve the timing of dialysis initiation. During the Project Period, the percentage of patients province-wide who receive PD within the first 180 days of starting dialysis increased from 25% to 32% ($p<0.001$), surpassing our target, with 4 out of 5 participating sites showing growth. During the same time period, the proportion of outpatients in Alberta initiating dialysis earlier than guidelines suggest decreased from 16% to 13% ($p=0.17$) and we are on track to achieving this target.

While we have made improvements over the course of the START Project, we believe further uptake of peritoneal dialysis can be achieved if additional process and practice changes are implemented. The START Project was the beginning of a culture change toward continuous quality improvement, and has equipped the teams with the tools necessary to continue to identify and address local and provincial barriers to adopting best practices. The teams' enthusiasm and quality improvement efforts should be celebrated and supported.