

Investing in Quality Improvement:

Economic Analysis of the Renal Program Body Access and Independent Dialysis Initiative at the London Health Sciences Centre

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The Problem

The function of the kidneys is to filter waste products and excess fluids from the blood that are then excreted in urine. When kidneys are no longer able to perform well, a condition referred to as end stage renal disease (ESRD), toxic levels of fluid, electrolytes and waste build up in the body.¹ In this condition, the patient requires dialysis or a kidney transplant to stay alive.¹

Due to an aging population and increased incidence of risk factors for kidney disease (notably diabetes and hypertension), the incidence of ESRD has increased globally.² In Ontario, the rate of ESRD patients grew from 182.0 per million population in 2006 to 219.4 per million in 2015, an increase of 20% over the 10-year period.³ Because improved treatment means that ESRD patients are living longer, prevalence has increased to an even greater extent. In Ontario, the prevalence of ESRD increased from 1,080.4 per million population in 2006, to 1,364.7 per million population in 2015, an increase of 26%.³

There are two types of dialysis: peritoneal dialysis and hemodialysis. During hemodialysis, blood is pumped into a machine which performs the functions of the kidneys, filtering the waste, electrolytes and excess fluid from the blood.⁴ The filtered blood is then returned to the body. Most hemodialysis patients receive their treatment at home.⁵ During peritoneal dialysis, the peritoneal space is filled with fluid; waste products move into the fluid by osmosis, and the fluid is then drained.⁵ Peritoneal dialysis is generally performed at home. In Ontario in 2015, 75.9% of ESRD patients were initially treated using hemodialysis (down from 80.4% in 2012), while 21.4% were initially treated using peritoneal dialysis (up from 16.8% in 2012).³ For the remaining 2.7%, the initial treatment was a pre-emptive transplant.³

Studies have consistently shown that peritoneal dialysis is less expensive than hemodialysis, while providing similar outcomes in terms of patient survival and quality of life.^{6,7} As well, despite higher initial costs for set-up and training, home hemodialysis is less expensive than hospital or clinic-based hemodialysis.^{8,9}

The Renal Program Body Access and Independent Dialysis Initiative Project

The goal of the London Health Sciences Centre: Renal Program Body Access and Independent Dialysis Initiative is to empower dialysis patients and improve the dialysis experience.^{10,11} The project focuses on ensuring that patients receive all the education, advice and recommendations necessary to make an informed decision regarding their course of dialysis treatment.¹⁰ The project is a quality improvement (QI) initiative designed to improve both peritoneal and vascular access for dialysis patients and improve the uptake of independent (i.e. home-based) dialysis by implementing a new process for referral to vascular surgery, peritoneal dialysis and home hemodialysis consultation at the time the patient starts outpatient dialysis.¹¹ The process focuses on suboptimal starting dialysis patients, which the team defined as: all general nephrology patients starting hemodialysis, chronic kidney disease patients who had not indicated a choice of dialysis modality, patients who had failed peritoneal dialysis, and transplant patients whose transplant had failed and who had not had a discussion of their options.¹⁰ The project was originally implemented at the London Health Sciences Centre University Hospital site as part of the IDEAS (Improving & Driving Excellence Across Sectors) Advanced Learning Program.*¹

During the course of IDEAS, from September 2014 to February 2015, the London Health Sciences Centre team was able to shorten referral times from an average 180 days to an average of 50 days for vascular access¹⁰ (the creation of a vascular access is required for both home and hospital or clinic-based hemodialysis). The team was also able to reduce

*IDEAS is a comprehensive, evidence-based quality improvement training program for Ontario's healthcare professionals. Funded by the Ontario Ministry of Health and Long-Term Care and delivered in partnership with The Institute of Health Policy, Management and Evaluation at the University of Toronto, Health Quality Ontario, and the Institute for Clinical Evaluative Sciences, along with the six medical schools in Ontario, IDEAS is designed for frontline clinicians and administrators to improve the quality of patient care. An essential component of the Advanced Learning Program is the team-based applied learning project. Over the five-month program, project teams identify an issue and develop, implement and report on a quality improvement project in their own organization of local health system.

average referral time from 110 days to 30 days for home dialysis, and from 80 days to 30 days for peritoneal dialysis.¹⁰ Since project implementation, the team has successfully spread their program to the Victoria Hospital site while maintaining these improvements.¹¹

Potential Economic Impact of the Project

In this economic analysis, we examined the potential impact of the London Health Sciences Centre's Renal Program Body Access and Independent Dialysis Initiative on healthcare costs by improving the uptake of peritoneal dialysis or home hemodialysis from the perspective of public healthcare payer over a 21-month period.

The Analysis: Methods, Results and Limitations

Methods

Using results collected from the London Health Sciences Centre project, the potential impact on healthcare costs was estimated based on the number of eligible patients converted to either home or peritoneal dialysis. Using estimates of the cost of each of the dialysis modalities derived from a recent study conducted by the Toronto Health Economics and Technology Assessment Collaborative (THETA)¹² (see Appendix A for further details regarding the estimated cost of dialysis treatment), this analysis was able to estimate the potential economic impact of the Renal Program Body Access and Independent Dialysis Initiative.

The Renal Program Body Access and Independent Dialysis Initiative targeted suboptimal starting dialysis patients including new dialysis patients who did not initially start on a home-based dialysis modality. The Ontario Renal Network reports that at the London Health Sciences Centre in the 4th quarter of the 2013/14 fiscal year, approximately 35% of patients initially started on a home-based dialysis modality with the remaining 64% on a hospital or clinic-based dialysis modality.¹³ This 64% of patients was the target population of the initiative.

This analysis examined costs from the perspective of the healthcare system as the funder of dialysis-related care (see Appendix B for costing methodology). Two scenarios were examined to determine the impact of the initiative on healthcare costs. Scenario 1 consisted of a hypothetical situation where the initiative was not provided to those who had already started treatment on hospital or clinic-based hemodialysis (the scenario without the initiative). Scenario 2 consisted of the initiative's implementation using the IDEAS team's data regarding patients who subsequently switched to either peritoneal dialysis or home hemodialysis (the scenario with the initiative). The incremental difference in the estimated total healthcare costs between scenarios represents the Renal Program Body Access and Independent Dialysis Initiative's potential impact on healthcare costs.

Results

The IDEAS team provided data for the period of January 2015 to September 2016. During that time, the team provided services to 210 individuals who had initiated treatment on hospital or clinic-based hemodialysis. Of those 210 individuals, nine patients switched to independent dialysis: four to home hemodialysis and five to peritoneal dialysis. Based on the cost estimates provided by THETA, for scenario 1 (the scenario without the initiative, in which patients remained on hospital or clinic-based hemodialysis), the estimated total healthcare costs were \$27,906,690 for all 210 patients in their first year of dialysis. For scenario 2 (the scenario with the initiative's implementation), the estimated total healthcare costs were \$27,434,066 for all 210 patients in their first year of dialysis. The expected impact on healthcare costs in the first year of dialysis was an estimated \$472,624, based on a cost-savings of \$48,071 for each patient who switched to home hemodialysis and \$56,068 for each patient who switched to peritoneal dialysis (Appendix B).

Limitations

This study warrants limitations in its usage of certain costing parameters to derive the estimates of total healthcare costs for each scenario. The overhead costs involved in the implementation of the initiative were not considered. Program costs may reduce the impact of the initiative's estimated savings. Based on this economic analysis and the IDEAS team data gathered over 21 months, if the implementation of the program were to cost less than or equal to approximately \$200,000/year, it has the potential to create savings in total healthcare costs.

The calculations presented here are based on the results of the THETA study, which examined costs from the perspective of the healthcare system.¹² Costs borne by the patient, their families and/or by private insurers were not included. Although these costs are harder to measure, some studies have reported that peritoneal dialysis is more likely to allow patients to continue in employment, and that it is associated with better quality of life than hospital or clinic-based hemodialysis.¹⁴

A limitation in extrapolating the results of this Initiative to other dialysis programs is the assumption that the IDEAS team's success will be repeatable in other sites and dialysis centers. However, the project was implemented at a dialysis center where many patients were already starting dialysis using a home-based modality.^{10,11} Therefore, increasing the rate of home hemodialysis might be expected to be easier in centers in which fewer patients are already informed of or using home-based dialysis modalities.

Seventeen of the 26 Regional Programs currently have lower utilization rates of home hemodialysis than London Health Sciences.¹⁴ Some of them are in more rural parts of the province, where it may be less cost-effective to distribute supplies to individual homes. It is quite possible that the high utilization rate achieved by the London Health Sciences Centre team depends, in part, on the fact that it serves a relatively densely populated urban population, making it easier to obtain and deliver the supplies needed for home-based treatment. This may also impact patient comfort with home-based treatment, given the ease of reaching a hospital if there is a problem. However, it should be noted that several regional programs with rates even higher than those attained by London Health Sciences serve rural areas.¹⁴

Data availability imposes limits on the timeliness with which costs and rates of dialysis can be assessed. For this study, the Canadian Organ Replacement Registry (CORR) was the database used to identify and characterize individuals who have initiated or changed treatment for ESRD.³ CORR data is not available until well after the end of each fiscal year. However, given the low overhead cost of this project^{10,11} and demonstration of a positive return on investment following a relatively small number of patients transferring from hospital or clinic-based hemodialysis, it can be assumed that even under conservative assumptions, return on investment would continue to be positive. In addition, although the London Health Sciences Chronic Kidney Disease Regional Program already has one of the highest rates of incident ESRD patients starting on home hemodialysis¹⁴, the project demonstrated the potential for impact on healthcare costs when only conservatively applied to a subgroup of patients termed 'suboptimal'.

Discussion

The London Health Sciences Centre's Renal Program Body Access and Independent Dialysis Initiative stems from the priorities of the Ontario Renal Network (ORN) Ontario Renal Plan.^{10,11} The Ontario Renal Network has set a target of initiating 40% of incident dialysis patients on independent (i.e. home-based) dialysis.¹⁴ In the fourth quarter of the 2013/14 fiscal year, the latest year for which data is reported, the province had reached 31.7% incident dialysis patients initiated on independent dialysis, with individual regional programs ranging from 0% to a high of 56.5%.¹⁴ In 2015, 3,000 Ontarians newly developed ESRD; most started dialysis.³ Reaching the ORN target means starting an additional 250 patients on home-based dialysis modalities each year. Based on this economic analysis, this initiative has potential to minimize economic burden to the healthcare system.

Conclusion

In summary, the program initiated by the IDEAS team demonstrated success and the potential for impact on healthcare costs. As this project continues to spread, its impact has the potential to assist other programs in reaching the ORN's goal of increasing the number of patients receiving independent dialysis, and with that, potentially reduce the economic burden on the healthcare system.

Appendix A: Estimated Cost of Dialysis Treatment by Modality

A recent study conducted by the Toronto Health Economics and Technology Assessment Collaborative (THETA) rigorously examined healthcare costs from the perspective of the Ministry of Health and Long-Term Care for patients newly initiating long-term dialysis in Ontario.¹² In addition to the costs directly associated with dialysis, they included other costs of treatment covered by the Ministry of Health and Long-Term Care, including such things as hospital admissions, emergency department visits and other ambulatory care, and prescription medications. Unadjusted costs in the first year of dialysis were (in 2012 Canadian Dollars):

- \$76,821 for peritoneal dialysis
- \$84,818 for home hemodialysis
- \$132,889 for hospital or clinic-based hemodialysis

This study also examined costs over a five-year period and found that costs for hospital-based hemodialysis continued to be higher than the costs for home hemodialysis and peritoneal dialysis for 5 years after initiation of dialysis. Average daily costs were approximately \$350 for hospital-based hemodialysis, compared with approximately \$200 for peritoneal dialysis and approximately \$175 for home-based hemodialysis.

In addition to finding substantial cost savings associated with home hemodialysis, the THETA study also found that home hemodialysis patients had longer survival times than did patients receiving hospital-based dialysis, even after adjusting for differences in the patient groups. Due to recent improvements in peritoneal dialysis, current evidence is that patients receiving peritoneal dialysis experience lower rates of infection and hospitalization and better quality of life than those receiving hospital-based hemodialysis. The THETA comparison of costs takes all publicly funded healthcare utilization into account and thus captures not only the reduced cost of the dialysis itself, but also any reductions in the use of healthcare services due to adverse events.

Appendix B: Costing Methodology

Estimated total healthcare costs associated with scenario 1 (patients remain on hospital or clinic-based hemodialysis)

- From January 2015 through September 2016, 210 individuals initiated treatment on hospital or clinic-based hemodialysis
- Using dialysis modalities costing parameters from Appendix A, the cost of hospital or clinic-based hemodialysis is **\$132,889 per patient** in the first year of dialysis
- This translates to an estimated total healthcare cost of **\$27,906,690** ($\$132,889 \times 210$)

Estimated total healthcare costs associated with scenario 2 (the impact of the initiative in allowing patients to make an informed decision regarding their course of treatment):

- When compared to the cost of hospital-based hemodialysis, peritoneal dialysis is associated with an estimated cost-savings of **\$56,068 per patient** ($\$132,889 - \$76,821$)
- When compared to the cost of hospital-based hemodialysis, home hemodialysis is associated with an estimated cost-savings of **\$48,071 per patient** ($\$132,889 - \$84,818$)

From January 2015 through September 2016, project implementation was associated with:

- Nine individuals switching to independent dialysis: four to home hemodialysis and five to peritoneal dialysis
 - Peritoneal costs for five patients in their first year of dialysis is associated with an estimated total healthcare cost of **\$384,105** ($5 \times \$76,821$ per patient)
 - Home hemodialysis costs for four patients in their first year of dialysis is associated with an estimated total healthcare cost of **\$339,272** ($4 \times \$84,818$ per patient)
- 201 patients remained on hospital or clinic-based hemodialysis resulting in an estimated healthcare cost of **\$26,719,689** ($201 \times \$132,889$ per patient)
- This translates to an estimated total healthcare cost of **\$27,434,066** ($\$26,719,689 + \$339,272 + \$384,105$)

Estimating the impact of the Renal Program Body Access and Independent Dialysis Initiative on total healthcare costs:

- Project implementation translated to an estimated savings in total healthcare cost of **\$472m642** in the first year of dialysis ($\$27,906,690 - \$27,434,066$)

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