CADTH

CADTH OPTIMAL USE REPORT

Dialysis Modalities for the Treatment of End-Stage Kidney Disease: A Health Technology Assessment

PROSPERO Registration Number:
CRD42016046980

Product Line: Optimal Use Report
Issue Number: volume 6, no. 2b
Publication Date: March 2017
Report Length: 292 Pages

CADTH

Clinical authors: Dr. Alison Sinclair,[1] Karen Cimon,[1] Mirhad Loncar,[1] Dr. Manish Sood,[2] Dr. Paul Komenda,[3] Melissa Severn[1]

Economic authors: Dr. Scott Klarenbach,[4] Dr. Helen So,[4] Dr. Bernice Tsoi,[1] Dr. Robert Quinn,[5] Dr. Robert Pauly,[4] Dr. Marcello Tonelli,[5] Dr. Braden Manns[5]

Patient preferences and experiences authors: Tamara Rader,[1] Kristen Moulton[1]

Implementation authors: Kristen Moulton,[1] Eftyhia Helis,[1] Janet Crain[1]

Ethics author: Dr. Daryl Pullman[6]

Cite as: *Dialysis Modalities for the Treatment of End-Stage Kidney Disease: A Health Technology Assessment*. Ottawa: CADTH; 2017. (CADTH Optimal Use Report; vol.6, no.2b).

ISSN: 1927-0127

Production of this report is made possible through a financial contribution from Health Canada.

About CADTH: CADTH is an independent, not-for-profit organization responsible for providing Canada's health care decision-makers with objective evidence to help make informed decisions about the optimal use of drugs, medical devices, diagnostics, and procedures in our health care system.

Funding: CADTH receives funding from Canada's federal, provincial, and territorial governments, with the exception of Quebec.

[1] CADTH, Ottawa, Ontario
[2] The Ottawa Hospital Research Institute, Ottawa, Ontario
[3] Seven Oaks General Hospital, Winnipeg, Manitoba
[4] University of Alberta, Edmonton, Alberta
[5] University of Calgary, Calgary, Alberta
[6] Memorial University, St John's, Newfoundland and Labrador

Reviewers

External Reviewers

This document was externally reviewed by content experts and the following individuals granted permission to be cited.

Ba' Pham, PhD
Senior Research Associate
Toronto Health Economics and Technology Assessment and Knowledge Translation Program
St. Michael's Hospital
Toronto, Ontario

Michael Copland, MD, FRCP (C)
Nephrologist
Vancouver General Hospital
Vancouver, British Columbia

Steven D. Soroka, BMus, MD, MSc, FRCPC, EXTRA
Fellow, CHE
Professor, Faculty of Medicine, Dalhousie University
Medical Lead, Central Zone
Renal Program, Nova Scotia Health Authority
Medical Lead, Nova Scotia Health Authority
Dalhousie University and Nova Scotia Health Authority
Halifax, Nova Scotia

Authorship

Clinical Review

Dr. Alison Sinclair led the clinical project protocol development; selected studies; extracted, tabulated, and analyzed data; wrote the clinical section of the report; and revised the report based on reviewers' comments.

Karen Cimon contributed to article screening and selection, data extraction, and tabulation of data for the clinical review, and contributed to the writing of the clinical section of the report.

Mirhad Loncar contributed to article screening and selection, data extraction, and the study quality assessment for the clinical review.

Dr. Manish Sood participated in the conceptualization of clinical approaches to dialysis treatment and in the preparation and review of the draft reports.

Dr. Paul Komenda participated in the conceptualization of clinical approaches to dialysis treatment and in the preparation and review of the draft reports.

Melissa Severn designed and executed the literature search strategies, wrote the literature search methods section and appendix, and managed report referencing.

Economic Review

Dr. Scott Klarenbach led the economic protocol development, conducted the review of the economic literature, conducted the economic evaluation, wrote the economic section of the report, and revised the report based on reviewers' comments.

Dr. Helen So performed the literature review, data collection, model design, generated the economic results, and critically revised the report for intellectually important content.

Dr. Bernice Tsoi assisted in the validation of the economic model and the economic findings, critically revised the report for intellectually important content and co-wrote the report's discussion section based on interpretation of the economic results.

Dr. Marcello Tonelli provided contributions to conception/design and interpretation of findings, and critically revised the report for intellectually important content.

Dr. Robert Pauly provided contributions to conception/design and interpretation of findings, and critically revised the report for intellectually important content.

Dr. Robert Quinn provided contributions to conception/design and interpretation of findings, and critically revised the report for intellectually important content.

Dr. Braden Manns contributed to the economic protocol development, conducted the costing portion of the economic evaluation, and co-wrote the report's discussion section based on interpretation of the economic results.

Patient Preferences and Experiences Review

Tamara Rader contributed to drafting and reviewing the protocol sections for the patient preferences and experiences review, performed article selection, coding and analysis, and reviewed, and contributed to the drafting of the report.

Kristen Moulton contributed to drafting and reviewing the protocol sections for the patient preferences and experiences review, performed article selection, coding and analysis, and reviewed, and contributed to the drafting of the report.

Implementation Review

Kristen Moulton contributed to drafting and reviewing the protocol sections for the Implementation review, performed analysis, and contributed to the drafting of the report.

Eftyhia Helis contributed to the conception of the methodology for the implementation review and the design of the survey to the national stakeholders; collected, analyzed, and interpreted survey data; and wrote the implementation section content in collaboration with the section's co-authors.

Janet Crain contributed to the methodology for the implementation review and the design and distribution of the survey to the national stakeholders and specialist stakeholders.

Ethics Review

Dr. Daryl Pullman conducted and wrote the ethics analysis of this report, participated in discussion, and interpretation of the results.

Acknowledgements

The authors would like to acknowledge Dr. Laura Weeks and Dr. Lauren Bresee for providing methodological support and critical appraisal of the HTA protocol and draft reports; Ken Bond for his contribution to the ethics review; Bert Dolcine for his contribution to the scoping of the clinical report; and Adina Gottardi for her assistance in project management support.

Conflicts of Interest

Dr. Michael Copland has received funding from NxStage Medical Inc. for travel, educational lectures and writing articles/editorials, and from Baxter Health Care (Global) for travel. No other conflicts were declared.

CADTH

Table of Contents

ABBREVIATIONS 9
PROTOCOL AMENDMENTS 10
EXECUTIVE SUMMARY 12
INTRODUCTION 16
Clinical and technology background 16
POLICY QUESTIONS 18
ANALYTIC FRAMEWORK 18
OBJECTIVES 18
Research questions 18
CLINICAL REVIEW 20
Methods 20
Results 24
Summary of clinical results 48
ECONOMIC EVALUATION 50
Review of economic studies 50
Primary economic evaluation 50
Summary of results of the economic analysis 77
PATIENT PERSPECTIVES AND EXPERIENCES REVIEW 79
Methods 79
Results 82
Summary of results 94
ETHICAL ISSUES 95
Introduction 95
Methods 95
Background and context 97
Macro-level considerations 99
Meso-level considerations 100
Micro-level considerations 103
Summary of results 104
IMPLEMENTATION ISSUES 106
Methods 106
Results 107
Summary of results 113
DISCUSSION 114
Integration of findings 114
Generalizability of findings 116
Limitations 117
Directions for future research 119
CONCLUSIONS 121

APPENDIX 1: ANALYTICAL FRAMEWORK 137
APPENDIX 2: LITERATURE SEARCH STRATEGY 138
APPENDIX 3: LIST OF INCLUDED STUDIES — CLINICAL REVIEW 155
APPENDIX 4: STUDY SELECTION FLOW DIAGRAM — CLINICAL REVIEW 165
APPENDIX 5: FULL-TEXT SCREENING CHECKLIST — CLINICAL REVIEW 166
APPENDIX 6: DATA EXTRACTION FORM — CLINICAL REVIEW 168
APPENDIX 7: STUDY AND PATIENT CHARACTERISTICS — CLINICAL REVIEW 171
APPENDIX 8: DETAILED OUTCOME DATA — CLINICAL REVIEW 196
APPENDIX 9: CRITICAL APPRAISAL — CLINICAL REVIEW 219
APPENDIX 10: VALIDITY OF OUTCOMES FOR HEALTH-RELATED QUALITY OF LIFE INSTRUMENTS — CLINICAL REVIEW 233
APPENDIX 11: LIST OF STUDIES EXCLUDED AND THE REASONS FOR EXCLUSION — CLINICAL REVIEW 236
APPENDIX 12: MODELLING MORTALITY — ECONOMIC REVIEW 247
APPENDIX 13: CLINICAL INPUTS ON RELATIVE EFFICACY AND SAFETY ESTIMATES, APPLIED IN SCENARIO ANALYSES 248
APPENDIX 14: SUBCATEGORIES OF COSTS BY STUDY (2015 CAN $) — ECONOMIC REVIEW 251
APPENDIX 15: ADDITIONAL COSTS INPUTS IN THE ECONOMIC REVIEW 255
APPENDIX 16: SENSITIVITY ANALYSES — VARYING DISCOUNT RATES, TIME HORIZON, AND OLDER AGE (ALL MODALITIES) 258
APPENDIX 17: SCENARIO ANALYSES — PREVALENT PATIENTS (ALL MODALITIES) 260
APPENDIX 18: REFERENCE CASE RESULTS, ALL DIALYSIS MODALITIES 261
APPENDIX 19: FINDINGS FROM SENSITIVITY ANALYSES, PD VERSUS CONVENTIONAL ICHD 262
APPENDIX 20: FINDINGS FROM SENSITIVITY ANALYSES — HOME HD VERSUS CV ICHD 265
APPENDIX 21: FINDINGS FROM SENSITIVITY ANALYSES — HHD VERSUS PD 268
APPENDIX 22: FINDINGS FROM ADDITIONAL SENSITIVITY ANALYSES 270
APPENDIX 23: QUALITY ASSESSMENT INSTRUMENT — PATIENT PREFERENCES REVIEW 274
APPENDIX 24: STUDY SELECTION FLOW DIAGRAM — PATIENT PREFERENCES REVIEW 275
APPENDIX 25: LIST OF INCLUDED STUDIES — PATIENT PREFERENCES REVIEW 276
APPENDIX 26: LIST OF EXCLUDED STUDIES — PATIENT PREFERENCES REVIEW 277
APPENDIX 27: CHARACTERISTICS OF INCLUDED STUDIES — PATIENT PREFERENCES REVIEW 278
APPENDIX 28: QUALITY ASSESSMENT OF INCLUDED STUDIES — PATIENT PREFERENCES REVIEW 281
APPENDIX 29: IMPLEMENTATION SURVEYS — IMPLEMENTATION REVIEW 283

CADTH

Tables

Table 1: Dialysis Modalities and Prescriptions 19
Table 2: Clinical Review Study Selection Criteria 21
Table 3: Summary Evidence Reporting Survival and Mortality for HD Compared With ICHD 32
Table 4: Summary of Evidence Reporting Survival for PD Compared With ICHD 36
Table 5: Summary of Evidence Reporting Cardiovascular Adverse Events for PD Compared With ICHD 41
Table 6: Summary of Evidence Reporting Adverse Events for PD Compared With ICHD 43
Table 7: Summary of Evidence of Technique Failure or Switch Between Modalities for PD Compared With ICHD 45
Table 8: Summary of Evidence of All-Cause Mortality for HHD Compared With PD 46
Table 9: Summary of Evidence of Technique Failure or Modality Switch for HHD Compared With PD 47
Table 10: Economic Review Modality Comparisons 51
Table 11: Baseline Probabilities (Annual) 53
Table 12: Utility Values for Health States 54
Table 13: Annual Dialysis Cost (2015 Canadian Dollars; Absolute Cost, Incremental Cost, and Cost Ratio[a] Versus ICHD Within Each Referenced in Parentheses) 56
Table 14: Rural and Remote Satellite Hemodialysis Unit Cost (2015 Canadian Dollars, Absolute Cost, Incremental Cost and Cost Ratio Versus ICHD in Bracket) 58
Table 15: Training and Setup Costs (Specific to HD Modalities) (2015 C$) 59
Table 16: Indirect and Out-of-Pocket Costs (2015 Canadian Dollars) 61
Table 17: Additional Model Assumptions 62
Table 18: Reference Case (Deterministic) (RR = 1) 63
Table 19: Reference Case (All Modalities) Anchored to ICHD (Conventional) 64
Table 20: Annual Absolute and Incremental Costs of Each Dialysis Modality (Compared With Conventional ICHD) Using Cost Ratio Applied to the Reference-Case Costs 67
Table 21: Annual Cost of Dialysis Modalities (Actual Reported Costs) Compared With Conventional ICHD 68
Table 22: Sensitivity Analysis Comparing Home Modalities With Conventional ICHD in Remote and Rural Settings 69
Table 23: Reference Case (PD Versus ICHD) 69
Table 24: PD Versus Conventional ICHD — Societal Perspective 70
Table 25: Reference Case (HHD Versus ICHD) 70
Table 26: HHD Versus Conventional ICHD — Deterministic Sensitivity Analysis Assuming Utility Inputs Are Reimbursed 71
Table 27: HHD Versus Conventional ICHD — Scenario Analysis Varying the RR of Hospitalization 72
Table 28: HHD Versus ICHD — Societal Perspective 74
Table 29: Reference Case (HHD Versus PD) 75
Table 30: HHD Versus PD — Scenario Analysis Varying RR of Death 75
Table 31: Reference Case (Assisted PD Versus Conventional ICHD) 76
Table 32: Assisted PD Versus Conventional ICHD — Deterministic Sensitivity Analysis 76
Table 33: Assisted PD (Provided Intermittently) Versus ICHD 77
Table 34: Inclusion Criteria Patient Preferences Review 80
Table 35: Emergent Data Categories, Descriptive Themes, and Interventions Included in Categories 84
Table 36: Summary of ELSI Considerations for Modality Selection for ESKD 104
Table 37: Nephrologists' Support for Various Interventions to Promote the Optimal Use of Home-Based Dialysis (INTEGRATE-HTA Framework) 111
Table 38: Nephrologists' Recommended Strategies for Supporting Implementation of Home-based or Self-Care ICHD in Rural and Remote Settings 112
Table 39: Relative Efficacy and Safety 248
Table 40: Relative Efficacy and Safety of PD Versus ICHD (Scenario Analysis Values from Yeates et Al.[79] and Marshall et Al.[64]) 249
Table 41: RR of Hospitalization, Different Parameter Values Assessed in Scenario Analysis 250
Table 42: Cost Parameters Used in the Model (2015 C$) 255

Table 43: Hospitalization cost associated with an infection (based on CMG grouper 654) 256
Table 44: Hospitalization cost associated with a cardiovascular event (based on CMG grouper 202 and 175) 256
Table 45: Hospitalization cost associated with kidney disease 257
Table 46: PD Versus Conventional ICHD — Deterministic Sensitivity Analysis 263
Table 47: PD Versus Conventional ICHD — Additional Deterministic Sensitivity Analysis 264
Table 48: HHD Versus Conventional ICHD — Deterministic Sensitivity Analysis of Additional Parameters 266
Table 49: HHD Versus PD — Deterministic Sensitivity Analyses (Varying RR of Technique Failure) 269

Figures

Figure 1: Outline of Model Structure and Health States (Example in Which Nocturnal HHD Is Compared With Conventional ICHD — Figure Adapted From Previous Publication)[29,86] 52
Figure 2: Cost-Effectiveness Acceptability Curve With Triangular Distributions (Centred RR = 1) 65
Figure 3: Analytic Themes and Related Categories 83
Figure 4: Levels of Decision-Making and Types of Ethical Consideration 97
Figure 5: Scatter Plots With Triangular Distributions (Centred HR = 1) 261
Figure 6: Cost-Effectiveness Acceptability Curve, PD Versus ICHD (Conventional) 262
Figure 7: Scatterplots of 5,000 Probabilistic Simulations, PD Versus ICHD (Conventional) 262
Figure 8: Cost-Effectiveness Acceptability Curve, Acceptability Curve HHD Versus Cv ICHD 265
Figure 9: Scatterplots of 5,000 Probabilistic Simulations — HHD Versus Cv ICHD 266
Figure 10: Cost-Effectiveness Acceptability Curve, HD (HHD or PD) Versus Cv ICHD 268
Figure 11: Scatterplots of 5,000 Probabilistic Simulations — HHD Versus Cv ICHD 269
Figure 12: Cost-Effectiveness Acceptability Curve, Assisted PD Versus Cv ICHD 270
Figure 13: Scatterplots of 5,000 Probabilistic Simulations — Assisted PD Versus Cv ICHD 271
Figure 14: Cost-Effectiveness Acceptability Curve — Different ICHD Modalities 272
Figure 15: Scatterplots of 5,000 Probabilistic Simulations — Different ICHD Modalities 273

Abbreviations

ANZDATA	Australia and New Zealand Dialysis and Transplant Registry
APD	automated peritoneal dialysis
BMI	body mass index
CAPD	continuous ambulatory peritoneal dialysis
CCT	controlled clinical trial
CHF	congestive heart failure
CI	confidence interval
CIHI	Canadian Institute for Health Information
CHOICE	Choices for Healthy Outcomes in Caring for ESRD
CORR	Canadian Organ Replacement Register
DMAR	Dialysis Measurement, Analysis, and Reporting (Canada)
EQ-5D	EuroQoL 5-Dimensions questionnaire
EQ-5D-3L	EuroQoL 5-Dimensions questionnaire (three-level version)
ESKD	end-stage kidney disease
GI	gastrointestinal
HCHD	home conventional hemodialysis
HD	hemodialysis, setting not specified
HHD	home hemodialysis, all types
HIRA	Korean Health and Insurance Review and Assessment Service
HR	hazard ratio
ICHD	in-centre hemodialysis
ICUR	incremental cost-utility ratio
IQR	interquartile range
LVH	left ventricular hypertrophy
MCID	minimal clinically important difference
MI	myocardial infarction
NHHD	nocturnal home hemodialysis
NHIRD	National Health Insurance Research Database (Korea)
ORN	Ontario Renal Network
PD	peritoneal dialysis
PSA	probabilistic sensitivity analysis
QALY	quality-adjusted life-year
QoL	quality of life
RCT	randomized controlled trial
REIN	Réseau épidémiologique et information en néphrologie ;
KDQoL	kidney disease quality of life
RR	relative risk
RRT	renal replacement therapy
SDHHD	short-daily home hemodialysis
SR	systematic review
USRDS	United States Renal Data System

Protocol Amendments

Section	Date	Description/Changes Made	Reason for Change
Clinical Review Study Selection Criteria	June 28, 2016	Comparator for Q4 should read: Any of: in-centre conventional HD, in-centre short-daily HD, in-centre nocturnal HD. "*Assisted dialysis only.*"	Previously read "*Self-care dialysis only.*"
Clinical Review Study Selection Criteria	July 19, 2016	Added: • Caregiver quality of life, as reported by a standardized tool.[a] • Caregiver depression and/or anxiety, as reported by a standardized tool.[a] • Adherence to dialysis prescription. • Technique failure (permanent switch to another dialysis modality). • All-cause discontinuation of intervention, other than due to transplant. Includes technique failure and switching between self-care and assisted, home and in-centre. • Technical adverse events and equipment malfunctions.	Several outcomes were omitted during editing.
Clinical Review Data extraction	August 2, 2016	The pilot phase for data extraction was omitted.	Due to time constraints.
Clinical Review Data analysis methods	August 2, 2016	• Studies that did not feature a balance of a minimum set of key baseline covariates were not synthesized. • For primary QoL studies, we chose the same time frame identified in our pre-defined selection criteria.	• The studies were not synthesized given the importance of confounding and factors that contribute to treatment selection being correlated with treatment outcomes. • The same time frame was chosen for QoL studies identified in our pre-defined selection criteria to avoid any restrictions to the primary outcome of this report. • QoL studies that used a cross-sectional design were not synthesized, as they did not provide data to allow comparison of the groups at baseline

Section	Date	Description/Changes Made	Reason for Change
Patient Experiences and Perspectives	September 16, 2016	Study design changed to an overview of systematic reviews.	Given the volume of published systematic reviews of qualitative literature related to the policy issue, an overview of systematic reviews was deemed an efficient use of resources while not compromising ability to provide rich information to inform this HTA. Accordingly, instead of using the Critical Appraisal Skills Program (CASP) checklist to appraise individual studies, the JBI Critical Appraisal Checklist for Systematic Reviews and Research Syntheses was used to appraise the quality of included systematic reviews.
Implementation Issues	September 16, 2016	Two surveys were sent – one to nephrologists, one to other health care professionals and stakeholders.	The survey for nephrologists was based on a previously unpublished survey by Nesrallah et al. (2013),[1] which we identified after the study protocol had been posted. While the original survey included a series of questions on Canadian nephrologists' perceptions, attitudes, and beliefs around barriers and facilitators around the use of home HD and PD, the updated, follow-up survey aimed to provide more information on supports to implementation, strategies as well as potential resources that could be of use to nephrologists. New information as reported by nephrologists in this survey will supplement the Nesrallah et al. (2013) findings.
Implementation Issues	September 16, 2016	NVivo not used to analyze survey and literature data. Data are instead hand-sorted into the relevant INTEGRATE-HTA categories.	This was done to simplify categorization of implementation issues using an existing model.

HTA = health technology assessment; QoL = quality of life.

Executive Summary

Issue

An increasing number of patients with end-stage kidney disease (ESKD) receive long-term dialysis every year in Canada. Available evidence suggests that for eligible patients, home-based hemodialysis (HHD) and peritoneal dialysis (PD) may achieve similar clinical outcomes to in-centre hemodialysis (ICHD) and are less resource intensive. Based on the potential comparable clinical effectiveness and cost savings that these therapies may yield, it is often argued that HHD modalities, particularly PD, may be underused among eligible patients in Canada.

Objectives and Research Questions

The aim of this health technology assessment (HTA) is to inform policy questions regarding the optimal treatment for eligible patients and effective methods of implementation support for the various dialysis options reviewed through an assessment of the clinical effectiveness, cost-effectiveness, patient experiences and perspectives, ethical issues, and implementation issues of dialysis modalities for the treatment of ESKD.

The report addresses the following Research Questions:

Clinical questions:

1. What is the clinical effectiveness and safety of HHD or PD compared with ICHD for the treatment of ESKD?
2. What is the clinical effectiveness and safety of HHD compared with PD for the treatment of ESKD?
3. What is the comparative clinical effectiveness and safety of HHD modalities, including nocturnal, short-daily, and conventional?
4. What is the clinical effectiveness and safety of self-care ICHD compared with traditional ICHD?

Economic questions:

5. What is the cost-effectiveness of different dialysis modalities across different delivery settings for the treatment of ESKD in Canada?

Patient Experience and Perspectives questions:

6. What are the experiences and perspectives of adults with ESKD, their family members, and their caregivers regarding dialysis care?

Ethics questions:

7. What are the main ethical issues that ought to be considered when considering expanding the offer of self-care or assisted home dialysis (PD or HD), and self-care ICHD for patients with ESKD?

Implementation questions:

8. What strategies and processes have been used to implement home-based and self-care in-centre dialysis programs for eligible patients with ESKD?
9. What contextual factors contribute to the successful implementation of home-based and self-care dialysis programs for eligible patients with ESKD?

Clinical Evidence

Methods

A systematic review (SR) of the literature was conducted, using MEDLINE, Embase, CENTRAL, Cochrane Database of Systematic Reviews, DARE, Cochrane Central Register of Controlled Trials, and PubMed, for HTAs, SRs, randomized controlled trials (RCTs) and non-randomized studies. The methodological quality of SRs was assessed by the Risk of Bias in Systematic Reviews (ROBIS) tool; RCTs were evaluated using the Scottish Intercollegiate Guidelines Network (SIGN 50) checklist for controlled trials; and case-control studies were evaluated using the SIGN 50 checklist for case-control studies.

Studies were selected if they included adults (≥ 18 years) with ESKD of any cause who needed dialysis treatment, either as lifetime treatment or while waiting for kidney transplantation, and that included one or more of the comparisons of interest (HHD or PD with ICHD, HHD with PD, different prescriptions of HHD with each other, and

self-care HHD with assisted PD). Study designs of interest were SRs and RCTs. For the evidence synthesis, balance at baseline for a minimal set of covariates was also required.

Results

In total, six SRs and 154 primary studies met the inclusion criteria. SRs were reviewed first, and primary studies were subsequently reviewed to resolve uncertainties and address evidence gaps. Forty-four articles were subsequently synthesized. These consisted of six SRs, covering the literature to the end of 2014, and 38 articles describing 34 primary studies. The overall findings of this review suggest that there is no consistent difference in quality of life (QoL) outcomes between HHD and PD compared with ICHD, although studies may not have been large enough to reliably detect a difference. Both home-based dialysis modalities (HHD or PD) may offer a greater survival benefit among younger, motivated patients in supportive settings compared with ICHD; however, there is insufficient high-quality evidence to clearly support that either is clinically superior to ICHD. Patients with diabetes and other comorbidities have similar survival on HHD as patients on ICHD. When comparing PD with ICHD, it is unclear whether there is a survival benefit in these patients. HHD compared with PD may offer a potential survival benefit; however, findings are based on limited evidence. There is insufficient evidence to determine which HHD prescription (i.e., nocturnal, short-daily, and conventional) might be preferable and of greater clinical benefit. There was no evidence found regarding the clinical effectiveness and safety of self-care versus assisted ICHD. The SRs were conducted with a low risk of bias, but the evidence is dominated by non-randomized studies.

Economic Evidence

Methods

A review of the literature identified numerous economic evaluations and costing studies in Canada, but few considered at all modalities and prescriptions of interest to this review. A Markov cohort model was constructed to assess the lifetime incremental cost-effectiveness of alternate dialysis modalities and prescriptions in patients with ESKD in Canada. Although the intent was to conduct a cost-utility analysis, given that the clinical review identified a paucity of high-quality RCTs to inform relative efficacy and safety parameters, the reference case assumed no clinical difference among modalities (following a priori methods) and treatment effect estimates from observational studies were tested in sensitivity analyses. The reference-case patient population was incident dialysis outpatients (i.e., initiating dialysis treatment for ESKD for the first time) with patient characteristics defined by data from the Canadian Organ Replacement Registry (CORR) and, in the reference case, it was assumed all patients would be eligible for all modality types being considered. Various prescriptions of HD (including conventional, short daily, and frequent nocturnal) were compared. The location in which dialysis is performed (ICHD or home for HD), differences in how assisted dialysis modalities are delivered and geographical settings (urban and rural/remote regions) were also considered. The primary perspective was that of a Canadian health care payer, although a societal perspective was also examined to account for patient- and caregiver-borne costs. Discounting for both costs and outcomes was at 5% per year.

Results

Given the available clinical evidence, no differences in efficacy and safety were assumed in the reference case, which reflects a comparison of lifetime costs for each dialysis modality. Under a healthcare payer perspective, the least costly modality was conventional HHD ($561,962). Other HHD modalities (with the exception of assisted PD) were found to be less costly than ICHD in eligible patients. Assisted PD may be more or less costly than ICHD depending on how it is delivered; for example, short-term or intermittent assisted PD appeared less costly than ICHD. Under a societal perspective that considered patient and caregiver-borne costs, the cost of water and electrical power for HHD may be significant for patients, especially if these costs are not offset by reduced travel costs and gains in producitivity. Probabilistic sensitivity analyses and the comparisons among specific dialysis modalities were conducted, incorporating the treatment effects from observational studies. The economic findings were found to remain relatively robust through most sensitivity analyses.

Patient Perspectives and Experiences Evidence

Methods

An overview of SRs and a thematic synthesis of the literature relevant to the research question on patient experience and perspectives was conducted. Published literature was identified by searching MEDLINE, Embase, and the Cochrane Library. A limited PubMed search was performed to capture records not indexed in MEDLINE. To be eligible, SRs must have included a detailed description of search methods, clear selection criteria, and an assessment of the quality of included studies. Furthermore, to be eligible, reviews had to explore or assess participants' own perspectives directly. Result statements from the included SRs were captured for analysis, or coded, using NVivo qualitative data analysis software. The quality of each included study was assessed using the JBI Critical Appraisal Checklist for Systematic Reviews and Research Syntheses. A descriptive analysis of study characteristics was conducted, with the goal to characterize the set of included SRs in terms of important study and

patient characteristics. A thematic synthesis of the results of the included SRs was also conducted, comprising three stages: coding, developing descriptive themes, and developing analytic themes.

Results

Six SRs were included in the thematic synthesis. Three analytic themes emerged from the data. The first theme identified that patients desire a sense of freedom over their lives, and control over their treatment. This desire influences their perspectives, and sometimes choice, of dialysis modalities. The second analytic theme identified that caregivers face a significant and ongoing burden that may be affected (positively or negatively) by modality choice. The third analytic theme revealed that a range of factors influence people's perspectives and experiences of different dialysis modalities such as the burden on caregivers, the opinions of health care practitioners and family members, and patient education.

Ethics

Methods

The ethical, legal, and social issues (ELSI) analysis drew on the other sections of the HTA that has reviewed the literature on various aspects of modality selection and use with regard to ESKD. In addition, a variety of other sources that were identified through a separate electronic search of articles from the ethics and clinical science literature that raised ELSI related to modality selection for ESKD were examined. This analysis drew most directly on two classic perspectives that are well-established in the health ethics literature, namely the utilitarian/consequentialist approach, and the deontological/duty based approach.

Results

Key findings from the ELSI analysis revealed that the history of ESKD treatment in North America has resulted in a kind of "exceptionalism," with regard to how the disease is managed. For a variety of complex reasons, a pervasive cultural preference toward conventional ICHD has developed over the past decades. Cultural change seldom occurs quickly or without considerable resistance. The factors affecting modality selection for ESKD are complex and systemic, and any efforts to affect a cultural shift in this regard will occur only with a sustained effort at multiple levels and over an extended period of time.

Implementation Issues

Methods

Two surveys of a cross-Canada network of dialysis stakeholders (one for dialysis program professionals and another for nephrologists) were conducted as part of a CADTH Environmental Scan that collected information on the range of strategies that have been used to establish or improve the uptake of HHD and PD and self-care ICHD programs in Canada. Specific questions regarding implementation considerations for rural or and remote patient populations were also included. The surveys were distributed using the Fluid Surveys online platform. In conjunction with the surveys, a narrative literature review was conducted to identify information on issues relevant to implementation of HHD and self-care ICHD in Canada. Published literature was identified by searching the following bibliographic databases: MEDLINE, Embase; Cumulative Index to Nursing and Allied Health Literature (CINAHL); PubMed and Scopus. The survey data were sorted into categories to identify themes related to the strategies used to establish or improve the uptake of HHD and self-care ICHD programs, as well as to the common barriers and facilitators for implementing these programs. Using the INTEGRATE-HTA framework, four domains of implementation, i.e., "provider," "organization and structure," "policy," and "funding," as well as the additional domain of "patient" were used to further guide the taxonomy of the identified strategies, barriers, and facilitators as they relate to the various levels of the health care services delivery system. Strategies, barriers, and facilitators, as identified from relevant studies, were also organized according to the INTEGRATE-HTA implementation domains. This information was summarized narratively.

Results

The review of implementation issues and strategies around HHD and self-care ICHD identified several important barriers, facilitators, and strategies that will influence the ultimate knowledge mobilization strategy around this work. Central to the findings is the importance of patient choice in decision-making, while considering the various perspectives of stakeholders including policy and clinical levels. Education to address knowledge gaps at various levels of health care decision-making, as well as sharing successful strategies already under way, will be central to implementation support in all jurisdictions across Canada.

Conclusions

Based on the overall evidence from the assessment of the clinical effectiveness, cost-effectiveness, patient experiences and perspectives, ethical issues, and implementation issues, home-based dialysis (HHD and PD), are

appropriate modality options for the treatment of ESKD and could be more widely implemented in Canadian jurisdictions. No studies were identified that compare self-care with assisted HD, either in the home or in-centre. Education, to address knowledge gaps at various levels of health care decision-making as well as sharing successful strategies already under way, will be central to implementation support in all jurisdictions across Canada.

Introduction

An increasing number of patients with end-stage kidney disease (ESKD) are being initiated on long-term dialysis every year in Canada.[2] Hemodialysis (HD) and peritoneal dialysis (PD) are the two main types of dialysis provided under Canadian kidney care programs.

In all provinces, HD remains the modality most frequently used for new patients. In 2013, the rate of ESKD patients initiated on HD varied from 91% in Newfoundland and Labrador to 71% in Manitoba.[2] Moreover, for the same year, most Canadian dialysis patients (76%) received in-centre HD (ICHD), which describes HD performed in an institution such as a hospital, satellite unit, or a dialysis facility, with the assistance of a health care professional.[2]

In contrast, home-based therapies such as PD and home HD (HHD) are less frequently used according to the latest available data. In 2013, about 19% of new ESKD patients in Canada were initiated on home PD, while this rate was 0.6% for HHD.[2] For the same year, the prevalence for patients being treated by home dialysis across the country was about 17% for PD and 2.5% for HD.[2]

Available evidence suggests that home PD and HHD may achieve similar clinical outcomes for some patients compared with ICHD.[3,4] Studies also indicate that home PD and HHD are potentially more cost-effective relative to ICHD.[3,5-7] Based on the potential comparable clinical effectiveness and potential cost savings that they may yield, it is often argued that HHD therapies, particularly PD, may be underutilized in eligible patients in Canada and other developed countries.[8-10] Similarly, the literature and jurisdictional input suggest a growing interest in other dialysis delivery models, namely, “self-care” ICHD, “assisted” PD, and HHD. These options may allow for effective clinical results while being potentially less costly than standard ICHD and may also be more desirable from a patient and caregiver perspective.[11-14]

Clinical and technology background

Epidemiology

Stage 5 chronic kidney disease occurs when the estimated glomerular filtration rate is less than 15 mL/min per 1.73 m^2, resulting in kidney failure, also known as ESKD.[15,16] According to data published by the Canadian Institute for Health Information (CIHI) in 2013,[2] an estimated 41,931 Canadians were living with ESKD, with most 57.5% (24,114) being treated with dialysis. Among these prevalent ESKD patients, 41% were 45 to 64 years of age, and 43% were age 65 years or older. Still, in 2013, the number of newly diagnosed ESKD patients was a reported as 5,333. Among these incident patients, about 35% were age 45 to 64 years, and 53.5% were age 65 years or older. Of note, the 75-and-older age group accounted for more than 28% of the newly diagnosed ESKD patients.

Dialysis modalities

In HD, the patient’s blood is circulated to an external dialysis machine that filters wastes and extra water from the blood before returning it to the body. In terms of administration, conventional HD is typically performed three days a week for three to four hours per session.[17] This schedule can be modified to allow for more frequent or longer dialysis, intended to produce a more physiological effect (greater solute clearance and extracellular fluid volume control) and to interfere less with patients’ daily lives.[17,18]

Alternatively, short-daily HD can be performed six to seven days a week for two to three hours per session, and frequent nocturnal HD can be administered five to seven days a week for six to nine hours each time, usually during sleep hours; pragmatically three to four sessions per week of home nocturnal HD is often done.[17]

Further, the provision of HD can be categorized as ICHD or home HD (HHD) to distinguish the setting where the treatment is delivered. ICHD is dispensed in a health care institution such as a hospital, satellite unit, or other dialysis facility under the direct supervision of health care professionals. Likewise, self-care ICHD is performed in a health care institution, but with the patient administering and managing their own dialysis with minimal support from on-site personnel. HHD is performed at the patient’s residence under self-care (administration by the patient and/or caregiver without the assistance of a health care professional) or assisted by a health care professional. Increasingly, patients undergoing HD at home are treated with one of the frequent HD modalities — short-daily HD or frequent nocturnal HD;[18,19] home-based delivery allows flexibility in dialysis prescription.

In PD, a permanent catheter, inserted into the abdomen, is used to fill the peritoneal cavity with a dialysis solution called dialysate.[20] The dwell, the volume of dialysate in the peritoneal cavity, remains in the patient’s body for a few hours. Dialysis occurs as waste and excess water from the blood flows gradually through the filter-like peritoneal membrane and collects in the dwell. After a period of time, the so-called “exchange” step takes place; whereby, the peritoneal cavity is drained of the used solution, called the effluent, and filled with fresh dialysate.[20,21] There are two main types of PD: continuous ambulatory PD (CAPD) and automated PD (APD). CAPD is usually carried out during

the daytime; the process of filling and draining the peritoneal cavity is done manually and is commonly repeated four to six times in a 24-hour period.[20] With APD, a machine performs the automatic cycling of the dialysis solution in the body, usually at night while the patient sleeps.[20] Whether CAPD or APD, PD is typically delivered in a home setting and prescribed to eligible patients who are able to perform the treatment on their own, or with assistance from a family member or other informal caregiver. Some patients, such as the elderly and those with physical limitations or cognitive impairment, who do not have sufficient informal caregiver assistance, may be put on assisted PD in the same manner described above for HHD.[11,13] Assisted PD is a well-established model in several European countries, including France, Belgium, and the UK.[11,12]

Choice of dialysis modality may be affected by a range of elements that include health system policy, patient eligibility, physician and clinical team's clinical judgment and preference, available capacity for a specific modality, reimbursement practices, patient preference, quality of life (QoL) considerations, and patient awareness and education about dialysis modalities.[9,10] The patient's age may also be an important factor influencing modality choice as available evidence show that, in 2013, the average age for patients initiated on PD was 61, while patients initiated on HD had an average age of 65.[2]

Uncertainty and debate persist on the proportion of ESKD patients who would be eligible for HD or PD and the optimal level of PD use that should be targeted in the provision of dialytic care. One study[22] that evaluated modality eligibility in patients with chronic kidney disease (stages 3 to 5) at seven medical facilities in Canada and the US found that the proportions of patients considered medically eligible for home HD and PD were, respectively, 98% and 87%. For psychosocial eligibility (examples of ineligibility would include a strong preference against a particular modality, family opinion and responsibility, or fear of needles in the case of HD), the proportions were 95% for HD and 83% for PD. Finally, an estimate from the UK puts the optimal level for patients on PD (when the population on PD consists entirely of people who have been offered that modality as a first choice where appropriate) at 39% of UK dialysis patients.[23,24]

Clinical outcomes

ESKD is a disorder associated with multiple complications. Some are a direct cause of the loss of kidney function: fluid overload, hyperkalemia, hyperphosphatemia, metabolic acidosis, secondary hyperparathyroidism, anemia, and hypertension.[25] Other complications can be a consequence of the underlying condition, (e.g., diabetes, hypertension, glomerulonephritis) or of its treatment. Chronic kidney disease is associated with increased cardiovascular risk, although most of the increase is related to its effect on cardiovascular risk factors. For example, more than 50% of dialysis patients have atherosclerosis, more than 80% have hypertension, approximately 74% have left ventricular hypertrophy (LVH), and 30% to 40% have congestive heart failure (CHF).[25]

Mortality for patients on dialysis has been reported as 5% to 27% annually in developed countries.[25] For Canada, the mortality rate has been reported as 16.1 per 100 patient-years. Cardiovascular disease and infection are the two leading causes of death. Cardiovascular mortality, which includes sudden cardiac death, myocardial infarction, stroke, and pulmonary embolism, is 10 to 20 times that of the general population for dialysis patients older than 45 years of age, and greater than 100 times that of the general population for patients under 45 years of age.[25] Risk of death from septicemia and lower respiratory infections in patients who are on dialysis, or who have undergone transplant with its associated immunosuppression are 50-fold and 15-fold higher, respectively, than in the general population.[25] Patients on dialysis also have 10% to 80% increased risk of some cancers.[25]

Economic impact

According to various estimates, the costs of ESKD care, including kidney transplantation and dialysis, may account for up to 1.3% of Canada's total health care expenditures.[8,26,27] In 2000, the direct costs of ESKD were estimated at $1.3 billion and more than two-thirds of this amount was associated with the provision of dialysis care.[27] With regard to specific dialysis modalities, the authors of one paper calculated that in 2013, the total cost per patient, per year in Canada was $95,000 to $107,000 for ICHD, $71,000 to $90,000 for HHD, and $56,000 for home PD.[8] Several economic studies from various countries have reported similar cost differences between the modalities and a consistent economic advantage for PD in most circumstances compared with HHD and/or ICHD.[6,23,28] Other studies indicate that while HHD often incurs high setup costs in the first year, it is generally more cost-effective than ICHD as ongoing costs of HHD are lower than ICHD in subsequent years.[7,29]

In 2013, it was estimated that 17% of dialysis patients in Canada were receiving PD.[2] Therefore, preliminary estimates generated within CADTH suggest that by switching patients from HD to PD to reach an optimal level for PD of 39% (similar to the UK estimate noted above), this would generate more than $206 million in cost savings for the health care system.

Policy Questions

Should the provision of home-based self-care or assisted dialysis (PD or HD) and self-ICHD be more widely implemented in the jurisdictions? If so, what strategies and practices could improve implementation and uptake of these different dialysis modalities in the jurisdictions?

Analytic Framework

The analytic framework for this review is presented in Appendix 1.

Objectives

The aim of this HTA is to inform the policy questions through an assessment of the clinical effectiveness, cost-effectiveness, patient experiences and perspectives, ethical issues, and implementation considerations for dialysis modalities for the treatment of ESKD. The results of the HTA will be used to develop recommendations about optimal treatment for eligible patients and effective methods of implementation support for the various dialysis options reviewed.

Research questions

For the purposes of this review, ICHD includes HD offered within any facility set up for providing the treatment, including hospitals and community dialysis units. Home HD takes place at the patient's place of residence, which could include long-term care facilities, rehabilitation facilities, and prisons or jails. Self-care dialysis involves the administration of dialysis by a patient and/or caregiver without the assistance of a health care professional. Assisted dialysis involves the administration of dialysis with the assistance of a health care professional. The included modalities are defined in Table 1.

This HTA project addresses the following Research Questions:

Clinical questions (see Clinical Review):

1. What is the clinical effectiveness and safety of home HD or PD compared with in-centre HD for the treatment of ESKD?
2. What is the clinical effectiveness and safety of home HD compared with PD for the treatment of ESKD?
3. What is the comparative clinical effectiveness and safety of home HD modalities, including nocturnal, short-daily, and conventional?
4. What is the clinical effectiveness and safety of self-care in-centre HD compared with traditional in-centre HD?

Economic questions (see Economic Evaluation):

5. What is the cost-effectiveness of different dialysis modalities across different delivery settings for the treatment of ESKD in Canada?

Patient Experience and Perspectives questions (see Patient Perspectives and Experiences Review):

6. What are the experiences and perspectives of adults with ESKD, their family members, and their caregivers regarding dialysis care?

Ethics questions (see Ethical Issues):

7. What are the main ethical issues that ought to be considered when considering expanding the offer of self-care or assisted home dialysis (PD or HD), and self-care in-centre HD for patients with ESKD?

Implementation questions (see Implementation Issues):

8. What strategies and processes have been used to implement home-based and self-care in-centre dialysis programs for eligible patients with ESKD?
9. What contextual factors contribute to the successful implementation of home-based and self-care dialysis programs for eligible patients with ESKD?

Table 1: Dialysis Modalities and Prescriptions

Modality	Treatment Description	Delivery Location	Assistance
Hemodialysis (HD)			
In-centre conventional hemodialysis (ICHD)	Three days a week; usually three to four hours per session	In-centre (hospital, satellite units) setting	Mainly assisted; can be self-care
Home conventional hemodialysis (HHD)	Three days a week; usually three to four hours per session	Home-based setting	Self-care or assisted
Short-daily hemodialysis (short-daily HD)	Six to seven days a week; two to three hours per session	Home-based or in-centre setting	Self-care or assisted
Nocturnal hemodialysis (nocturnal HD)	Three days a week, and frequent nocturnal HD, five to seven days a week. For both, 6 to 9 hours per session; performed during sleeping hours	Home-based or in-centre setting	Self-care or assisted
Peritoneal Dialysis (PD)			
Continuous ambulatory peritoneal dialysis (CAPD)	Manual exchange (draining and filling of dialysis solution) four to six times in a 24-hour period; performed during awake time	Home-based setting	Self-care or assisted
Automated peritoneal dialysis (APD)	Machine performs the cycling process; performed mostly during sleep hours	Home-based setting	Self-care or assisted

Clinical Review

This section addressed the following Research Questions:

Research question 1: What is the clinical effectiveness and safety of home HD or PD compared with in-centre HD for the treatment of ESKD?

Research question 2: What is the clinical effectiveness and safety of home HD compared with PD for the treatment of ESKD?

Research question 3: What is the comparative clinical effectiveness and safety of home HD modalities, including nocturnal, short-daily, and conventional?

Research question 4: What is the clinical effectiveness and safety of self-care in-centre HD compared with traditional in-centre HD?

Methods

Literature searches

The literature search was performed by an information specialist, using a peer-reviewed search strategy.

Published literature was identified by searching the following bibliographic databases: MEDLINE (1946-) with in-process records and daily updates, via Ovid; Embase (1974-) via Ovid; the Cochrane Database of Systematic Reviews, the Database of Abstracts of Reviews of Effects (DARE) and the Cochrane Central Register of Controlled Trials via Ovid; Cumulative Index to Nursing and Allied Health Literature (CINAHL) via EBSCO; and PubMed. The clinical search strategy was comprised of both controlled vocabulary, such as the National Library of Medicine's MeSH (Medical Subject Headings), and keywords. The main search concepts were home dialysis, peritoneal dialysis, and self-care in-centre dialysis.

Methodological filters were applied to limit retrieval to HTAs, systematic reviews (SRs), meta-analyses, randomized controlled trials (RCTs) and non-randomized studies. Retrieval was limited to documents published since January 1, 2000, following discussion with experts as to which period would be most relevant to current clinical practice. The search was limited to English- or French-language publications. Conference abstracts were excluded from the search results. See Appendix 2 for the detailed search strategy.

The search was completed between May 11, 2016 and June 3, 2016. Regular alerts were established to update the searches until the publication of the final report. Regular search updates were performed on databases that do not provide alert services. Studies identified in the alerts and meeting the selection criteria of the review were incorporated into the analysis when identified before completion of the stakeholder feedback period of the final report. Any studies that were identified after the stakeholder feedback period are described in the discussion, with a focus on comparing the results of these new studies to the results of the analysis conducted for this report.

Grey literature (literature that is not commercially published) was identified by searching the *Grey Matters* checklist (www.cadth.ca/grey-matters), which includes the websites of HTA agencies, clinical guideline repositories, SR repositories, economics-related resources, patient-related groups, and professional associations. Google and other Internet search engines were used to search for additional web-based materials. These searches were supplemented by reviewing the bibliographies of key papers and through contacts with appropriate experts and industry.

Selection criteria

Studies were included that met the criteria presented in Table 2. Multiple publications of the same study were excluded, unless they provided additional outcomes of interest.

Table 2: Clinical Review Study Selection Criteria

	Q1	Q2	Q3	Q4
Population	Adults (≥ 18 years) with ESKD of any cause who need dialysis treatment, either as lifetime treatment or while waiting for kidney transplantation.			
Intervention	Any of: conventional HHD, short-daily HHD, nocturnal HHD, APD, or CAPD. Dialysis may be self-care or assisted.	Any of: conventional HHD, short-daily HHD, nocturnal HHD. Dialysis may be self-care or assisted.		Any of: conventional ICHD, short-daily ICHD, nocturnal ICHD. Self-care dialysis, only.
Comparator	Any of: conventional ICHD, short-daily ICHD, nocturnal ICHD. Dialysis administered or assisted by health care professionals.	Any of: CAPD or APD. Dialysis may be self-care or assisted.	Any of: conventional HHD, short-daily HHD, nocturnal HHD. Dialysis may be self-care or assisted.	Any of: conventional ICHD, short-daily ICHD, nocturnal ICHD. Assisted, only.
Outcome	Primary • Patient quality of life, as reported by a standardized tool.[a] Generic and dialysis-specific. Secondary • Mortality (all-cause) • Hospitalization (all-cause) • Hospitalization (dialysis-related; e.g., revision of access, volume overload, uremic complications, hyperkalemia) • Adverse events (all-cause) • Clinical adverse events (during dialysis, following dialysis) • Infection (all-cause) • Infection (dialysis-related; e.g., access site infection, septicemia, peritonitis) • Cardiovascular adverse events • Kidney transplants • Patient depression and anxiety, as reported by a standardized tool[a] • Patient satisfaction, as reported by a standardized tool.[a] • Caregiver quality of life, as reported by a standardized tool[a] • Caregiver depression and/or anxiety, as reported by a standardized tool[a] • Adherence to dialysis prescription • Technique failure (permanent switch to another dialysis modality) • All-cause discontinuation of intervention, other than due to transplant. Includes technique failure and switching between self-care and assisted, home and in-centre • Technical adverse events and equipment malfunctions			
Study Design	• Systematic reviews (systematic reviews with and without meta-analysis, health technology assessments incorporating systematic reviews) of randomized controlled trials and non-randomized controlled trials[b] • Randomized controlled trials[c] • Non-randomized controlled studies (for effectiveness: non-randomized controlled trials, cohort studies with a control group, case-control studies; for harms, all designs).[c]			
Date Limits	Systematic reviews were selected if the date of the last search update was June 2011 or later. Primary studies were selected if the publication year was 2000 or later.			

APD = automated peritoneal dialysis; CAPD = continuous ambulatory peritoneal dialysis; ESKD = end-stage kidney disease; ICHD = in-centre hemodialysis; HHD = home hemodialysis; PD = peritoneal dialysis.

[a] Patient and caregiver quality of life, satisfaction, depression and anxiety, are also explored in the section in this report entitled Patient Experiences and Perspectives, as described through patient and caregivers' own words and not through measurement with standardized tools.
[b] To be eligible, published systematic reviews must have included a detailed description of comprehensive selection criteria and search methods (i.e., with at least two electronic sources having been searched; with adequate reporting of years searched and databases used, keywords and/or MeSH terms; and, where feasible, the search strategy provided); assessed the quality (or risk of bias) of included studies; and synthesized the findings quantitatively and/or qualitatively.[30]
[c] Individual randomized controlled trials and non-randomized controlled studies were selected if they were not captured in an included systematic review.

Selection method

Two reviewers independently screened titles and abstracts of all citations retrieved from the literature search relevant to Research Questions 1 to 4, followed by an independent review of the full-text articles, based on the pre-determined selection criteria outlined on page 20. The two reviewers compared their list of included and excluded studies from their full-text reviews and resolved any disagreements through discussion until consensus was reached. SRs and primary studies were screened following the same process.

Based on our scoping review, we expected to identify at least one recent, published SR that met inclusion criteria. For this reason, and to help ensure CADTH does not conduct redundant research, all eligible SRs identified from the included studies list were examined to determine suitability for integrating in the CADTH SR. Our a priori-defined criteria for selecting such SRs were currency, relevance, and quality.[31] Currency and relevance were established during the study screening process, based on the study selection criteria. Quality was assessed using the Risk of Bias in Systematic Reviews (ROBIS) tool,[32] as further outlined in the Quality Appraisal section which follows. Published SRs deemed to be of "high" risk of bias were not considered for integration into this SR.

If a single included SR met criteria of currency, relevance, and quality, that review was included for the relevant Research Question(s) within this review. Further details are outlined in the Summary of Evidence section (page 23). For clarity, at this point, primary studies included within published SRs did not proceed through the next steps of data extraction, quality appraisal, and data analysis.

If multiple SRs met the criteria of currency, relevance, and quality, for a given research question, the concordance or discordance of the results was assessed. Concordance meant consistent conclusions, and consistent direction and magnitude of effect if meta-analyses were conducted. If results were concordant among published SRs, we planned to integrate the SR that appeared most appropriate based on the criteria of quality, comprehension, and relevance to our policy question.[31]

Where there was no eligible SR published for a given research question, we proceeded with our SR based on primary studies. The study selection process is presented in a Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart. A full-text screening checklist for Research Questions 1 to 4 can be found in Appendix 5.

Standardized data extraction forms were designed a priori to document and tabulate information from included SRs and individual primary studies and can be found in Appendix 6. Relevant information included both descriptive data and results reported in all included studies. Further detail is given in the protocol.[33]

The planned pilot phase for data extraction was omitted due to time constraints. A single reviewer extracted data from each paper, and a second reviewer checked the extracts for accuracy. Four reviewers shared data extraction and review. Disagreements between extractor and reviewer were resolved through discussion, involving a third reviewer, if necessary. Figures were used if they explicitly provided numerical data.

Quality appraisal

Studies were appraised by one reviewer with verification by a second. Differences in assessments were resolved through discussion, involving a third reviewer where necessary. No formal assessment of inter-rater agreement was used.

The methodological quality of SRs was assessed by the Risk of Bias in Systematic Reviews (ROBIS) tool.[32] Twenty-one questions across four domains were answered as ''yes,'' ''probably yes,'' ''probably no,'' ''no,'' and ''no information,'' with ''yes'' indicating very low concerns and "no" indicating very high concerns about potential bias.

The methodological quality of included RCTs was evaluated using the Scottish Intercollegiate Guidelines Network (SIGN 50) checklist for controlled trials.[34] Ten questions assessing internal validity were answered "yes," "no," "can't say," or "does not apply." The methodological quality of included comparative cohort studies was evaluated using the SIGN 50 checklist for cohort studies.[35] Fourteen questions assessing the internal validity (including selection of patients, methods of exposure assessment, and confounding) were answered "yes," "no," "can't say," or "does not apply."

The methodological quality of included case-control studies was evaluated using the SIGN 50 checklist for case-control studies.[36] Eleven questions assessing the internal validity (including the selection of cases and controls, methods of exposure assessment, and confounding) were answered as "yes," "no," "can't say," or "does not apply" (e.g., for retrospective studies, the question regarding whether the outcome assessment was made blind to exposure status may not be applicable).

For all study types, an overall rating of “High Quality” (++), “Acceptable” (+), “Low Quality” (–), and “Unacceptable — reject” was assigned to the study as recommended by SIGN and based on the reviewers’ confidence regarding the attempt to minimize bias, accompanied by an overall evaluation of the methodology used, the statistical power of the study, and level of certainty that the overall effect observed is because of the study intervention. The rating “Unacceptable — reject,” but primary studies were not excluded on the basis of quality appraisal. Quality was considered in formulating conclusions regarding strength of evidence and risk of bias.

Summary of evidence

Data analysis methods

A priori, it was planned to treat the different modalities of hemodialysis (conventional HD, short-daily HD, and nocturnal HD) as distinct. HD using the emerging NxStage System One (portable HD machine designed for home use) was also treated as distinct, on the advice of clinical experts consulted on this review, as the dialysis kinetics differed. When studies did not specify the HD modality used, it was assumed it to be ICHD. Use of terminology varied throughout the articles and reviews, and sometimes within articles. The authors’ terminology was generally followed. The majority of studies reported time-to-event data, where the event was mortality, and calculated hazard ratios. In the absence of other forms of heterogeneity, it was planned to pool CAPD and APD as a single group receiving PD.

Approach to integrating existing systematic reviews

Our strategy for integrating existing systematic reviews (SRs) was as follows:

- Where an included SR reported results for a given comparison between dialysis modalities for a population and an outcome of interest, the outcome of that review was reported. Studies that were published after the SR were integrated into additional syntheses.
- Where there were no eligible SR results for a given comparison between dialysis modalities, and there were eligible individual studies, a synthesis of evidence was conducted, as subsequently described.

Approach to evidence synthesis

The protocol[33] for this project described our approach to the exploration of heterogeneity and statistical pooling of outcomes. During our review, it became apparent that the heterogeneity of study designs, patient populations, interventions, and outcomes was such that statistical pooling would not be appropriate.

Therefore, a narrative synthesis was conducted, presenting findings within summary tables and texts, and describing study and clinical characteristics believed to contribute to heterogeneity, as determined during our exploration of the data. The aim was to synthesize the direction and size of any observed effects across studies in the absence of a meta-analysis, including our assessment of the likelihood of clinical benefits or harms. The intent was to emphasize better quality studies, on the assumption that they would be more likely to report a “true” finding, but it was found that most studies were of comparable quality.

Subgroup analyses

The benefit of dialysis is likely to depend upon patient, caregiver, and context factors. The following potential subgroups were identified to explore, as the data permitted:

- age subgroups: patients younger than 65 years, 65 to 79 years, 80 years and older
- sex subgroups, as reported in the articles
- Indigenous peoples, other identified racial or ethnic minorities, non-minorities
- for hemodialysis, the types of vascular access (arteriovenous fistula, arteriovenous graft, or venous catheter)
- patients with diabetes or other important comorbidities (cardiovascular), compared with patients without
- frailty/functional status, as reported in the articles
- home care settings (i.e., single-family residence, long-term care)
- types of assistance (i.e., both health care professionals and non-health care professionals)
- patient or household socioeconomic status, as reported in the articles
- geographical subgroups (i.e., urban, rural, and remote), as reported in the articles
- patients who are initiating dialysis versus patients who are switching from another form of renal replacement therapy (including patients with kidney graft failure)
- lifetime dialysis versus awaiting transplant.

Changes made to the protocol during the review

A draft protocol was released for stakeholder feedback on June 10, 2016, and the protocol was published to PROSPERO (CRD42016046980) on that date.[33] A list of all protocol amendments can be found at the beginning of this report (see Protocol Amendments).

As studies were restricted to those that included a comparison of modalities, this led to the exclusion of papers describing experiences with dialysis in Indigenous communities. As these are important and unique communities, a separate review of this literature was initiated, "Dialysis for the Treatment of End-Stage Kidney Disease in Indigenous Patients in Canada: A Review of Clinical Effectiveness".[37] The findings of this review are included in the discussion (page 114).

Results

Selection of primary studies

The literature search and its updates identified 7,068 studies. Of these, 6,759 were excluded on screening of the titles and abstracts, and 309 were retained for full-text review. One additional report was selected from the grey literature search, and four from updates subsequent to the main search. Following full-text review, 160 articles were excluded, leaving a final total of 154 eligible articles (including SRs). Studies were excluded for the following reasons: study type other than those specified, 49 articles; outcome not of interest, 45 articles; comparator not of interest, 26 articles; population not relevant, 15 articles; intervention not of interest, four articles; duplicates, three articles; language other than English or French, one article; other reason, 17 articles. The list of excluded studies is provided in Appendix 11.

Six eligible SRs satisfied our criteria for currency, relevance and quality, and addressed one or more of our research questions.[3,4,38-41] One hundred and fifty-four primary studies addressed one or more of our questions. Because the six SRs were incorporated into our report, we chose not to duplicate effort by synthesizing the studies, which would have been available at the time the SRs were in process, whether or not they were included in a SR. Therefore, when the SRs addressed any of our research questions, we relied on the results of the SRs; then we included an additional synthesis of studies published since that time, in order to update the evidence, as detailed in the previous section. Of the 154 primary studies identified as meeting our inclusion criteria, 110 of these studies were not synthesized for this reason. Forty-four articles, including six SRs and 38 articles describing 34 primary studies, were subsequently synthesized as both an update to the SRs and to address research questions that were not included in the SRs. The lists of included studies and studies not synthesized are provided in Appendix 3, and the PRISMA diagram is presented in Appendix 4.

Question 1

Primary outcome: quality of life

Six SRs addressed one or more outcomes for Question 1, which compared HHD or PD with ICHD.

It was required that studies reported the primary outcome of QoL either as baseline data or adjusted for covariates. With the exception of one Cochrane review, which included a single RCT that reported QoL data,[40] the SRs included unadjusted cross-sectional studies, so our own SR of primary studies was undertaken for the primary outcome of QoL.

Secondary outcomes

The most recent SR reported on survival, hospitalization, and major adverse events, with a last update in December 2014.[38] A second SR with meta-analysis was last updated in August 2013.[4] For all outcomes, the data were of low quality, with imprecision or inconsistency or both, and an update seemed indicated. Therefore, all eligible primary studies published since January 2015 were included, in addition to the reviews.

In the majority of studies, patients were not assigned to receive dialysis modalities randomly, but on the basis of characteristics that potentially could affect the final outcome, therefore a final filter was applied before data extraction. Studies for data extraction were required to include adjustment for, or show baseline balance for, a minimum list of important covariates: age, sex, and covariates of diabetes and cardiovascular disease. No studies published since 2015 were excluded for this reason.

Question 2

Two SRs addressed one or more outcomes for Question 2, which compared HHD with PD.

Primary outcome: quality of life

It was required that studies reported the primary outcome of QoL either as baseline data or adjusted for covariates. The identified SRs included unadjusted cross-sectional studies, so our own SR of primary studies was undertaken for this end point.

Secondary outcomes

The most recent SR reported on survival, hospitalization, and major adverse events, with a last update in December 2014.[38] A second SR with meta-analysis was last updated in August 2013.[4] For all outcomes, the data were of low quality, with imprecision or inconsistency or both, and an update seemed indicated. Therefore, all eligible primary studies published since January 2015 were included, in addition to the reviews.

As confounding was of significant concern, a final filter was applied before data extraction, and required that studies for data extraction had to included adjustment for, or show baseline balance for, a minimum list of important covariates: age, sex, and covariates of diabetes and cardiovascular disease. No studies published since 2015 were excluded for this reason.

Question 3

None of the SRs addressed Question 3, which compared home dialysis prescriptions (home conventional HD [HCHD], short-daily HD [SDHD], nocturnal HHD [NHHD]) with each other. Therefore all eligible primary studies published since 2000 were considered.

Question 4

None of the SRs addressed Question 4, which compared self-care in-centre with traditional in-centre HD. Therefore all eligible primary studies published since 2000 were considered.

Study characteristics

Quantity of research available

Six SRs published since 2011 met our eligibility criteria.[3,4,38-41] Ishani et al. (2015), retrieved 32 non-randomized studies using registry data, three RCTs, and three controlled clinical trials for questions relevant to this review.[38] Pike et al. (2013), retrieved two RCTs and 15 observational studies for questions relevant to this review.[4] Two SRs, Palmer et al.[40] and Vale et al.[41] limited their study design to RCTs and retrieved one study each. Two SRs limited their inclusion to patient subgroups: Couchoud et al. (2015),[3] retrieved 25 observational studies on patients with diabetes; Han et al. (2015),[39] retrieved 14 observational studies of elderly patients, plus the results of their own registry study restricted to patients 65 years or older. Additional details of the SRs are provided in Appendix 7.

Thirty-eight articles describing 34 primary studies were included in the analysis. Of these studies, 28 addressed Question 1, six addressed Question 2, and six addressed Question 3. Eight of the articles described QoL. No articles were identified for Question 4. Additional details of the primary studies are provided in patient and study characteristics tables in Appendix 7.

Study design

Six SRs were included,[3,4,38-41] two of which also included meta-analyses.[4,39] The majority of studies described by the SRs were non-randomized studies using registry data and prospective or retrospective cohort studies, along with three RCTs and three controlled clinical trials.

Of the included primary studies, two were RCTs (described by six articles), [42-47] 10 were non-randomized studies of prospective cohorts,[48-57] and 22 were non-randomized studies of retrospective cohorts.[19,58-78]

Country and year of publications

The SRs were conducted in France (2015),[3] Korea (2015),[39] the US (2015),[38] New Zealand (2014),[40] Norway (2013),[4] and the UK (2014).[41]

The primary studies were conducted in Canada (including one RCT reported in two articles),[42,43,55,68] the US,[29,54,57,75] the UK,[50] France,[49,58] Brazil,[48] India,[51] Australia and New Zealand,[19,59,64-66] Korea,[52,53,60] Taiwan,[61-63,69,71-74,78] Romania,[56] both Canada and the US (one RCT reported in four articles),[44-47] and Singapore,[77] and two were conducted in Canada but utilized US data.[67,70] Primary studies were restricted to those published in 2015 or later in order to prevent overlap with the included SRs, except for studies addressing Question 3 (which was not addressed in the SRs) and QoL (our primary outcome). Eleven articles describing nine studies were included that were published before 2015,[19,42,43,45,46,48-50,54,55,57] with the oldest published in 2002.[50]

Patient population

All SRs included adult patients with ESKD receiving dialysis. None restricted study inclusion on the basis of duration of dialysis or transplant eligibility.

Ishani et al. (2015)[38] included studies based on publication date, location, and size. Their search ran from 1995 to December 2014. They restricted study setting to North America, Europe, and Australia and New Zealand (their target population and health care system was US), and registry study size to 1,000 patients or more for key outcomes, and 100 patients or more for the remaining outcomes and for non-registry studies. Follow-up had to be at least one year.

Pike et al. (2013)[4] included studies based on date and balance of baseline covariates. They searched from 1995, chosen because this was around the introduction of erythropoietin for treatment of anemia in kidney disease, to a last update of August 2013. They limited their analysis to studies that had a balance of important covariates at baseline or adjusted covariates to achieve balance, although they were not explicit about their methods of assessing bias.

Vale et al. (2004) (last assessed as current in 2012),[41] included RCTs comparing CAPD with HHD or ICHD for patients with ESKD.

Palmer et al. (2014)[40] included RCTs that compared HHD with ICHD.

Couchoud et al. (2013)[3] selected studies that reported on a well-defined subgroup of patients with any form of diabetes, and that compared any form of PD with any form of HD.

Han et al. (2015)[39] included studies of elderly patients or studies with subgroups of elderly patients, although they did not require the studies to specify a particular definition of elderly.

All primary studies included adult patients with ESKD receiving dialysis. Two studies restricted enrolment to patients 65 years and older,[51,52] and one study was restricted to those 70 years and older.[50] Six studies, reported in 10 articles, included patients who had already been on dialysis before inclusion in the study (prevalent),[42-48,55,56,70] and 23 studies included only patients who were beginning dialysis (incident).[19,49,51-53,57-62,64-68,71-77] Two studies included both prevalent and incident patients.[50,63] Three studies did not report dialysis history.[54,69,78]

Interventions

The comparative dialysis modalities in the included SRs and primary studies are presented below, according to the research question they address. Some studies did not specify whether HD was performed in-centre or at home. In these instances, it was assumed that the modality was ICHD.

Question 1

The SRs addressed various comparisons. Ishani et al.[38] and Pike et al.[4] compared both HHD versus ICHD and PD versus ICHD. Pike et al.[4] also separately compared PD versus satellite HD (considered for this review to be ICHD). Palmer et al.[40] compared HHD versus ICHD. Han et al.[39] and Couchoud et al.[3] compared PD versus ICHD. Vale et al.[41] compared PD versus HD (the single included study did not specify HHD or ICHD, so this was considered to be ICHD). It should be noted that in Pike et al.'s[4] definition of satellite units, they pooled settings that would be treated in this review as home (nursing home) and in-centre (local medical centre). Results were reported according to our own classification, and those summaries with mixed settings were excluded.

Four primary studies (described by five articles) compared HHD versus ICHD,[42,43,59,64,70] and 24 studies compared PD versus ICHD.[48,50-53,55-64,68,69,71-74,76-78]

Question 2

Two SRs, Ishani et al.[38] and Pike et al.,[4] compared PD versus HHD.

Five primary studies compared PD versus HHD.[65-67,70,75] In two studies, patients underwent HHD with the low flux NxStage System One unit.[70,75]

Question 3

None of the SRs compared HHD modalities with each other.

Three primary studies (described by six articles) compared HHD modalities with each other.[19,44-47,54]

Question 4

None of the SRs or primary studies compared self-care ICHD with traditional ICHD.

Critical appraisal of individual studies

Detailed strengths and limitations of all studies included in this synthesis are given in Appendix 9.

Overall, the included SRs presented a low risk of bias. All were deemed to have low risk of bias for study eligibility criteria, with the exception of Han 2015,[39] which lacked clarity around the inclusion criteria. All SRs were deemed low risk of bias for identification and selection of studies, except for Ishani et al. 2015,[38] where the search was limited to a single database and a grey literature search was not performed. Two of the six SRs were considered to be low risk of bias for data collection and study appraisal.[3,4] Ishani et al. 2015[38] did not describe a scale-based quality appraisal, but provided a narrative summary, and the other three did not include duplicate data extraction or independent verification of data. Four of the six SRs had low risk of bias around synthesis of data, having matched the synthesis method to the data. The remaining two SRs both reported meta-analyses, which may not have been appropriate due to the statistical and clinical heterogeneity of the data (based on the reported forest plots, I^2 statistics of > 70%, and descriptions of included studies).[4,39]

The two RCTs[42-47] were of moderate overall quality, since they were generally well conducted, with blinding of allocation of the intervention, use of validated end points, and a low proportion of dropouts. The studies were generalizable to patients in reasonable health and receiving dialysis three times per week. However, both studies included fewer than 100 patients, with power calculation based on composite end points, so were unlikely to be sufficiently powered to detect meaningful differences in the endpoints. Owing to the nature of the intervention, did not allow patients or treating physicians to be blind to the intervention itself, thereby risking treatment or assessment biases. Quality of life outcomes could be susceptible to this type of bias, but mortality and survival outcomes would not.

The majority of the primary non-randomized studies were of adequate quality, allowing for the limitations imposed by their data sources (e.g., collection of end points was not directed to the study questions, and opportunities for adjustment of covariates was limited by the covariates collected) and their non-randomized, non-blinded design. The ascertainment of dialysis modality at an individual level would be reliable, and studies generally used standard methods and assumptions for attributing exposure (e.g., fixed exposure based on a single time-point, or time-varying exposure). End points were validated (e.g., the QoL scales) or were clinical hard end points (e.g., survival). The registry studies with greater than 1,000 patients[19,58-72,75,78] had the advantages of patient numbers and standardized data collection of end points and an extensive group of largely clinical covariates, which enabled use of statistical methods for adjustment for covariates. As data for administrative registries were not collected with the intent of studying a particular interaction, it is unlikely that knowledge of exposure influenced collection. The most significant weakness is that, in the absence of randomization, residual confounding cannot be excluded, and the studies could not explore the impact of non-clinical patient-level or health care system-level covariates. The smaller retrospective or prospective cohort studies[48-56,77] were limited in the covariates that could be included in their adjustment models. They all achieved balance for the covariates that were considered essential, but the likelihood of residual confounding is high. As the intervention is one that is self- or system-selected, this is an important weakness.

Primary outcome: quality of life

The structure, scoring, validation, and minimal clinically important differences (MCIDs) for the studies used in the QoL studies are described in Appendix 10.

Question 1

HHD versus ICHD

Systematic review evidence

For QoL, Ishani et al. 2015[38] included cross-sectional and unadjusted studies in their narrative synthesis, and Pike et al. did not report QoL.[4] The single RCTs included in Palmer et al. 2014[40] and Vale et al. 2004 (current as of 2012)[41] were also included in Ishani et al. [38] and Couchoud et al. (both 2015)[3] and Han et al. 2015[39] did not report QoL. Therefore, primary studies published between 2000 and 2016 that reported baseline and post-baseline data for QoL were reviewed.

Primary study evidence

One RCT met the eligibility criteria, comparing nocturnal HHD with ICHD.[42,43] It was conducted at two urban centres in Alberta between August 2004 and December 2006. Patients were recruited from ongoing dialysis patients (home

and in-centre) who had expressed an interest in nocturnal HHD. They were randomized to nocturnal HHD (five to six sessions per week, for a minimum of six hours per night) or conventional ICHD (three times weekly). The primary outcome was difference between groups in mean left ventricular mass, as measured by MRI at six months.

Fifty-two patients were randomized, 27 to nocturnal HHD (one of whom withdrew after randomization) and 25 to conventional ICHD. Patients had a mean age of 55.1 years for nocturnal HHD and 53.1 years for ICHD, and had been on dialysis for a mean 5.5 years and 4.8 years, respectively. The nocturnal HHD group had a higher proportion of men, 69% versus 56%. The ICHD group had a higher proportion of patients with diabetes (44% versus 38%), and cardiovascular morbidities were similar (i.e., ischemic heart disease 40% versus 38%, and CHF 20% versus 23%).

In an intent-to-treat analysis, there was no significant difference between groups in the change from baseline to six months for the EQ-5D three-level version (EQ-5D-3L), 0.05 (95% CI, –0.07 to 0.17)[42] (see also Appendix 8). Higher scores in this scale reflect better QoL. Nocturnal HHD showed statistically significant differences between groups in change from baseline for the kidney disease quality of life (KDQoL) "burden of kidney disease" domain at six months, 9.4 (95% CI, 1.29 to 17.52). For change from pre-randomization to six months, both the KDQoL "burden of kidney disease" and the SF-36 domain "general health," showed statistically significant differences between groups, 10.70 (95% CI, 2.42 to 18.99) and 12.82 (5% CI, 2.88 to 22.77), respectively, which favoured HHD.[43] The KDQoL has been validated in patients receiving dialysis, and the SF-36 has been shown to allow adequate comparison between patients on various forms of dialysis, but no MCID in patients receiving renal replacement therapy has been reported for either scale (Appendix 10). It is difficult, therefore, to assess clinical significance. All other domains of the SF-36 and KDQoL did not demonstrate statistically significant differences in change from baseline (Appendix 8). Some subscales show wide differences between means, but the calculated uncertainties, with confidence intervals (CIs) crossing 1, means that a chance finding cannot be precluded. The study was not powered to detect difference in QoL, and may have been underpowered to detect a clinically meaningful difference in that outcome.

PD versus ICHD

Systematic review evidence

Ishani et al. 2015[38] and Pike et al. 2013[4] included cross-sectional and unadjusted studies in their comparison of QoL in PD compared with ICHD. The single RCTs included in Palmer et al. 2014[40] and Vale et al. 2004 (current as of 2012)[41] were also included in Ishani et al. [38] and Couchoud et al. (both 2015),[3] and Han et al. 2015[39] did not report QoL. Therefore, studies published between 2000 and 2016 that reported baseline and post-baseline data for QoL were reviewed.

Primary study evidence

Five non-randomized studies published from 2000 to 2016 that reported QoL at baseline and post-baseline time points were retrieved.[48-50,55,57] Four reported SF-36;[49,50,55,57] four reported KDQoL;[48-50,55] and one each reported CHOICE Health Experience Questionnaire (CHEQ),[57] EQ-5D-3L visual analogue scale (VAS), and index score (IND).[55] Data were reported for baseline and six and/or 12 months. Four studies reported on patient cohorts assembled before 2000,[49,50,55,57] and one reported a post-2000 cohort.[48] Sample size ranged from 174[50] to 1,041[57] patients.

Two studies reported QoL at initiation of dialysis, and one also captured QoL before initialization of dialysis. A third study included a mixture of patients initiating and established on dialysis, but did not report the subsets separately, and the fourth and fifth included patients with a mean of two to three years history on dialysis. Three studies allowed transplant-eligible patients;[48,55,57] one excluded transplant-eligible patients;[49] and none of the patients in the fifth study, which was limited to patients 70 years and older, received a transplant.[50] The mean age of PD patients in the studies ranged from 54 to 77 years, [50,57] and that of ICHD patients from 53 to 77 years. [50,55] There were age discrepancies between the groups of up to five years, but no consistent pattern.

Reporting varied: results for the SF-36 appeared as mean scores,[49,50,55,57] adjusted mean difference,[50] and proportion with improved/same/worsened scores.[48,57] Similarly, results for the KDQoL appeared as mean domain scores,[49,50,55,57] adjusted mean difference,[50,57] and proportion with improved/same/worsened scores.[48,57]

One study of 174 elderly patients[50] found no statistically significant difference between the adjusted mean difference between PD and ICHD in the SF-36 physical component score, the SF-36 mental component score, or the KDQoL "symptoms" domain (see Appendix 10) at six and 12 months. The adjusted mean differences for SF-36 physical and mental component scores did not exceed three points at any time point and the Cis were wide. The adjusted mean difference for the symptoms domain was 3.5 at baseline (95% CI, 0.3 to 6.6) and narrowed thereafter. Models were adjusted for new versus ongoing patients, time on dialysis, age, sex, and a number of comorbid conditions.

A second study of predominately middle-aged patients (PD mean age 54 years, ICHD mean age 59 years) compared the percentage of patients with improved/same/worsened scores in SF-36 and CHEQ, the adjusted mean difference, and odds ratios (ORs) for improvement between PD and ICHD.[57] This was the largest study, with 230 patients receiving PD and 698 receiving HD). Improvement was defined as an increase in the domain score greater than two standard errors of measurement. Clinically significant differences were defined by the authors as physical and mental health summary scores in the range of two to three points, and in the individual scale scores as five or more points; these are, however, generic rather than dialysis or kidney disease specific differences. Scores were adjusted for baseline domain score, age, sex, race, education, albumin, creatinine, and hematocrit. For adjusted mean difference of PD versus ICHD at 12 months, there were statistically ($P < 0.05$) significant differences favouring PD in SF-36 "bodily pain" domain (62.6 for PD versus 57.2 for ICHD), and CHEQ "travel," "finance," "diet restrictions," and "access" domains. Conversely, ICHD was favoured for CHEQ "sex." The authors assessed these as clinically significant differences on the basis of general definitions for the SF-36. There was no statistical adjustment for multiple testing. A statistically significant OR for "body image" favoured ICHD.[57]

Three studies compared scores at multiple time points for the SF-36 or SF-12 and KDQoL,[48,49,55] and one study compared scores at multiple time points for the EQ-5D-3L.[55] One study of 192 patients on ongoing dialysis found no statistically significant difference in QoL at six and 12 months.[55] Some of the mean individual subscale differences were large, but with high associated uncertainty, meaning that CIs crossed 1 (see Appendix 10). Of the 192 patients, only 41 received PD, so the study may not have been large enough to confirm differences.

One study of 387 patients who had contraindications for transplant (103 receiving PD and 284 on ICHD) found that differences generally favoured PD, with the largest differences in KDQoL being "role limitation due to emotional function," "burden of kidney disease," and "role limitation due to physical function".[49] Results of statistical testing were reported without CIs, and without correction for multiple testing (see Appendix 10).

One study of 477 patients who had received either PD or ICHD for at least a month measured improvement and change from baseline.[48] Clinically significant changes were defined as changes of more than 5.7 points for the physical component score, 6.3 points for the mental component scale, and 5.0 points for individual subscales. Patients receiving PD had higher scores in several domains at baseline and follow-up, including "patient satisfaction," "burden of kidney disease," and "encouragement from staff;" subsequently patients on ICHD showed more improvement (see Appendix 10). Results at individual time points were not reported, and there was no correction for multiple testing.

Comprehensive data regarding QoL scores for all studies are provided in Appendix 8.

Question 2

HD versus PD

Systematic review evidence

Neither of the studies reported by Ishani et al. provided QoL data.[38] Pike et al. reported the KDQoL for one (N = 93), which, as a cross-sectional study did not meet our inclusion criteria.[4]

Primary Study Evidence

No studies reporting QoL for HHD versus PD were identified.

Question 3

HD prescriptions versus each other

Systematic review evidence

None of the SRs compared prescriptions of HHD with each other.

Primary study evidence

One RCT, the Frequent Hemodialysis Network (FHN) Nocturnal Trial,[44-46] included a comparison of QoL between nocturnal HHD and conventional HHD. This study was conducted in Canada and the US, and was designed to compare nocturnal HHD (six times a week, six or more hours per session) with conventional ICHD (three times a week, less than five hours per session). Difficulty in recruitment because of patient preference for home dialysis led to a change in protocol, and as a result 83% of the patients in the conventional HD group had dialysis at home. These patients were not reported separately.[44,45] Patients were recruited from those on ongoing dialysis during the period of 2006 to 2009, with follow-up to May 2010 and an extension study to July 2011. The co-primary end points were death, left ventricular mass and death, or change in the SF-36 Physical Component Score.

Eighty-seven patients were recruited, 45 randomized to frequent nocturnal HHD and 42 to conventional HHD. Patients assigned to nocturnal HHD underwent dialysis more frequently and for longer periods of time than those assigned to conventional HHD. Patients were relatively young, mean age 51.7 years in the nocturnal HHD group, and 54.0 years in the conventional HHD group. A similar proportion in each group was male, and diabetes and cardiovascular comorbidities were well balanced between study groups.

There was no significant difference in adjusted mean difference at 12 months between nocturnal HHD and conventional HHD for any of the component or composite scores reported for the RAND-36 QoL scale ("mental health composite," "emotional well-being," "role limitation due to emotional problems," "energy/fatigue," or "social functioning"). Individual results ranged from 3.0 (95% CI, –5.9 to 11.9) for RAND-36 "energy/fatigue" to 7.2 (95% CI, –3.1 to 17.5) for "social functioning." The difference in the adjusted mean change in the Sleep Problems Index was not significant: –4.5 (95% CI, –12.2 to 3.2). The authors acknowledged that the small size of the trial meant that even clinically meaningful differences might not be detected.[46]

Question 4

Self-care ICHD versus traditional ICHD

No studies reported outcomes for Question 4.

Summary

No consistent difference in the primary outcome of QoL between HHD and ICHD or PD was found. Quality of life studies to date adjust for limited baseline covariates, use different standardized measures to determine QoL, and measure QoL at differing time points.

Secondary outcomes

Question 1

HD versus ICHD

Survival and mortality

SYSTEMATIC REVIEW EVIDENCE

Three SRs[4,38,40] reported data for survival for HHD versus ICHD (Table 3). One SR provided meta-analytic results. All three reviews pooled all prescriptions of HHD into a single category for their major analysis.

Ishani et al. 2015[38] reported results for seven registry studies that compared all forms of HHD with ICHD. Three were conducted in the US, two in Australia and New Zealand (Australia and New Zealand Dialysis and Transplant Registry [ANZDATA] registry), one in the UK, and one was based on a multinational registry (US, Canada, and France). Four reports pooled all prescriptions for HHD, two studies combined short-daily HHD and nocturnal HHD into frequent/extended or intensive HHD, and one study investigated HHD five to six times a week with the NxStage System One. Two studies started recruitment on or after 2000, one study finished recruitment before 2000, and four studies recruited across both decades. Study sizes ranged from 1,726 to 458,329 patients, and the maximum length of follow-up ranged from four to 15 years.

In five studies, including the three with more frequent or intensive HHD, HHD was associated with statistically significantly lower mortality; in one, ICHD was associated with statistically significantly lower mortality; in one there was no difference.

In addition, two small RCTs showed no difference in mortality over a short follow-up, but neither was powered to detect a difference in mortality. The study reported by Culleton et al., 2007, is described in the QoL section for HHD compared with ICHD.[42] One patient died in the HHD group, compared with none in the ICHD group (N = 51), althought the cause of death was not reported. The other RCT was a randomized crossover trial of nine patients that compared the effect on blood pressure of long (six to10 hours) HHD with short ICHD; there were no deaths in either group.[38]

Three controlled clinical trials were also included, from the US, Canada, and multinational. The multinational trial (which was also the largest) showed lower mortality for HHD; the other two showed no difference.

The authors concluded that the strength of the evidence for effects on mortality was low. Clinical trials were small, with short follow-up and intermediate outcomes. Registry studies were at high risk of bias and their results were to be interpreted with caution due to the likelihood of residual confounding.

The second SR, Pike et al. 2013,[4] found no significant difference between HHD and ICHD in a meta-analysis pooling two studies of HHD versus satellite HD (which was treated as ICHD), one of which included two different HHD prescriptions, relative risk (RR) 0.60 (95% CI, 0.33 to 1.1), N = 12,745. Heterogeneity was high (I^2 = 83), and quality of evidence low. One of the two studies was also included in Ishani et al. 2015.[38]

The authors concluded that there were no significant differences in mortality, but they had limited confidence in the estimate, due to the study quality.[4]

The third SR, Palmer et al. 2014,[40] included one RCT, which was also included in Ishani et al. 2015.[38]

Primary study results

Two primary registry studies published between 2015 and 2016 reported mortality for HHD versus ICHD[59,64] (Table 3). Both analyzed data from Australia and New Zealand patients, from the ANZDATA database.

Marshall et al. 2016[64] analyzed the effect of renal replacement therapy including ICHD, HHD, and PD on survival using time-varying exposures and marginal structural modelling for covariate adjustment. The study included transplant explicitly as an exposure rather than excluding transplant recipients or censoring follow-up at transplantation. Patients started dialysis after March 31, 1996, and were followed until death or December 31, 2012, or were censored at return of kidney function or loss to follow-up. HHD was grouped into three prescriptions on the basis of intensity, and compared with conventional ICHD, three sessions per week or fewer, less than six hours per session. Conventional HHD occurred at the same frequency, three sessions per week or fewer. Quasi-intensive HHD involved five sessions per week or fewer, six hours per session or more. Intensive HHD involved greater than five sessions per week, of any session duration. Classification was hierarchical, with frequency considered before duration. Deaths that occurred within three months of a modality switch were attributed to the previous modality, and sensitivity analyses were performed using six and 12 months delay.

The study included 40,850 patients, 32,823 of whom received ICHD, and 3,626, 1,763, and 375 of whom received conventional HHD, quasi-intensive HHD, and intensive HHD, respectively. Patients could contribute time on multiple modalities. Patients receiving HHD were younger, with an average age of 49.8 to 51.5 years, compared with 62.4 years for those receiving ICHD. Patients on HHD were also more likely to be male: 71% to 78%; compared with 60% male patients on ICHD and were less likely to have other comorbidities or to have been referred late for predialysis care than those on ICHD. Follow-up for individual patients ranged from one to six years.

On the adjusted analyses (Table 3), conventional HHD and intensive HHD were not significantly different from conventional ICHD, HR 0.68 (95% CI, 0.42 to 1.10) and 0.59 (95% CI, 0.32 to 1.10). Quasi-intensive HHD showed lower mortality compared with conventional ICHD, HR 0.56 (95% CI, 0.44 to 0.73). Similar results were seen at 12, 24, and 36 months follow-up. In the sensitivity analysis of the period of lag for attributing mortality to modality after switches, the results for intensive HHD were sensitive to the lag time chosen, but this was the smallest group, and results for the other two groups were not affected.

The study was a well-executed analysis of a large, data set relevant to Canadian patients that sought to distinguish between home dialysis prescriptions. The model included adjustment for demographic and clinical covariates, primary kidney disease, measures of residual kidney function, comorbid conditions, and country or state of dialysis initiation. The predominately clinical covariates did not include social or system-level covariates predictive of dialysis outcome, which the authors acknowledge in their discussion. Residual confounding cannot be excluded.

Kasza et al. 2016[59] also treated dialysis as a time-varying exposure using marginal structural modelling. Patients received 90 days or more of dialysis between October 2003 and December 2011, and were followed up until death, loss to follow-up, or December 31, 2011. Patients were censored at the time of kidney transplant or as they regained kidney function. Exposure was classified as PD, ICHD, or HHD (any prescription), and subclassified by vascular access, starting from day 90 of dialysis. Patients with less than 90 days on dialysis were excluded. Exposure was classified in 90-day periods, with exposure attributed to the modality in use for the majority of the period.

The study found no significant difference in mortality for HHD compared with ICHD, hazard ratio (HR) for death 0.63 (95% CI, 0.4 to 1.0) at 24 months.

As with the Marshall et al. 2016 study, the study was a well-executed analysis of the same, large, relevant data set. The model included adjustment for demographic and clinical covariates, but not social or system-level covariates. Residual confounding cannot be excluded. The difference between results may arise from the pooling of the various HHD prescriptions. In addition, excluding patients with less than 90 days of dialysis would exclude a subset of

patients who were started on ICHD while seriously ill, or without prior planning, and who were at increased risk of death.

Table 3: Summary Evidence Reporting Survival and Mortality for HD Compared With ICHD

Systematic Reviews					
Study	Results				
Ishani et al.,[38] 2015	**Summary of findings from the individual studies** • 7 registry studies: HHD associated with statistically significantly lower mortality vs. ICHD (5 studies); ICHD associated with lower mortality vs. HHD (1 study); no difference (1 study) • 2 RCTs: no difference (small trials, short follow-up) • 3 CCTs: HHD associated with lower mortality (1 large, multinational study); no difference (2 studies).				
Pike et al.,[4] 2013	**Meta-analysis of 3 studies** (N = 12,745) No significant difference (RR 0.60 (95% CI, 0.33 to 1.1), I^2 = 83. • Quality of evidence: low				
Palmer et al.,[40] 2014	• **1 RCT** (n = 9), nocturnal HHD (6 to 8 hours, 3x week) versus ICHD: No deaths reported				
Primary Studies					
Study	Country (Registry)	Years	Follow-up	N HHD: ICHD	All-cause mortality HHD:HD (95%CI)
Marshall et al., 2016[64]	Australia/NZ (ANZDATA)	1996 to 2012	Dec. 31, 2012	3,626:32,823	Conventional HHD vs. ICHD HR 0.68 (0.42 to 1.10)
				1,763:32,823	Quasi-intensive HHD vs. ICHD HR 0.56 (0.44 to 0.73)
				375:32,823	Intensive HHD vs. ICHD HR 0.59 (0.32 to 1.10)
Kasza et al., 2016[59]	Australia/NZ (ANZDATA)	2003 to 2011	Dec. 31, 2011	357:5,729	All HHD vs. ICHD HR 0.63 (0.4 to 1.0)

ANZDATA = Australia and New Zealand Dialysis and Transplant Registry; CCT = controlled clinical trial; CI = confidence intervals; HHD = home hemodialysis; HR = hazard ratio; ICHD = in-centre hemodialysis; N = number of patients; NZ = New Zealand; PD = peritoneal dialysis; RCT = randomized controlled trial; RR = relative risk.

Subgroups: Age

Systematic review results

Three of the studies captured by Ishani et al. 2015[38] and described above examined the interaction between dialysis modality and age. Two were conducted in Australia and New Zealand (ANZDATA) and one was multinational study. One of the Australia and New Zealand studies found that older patients (> 74 years) showed less of a decrease in mortality risk with frequent/extended HHD than did younger patients. When a cohort from the same data set was reanalyzed with all prescriptions of HHD pooled, and with age in categories, the effect of modality on mortality risk was not modified by age category. A multinational study comparing intensive HHD with ICHD showed no interaction with age.

Primary study evidence results

In the updated search, Marshall et al. 2016,[64] who also analyzed the ANZDATA data set, found that there was an interaction of modality and age on statistical testing, although that was primarily driven by the significant age interaction for the comparison of PD with ICHD (discussed in the relevant section of this report). Quasi-intensive HHD did not have a significant effect on survival for patients > 65 years (HR for death 0.74 [95% CI, 0.49 to 1.11]), in contrast to the overall result and that for patients ≤ 65 years, but the CIs were wide. Conventional and intensive HHD showed no significant difference in survival between age strata.

Race

Systematic review results

One registry study from Australia and New Zealand included in Ishani et al. 2015[38] found a lower mortality benefit from HHD compared with ICHD for non-white and non-Asian patients. When a cohort from the same data set was reanalyzed in a separate study, there was no association with race.

Diabetes

Systematic review results

One registry study from Australia and New Zealand included in Ishani et al. 2015[38] found no difference in risk of mortality for patients with and without diabetes.

Primary study evidence results

Marshall et al. 2016[64] found that there was an interaction between dialysis modality and diabetes on statistical testing, although that was primarily driven by the effect in their PD to ICHD comparison (discussed in the relevant section of this report). Results for people with and without diabetes were similar to those for the whole cohort for all three prescriptions for HHD, with quasi-intensive HHD favoured for survival (no diabetes: HR 0.53 [95% CI, 0.38 to 0.75], diabetes: HR 0.62 [95% CI, 0.42 to 0.92]), but the other modalities were no different between people with and without diabetes.

Other comorbidities

Primary study evidence results

Marshall et al. 2016[64] found that there was an interaction between dialysis modality and other comorbid conditions (vascular or pulmonary disease) on statistical testing, although that was primarily driven by the effect in their PD to ICHD comparison (discussed in the relevant section of this report). Results for patients with and without comorbidities were similar to those for the whole cohort for all three prescriptions for HHD, with quasi-intensive HHD favoured for survival (no comorbidities: HR 0.59 95% CI, 0.37 to 0.95], comorbidities: HR 0.59 [95% CI, 0.43 to 0.81]), but the others showing no significant difference.

Cardiovascular mortality and adverse events

Systematic review results

One SR, Ishani et al. 2015, reported cardiovascular mortality for two registry studies.[38] In a US registry study, there was no significant difference between HHD and ICHD over four years of follow-up. In an Australia and New Zealand registry study, 65% of deaths in the HHD group were attributed to cardiovascular causes, compared with 47% in the ICHD group.

Hospitalization

Systematic review results

Two SRs[4,38] compared hospitalization for HHD and ICHD, but the overall evidence base is small and may contain duplicate patients. Studies showed no difference in overall risk of hospitalization between HHD and ICHD.

One US registry study identified by Ishani et al.[38] showed no significant difference in overall hospitalization risk between HHD five to six times a week using the NxStage System One and conventional ICHD (RR 1.03 [95% CI, 0.99 to 1.08]). Patients receiving dialysis with the NxStage System One came from a device-specific registry; those using ICHD were from the United States Renal Data System (USRDS), matched for demographics and clinical covariates. The study was conducted between 2006 and 2010, with follow-up to five years. A total of 3,480 HHD patients were matched by age, race, sex, cause of ESKD, and comorbid condition with 17,400 ICHD patients. The average age of the overall cohort was 54 years and 66% were male. There was increased risk of hospitalization for infection (RR 1.32 [95% CI, 1.24 to 1.40]), and lower risk for hospitalization for cardiovascular disease (RR 0.83 [95% CI, 0.78 to 0.88]) for HHD relative to ICHD. One small RCT showed no difference in all-cause hospitalization, and one controlled clinical trial (CCT) from Canada showed no difference in hospitalization.[38]

Pike et al. identified one US study that compared vascular access hospitalization and cardiovascular disease hospitalization for both nocturnal HHD and short-daily HHD.[4] There was no statistical difference in either measure for either prescription, but the number of patients on HHD were small, 43 and 94 patients for nocturnal HHD and short-daily HHD, respectively. They assessed the evidence as very low quality, with a very high risk of bias.

Primary study evidence results

One study of US patients published in 2015 showed no difference in overall hospitalization between daily HHD with the NxStage System One and ICHD, HR 0.92 (95% CI, 0.85 to 1.00).[70] A similar strategy was used as described in

the study above, comparing patients in the NxStage System One cohort with ICHD patients drawn from the USRDS, with propensity-score matching and a non-proportional hazards survival model. Patients initiated dialysis between 2004 and 2009, with follow-up to a maximum 7.9 years. Duplication of patients between the previous study and this study cannot be excluded.

At total of 1,187 patients received HHD and were matched with 3,173 patients receiving ICHD. The average age of patients who received HHD was 50.3 years, compared with 50.8 years for those on ICHD. Two-thirds in each group were male. The majority (> 80%) had more than one year of dialysis.

There was greater risk of hospitalization for infection, HR 1.25 (95% CI, 1.08 to 1.43) or access revision for patients with HHD, and lower risk of hospitalization for cardiovascular disease, HR 0.68 (95% CI, 0.61 to 0.77) when compared with ICHD.

TECHNIQUE FAILURE / SWITCHING BETWEEN MODALITIES

Systematic review results

One SR[38] compared technique failure or switching between modalities for HHD and ICHD. Patients on HHD were generally more likely to switch to other modalities. One SR[38] reported no difference in rates of transplant between patients receiving HHD and ICHD.

Ishani et al. found two registry studies that suggested patients receiving HHD may be more likely to switch modalities than ICHD, and one CCT that showed no significant difference.[38] A US registry study found that 26% of HHD patients switched modality over four years follow-up, compared with 3% of ICHD patients, HR 10.4 (95% CI, 8.9 to 12.3). Of the HHD patients who switched, 97% switched to ICHD, and 3% to PD. A UK registry study found that 23% of HHD patients switched to ICHD and 0.8% to PD, with median technique survival of 18 months (IQR 3 to 33 months). The CCT was conducted in the US and compared nocturnal HHD (five to six times a week) with ICHD. Sixty-three patients (34.2%) received nocturnal HHD and 121 (65.8%) received ICHD. Over 20 months' follow-up, no nocturnal HHD patients switched to PD, and 6.6% of ICHD patients switched to PD.

Ishani et al.[38] included two studies, one from the US and one multinational, which reported no difference in proportions or rates of transplant between patients receiving HHD and those receiving ICHD. Both studies followed patients for a maximum of four years.

Primary study evidence results

One US study published in 2015 compared HHD with propensity-matched cohorts of patients receiving ICHD.[70] The study has been described above, for hospitalization. HHD patients used the NxStage System One (five to six times a week), and comparator patients were recruited from the USRDS registry, as described above. Patients were more likely to switch back to ICHD from PD than from HHD, RR 3.4 (95% CI, 2.9 to 4.0). Patients on PD were also more likely to switch to HHD (25%) than the reverse (1%).

ADVERSE EVENTS

Systematic review results

Ishani et al. reported mixed results from three studies.[38] One small Canadian RCT (N = 51) that found no difference between the number of patients assigned to HHD (all prescriptions) with infections or need for vascular intervention and those assigned to ICHD. A prospective study conducted in Europe that compared patients receiving short-daily HHD with those receiving ICHD found a lower rate of access closures for HHD, rate difference 7.6 per 100 person-years (95% CI, 3.4 to 11.9), and a greater percentage of access survival for HDD, 92% versus 70%, $P < 0.05$. A second prospective study conducted in the US found no difference between nocturnal HHD and ICHD for the rate of sepsis for the first catheter, and similar median catheter duration.[38]

PD versus ICHD

Survival and mortality

Systematic review results

Five SRs[3,4,38,39,41] reported data for mortality for PD versus ICHD (Table 4). Two SRs provided meta-analytic results.[4,39] One SR included a single RCT, which was also included in Ishani et al.;[38] and two reported on patient subgroups, and are discussed in the sections on elderly[39] and diabetic patients.[3] Use of terminology varied throughout the articles and reviews, and sometimes within articles. The study authors' terminology has generally been followed. The majority of studies reported time-to-event data, where the event was mortality, and calculated hazard ratios.

Ishani et al. identified 27 registry studies comparing mortality for PD with mortality for ICHD for all patients (no subgroups), of which 22 reported usable data. Four were from Canada, 12 were from the US, eight from Europe or the UK, and three were from Australia and New Zealand. One of the Canadian studies, Yeates et al. 2012,[79] which was not synthesized because it was included in the Ishani et al. review, is discussed further in the Economic Evaluation. All but one study selected patients initiating dialysis. Seven studies started recruitment on or after the year 2000, 10 studies finished recruitment before 2000, and 10 studies recruited across both decades. Sample sizes ranged from 3,337 to 648,426, and mean follow-up from one to six years.

All studies adjusted for demographic and clinical covariates, although the method of adjustment and the number of covariates varied. Twelve studies showed no significant difference between PD and ICHD, four studies showed lower mortality in PD, and six studies showed lower mortality in ICHD.[38] Of the Canadian studies, three showed no difference and one favoured PD.

The authors assessed this evidence as inconsistent and imprecise, with high risk of bias, and overall low strength of evidence. They suggested there might be a period effect, with studies published before 2003 favouring ICHD; this was not borne out on our update.

A small RCT from the Netherlands published in 2003, and included in Ishani et al.[38] and Vale et al.[41] showed no difference in mortality. The planned sample size was 100, powered to detect difference in QALYs, but enrolment was stopped prematurely due to poor recruitment (N = 38). At five years follow-up, the HR for the secondary end point of death for ICHD versus PD was 3.6 (95% CI, 0.8 to 15.4), adjusted for baseline imbalance in age at randomization.

Two prospective cohort studies included in Ishani et al.[38] each showed no difference in adjusted mortality in the first one or two years of follow-up, but lower mortality with ICHD after the first or second year. In a US prospective study, the HR for death for PD versus ICHD in the first year was 1.39 (95% CI, 0.64 to 3.06) and over total follow-up of seven years, 1.61 (95% CI, 1.13 to 2.30).[38] In a prospective study conducted in the Netherlands, there was no significant difference in the RR for death in the first year (ICHD versus PD), 1.32 (95% CI, 0.80 to 2.18), or in the second, but subsequent follow-up favoured ICHD (0.55 [95% CI, 0.34 to 0.87]).

Pike et al. found no difference in mortality in one small RCT for PD versus ICHD (same RCT as above), or in a meta-analysis of six non-randomized studies (N = 793, RR 1.11 [95% CI 0.59 to 2.10], I^2 = 71%).[4] One additional study of PD versus HD in a satellite unit (which was considered ICHD for this review), found lower mortality for PD (RR 0.41 [95% CI, 0.19 to 0.87]). Quality of evidence was low to very low, and the heterogeneity for the meta-analysis was high.[4]

Primary study evidence results

Six non-randomized studies published in 2015 to 2016 reported mortality data for PD versus ICHD (conventional, or not specified) for all patients[56,58-60,64,77] (Table 4). Two additional studies reported mortality data only for an identified subset of patients,[51,78] and are described in the subgroups section.

Studies were conducted in Australia and New Zealand,[59,64] Korea,[60] France,[58] Romania,[56] and Singapore.[77] Overall sample size ranged from 92[56] to 40,850,[64] of whom 11[56] to 17,022[64] received PD. Patients were followed for 3.5 years up to 10 years.

Patients who received PD were generally younger, 53.7 years[60] to 67.9 years,[58] compared with those receiving ICHD, 58.7 years[56] to 69.9 years.[58] The proportion of patients with diabetes and other comorbidities tended to rise with age and varied widely across studies; diabetes, for example, ranged from 2%[56] to 74.8%[58] of those receiving PD, and 10%[56] to 69.9%[58] of those receiving ICHD.

Definitions of exposure varied across studies. Four studies defined exposure from a fixed time-point; three defined exposure as the modality on day 90,[56,60,77] and one at the start of dialysis.[58] Later follow-up for PD reflected outcomes for a mixture of patients remaining on PD and those crossing over to ICHD (since the reverse is far less likely), most likely for health-related reasons. Two studies used time-varying exposure, one analyzing from the start of dialysis[64] and one from day 90.[59] Discarding the initial exposure time would exclude those patients who are started on ICHD late, without prior planning, or while seriously ill, all of which increase the risk of death. Handling of transplant as a competing risk also varied, with transplant being included in the model as an exposure,[64] or patients being censored at the time of transplant.[59,77] All studies adjusted for covariates, although the number of covariates included in the model varied.

Despite this variability in patients, design, and analysis, the results across studies were consistent. Of six studies describing overall mortality, five showed higher mortality for patients on PD (HR 1.07 [95% CI, 1.03 to 1.12] to HR

2.08 [95% CI, 1.67 to 2.59]) for total follow-up,[58-60,64,77] and the smallest study (N = 92) showed no significant difference.[56]

Some previous literature suggested possible lower mortality for PD over ICHD within the first one or two years after initiation. The largest study, Marshall et al. 2016,[64] (described above for HHD versus ICHD) found lower mortality for PD as compared with ICHD at 12 months (HR 0.72 [95% CI, 0.66 to 0.79]) and 24 months (HR 0.88 [95% CI, 0.83 to 0.94]), but not at 36 months follow-up and overall follow-up, where mortality for PD appeared higher.

Using data from the same registry, Kasza et al. 2016[59] found higher mortality for PD at all years of follow-up, including 12 months, HR 1.49 (95% CI, 1.31 to 1.68). Both analyses treated the dialysis modality as a time-varying exposure, but Marshall et al. 2016 started follow-up at the start of dialysis, while Kasza et al. 2016 excluded patients who did not have 90 days on dialysis and started follow-up at 90 days, intending to exclude the effect of early mortality in patients started on ICHD without prior planning, or while severely ill.

Yang 2015,[80] which also excluded patients with less than 90 days of dialysis, found no significant difference between PD and ICHD during the first 12 months, but higher mortality for patients on PD thereafter, 2.08 (95% CI, 1.67 to 2.59) at five years. The other studies did not explore the effect of length of follow-up.

Table 4: Summary of Evidence Reporting Survival for PD Compared With ICHD

Systematic Reviews	
Study	Findings
Ishani et al.,[38] 2015	***Survival*** • **22 registry studies:** no difference (12 studies); lower mortality in PD (4 studies), lower mortality in ICHD (6 studies). Possible period effect, with studies pre-2003 favouring ICHD. • **Small RCT:** no difference in mortality • **2 prospective cohort studies**: no difference in mortality in first 1-2 years; favours ICHD after 2 years for both studies
Pike et al.,[4] 2013	• **Meta-analysis of 7 studies**: one RCT (n = 38) and 6 observational studies (N = 793; 5 studies). • No significant difference in RCT (RR 0.28 [95%CI 0.06, 1.22]), or meta-analysis of five observational studies (RR 1.11 [95% CI, 0.59 to 2.10], I^2 = 71%); one cohort study also reported no significant difference in mortality between groups • Small RCT and high heterogeneity in meta-analysis of observational studies. • **Quality of evidence**: very low to low. • *PD vs. satellite HD (reported separately in SR, although classifiedt as PD vs. ICHD for this review):* ***Mortality*** • **One observational study** (n = 181): Favours PD. RR 0.41 (95% CI, 0.19 to 0.87). • **Quality of evidence:** Very low
Couchoud et al.,[3] 2014	***Survival*** • 23 incident cohort studies (N = 1,008,453) • No significant difference (8 studies); favoured PD (3 studies); favoured ICHD (4 studies). 3 studies favoured ICHD or detected no significant difference, depending on stratification by age, comorbidity or duration of follow-up; 4 favoured ICHD, or detected no difference; 2 favoured ICHD, favoured PD, or detected no significant difference, depending on subgroup.
Han et al.,[39] 2015	***Mortality (cohort of elderly patients)*** • **Meta-analysis of 15 studies** (N = > 631,421; 3 studies did not report sample size) • Higher mortality in PD: HR 1.10 (95% CI, 1.01 to1.20) • No difference in first year; significant difference in second year
Vale et al.,[41] 2004 (current as of 2012)	***Mortality*** • 1 RCT (n = 38; abstract only), HHD and ICHD combined. Small study, discontinued early: No significant difference RR 0.50 (95% CI, 0.21 to 1.22)

Primary Studies					
Study	**Country (Registry)**	**Years**	**Follow-up**	**N PD:ICHD**	**All-cause mortality: PD versus ICHD (95% CI)**
Habib et al., 2016[58]	France (REIN)	2004 to 2012	June 30, 2014	448:6,724	RR 1.66 (1.16 to 2.44)
Kim et al., 2016[60]	Korea (HIRA)	2005 to 2008	Dec. 31, 2009	7,387: 22,892	RR 1.23 (1.16 to 1.31)
Marshall et al., 2016[64]	Australia/NZ (ANZDATA)	1996 to 2012	Dec. 31, 2012	3,626: 32,823	HR all follow-up 1.07 (1.03 to 1.12) HR 12 months 0.72 (0.66, 0.79) HR 24 months 0.88 (0.83, 0.94)
Moldovan et al., 2016[56]	Romania	NR	NR	11:81	27.3% versus 30.9%
Kasza et al., 2016[59]	Australia/NZ (ANZDATA)	2003 to 2011	Dec. 31 2011	6,665: 5,729	HR 1 year 1.49 (1.31 to 1.68) HR 2 years 1.7 (1.53 to 1.93) HR 5 years 1.75 (1.56 to 2.01)
Yang et al., 2015[77]	Singapore	2005 to 2011	Aug. 31, 2013	230:641	HR 2.08 (1.67 to 2.59)

ANZDATA = Australia and New Zealand Dialysis and Transplant Registry; CI = confidence interval; HIRA = Korean Health and Insurance Review and Assessment Service; HR = hazard ratio; ICHD = in-centre hemodialysis; NR = not reported; NZ = New Zealand; PD = peritoneal dialysis; REIN = Réseau épidémiologique et information en néphrologie ; RR = relative risk.

Subgroups: Age

SYSTEMATIC REVIEW RESULTS

Two SRs[4,38] studied the effect of age on mortality and dialysis modality, whether by stratified or subgroup analyses. Studies either found no difference between younger and older patients, or found higher mortality for PD in elderly patients.

Ten mortality studies included in Ishani et al. 2015[38] examined the interaction between age and dialysis modality. Four were conducted in the US, three in Australia and New Zealand, and three in Europe and the UK. Five found significant interactions between dialysis modality and age and reported greater risk of death or reduced benefit for PD in older patients, compared with ICHD. Three studies found no significant difference.

Han et al. 2013[39] analyzed mortality for an elderly subgroup (70 years and older) in the Korean Health Insurance database, and incorporated their results into a SR with a meta-analysis of studies that compared PD with ICHD for elderly patients. These non-randomized studies included adjustment for covariates. Individual study definitions of "elderly" were used, and the threshold varied from 56 to 75 years. Patients initiated dialysis between 1990 and 2011. One report was from Canada, nine from Europe, six from the US, two from Asia, one from South America, and one from Australia and New Zealand.

Individual study HRs ranged from 0.85 (95% CI, 0.76 to 0.94) to 2.01 (95% CI, 1.09 to 2.92). For the 15 studies with data available for pooling, there was an overall higher pooled risk of mortality in PD than in ICHD, HR 1.10 (95% CI, 1.10 to 1.20). Both clinical (in terms of study baseline characteristics) and statistical heterogeneity (I^2 = 83%) were high.

PRIMARY STUDY EVIDENCE RESULTS

Among the three primary studies that examined the effect of age on mortality and dialysis modality, one study specifically recruited an elderly cohort of patients,[51] and two reported a subgroup analysis for elderly patients.[64,77] One study reported data from Australia and New Zealand,[64] one from South-East Asia,[77] and one from India.[51] All studies used the threshold of 65 years to identify older and younger patients.

Jeloka et al. 2015[51] studied a small (N = 42) prospective cohort of patients from India who initiated dialysis at age 65 years or older. Patients receiving PD had similar median survival to those receiving ICHD, 25.1 months and 25.2 months, respectively. Patients older than 70 years did not have significantly different rates of survival from those 65 to 70 years old.[51]

Marshall et al. 2016[64] reported significant interaction between dialysis modality and age for patients in Australia and New Zealand. Patients older than 65 years who received PD were at increased risk of death compared with those

receiving ICHD, HR 1.15 (95% CI, 1.10 to 1.21). No difference was found in those aged 65 years or younger between PD and ICHD, HR 0.93 (95% CI, 0.86 to 1.00).[64]

Yang et al. 2015[77] studied the effect of modality, age, and comorbidity in patients who initiated dialysis in Singapore. Patients older than 65 years receiving PD were at increased risk of death compared with those receiving ICHD, HR 1.85 (95% CI, 1.50 to 2.27). The risk was higher for patients with diabetes or cardiovascular disease than those without. Patients 65 years old or younger, who had no comorbidities, were not at increased risk.

Sex

Systematic review results

One SR reported the interaction between sex and dialysis modality related to mortality for PD versus ICHD.[38] Results varied within the SR, with some studies suggesting poorer outcomes for women in some disease subsets.

Four mortality studies included in Ishani et al. 2015[38] examined the interaction of sex and dialysis modality, with varying results. Two were conducted in the US, and two in Europe and the UK. One study from the US reported that patients receiving PD were at greater risk of death than those receiving ICHD, and that the risk was higher for women than for men. One study from Europe and the UK reported that females with ischemic heart disease or peripheral vascular disease did not have a survival benefit with PD, while men did. Two studies reported no interaction.

Race

Systematic review results

One SR reported the interaction between race and dialysis modality for PD versus ICHD.[38] Results varied, with some studies suggesting poorer outcomes for non-white patients in some disease subsets.

Five mortality studies included in Ishani et al. 2015[38] examined the interaction between race and dialysis modality for mortality, with varying results. None were conducted in Canada. Three were conducted in the US and two in Australia and New Zealand. One US study reported that white patients with BMI greater than 30 had a reduced risk of death with PD while non-white patients did not. One Australian/New Zealand study reported significant interaction for Asian patients and those in other categories. The second US study reported time-varying risk (less than three years from inception of dialysis compared with more than three years) that differed by race. The remaining two studies reported no interaction.

Diabetes

Systematic review results

Two SRs[3,38] reported the interaction between diabetes and dialysis modality. Results varied, with no clear preference for PD or ICHD, but a suggestion of increased risk for patients receiving PD who were elderly or frail.

Of the studies included in Ishani et al. 2015,[38] 12 examined the interaction between dialysis modality and diabetes for mortality. Seven studies (five datasets) were conducted in the US, two in Australia and New Zealand, two in Europe and the UK, and one in Canada. Five studies found higher risk of mortality for PD compared with ICHD; one, which was designed to examine the effect of BMI, found that PD increased risk across all strata for BMI; and four found no significant interaction. Two studies looked at interactions within a cardiovascular disease subset: patients with coronary artery disease or congestive heart failure and diabetes had higher mortality with PD than those without diabetes.

Couchoud et al. 2015[3] conducted a SR of outcomes including mortality for patients with diabetes. They found 25 non-randomized studies that analyzed a diabetic subset (9% to 61% of patients in the study), 23 studies that involved patients initiating dialysis and two that involved ongoing dialysis patients. One study was published in Canada, 12 in the US and North America, eight in Europe and the UK, three in Asia, and one in South America. Three studies were published before the year 2000. Nine studies finished recruitment before 2000, and seven studies started recruitment in or after 2000. The remaining studies recruited across both decades. Six of the studies included in Couchoud et al. 2015[3] were also in Ishani et al. 2015.[38] The number of patients receiving PD ranged from 62 to 46,234, and those receiving ICHD ranged from 119 to 93,900. Length of follow-up ranged from one to eight years.

Results were variable: In the analyses in which patients were analyzed according to the first modality they were established on in dialysis, eight studies that analyzed all diabetic patients had no significant difference in mortality between PD and ICHD, three favoured PD, and four favoured ICHD. In studies that reported stratification by age, comorbidity or duration of follow-up, three studies favoured ICHD or detected no significant difference, depending on the subgroup; and two favoured PD, favoured ICHD, or detected no significant difference, again depending on the

subgroup. There was no obvious clustering of result by subgroup, method of covariate adjustment, length of follow-up, or era of dialysis.

The authors assessed the studies as having moderate to high risk of bias, lacking details of patients, and heterogeneous in follow-up. They concluded that there was no evidence for preferring one modality over the other, but there was possibly increased risk with PD for elderly or frail patients with diabetes.

For the elderly subset analyzed by Han et al. 2013,[39] both patients with and without diabetes had a higher risk of death with PD compared with HD, HR 1.26 (95% CI, 1.13 to 1.40) and 1.10 (95% CI, 1.02 to 1.18), respectively.

PRIMARY STUDY EVIDENCE RESULTS

Two studies published in 2015 to 2016 reported the interaction between age and dialysis modality.[64,77]

Marshall et al. 2016[64] reported significant interaction between diabetes and dialysis modality for patients in Australia and New Zealand. Patients with diabetes who received PD were at increased risk of death compared with those receiving ICHD, HR 1.17 (95% CI, 1.11 to 1.25). Patients without diabetes did not experience increased risk, HR 0.99 (95% CI, 0.94 to 1.25).[64]

Yang et al. 2015[77] studied the effect of modality, age, and comorbidity in patients who initiated dialysis in Singapore. Patients with diabetes receiving PD were at increased risk of death compared with those receiving ICHD, HR 1.54 (95% CI, 1.20 to 1.99).[77] Younger patients without diabetes had no increased risk.

Cardiovascular disease and other comorbidities

SYSTEMATIC REVIEW RESULTS

One SR[38] reported the interaction of cardiovascular disease or other comorbidities with dialysis modality for PD versus ICHD. Results varied, but where studies showed a statistically significant difference, it tended to favour ICHD for this subset. One study[78] reported mortality for a subset of patients with polycystic kidney disease (PCKD) as a cause of kidney failure.

Of the studies included in Ishani et al. 2015,[38] six examined the interaction between dialysis modality and cardiovascular disease, usually coronary artery disease or CHF, for mortality. Four studies (three datasets) were conducted in the US, one in Australia and New Zealand, and one in Europe and the UK. Three studies reported a significant interaction between cardiovascular disease and dialysis modality which favoured ICHD. In one, the interaction was only in patients without diabetes; patients with diabetes were at an overall increased risk of death with PD regardless of their cardiovascular status. Two studies did not report a significant interaction.

PRIMARY STUDY EVIDENCE RESULTS

In terms of primary studies, Marshall et al. 2016[64] reported significant interaction between comorbid conditions (coronary artery disease, peripheral artery disease, cerebrovascular disease, chronic lung disease) and dialysis modality for patients in Australia and New Zealand. Patients with comorbid conditions who received PD were at increased risk of death compared with those receiving ICHD, HR 1.15 (95% CI, 1.10 to 1.20). Patients without comorbid conditions had better survival with PD, HR 0.85 (95% CI, 0.77 to 0.94).[64]

Yang et al. 2015 studied the effect of modality, age, and cardiovascular disease in patients who initiated dialysis in Singapore.[77] Patients with cardiovascular disease receiving PD were at an increased risk of death compared with those receiving ICHD, HR 2.06 (95% CI, 1.65 to 2.56).[77] Younger patients without cardiovascular disease had no increased risk.

Wang et al. 2015 reported deaths and deaths during hospitalization in a matched cohort (matched by propensity score and year of dialysis initiation) of 366 patients with PCKD in Taiwan.[78] The proportion of death and death during hospitalization was lower in patients who received PD: 18.0% of patients who received PD and 25.4% of patients who received ICHD died during follow-up of up to three years.

Cardiovascular mortality and adverse events

SYSTEMATIC REVIEW RESULTS

One SR[38] reported cardiovascular mortality and/or adverse events (Table 5). Cardiovascular comorbidities were common, and the rates of cardiovascular adverse events high. Results were variable, and depended on the outcome.

Five registry studies included in Ishani et al. 2015[38] reported cardiovascular mortality, three from Europe, one from the US, and one from Australia and New Zealand. Two studies started recruitment on or after the year 2000, two studies finished recruitment before 2000, and one study recruited across both decades. The number of patients ranged from 4,401 to 117,158; all incident patients. Patients in these subsets were older, with mean age from 60 years to 73 years.

One study from Europe reported the incidence of newly diagnosed cardiovascular disease, and cardiac death; in patients who had no significant difference in cardiovascular disease at baseline, 11.4% of deaths in patients receiving PD and 21.1% of deaths in patients receiving ICHD were attributed to cardiac causes. Follow-up was four years.

The proportion of deaths due to cardiovascular causes in three Ishani et al. studies was even higher: 40% to 57% of deaths in patients receiving PD, and 35% to 49% of deaths in patients receiving ICHD. Follow-up ranged from four years to nearly 12 years. In one study, the difference was statistically significant in favour of PD, in another not significant, and in the third the significance was not reported. The fifth study reported that, for patients 55 years and older, both men and women with diabetes who were receiving PD had a reduced risk of cardiac death, compared with men receiving ICHD; however, it is unclear whether the comparison of both men and women versus men only is valid.

Primary Study Evidence Results

Four studies published between 2015 and 2016 reported cardiovascular mortality and/or adverse events (Table 5).[56,60,63,74]

Kim et al. 2015,[60] reported all-cause mortality and major adverse cardiovascular events for 30,279 Korean patients, 7,387 of whom received PD. Median follow-up was 21.5 months. The average age for patients on PD was 53.7 years and for ICHD 57.2 years. Baseline cardiovascular comorbidities were, for PD versus ICHD: prior myocardial infarction (MI), 3.7% versus 2.6%, prior stroke, 8.3% versus 10.8%, and CHF, 15.6% versus 13.8%. Analysis was by Cox proportional hazards, with covariate adjustment by inverse probability weighting.

Compared with patients receiving ICHD, patients receiving PD were at increased risk of major adverse cardiac and cerebrovascular events, HR 1.09 (95% CI, 1.03 to 1.15), non-fatal acute MI, HR 1.29 (95% CI, 1.13 to 1.48), and percutaneous coronary intervention, HR 1.19 (95% CI, 1.03 to 1.38). There was no difference in non-fatal stroke, HR 1.01 (95% CI, 0.92 to 1.09) or coronary artery bypass graft, 0.95 (95% CI, 0.59 to 1.52).

Wang et al. 2016[74] reported risk of pulmonary embolism for a matched cohort of 14,680 Korean patients, 7,340 of whom received PD. Patients with prior history of PE were excluded. Mean follow-up for PD patients was 4.19 years.

Compared with patients receiving ICHD, patients receiving PD were at lower risk of pulmonary embolism, HR 0.43 (95% CI, 0.23 to 0.81).[74]

Lin et al. 2015[63] reported risk of new diagnosis of peripheral vascular disease for a matched cohort (matched by propensity score age, sex and year of the index date) of 18,380 incident and prevalent Korean patients, 9,190 of whom received PD. Patients with previous diagnosis of peripheral vascular disease were excluded, as were those who died within the first 90 days of dialysis. Mean follow-up for PD patients was 2.9 years, while that for ICHD patients was 3.6 years. Baseline comorbidities were, for PD versus ICHD: coronary artery disease 29.3% versus 29.6%, stroke 9.4% versus 9.5%, hyperlipidemia 44.1% versus 43.4%, and diabetes, 34.3% versus 33.8%.

Compared with patients receiving ICHD, patients receiving PD were at lower risk being diagnosed with peripheral vascular disease, HR 0.52 (95% CI, 0.44 to 0.62).

In a small study conducted in Romania,[56] 18.1% of 11 patients receiving PD and 13.6% of 81 patients receiving ICHD died of cardiovascular causes. The difference was not statistically significant.

Table 5: Summary of Evidence Reporting Cardiovascular Adverse Events for PD Compared With ICHD

Systematic Reviews					
Reviews				Findings	
Ishani et al.,[38] 2015				Cardiovascular mortality • **5 registry studies**: higher cardiovascular deaths in PD (1 study); no difference or not reported (4 studies)	
Primary Studies					
Study	Country (Registry)	Years	Follow-Up Until/ Duration	N PD:ICHD	Adverse Events: PD Versus ICHD
Kim et al., 2015[60]	Korea	2005 to 2008	Dec. 31, 2009	7,387:22,892	Major adverse cardiac and cerebrovascular events HR 1.09 (95% CI, 1.03 to1.15) Non-fatal acute myocardial infarction HR 1.29 (95% CI, 1.13 to 1.48) Non-fatal stroke (non-fatal ischemic and hemorrhagic stroke) HR 1.01 (95% CI, 0.92 to 1.09) Percutaneous coronary intervention HR 1.19 (95% CI, to 1.03 to 1.38) Coronary artery bypass graft HR 0.95 (95% CI, 0.59 to 1.52)
Wang et al., 2016[74]	Taiwan (NHIRD)	1998 to 2010	Dec. 31, 2011	7,340:7,340	Pulmonary embolism HR 0.43 (95% CI, 0.23 to 0.81)
Lin et al., 2015[63]	Taiwan (NHIRD)	2000 to 2010	Dec. 31, 2011	9,190:9,190	Peripheral vascular disease HR 0.52 (95% CI, 0.44 to 0.62)
Moldovan et al., 2016[56]	Romania	NR	40 months	11:81	Cardiovascular mortality 18.1% versus 13.6%; not statistically significant

CI = confidence intervals; HR = hazard ratio; ICHD = in-centre hemodialysis; PD = peritoneal dialysis.

Hospitalization

SYSTEMATIC REVIEW RESULTS

Two SRs[4,38] reported hospitalization for PD compared with ICHD. Results were variable. Where a difference was seen, it tended to favour lower hospitalization in PD.

Five non-randomized single or multi-centre studies included in Ishani 2015 et al.[38] reported hospitalization, two from the UK, two from Europe and the UK, and one from Canada. None started recruitment after the year 2000, three finished recruitment before 2000, and two recruited across both decades.

Three of five studies showed lower measures of hospitalization for PD, while two showed no difference. In one US study (N = 181 patients), the risk of admission due to peritonitis was higher in PD, while the risk of bacteremia orfungemia was higher in ICHD. The second US study reported fewer hospitalizations and days as hospital in-patients (unrelated to dialysis) for PD patients compared with ICHD patients. One study from the Netherlands reported that a lower percentage of patients receiving PD were hospitalized compared with ICHD, while a study from the UK reported no difference in hospitalization for a subset of elderly patients. The Canadian study, which recruited patients between 1987 and 1989, reported no difference.

Meta-analyses carried out by Pike et al. did not find a significant difference in-hospital days per patients per year (n = 4, N = 398, RR 1.13 [1.04 to 1.23], I^2 = 16%), or hospital admissions per patients per year (n = 3, N = 370, RR 0.89 [95% CI, 0.5 to 1.55], I^2 = 91%).[4] None of the studies were included in Ishani et al. 2015.[38] One small study

showed no difference in hospitalization for infection (n = 1, N = 28, RR 2.25 [95% CI 0.9, 5.62]).[4] Separate meta-analyses of two studies of PD versus HD in a satellite unit (which was considered ICHD) also found no difference for infection-related hospitalization, RR 1.48 (95% CI, 0.98 to 2.23).[4] Hospitalization for bacteremia was lower in PD, and for peritonitis was higher in ICHD, but the estimates were imprecise.

PRIMARY STUDY EVIDENCE RESULTS

Two studies published 2015 to 2016 reported hospitalization for PD compared with ICHD.

Suri et al. 2015,[70] conducted in the US, found lower hospitalization for PD than for ICHD, HR 0.73 (95% CI, 0.67 to 0.79). Hospitalization for cardiovascular disease, infection, access-related reasons, and bleeding all occurred at lower frequency.

Oliver et al. 2016[68] compared hospital visits for patients receiving assisted PD with ICHD, for 1,075 Canadian (Ontario) patients initiating dialysis. After matching by propensity score, 203 patients were included in the PD group, and 198 in the ICHD group. Patients were elderly: the average age for patients receiving PD was 68.9 ± 13.2 years, and for patients receiving ICHD was 68.8 ± 6.6 years. Comorbidities were balanced between groups (34% versus 33%) and were common, for PD versus ICHD: CHF 23% versus 21%, other cardiovascular disease 24% versus 21%, and diabetes 52% versus 50%.

For this cohort, there was no difference between PD and ICHD in-hospital visits per patient-year of follow-up (1.9 versus 1.7) or in days of hospitalization per patient-year of follow-up (11.1 versus 12.9).

Adverse events

SYSTEMATIC REVIEW RESULTS

One SR[38] reported adverse events for PD compared with ICHD other than the cardiovascular adverse events or adverse events leading to hospitalization described above.[61,62,71-73,76] The data set for infection is relatively sparse, although it suggests lower risk of infection for PD (with the exception of peritonitis).

Ishani et al. found that few studies reported adverse events.[38] Of three studies comparing dialysis-related or access-related infections between PD and ICHD, two found a lower incidence of infections in PD compared with ICHD, and one found no difference, although the latter found more peritonitis in the PD group and more bacteremia in the ICHD group.[38]

PRIMARY STUDY EVIDENCE RESULTS

Six articles published between 2015 and 2016 reported adverse events for PD compared with ICHD,[61,62,71-73,76] five of which used data from the same administrative data set for Taiwan (Table 6). Five articles reported neurological adverse events: dementia,[62,76] subdural hematoma,[71] hydrocephalus,[73] and hearing loss,[72] and one reported gastrointestinal adverse events.[61]

Lin et al. 2015[62] studied the incidence of dementia in 55,624 patients from Taiwan. Patients who were diagnosed with dementia before the start of dialysis were excluded, as were those who received less than 90 days of dialysis. Survival was estimated by proportional hazards regression incorporating competing risks. The mean duration of follow-up was 4.7 years. Average age was not reported, and patients older than 40 years were included.

The authors found no difference between PD and ICHD for risk of dementia, HR 0.92 (95% CI, 0.80 to 1.06). [62]

Wolfgram et al. 2015[76] studied the incidence of dementia in a propensity-matched cohort of 13,035 patients in the USRDS. Patients diagnosed with dementia before the start of dialysis were excluded, as were those diagnosed within 90 days of dialysis initiation, to exclude those diagnosed during that period as a result of increased cognitive demands and medical attention. As well as demographic and clinical covariates, the propensity model included for need for assistance in daily activities, and whether or not they were in a nursing home, assisted living, or other institutional situation. The mean age at baseline for patients receiving PD was 62.4 ± 15.9 years and for ICHD 64.1 ± 14.4 years. The mean duration of follow-up was 1.5 years, with a maximum of 3.75 years.

In this cohort, PD was associated with increased risk of dementia, HR 1.16 (95% CI, 1.35 to 1.56).[76]

These studies included all dementia subtypes. For Alzheimer disease or other neurodegenerative diseases, the follow-up time of the second study in particular is short relative to the natural history of the disease; it is unlikely that dialysis modality influenced the underlying pathology.

Wang et al. 2015[71] compared the risk of subdural hematoma in a matched cohort (matched by propensity score and year of dialysis initiation) of 20,272 patients initiating dialysis in Taiwan. Patients who had a history of subdural hematoma or who had received less than 90 days of dialysis were excluded. Cox proportional hazards regression was used, and covariates included anticoagulant or antithrombotic medications.

Patients on PD were at decreased risk of subdural hematoma, HR 0.62 (95% CI, 0.43 to 0.85).[71]

Wang et al. 2016[73] compared the risk of hydrocephalus in a matched cohort (matched by propensity score, age, sex, and index year) of 12,750 patients initiating dialysis in Taiwan. Patients who had a history of hydrocephalus or who had received less than 90 days of dialysis were excluded. Cox proportional hazards regression was used to calculate survival.

There was no difference between PD and ICHD in risk of hydrocephalus, HR 1.39 (95% CI, 0.81 to 2.38).[73]

Wang et al. 2016[72] compared the risk of hearing loss confirmed by audiometry in a matched cohort (matched by propensity score, age, sex and index year) of 29,684 patients initiating dialysis in Taiwan. Patients who had a history of hearing loss or who had received less than 90 days of dialysis were excluded. Cox proportional hazards regression was used to compare survival.

Patients who received PD were at increased risk of hearing loss, 2.96% versus 1.70%. Statistical significance was not assessed.[72]

Lee et al. 2015[61] reported the risk of new onset of gastrointestinal (GI) disorders as well as an overall rate for GI events for a propensity-matched cohort of 10,746 patients in Taiwan. Patients were excluded if they had a history of common GI disorders, had less than 90 days of dialysis, or had received both modalities for a similar duration (one to two months). Analysis involved a multivariate competing risk regression model.

There was no significant difference between PD and ICHD for all gastrointestinal disorders, RR 1.0 (95% CI, 0.91 to 1.10).[61] Risk of gastroesophageal reflux disease, intestinal obstructions and adhesions, and abdominal hernia were elevated in PD (Table 6); risk of peptic ulcer disease, appendicitis, and lower GI diverticula and bleeding were elevated in ICHD; and risk of mesenteric ischemia, liver cirrhosis, and acute pancreatitis was not significantly different.[61]

Table 6: Summary of Evidence Reporting Adverse Events for PD Compared With ICHD

Systematic Reviews					
Study	Results				
Ishani et al.,[38] 2015	• Lower incidence of dialysis-related or access-related infections in PD compared with HD in two studies; no overall difference in one study				
Primary Studies					
Study	Country (Registry)	Years	Follow-Up Until / Duration	N PD:ICHD	Adverse events: PD versus ICHD
Neurological					
Lin et al., 2015[62]	Taiwan (NHIRD)	1998 to 2007	Dec. 31, 2008 Mean 4.7 years	3,292:52,552	Dementia HR 0.92 (95% CI, 0.80 to 1.26)
Wolfgram et al., 2015[76]	US (USRDS)	2006 to 2008	Dec. 31, 2009 Mean 1.5 years	8,083:15,468	Dementia HR 1.16 (95% CI, 1.35 to 1.56)
Wang et al., 2015[71]	Taiwan (NHIRD)	1998 to 2010	Dec. 31, 2011 Duration NR	10,136:10,136	Subdural hematoma HR 0.62 (95% CI, 0.43 to 0.85)
Wang et al., 2016[73]	Taiwan (NHIRD)	2000 to 2010	Dec. 31, 2011 Duration NR	10,014:10,014	Hydrocephalus HR 1.39 (95% CI, 0.81 to 2.38)
Wang et al., 2016[72]	Taiwan (NHIRD)	2000 to 2010	Dec. 31, 2011 Duration NR	6,375:6,375	Hearing loss 2.96% versus 1.70%

Primary Studies					
Gastrointestinal					
Lee et al., 2015[61]	Taiwan (NHIRD)	2000 to 2009	2010 Duration NR	1,791:8,955	Total GI events HR 1.00 (95% CI, 0.91 to 1.10) Gastroesophageal reflux HR 2.25 (95% CI, 1.65 to 3.06) Mesenteric ischemia HR 0.47 (95% CI, 0.17 to 1.32) Intestinal obstruction or adhesions HR 1.52 (95% CI, 1.10 to 2.09) Liver cirrhosis HR 0.74 (95% CI, 0.50 to 1.09) Acute pancreatitis HR 0.81 (95% CI, 0.52 to 1.27) Abdominal hernia HR 4.13 (95% CI, 3.20 to 5.34)

CI = confidence intervals; HR = hazard ratio; ICHD = in-centre hemodialysis; GI = gastrointestinal; NHIRD = National Health Insurance Research Database (Korea); NR = not reported; PD = peritoneal dialysis; USRDS = United States Renal Data System.

Technique failure / switching between modalities and transplant

SYSTEMATIC REVIEW RESULTS

One SR[38] reported change in treatment modality (Table 7). Patients receiving PD tended to switch modalities more often than those receiving ICHD. One SR[38] reported transplants for PD compared with ICHD. In Canadian and US studies, patients on PD were more likely to receive transplants.

According to Ishani 2015,[38] switching between modalities, technique failure, and kidney transplantation were all more likely for PD. Nine studies reported a change in dialysis modality. Two studies were conducted in Canada, three in the US, and four were in Europe and the UK. Three studies recruited patients starting later than 2000, three finished recruitment before the year 2000, two recruited in both decades, and one did not report dates.

Six studies reported the percentage of patients who switched from PD and from ICHD. In five studies, patients on PD were more likely to switch, PD 10.5% to 57% versus ICHD 0.6% to 6%. In a sixth, a similar proportion of patients switched, PD 0.9% and ICHD 0.6%. Two studies reported the results in terms of technique survival. In one, the difference between PD and ICHD emerged at 10 months follow-up, and in the other, the proportions with technique survival (at two years) were PD 74% versus ICHD 96%.

Regarding transplantation, Ishani et al. 2015[38] included seven studies, one from Canada, two from the US, three from Europe, and two multinational. Maximum follow-up ranged from two to seven years. Four studies started recruitment on or after the year 2000, one study finished recruitment before 2000, and one study recruited across both decades. The seventh did not specify dates of recruitment. In the three studies from North America, patients receiving PD were also more likely to undergo transplant. In the studies for the rest of the world PD patients were as likely (two studies) or less likely (two studies) to undergo transplant.

PRIMARY STUDY EVIDENCE RESULTS

Four studies published between 2015 and 2016 reported technique failure or switch between modalities for PD compared with ICHD (Table 7). One study was conducted in Canada,[68] one in the US,[76] and two in Asia.[53,72] Overall sample sizes ranged from 1,042 to 23,551, with 203 to 8,083 patients receiving PD.

Table 7: Summary of Evidence of Technique Failure or Switch Between Modalities for PD Compared With ICHD

Systematic Reviews					
Study	Findings				
Ishani et al.,[38] 2015	• Five of six studies: patients receiving PD more likely to change dialysis modality; sixth study similar proportion changed dialysis modality				
Primary Studies					
Study	Country (Registry)	Years	N PD:ICHD	Follow-up	Modality Failure / Switch: PD vs. ICHD
Lee et al., 2016[53]	Korea	2008 to 2011	311:731	PD mean 11.1 months	HR 10.78 (95% CI, 1.87 to 62)
Oliver et al., 2016[68]	Canada (DMAR)	2004 to 2013	203:862	July 31 2013, mean NR	25% vs. 21%
Wang et al., 2016[72]	Taiwan (NHIRD)	2000 to 2010	6,375:6,375	1-11 years, mean NR	35.8% vs. 1.3%
Wolfgram, 2015[76]	US	2006 to 2008	8,083:15,468	Mean 1.5 years	25.4% vs.1.2%

CI = confidence intervals; DMAR = Dialysis Measurement, Analysis, and Reporting (Canada); HR = hazard ratio; ICHD = in-centre hemodialysis; NHIRD = National Health Insurance Research Database (Korea); NR = not reported; PD = peritoneal dialysis.

In three of the four studies,[29,53,72] patients receiving PD were more likely to switch than those on ICHD; Lee et al. 2016[53] reported a hazard ratio of 10.78,[53] although the CIs were very wide. In the fourth study,[68] which was conducted in Canada, the proportion of patients switching was comparable. This study included incident patients who received assisted PD for 30 days or more, while the other three included all PD patients who had received PD for 90 days or more.

One primary study examined the likelihood of transplantation. Yang et al. 2015[78] reported transplant for a subset of patients in Taiwan with PCKD. The percentage of patients receiving transplant was equivalent in both groups; 9.0% and 8.6% for PD and ICHD, respectively.

Question 2

Home hemodialysis versus peritoneal dialysis

Overall survival / all-cause mortality

SYSTEMATIC REVIEW RESULTS

One SR[38] reported data for survival for HHD versus PD (Table 8). Ishani et al. identified two studies of HHD versus PD, one of which found no difference in mortality between HHD and PD, and one of which found a lower mortality for HHD.[38] A registry study of US Medicaid recipients included 38,894 incident patients, with 1,641 of them receiving out-of-centre dialysis and they were followed for 9 years and 3 months. There was no significant difference between HHD (all prescriptions) and PD, HR 1.04 (95% CI, 0.98 to 1.11). A smaller registry study from the UK included 1,125 incident patients, with 225 receiving HHD who had 10 years follow-up. There was lower mortality for patients on HHD (all prescriptions) than PD, HR for death 0.61 (95% CI, 0.40 to 0.93).[38]

PRIMARY STUDY EVIDENCE RESULTS

Three studies published between 2015 and 2016 directly compared survival in HHD and PD (Table 8).[65-67] Two of the three analyzed the same registry (Australia and New Zealand, ANZDATA),[65,66] and one reported US data.[67] They ranged in size from 336 to 11,416 patients, with the number of patients on HHD ranging from 168 to 2,668.

All three studies reported significantly better survival for patients receiving HHD compared with PD. Nadeau-Fredette et al. 2015[66] used a multivariable Cox proportion hazards regression model to calculate an HR for mortality for HHD versus PD for 11,416 patients from Australia and New Zealand. Patients receiving HHD showed better survival: HR 0.47 (95% CI, 0.38 to 0.59). The authors repeated the analysis using two different propensity-score approaches, with similar results.

In a separate paper, Nadeau-Fredette et al. 2015[65] created a matched cohort (matched by propensity score) balanced at baseline of 168 patients for each of HHD, PD, and those transitioning from PD to HHD.[65] The main survival analysis compared both groups of interest to the PD to HHD group. The proportions who died while receiving HHD compared with PD in the matched cohort were 7.7% versus 18.5%, respectively.

Nesrallah et al. 2016[67] matched a cohort of US patients being treated with HHD using the NxStage System One with PD patients from the USRDS. The HR for mortality was 0.75 (95% CI, 0.68 to 0.82), for HHD compared with PD.

Marshall et al. 2015[64] did not report a direct comparison, but compared survival for three prescriptions of HHD and PD to a common comparator, conventional ICHD, within the same model, as previously described.[64] Their findings were consistent with the other studies. There is no overlap between the confidence intervals of the comparison of quasi-intensive HHD, HR 0.6 (95% CI, 0.47 to 0.78), or intensive HHD, 0.41 (95% CI, 0.2 to 0.85), or for PD, 1.09 (95% CI, 1.04 to 1.13). There is overlap for conventional HHD, 0.77 (95% CI, 0.49 to 1.20) and PD.

Table 8: Summary of Evidence of All-Cause Mortality for HHD Compared With PD

Systematic Reviews					
Review	Findings				
Ishani et al.,[38] 2015	Survival • **2 registry studies**: statistically significantly better survival with HHD (1 study); no significant difference in mortality risk (1 study)				
Primary Studies					
Study	Country (Registry)	Years	N HHD:PD	Follow-Up	All-Cause Mortality HHD:PD (95% CI)
Nadeau-Fredette et al., 2015[66]	Australia/NZ (ANZDATA)	2000 to 2012	3,626:32,823	To Dec. 31, 2012	HR 0.47 (0.38 to 0.59)
Nadeau-Fredette et al., 2015[65]	Australia/NZ (ANZDATA)	2000 to 2012	168:168	To Dec. 31, 2012	7.7% versus 18.5% (statistical analysis not reported)
Nesrallah et al., 2016[67]	USRDS	2004 to 2011	2,668:2,668	To Dec. 31, 2012	HR 0.75 (0.68 to 0.82)

ANZDATA = Australia and New Zealand Dialysis and Transplant Registry CI = confidence intervals; HHD = home hemodialysis; HR = hazard ratio; PD = peritoneal dialysis; USRDS = United States Renal Data System.

Hospitalization

Systematic Review Results

One SR reported data for hospitalization for HHD versus PD.[4] Neither of the studies reported by Ishani et al. provided hospitalization data.[38]

Pike et al. reported results for hospitalization from one study (N = 86).[4] There was no significant difference for HHD versus PD in hospitalization and hospital days, but the risk for hospitalization for cardiac reasons was increased for HHD, RR 1.45 (95% CI, 0.49 to 4.36), and for infectious disease was decreased for HHD, RR 0.24 (95% CI, 0.03 to 1.76). Patients undergoing HHD had more hospital days per patient for cardiac reasons, 910 versus 641. The study was assessed as very low quality.

Technique failure / switching between modalities and transplant

Primary Study Evidence Results

Four studies published between 2015 and 2016 reported technique failure for HHD compared with PD[65,66,70,75] (Table 9), and two reported switching between HHD and PD.[67,70]

Table 9: Summary of Evidence of Technique Failure or Modality Switch for HHD Compared With PD

Study	Country (registry)	Years	Follow-Up	N HHD:PD	Technique Failure / Switch HHD:PD
Nadeau-Fredette et al., 2015[66]	Australia/NZ (ANZDATA)	2000 to 2012	To Dec. 31, 2012, mean NR	3,626:32,823	HR 0.34 (95% CI, 0.28 to 0.41)
Nadeau-Fredette et al., 2015[65]	Australia/NZ (ANZDATA)	2000 to 2012	Dec. 31, 2012, mean NR	168:168	12.5% versus 35.7% (NR)
Nesrallah et al., 2016[67]	USRDS	2004 to 2011	Maximum 5 years of Dec. 31, 2012	2668:2668	PD switched to HHD 20% HHD switched to PD 2%
Suri et al., 2015[70]	Home dialysis provider/USRDS	2004 to 2009	Mean 1.9 years, max 7.9 year	1,116:2,784	Switch to ICHD 15% versus 44% HR 0.29 (95% CI, 0.25 to 0.34) PD switched to HHD 25% HHD switched to PD 1%
Weinhandl et al., 2016[75]	NxStage Medical Registry/USRDS	2006 to 2010	Mean HHD 1.79 years	4,201:4,201	Switch to ICHD 1 year 27.5% versus 37.0% 3 years 32.1% versus 44.1%

Australia and New Zealand Dialysis and Transplant Registry; CI = confidence intervals; HHD = home hemodialysis; HR = hazard ratio; ICHD = in-centre hemodialysis; NR = not reported; PD = peritoneal dialysis; USRDS = United State Renal Data System.

In three of four studies, patients receiving HHD had lower hazard or risk of technique failure compared with PD (Table 9).[65,66,70] Patients were more likely to switch from PD to HHD than from HHD to PD, 20% versus 2%[67] and 25% versus 1%.[70]

Question 3

Comparison of hemodialysis prescriptions versus each other

Survival

SYSTEMATIC REVIEW RESULTS

Neither SR compared prescriptions for HHD directly with each other (e.g., nocturnal home dialysis or short-daily dialysis).[4,38] Ishani et al. 2015 included a subsection comparing separate modalities to ICHD, for which the results were inconclusive.[38]

PRIMARY STUDY EVIDENCE RESULTS

One RCT[44,45] and one non-randomized study were found that compared prescriptions, and one study that allowed an indirect comparison. Data are insufficient to determine whether one prescription is preferable to another.

During a 12-month RCT[44,45] that compared nocturnal HHD with conventional HHD (described above in the quality of life section), two patients in the nocturnal HHD group and one in the conventional HHD group died, for a calculated RR 1.87 (95% CI, 0.18 to 19.83). The primary reported end point was a composite of death and LV mass, and an HR was not calculated. In long-term follow-up to 3.7 years, 14/45 (31.1%) of nocturnal HHD versus 5/42 (11.9%) conventional HHD patients died, RR 3.88 (95% CI, 1.27 to 11.79).[45] This was an as-treated analysis that included changes in prescription and modality as clinically indicated.

A non-randomized study[54] of 191 patients that compared nocturnal HHD with short-daily HHD showed fewer deaths in the nocturnal HHD group over four years of follow-up, 12.3% versus 16%, respectively. In this case, the dialysis frequencies were similar (5.5 and 5.7 per week), but the duration for nocturnal HHD was longer than for short-daily HHD. In univariate dialysis, nocturnal HHD was associated with better survival. In multivariate analysis, in a model that also included weekly standard Kt/V (defined as the product of the urea clearance and the duration of the dialysis session normalized to the volume of distribution of urea plus residual renal function), there was no association of dialysis prescription with survival.

As described in the results for Question 1, Marshall et al. 2016[64] included comparisons of quasi-intensive HHD (three to five times per week, greater than six hours per session) and intensive HHD (more than five times per week, any

duration) with conventional HHD, within the same cohort and model. Both produced lower hazard of mortality than conventional HHD, with similar estimates and overlapping CIs (Table 3 and Table 4). Two additional studies reported side-by-side comparisons of prescriptions, but with individually matched subsets of a third control population that differed at baseline. As these studies did not include a direct comparison between prescriptions or allow an indirect comparison through a common comparator group, the results are not reported here.

Hospitalization

PRIMARY STUDY EVIDENCE RESULTS

In the RCT, comparisons for all-cause hospitalization; and hospitalization for cardiovascular events, infections, and access did not show a significant difference between nocturnal HHD and conventional HHD, with the caveat that numbers of events were small and CIs were broad.[45] For all-cause hospitalization, HR 1.42 (95% CI, 0.69 to 2.90).[45]

Technique failure / switching between modalities and transplant

PRIMARY STUDY EVIDENCE RESULTS

Lockridge et al. 2012[54] reported no significant difference between nocturnal HHD and short-daily HHD for technique failure 0.56 (95% CI, 0.27 to 1.14), where technique failure was defined as returning to ICHD.

In the RCT,[45] more patients who received nocturnal HHD underwent transplant than those who received conventional HHD, 11.1% compared with 4.8%.

Patient depression and anxiety

In the RCT described above, there was no significant difference in adjusted mean difference at 12 months between nocturnal HHD and conventional HHD for the Beck Depression Index (declined by 1.6 units [95% CI –4.9 to 1.7]).[46]

Question 4

Self-care ICHD versus traditional ICHD

No studies reported outcomes for Question 4.

Summary of clinical results

In our SR of the literature, no consistent difference in the primary outcome of quality of life was found between HHD and ICHD or PD and ICHD. Quality of life studies to date adjust for limited baseline covariates, use different standardized measures to determine quality of life, and measure quality of life at differing time points.

A series of secondary outcomes were examined. When comparing HHD with ICHD; overall, the evidence suggests that HHD may offer a potential survival benefit, but does not differ in any other secondary outcome compared with ICHD. Given the non-randomized nature of most of the evidence, these results may represent patients who are selected as being appropriate for the intervention, and who are in a health system that supports it. Older patients may benefit less from HHD as compared with ICHD, but patients with diabetes and other comorbidities have similar survival on both modalities. Evidence for a potential interaction between race and dialysis modality is conflicting and evidence on a potential interaction between sex and dialysis modality is lacking, although HHD patients tend to be younger and male. However, these findings likely reflect residual confounding, as the majority of studies are non-randomized, and may be due to underlying differences in the characteristics in patients who receive HHD. Hospitalization risk did not differ between HHD and ICHD, and adverse event information is relatively limited. Patients are more likely to transfer from HHD to ICHD, as opposed to the reverse, which is not unexpected, since patients who fail a home-based treatment typically default to in-centre treatment.

When comparing PD to ICHD, one registry study based in Australia and New Zealand suggested a possible survival advantage for PD over ICHD in the first two years of dialysis, while a second, which excluded patients with short survival, does not. For longer-term survival, results for PD were mixed: for studies in Canadian settings, patients showed no difference in mortality, or lower mortality for PD; while studies in other settings vary, with some showing poorer results. Experience of clinical staff with the interventions and clinical practice regarding selection and management of patients varied widely across health care systems, and will affect generalizability. Survival for elderly patients and patients with diabetes or cardiovascular disease tended to be poorer for PD as compared with ICHD, and results on sex and race interactions with these dialysis modalities gave variable results. More patients transfered from PD to ICHD than in the reverse, which is to be expected, again because by default people who fail a home-based treatment typically transfer to in-centre treatment. Overall, the evidence suggests that for the appropriately selected, motivated patient in a supportive setting, PD is an appropriate dialysis modality in comparison with ICHD.

Few studies compared HHD with PD. Those that did, found equivalent or lower mortality for patients treated with HHD, although once again patients were self-selected and residual confounding cannot be excluded. There were no subgroup data.

There is no definitive evidence as to which HHD prescription (i.e., conventional, nocturnal, short daily) might be preferable, either overall or for a subset of patients. The results suggest that more intensive dialysis may lead to better survival, based on a small subset of patients being selected for the intervention. No studies were identified that compared self-care with assisted HD, either in the home or in-centre.

Economic Evaluation

This section addressed the following Research Question:

Research question 5: What is the cost-effectiveness of different dialysis modalities across different delivery settings for the treatment of ESKD in Canada?

Review of economic studies

A review of the literature was conducted that identified numerous economic evaluations and costing studies of various dialysis modalities in Canada. Many of the more recent studies focused on assessing the cost-effectiveness of frequent HHD, based on largely single-centre or single-region experiences.[29,81,82] Other studies focused on costing of the various dialysis modalities, but did not integrate safety and effectiveness data.[83-85]

Existing models and costing studies did not answer the research question posed in this HTA, as not all dialysis modalities of interest were included (particularly PD and assisted PD); a systematic approach to quantify all potential benefits and harms of the various modalities was not conducted; many studies were region-specific and generalizability to all regions in Canada was unclear; and, region-specific studies may not have accounted for contextual issues that may have had an impact on results, such as providing dialysis in remote and rural areas, or considering patient-borne costs.

However, many of the identified economic evaluations and costing studies provided data that were incorporated into this economic analysis, including key parameters on resource utilization or probabilities from the Canadian perspective. These data were used either in the reference case or assessed in sensitivity analyses. The studies that informed this economic evaluation are described in more detail in later sections of the report.

Primary economic evaluation

Methods

The objective of this economic evaluation was to determine the incremental cost-effectiveness of alternate dialysis modalities in patients with ESKD in Canada.

This analysis was conducted according a protocol developed a priori.[33]

Target population

In the reference case, it was assumed that the patient population was incident dialysis outpatients (i.e., initiating dialysis treatment for ESKD for the first time) from Canada, with characteristics based on data from the Canadian Organ Replacement Registry (CORR). The reference case considers a cohort with an average age of 55. In sensitivity analysis, an older cohort with an average age of 65 was examined; prevalent patients (i.e., on dialysis > 1 year) were also considered. It was assumed that, for every analysis, the patients in the cohort were a subset of all dialysis patient comprised only of those eligible for all modality types considered.

Not all patients with ESKD are eligible or suitable for all dialysis modalities. Clear-cut eligibility and suitability criteria for alternate dialysis modalities are not clearly defined and may differ by setting, jurisdiction, and practitioner bias or preference. As such the “eligible” patients in the cohort examined were not characterized further due to lack of data.

While subgroups of patients (where differences in efficacy and/or safety among the various dialysis modality subtypes identified in the clinical review) were planned, none were examined given the lack of clinical evidence on subgroup effects.

Setting

Dialysis for ESKD is provided through provincial kidney programs in Canada. Provision of chronic dialysis is complex, as it is provided to a large number of patients and a variety of settings including hospital or centre-based care (i.e., ICHD), as well as home-based therapy (i.e., PD and HHD). Each setting requires unique ongoing nursing, technical, physician, and clinic support. A description of the various types of dialysis modalities and how they are provided is discussed in Table 1. The setting for this analysis is that of renal programs in Canada, including consideration of provision of dialysis in remote and rural regions in sensitivity analyses.

Comparators

HD and PD are the two primary dialysis modalities, and each modality has alternate methods of delivery and can be provided in different settings. HD includes a range of prescriptions including conventional, short daily, and frequent nocturnal; while PD includes CAPD and APD although most studies combine these two prescriptions. The location in which it is performed (in centre or home for HD) (Table 10) and differences in how these modalities are delivered were also considered (e.g., self-care, assisted by a health care professional, or assisted by a family member or informal caregiver).

The suitable comparators in the economic analysis are dependent on the target population and the dialysis setting. Not all patients with ESKD are eligible for all modalities, and only a few modalities may be relevant from a patient and program decision-making perspective, depending on the scenario. For example, in jurisdictions where there is low use of home-based therapy (PD or HHD), comparison between ICHD versus PD or HHD may be relevant. A comparison between HHD and PD may be relevant for patients considering a home-based therapy. Comparison of assisted PD versus ICHD may be relevant if this group of patients are unable to do PD at home without support (and would subsequently default to ICHD). Specific comparisons considered in the economic model are shown in Table 10. Comparisons conducted in this analysis were limited by the availability of direct comparative data on efficacy, safety, and to some extent cost. Many clinical and cost studies considered only few of the modalities of interest to this review. Using data from different studies for major parameters (for example, annual cost of dialysis) may introduce bias, as it assumes that data from different sources can be reliably "combined," which may not be valid (for example, wage rates at settings may differ, making indirect comparison invalid). As such, this analysis attempted to use data within a study, but not among studies; as such, not all comparators may be present in all analyses.

Table 10: Economic Review Modality Comparisons

Comparison	Modalities Considered							
	CAPD or APD	CAPD or APD Home Assisted	ICHD Short Daily	ICHD NHD	ICHD Cv	HCHD Short Daily	HHD Nocturnal	HHD Cv
1. All Modalities[a]	X	X	X	X	X	X	X	X
2. PD vs. ICHD	X				X			
3. HHD					X	X	X	X
4. Home Dialysis	X					X	X	X
5. PD Assist		X			X			

APD = automated peritoneal dialysis; CAPD = continuous ambulatory peritoneal dialysis; Cv = conventional; PD = peritoneal dialysis; ICHD = in-centre hemodialysis; HHD = home hemodialysis; HCHD = home conventional hemodialysis; NHD = nocturnal hemodialysis; NHHD = nocturnal home hemodialysis.
[a] Anchored to comparison with conventional ICHD.

Study design

As alternate treatment strategies for ESKD may impact both quality of life as well as survival, a cost-utility analysis was intended, where health outcomes were quantified using quality-adjusted life-years (QALYs). The incremental costs and QALYs of alternate treatment strategies were determined.

However, high-quality data from RCTs on relative safety, efficacy, and quality of life were not available for many modalities and comparisons, and other data did not offer compelling evidence that differences exist. As such, the reference-case analyses reflect no difference in QALYs among modalities, synonymous to a cost-minimization analysis. In sensitivity analysis, cost-utility analyses were conducted based on the treatment effects reported from the observational studies identified in the clinical review.

Study perspective

The perspective used was that of a Canadian health care payer, although a societal perspective was also examined to account for patient- and caregiver-borne costs (e.g., travel costs for ICHD, power and water costs for HHD, etc.) where data were available.

Time horizon and discounting

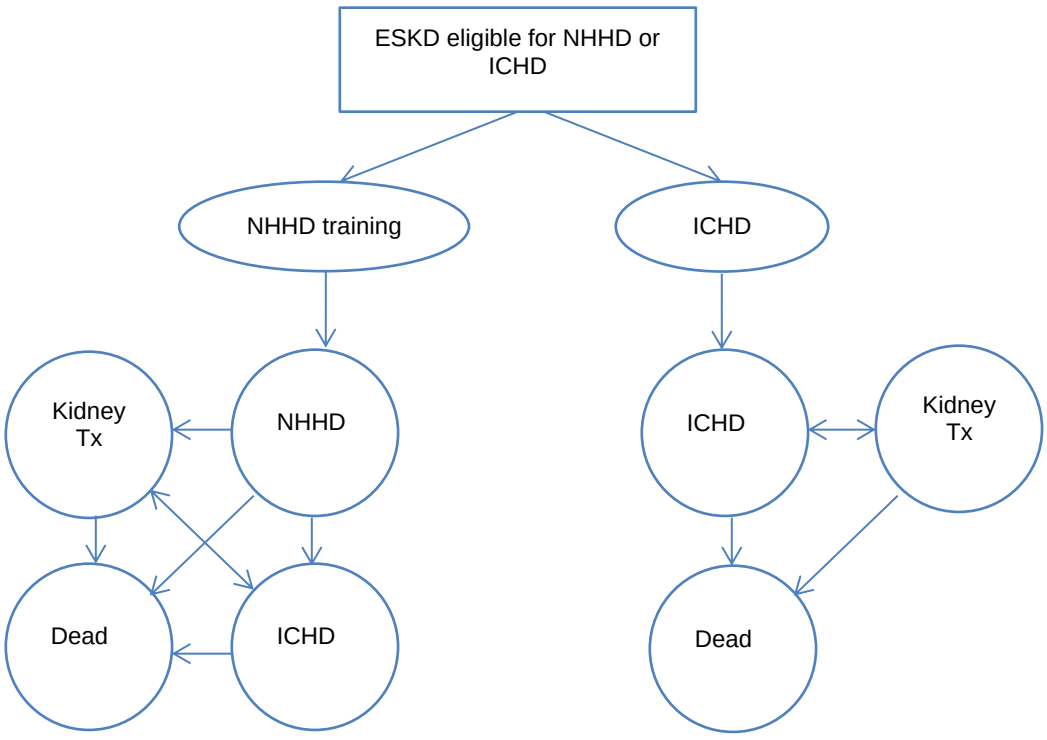
As ESKD is a chronic condition and treatment with dialysis will impact both short- and long-term morbidity and mortality, a lifetime horizon with annual cycles was used. Discounting for both costs and outcomes was at 5% per year with alternate values tested in sensitivity analyses (i.e., 0%, 1.5%, and 3.0%).

Model and health states

The structure of the Markov cohort model and health states were informed by review and adaptation of previously published Canadian economic evaluations that have examined dialysis modalities for ESKD,[29,86] and modified to include important clinical outcomes identified in the clinical review.

Patients started in the model as patients requiring dialysis with options of alternate dialysis modalities. For modalities that require training (such as PD or HHD), this training and its impact (i.e., resource use) was included in the first cycle. While being treated with a dialysis modality, patients may become hospitalized or have complications with their dialysis access. Patients may transition to the health state of kidney transplant, death, or may experience modality failure. It was assumed that patients experiencing modality failure would default to conventional ICHD, and may experience health care resource use when they transition. Patients on home-based therapies also had a probability of requiring retraining every year. An example of a model structure for ICHD and nocturnal HHD is provided in Figure 1.

Figure 1: Outline of Model Structure and Health States (Example in Which Nocturnal HHD Is Compared With Conventional ICHD — Figure Adapted From Previous Publication)[29,86]



ESKD = end-stage kidney disease; ICHD = in-centre hemodialysis; NHHD = nocturnal home hemodialysis; tx = treatment.

Baseline probabilities

Baseline probabilities were obtained from sources reflective of the Canadian ESKD population. Where possible, data from CORR were used. This represents a registry that captures and publishes data on the characteristics and the outcomes of Canadian ESKD patients (Table 11).[2,6,29,87]

The five-year survival of patients with ESKD on dialysis was reported by CORR (reported by age and diabetes status).[87] As the risk of mortality was generally greater in the first year of dialysis (for incident patients), but relatively stable in subsequent years, the mortality risk in the fifth year was extrapolated over a lifetime time horizon; age-associated increases in mortality was included using Canadian life table.[88] Additional details on calculating mortality are provided in Appendix 12. The annual probability of receiving a kidney transplant, transplant failure and return to dialysis, as well as the probability of death with a renal transplant was also obtained from CORR data.[2] The annual probability of complications requiring hospitalization (by cause) was obtained from a published secondary analysis of CORR data.[89] Data published on technique failure (HHD and PD) from Canadian cohorts was identified through focused literature searches.[6,29,90]

Table 11: Baseline Probabilities (Annual)

Variable Description	Base Estimate	Lower 95% CI/min	Upper 95% CI/max	Probability Distribution	Source
Probability of death on dialysis	1st year: 0.161 2nd year: 0.0998 3rd year: 0.0933 4th year:0.0900 5th year: 0.0813	NA	NA	Beta (1st year: 847/4422) (2nd year: 526/4743) (3rd year: 492/4777) (4th year: 474/4795) (5th year: 428/4841)	CORR[87] and Canadian lifetable[88]
Proportion of transplant	0.0548	NA	NA	Beta (1307/22556)	CORR[2]
Probability of transplant failure and return to dialysis	0.0171	NA	NA	Beta (294/171166)	CORR[2]
Probability of death after transplant	1st year: 0.061 0.03 afterwards	NA	NA	Beta (1121/16696) (535/17282)	CORR[2]
Rates of admission[a]	1.35 per person-year	0.667[a,b]	NA	Poisson (1.35)	Lafrance et al., 2014[89] Suri et al.[70]
Rates of admission (CV-related)[a]	0.35 per person-year	NA	NA	Poisson (0.35)	Lafrance et al., 2014[89]
Rates of admission (infection-related)[a]	0.20 per person-year [b]	NA	NA	Poisson (0.20)	Lafrance et al., 2014[89]
Probability of technique failure HHD	0.076	0.154[c]	NA	Beta (4/23 @yr2)	Klarenbach et al., 2014[29] Suri et al.[70]
Probability of technique failure PD	0.178	0.443[d]	NA	Beta (45/208)	Chui et al., 2013[6] Suri et al.[70]
Days of retraining (per person-year) PD SDHHD NHHD HHD	0.31 3.56 3.56 3.56	NA	NA	Poisson (0.31, 3.56)	ON renal network[91]

CV = cardiovascular; HHD = home hemodialysis; NHHD = nocturnal home hemodialysis; NA = not applicable; ON = Ontario; PD = peritoneal dialysis; SA = sensitivity analysis; SDHHD = short-daily home hemodialysis.
[a] Converted to annual probability in the model.
[b] Based on CORR data.
[c] Converted a probability of 1.2 years to annual probability in SA.
[d] Converted a probability of 1.4 years to annual probability in SA.

Quality of life

The baseline utility values for patients on PD and HD were obtained using the EQ-5D-3L instrument in dialysis patients in Alberta (Table 12).[55] Utility weights for patients with a kidney transplant were obtained from a study reporting on quality of life using a time trade-off instrument.[92]

Table 12: Utility Values for Health States

Variable Description	Base Estimate	Probability Distribution	Reference
Dialysis patients[a]			
< 65 years	0.639 (95% CI, 0.45 to 0.7)	Normal	Manns et al., 2003[55]
65 years and up	0.572 (95% CI, 0.55 to 0.8)	Normal	Manns et al., 2003[55]
Transplant patients	0.816	–	Laupacis et al., 1996[92]

[a] Same for all modalities as no evidence of difference in QoL among modalities.

Relative efficacy and safety

The clinical review found a paucity of high-quality (well conducted RCTs) studies to inform relative efficacy and safety. The few RCTs identified from the clinical review were small, and did not all assess relevant outcomes across all treatment strategies. While several observational and quasi-experimental studies deemed to be of adequate quality were identified, concerns remained that non-random selection of modality is likely to be associated with unmeasured or incompletely captured confounders. Health behaviours may impact both modality selection and the outcomes of interest — for example, high health literacy and strong social supports may be associated with the selection of a home-based therapy which are likely also associated with better clinical outcomes — but these are challenging to control for, if considered at all. A priori, statistically significant point and variance estimates from RCTs would be used when available, but in their absence, the relative difference in outcomes in the reference case were set to unity. As such, in the reference case, relative efficacy and safety, was set to unity for all comparisons based on the findings of the clinical review. In scenario analyses, the point and variance estimates from adequate-quality observational and quasi-experimental studies were assessed (Table 39 in Appendix 13).

Clinical data from non-randomized studies suggest that there may be a difference in the risk of death between PD and ICHD that changes over time (Table 40 in Appendix 13).[64,79] This was incorporated in the scenario analysis comparing PD and ICHD; the study that used Canadian data were preferentially used,[79] although other studies outcomes were considered. Of note, these values were also used to inform the probability distribution in the reference case probabilistic sensitivity analysis.

As outlined in the clinical review, evidence of differences in QoL by dialysis modality was of poor quality, and no consistent signals were found. As such, no difference in QoL by modality was assumed in the reference case. A clinically important but not statistically significant difference in utility for frequent nocturnal HHD compared with conventional ICHD from a RCT[43] was tested in sensitivity analysis (i.e., applied to all home-based modalities).

Resource use and cost

A focused literature search supplemented by expert opinion was used to identify estimates of resource use and cost for each of the dialysis modalities in Canada. Preference was given to recent data and analyses that considered all dialysis modalities and prescriptions. Numerous sources were found that varied in quality and approach –details of studies considered are shown in Table 13 (additional information on subcategories of cost in each study can be found in Appendix 14).

A recently published source that included all dialysis modalities and prescriptions of interest to this review was the 2016/2017 Chronic Kidney Disease Amalgamated Funding Guide, [91] published by the Ontario Renal Network (ORN). While this informs remuneration, it is based on costing data (informed by direct costs, small micro-costing studies, and expert opinion in some components) and was deemed to be a reasonable source to inform absolute and relative costs of dialysis modalities. Further, it included data for all dialysis modalities under consideration (unlike all other sources), which facilitated comparisons among multiple dialysis treatment regimens.

Other Canadian studies were identified (Table 13), and all used the most common dialysis modality in Canada of conventional ICHD as a comparator. Where possible, only the cost of dialysis provision was collected while other unrelated costs (such as hospitalization) were excluded, although this was not feasible for every study. Within each study, conventional ICHD was used as an anchor to estimate incremental costs of each modality (both absolute costs as well as a ratio compared with conventional ICHD). Only one Canadian source reported on the cost of assisted home dialysis (ORN)[91]; non-Canadian sources were considered to inform sensitivity analysis. All costs were reported in 2015 Canadian dollars, inflated using the consumer price index[93] for inflation and currency conversion[94] (from the Bank of Canada, using the average value of exchange rates in the year of the reported currency) where required.

Additional costs of training are required for initiation of PD and HHD, as well as home renovations and setup for HHD. Many of the studies reporting on the operating costs of HHD also reported on resource use and the cost of training and initial home setup. While data from ORN were used in the reference case, these other sources and estimates were considered in sensitivity analyses (Table 15).

The resource use and cost of providing ICHD may differ in different regions, particularly in rural regions and remote settings. The cost to treat a patient receiving dialysis may be much greater in rural and remote settings compared with urban areas due to various factors, including economies of scale, human resource availability and cost, capital costs, among others. A recent analysis in Manitoba estimated the cost of providing ICHD in rural and remote satellite dialysis units.[95] These data were adapted (inflated to 2015 Canadian dollars, using cost categories that are consistent throughout); the ratio of the costs of treating a patient on dialysis in an remote versus urban setting was determined (ratios ranged from 1.59 to 2.53) as shown in Table 14.

Table 13: Annual Dialysis Cost (2015 Canadian Dollars; Absolute Cost, Incremental Cost, and Cost Ratio[a] Versus ICHD Within Each Referenced in Parentheses)

Source	Methods	Notes	CAPD or APD Home	CAPD or APD Home Assisted	HD (In centre/ Satellite) Short Daily	HD (In centre/ Satellite) Nocturnal	HD (In centre/ Satellite) Conventional (anchor)	HD (Home) Short Daily Self	HD (Home) Nocturnal Self	HD (Home) Conventional Self
ON reimburse-ment[91]	2016/2017 Chronic Kidney Disease Amalgamated Funding Guide	Based on dialysis bundling amounts; **Assumed includes dialysis procedure and dialysis-related outpatient costs.**	36,801[b] (Δ –13,295) (cost ratio 0.73)	57,368 (Δ 7,292) (cost ratio 1.15)	83,467 (Δ 33,391) (cost ratio 1.67)	83,467 (Δ 33,391) (cost ratio 1.67)	50,076	36,661 (Δ –13,415) (cost ratio 0.73)	36,661 (Δ –13,415) (cost ratio 0.73)	23,825 (Δ –26,251) (cost ratio 0.48
Kroeker et al., 2003[81]	Operating cost study, 18-month in London, ON	Includes Treatment supplies, consults, ER, lab tests, machine, water, RN, other labour, biomedical engineering, non-treatment supplies; **excludes hospitalizations, pharmaceuticals, physician fees.**					59,613	55,232 (Δ –4,382) (cost ratio 0.93)	57,274 (Δ –2,339) (cost ratio 0.96)	
Komenda et al., 2012[83]	Costing model on published analyses	Includes machine costs, pump, consumables and peripheral costs, total allied health care costs, medical equipment, dialysis-related lab costs, costs of in-centre runs, facility costs; **excludes renal medication, dialysis water and electricity costs, patient evaluation/ recruitment & training costs, home preparation, travel costs to and from dialysis, and hospitalization costs.**					35,086 (based on costing model)	34,055 (Δ –1,031) (cost ratio 0.97)	34,055 (Δ –1,031) (cost ratio 0.97)	25,577 (Δ –9,509) (cost ratio 0.73)
Klarenbach et al., 2014[29]	CEA with RCT micro-costing data in Alberta	Includes nursing, water, dialysis supplies and machine, overhead					75,019		60,016 (Δ –15,003) (cost ratio 0.80)	49,262 (Δ –25,757) (cost ratio 0.66)
Wong, 2014 et al.,[14]	Micro-costing in Northern Alberta	Includes materials, staff and utilities; excludes HD machine maintenance, patient-borne costs, and physician billing				25,576 (Δ 9,922) (cost ratio 1.63)	Reference*			

Source	Methods	Notes	CAPD or APD Home	CAPD or APD Home Assisted	HD (In centre/ Satellite) Short Daily	HD (In centre/ Satellite) Nocturnal	HD (In centre/ Satellite) Conventional (anchor)	HD (Home) Short Daily Self	HD (Home) Nocturnal Self	HD (Home) Conventional Self
Chui et al., 2012[6]	Micro-costing in Alberta that characterize the economic effect of initial dialysis modality choice, subsequent early modality switching, and the impact of PD technique failure	Includes dialysis costs, inpatient costs, medication costs, and physician fees; cannot exclude as subcategories were not reported.	36,874 (Δ –59,679) (cost ratio 0.38)				96,553 (Includes IP, meds, and physician fees)			
McFarlane et al., 2002[85]	A prospective one-year descriptive costing study in Toronto	Includes staff, direct HD materials, overhead and support, admits/procedures, depreciation; excludes drug, physician fees, lab tests/imaging					57,407		52,524 (Δ –4,882) (cost ratio 0.91)	
Lee et al., 2002[84]	A prospective one-year descriptive costing study of 166 patients in Alberta	Includes outpatient dialysis costs only in this table	32,015 (Δ –24,803) (cost ratio0.56)				56,818			33,666 (Δ –23,152) (cost ratio 0.59)
Laplante et al., 2013[13] (Non-Canadian)	CEA with costing data taken from the Dutch official tariffs	No details on what cost categories were included.		122,531 (Δ 34,650) (cost ratio 1.39)			87,882			
Couillerot-Peyrondet et al., 2016[96] (Non-Canadian)	1-year retrospective study using two French national administrative databases	Includes RRT, nurse fees, lab expenditure, medical devices and health auxiliary; excludes other hospitalization, transport, pharmaceutical expenditure, personal autonomy allowances, doctor fees and other	55,208 (Δ –36,918) (cost ratio 0.60)	86,404 (Δ –5,922) 0.94)			92,326			60,996 (Δ –31,330) (cost ratio 0.66)

CEA = cost-effectiveness analysis; HD = hemodialysis; ON = Ontario; RRT = renal replacement therapy. Δ = incremental cost (compared with "anchor" of ICHD).
[a]Cost ratio is ratio of cost of modality vs. ICHD.

[b]Weighted average of APD (0.73) and CAPD (0.27) based on Ontario renal network data.

*Incremental instead of absolute costs were presented in the paper.
Note: To avoid double counting, this table only includes costs related to the dialysis runs (staff, supplies, machines, water, overhead) and outpatient costs (labs, clinics, ER).

Table 14: Rural and Remote Satellite Hemodialysis Unit Cost (2015 Canadian Dollars, Absolute Cost, Incremental Cost and Cost Ratio Versus ICHD in Bracket)

Source	Methods	Notes	Facility HD (anchor)	Satellite Unit Low[a]	Satellite Unit High[a]
Ferguson et al., 2015[95]	Cost model based on data derived from 16 of Manitoba, Canada's remote satellite units	Includes machine costs, consumables and peripheral costs, human resource expenses (salaries/wage and benefits), medical equipment, dialysis-related lab costs, facility costs, capital costs, return to tertiary care centre expenses, costs of using dialysis facility in tertiary care centre, nephrologist and physician costs (separate in the model); excludes renal medication, dialysis transportation expenses, and hospitalization-related expenses	Machine: 1,599 Consumables: 6,167 Medical Equipment: 436	Machine: 2,741 Consumables: 6,786 Medical Equipment: 699	Machine: 4,798 Consumables: 6,786 Medical Equipment: 2,411
			HR wage: 13,794 HR benefits: 0	HR wage: 20,405 HR benefits: 3,674	HR wage: 35,166 HR benefits: 6,333
			Facility: 11,891 Capital: 0	Facility: 11,891 Capital: 5,722	Facility: 11,891 Capital: 11,832
			Return to Tertiary care: 0 Cost of using Tertiary care: 0	Return to Tertiary care: 685 Cost of using Tertiary care: 2,035	Return to Tertiary care: 2,150 Cost of using Tertiary care: 6,364
			Dialysis Cost Total: 35,086	Dialysis Cost Total: 55,837 (Δ 20,751) (cost ratio **1.59**)	Dialysis Cost Total: 88,929 (Δ 53,843) (cost ratio **2.53**)
			Physician fees: 8,033	Physician fees: 12,142 (Δ 4,109) (cost ratio **1.51**)	Physician fees: 12,142 (Δ 4,109) (cost ratio **1.51**)

HD = hemodialysis; HR = hazard ratio; ICHD = in-centre hemodialysis.
[a] Satellite unit low referred to "Unit N" while satellite unit high referred to "Unit J" in the Ferguson et al. publication.[95]

Table 15: Training and Setup Costs (Specific to HD Modalities) (2015 C$)

Source	Methods	Notes	CAPD or APD Home	CAPD or APD Home Assisted	HD (Home) Short Daily Self	HD (Home) Nocturnal Self	HD (Home) Conventional Self
ON reimbursement[91]	2016/17 Chronic Kidney Disease Amalgamated Funding Guide	Based on dialysis bundling amounts	Training: 2,374[a]	Training: 2,374[a]	Training: 11,400 Installation: 3,000 Total: 14,400	Training: 11,400 Installation: 3,000 Total: 14,400	Training: 11,400 Installation: 3,000 Total: 14,400
Komenda 2012[83]	Costing model on published analyses		NA	NA	Training:7,680 Installation: 2,798 Total: 10,478	Training: 7,680 Installation: 2,798 Total: 10,478	Training: 7,680 Installation: 2,798 Total: 10,478
Klarenbach 2014[29]	CEA with RCT micro-costing data in Alberta		NA	NA	NA	Training: 18,538 Installation: 616 Total: 19,154	Training: 9,269 Installation: 616 Total: 9,885

APD = automated peritoneal dialysis; CAPD = continuous ambulatory peritoneal dialysis; CEA = cost-effectiveness analysis; HE = hemodialysis; NA = not applicable; RCT = randomized controlled trial.
[a] Weighted average of APD and CAPD based on Ontario renal network data.

Additional costs inputs to the model are described in Appendix 15. A proportion of patients require retraining every year; frequency per year and cost data were obtained from ORN data[91]). In sensitivity analyses that used other sources of cost, it was assumed that retraining costs were included in the ongoing cost of modality provision.

Data on medication costs were obtained from published micro-costing studies; however not all modalities were compared. Further, there is variability in the estimates of medication cost and it is not clearly established that costs differ by modality (for example, less use of anti-hypertensive agent and phosphate binders in nocturnal HHD may be offset by the need for more iron; however, iron costs may differ given changes in practice surrounding the use of intraveous versus orally taken iron). As such, medication costs were set to unity in the reference case and a range was tested in sensitivity analyses (Table 42 in Appendix 15).

An annual cost for vascular access care for HD patients was obtained from a Canadian study and applied to all comparisons where there may be differences in HD vascular access complications between HD modalities.[97] Patients that experience modality failure may require hospitalization and incur additional costs; the cost of modality failure was obtained from a Canadian study enumerating non–dialysis costs of PD failure (to ICHD).[6] In the reference case, these costs were only applied to PD failure, but the impact of a similar cost for other home-based modalities was assessed in a sensitivity analysis (Table 42 in Appendix 15).

The unit cost for hospitalization episodes, identified as clinically important and relevant to dialysis (i.e., infection, cardiovascular, and all cause), was obtained using CIHI data using the most relevant Case Mix Grouper codes (Appendix 15). As patients with ESKD may have an increased complexity, the model's estimated annual hospitalization cost was compared with data of annual hospitalization cost (using CIHI CMG + methodology) for dialysis patients in Alberta to validate assumptions (Appendix 15).

Patient-borne resource use and costs were also identified, although much less information was available and not all modalities were studied (Table 16). In many jurisdictions, patients on HHD pay the increased water and electricity charges, although an environmental scan produced by CADTH (*in progress*) identified that some dialysis programs reimburse these costs.[98] Further, there may be additional costs associated with training for home dialysis, as well as ongoing costs such as transportation costs to ICHD, and patient or caregiver productivity costs. In the reference case, these costs were not included given the model's primary perspective; a sensitivity analysis was conducted where utility costs are borne by the health care payer. As no information was available on patients receiving PD, patient and caregiver-borne costs (excluding utility costs) were assumed in sensitivity analyses. In addition, the reference case was re-examined from a societal perspective to explore the model findings when patient-borne costs were included.

Table 16: Indirect and Out-of-Pocket Costs (2015 Canadian Dollars)

Source	Methods	Notes	CAPD or APD Home	CAPD or APD Home Assisted	HD (In centre/ Satellite) Short Daily	HD (In centre/ Satellite) Nocturnal	HD (In centre/ Satellite) Conventional (anchor)	HD (Home) Short Daily Self	HD (Home) Nocturnal Self	HD (Home) Conven-tional Self
Klarenbach et al., 2014[29]	CEA with RCT micro-costing data in Alberta	Out-of-pocket costs include electrical bill, transportation, travel to dialysis, dialysis set up, and caregiver time.					Travel cost $2,410 Travel time cost $2,205 Setup time cost $315 Caregiver time cost $1,575 Training time cost $0 Loss Productivity $1,775 Total $8,279		Electricity $493 Travel cost $333 Travel time cost $315 Setup time cost $7,560 Caregiver time cost $3,780 Training time cost $2,874 Gain Productivity –$8,736 Total $6,619	
Kroeker et al., 2003[81]	Operating cost study, 18-month in London, ON						Water 933	Water 4,623	Water 5,253	
Komenda et al., 2012[83]	Costing model on published analyses						Travel cost $1,805	Water and elec-tricity $4,020	Water and electricity $4,020	Water and electricity $2,412
Nickel et al., 2014[99]	Simulations of 7 different home dialysis prescriptions with 5 hemodialysis machines and 5 reverse osmosis machines	Water and electricity costs						Water and elec-tricity $639	Water and electricity $998 (weighted average of 3.5 and 6 times per week)	Water and electricity $427

APD = automated peritoneal dialysis; CAPD = continuous ambulatory peritoneal dialysis; CEA = cost-effectiveness analysis; HD = hemodialysis; RCT = randomized controlled trial.

Sensitivity and scenario analysis

The ranges of plausible values for model parameters were tested in the model. Scenario analyses that considered point and variance estimates from non-RCTs of adequate quality identified in the clinical review were assessed. As the clinical data were often from pairwise comparisons only, these scenarios considered only the modalities compared in the clinical study (i.e., the assumption that indirect comparisons were valid was not made). Alternate estimates of incremental cost of the dialysis modalities were conducted (although this may not be an assessment of uncertainty, rather an assessment of the variability in the cost of provision). Further, the cost of ICHD in urban and remote settings was assessed. An analysis that considered a broader perspective, incorporating patient-borne and productivity costs, was also performed.

Probabilistic sensitivity analysis (PSA) was conducted, and distributions were informed using best available data. In the reference case PSA that considered all modalities, attempts were made to centre relative efficacy and safety around unity while using the range of relative efficacy and safety from non-RCT data inputs to inform the distributions. As such, a triangular distribution was used to define many parameters in order to reflect that the reference-case analysis assumed no treatment effect difference between comparators. Cost-effectiveness acceptability curves demonstrating the probability that a modality would be considered optimal at a given willingness-to-pay threshold were also performed.

Model validation

The model structure and data inputs were presented to two Canadian nephrologists to ensure that the model, parameters, and assumptions reflect clinical practice and the available body of literature (i.e., face validity). Internal validity was assessed through a peer review process to ensure the mathematical calculations were performed correctly and were consistent with the model specification.

Model assumptions

Additional model assumptions are listed in Table 17.

Table 17: Additional Model Assumptions

Treatment effects were based on randomized controlled trials with statistically significant results; otherwise, a RR = 1 was assumed between interventions.
Reference case: Incident Canadian ESKD patients initiating dialysis, mean age 55[86] (SA: prevalent Canadian ESKD patients cohort with average age 60).
The patient population in the model was comprised of patients who were eligible (medical, social, geographic) for **all** comparator modalities.
A patient could experience any event within a cycle regardless of their previous history; however patients that experienced modality failure did not return to any other modality other than conventional ICHD.
The relative efficacy and safety of treatments continued if patients remained on the same treatment modality.
The health state of treatment with renal transplantation was simplified and does not approach descriptive reality. However, there was no evidence available to suggest that the type of dialysis modality independently had an impact on the probability of transplantation or transplant-related events and outcomes. For simplicity, a more complex modelling of transplantation was not included.
It was assumed that each modality is a distinct treatment (with the exception of modality failure to ICHD), although in reality, over a lifetime, a patient may progress through several different modalities (e.g., PD to HHD to transplant to ICHD). There are no data suggesting differences in outcomes when a modality is used first or second, so this analysis avoids the complexity and uncertainty of modelling sequential therapies.
Modality failure occurs in in-home modalities only (nocturnal HHD, short-daily HHD, HHD, PD and assisted PD), and the modality switch is to ICHD. We assumed that patients on ICHD did not experience modality failure.
Quality of life on RRT does not change over time.
The cost of modality failure is applied to PD only in the reference case; this was applied to all home-based therapies in sensitivity analyses.
The cost of PD technique failure occurred only within the cycle when failure occurred.

Access-related costs related to HD were assumed to continue annually until patient transitioned to a non-HD modality or death.
Dialysis costs in the reference case were comprised of all resources required to provide the dialysis therapy only (excluding hospitalizations, medications, etc.)
The cost of building new infrastructure, such as a new hemodialysis unit, is not specifically captured in this analysis. While capital costs may be included in some cost estimates, their accuracy and completeness cannot be confirmed, further applicability to various setting are not available. Reference-case dialysis costs (ORN) are direct costs without overhead.

ESKD = end-stage kidney disease; HD = hemodialysis; HHD = home hemodialysis; ICHD = in-centre hemodialysis; PD = peritoneal dialysis; RR = relative risk; RRT = renal replacement therapy; SA = sensitivity analysis.

Results

1. All modalities

Results in a cohort of incident ESKD patients representative of the general Canadian population requiring dialysis and eligible for all dialysis modalities, are shown in Table 18. As the clinical review did not identify RCT data that demonstrated differences in efficacy or safety by modality, and no clearly identified differences in QoL were found, the expected QALYs for each strategy were identical. In this circumstance, the analysis reflects a cost-minimization analysis. The incremental costs of each modality were compared with ICHD, the most commonly used modality in Canada, and are shown in Table 19.

The lifetime cost of each modality ranges between $560,000 and $840,000, with the least costly strategy being conventional HHD. PD and frequent home dialysis (short-daily HHD and nocturnal HHD) were also less costly than conventional ICHD. Assisted PD (continuous) resulted in additional costs (~$33,000) compared with conventional ICHD, and short-daily ICHD and nocturnal ICHD were the mostly costly (Table 19).

Table 18: Reference Case (Deterministic) (RR = 1)

Strategy	Cost ($)	Incremental Cost ($)	QALYs	Incremental QALYs	ICUR ($/QALY)
HHD (Cv)	561,962	-reference-	5.45	-reference-	(Dominant)
PD	600,808	38,847	5.45	0	(Dominated – HHD(Cv) is less costly)
SDHHD	617,983	56,022	5.45	0	
NHHD	617,983	56,022	5.45	0	
ICHD (Cv)	637,101	75,139	5.45	0	
PD (assisted)	670,452	108,490	5.45	0	
SD ICHD	836,222	274,261	5.45	0	
Nocturnal ICHD	836,222	274,261	5.45	0	

Cv = conventional; HHD = home hemodialysis; ICHD = in-centre hemodialysis; ICUR = incremental cost-utility ratio; NHHD = nocturnal home hemodialysis; PD = peritoneal dialysis; SDHHD = short-daily home hemodialysis; SD ICHD = short-daily in-centre hemodialysis, QALY = quality-adjusted life-year; RR = relative risk.

Table 19: Reference Case (All Modalities) Anchored to ICHD (Conventional)

Strategy	Cost ($)	Incremental Cost ($)	QALYs	Incremental QALYs	ICUR ($/QALY)
ICHD (Cv)	**637,101**	**-reference-**	**5.45**	**-reference-**	**—**
HHD (Cv)	561,962	–75,139	5.45	0	(Dominant)
PD	600,808	–36,292	5.45	0	(Dominant)
SDHHD	617,983	–19,117	5.45	0	(Dominant)
NHHD	617,983	–19,117	5.45	0	(Dominant)
PD (assisted)	670,452	33,351	5.45	0	(Dominated–HHD(Cv) is less costly)
SD ICHD	836,222	199,122	5.45	0	
Nocturnal ICHD	836,222	199,122	5.45	0	

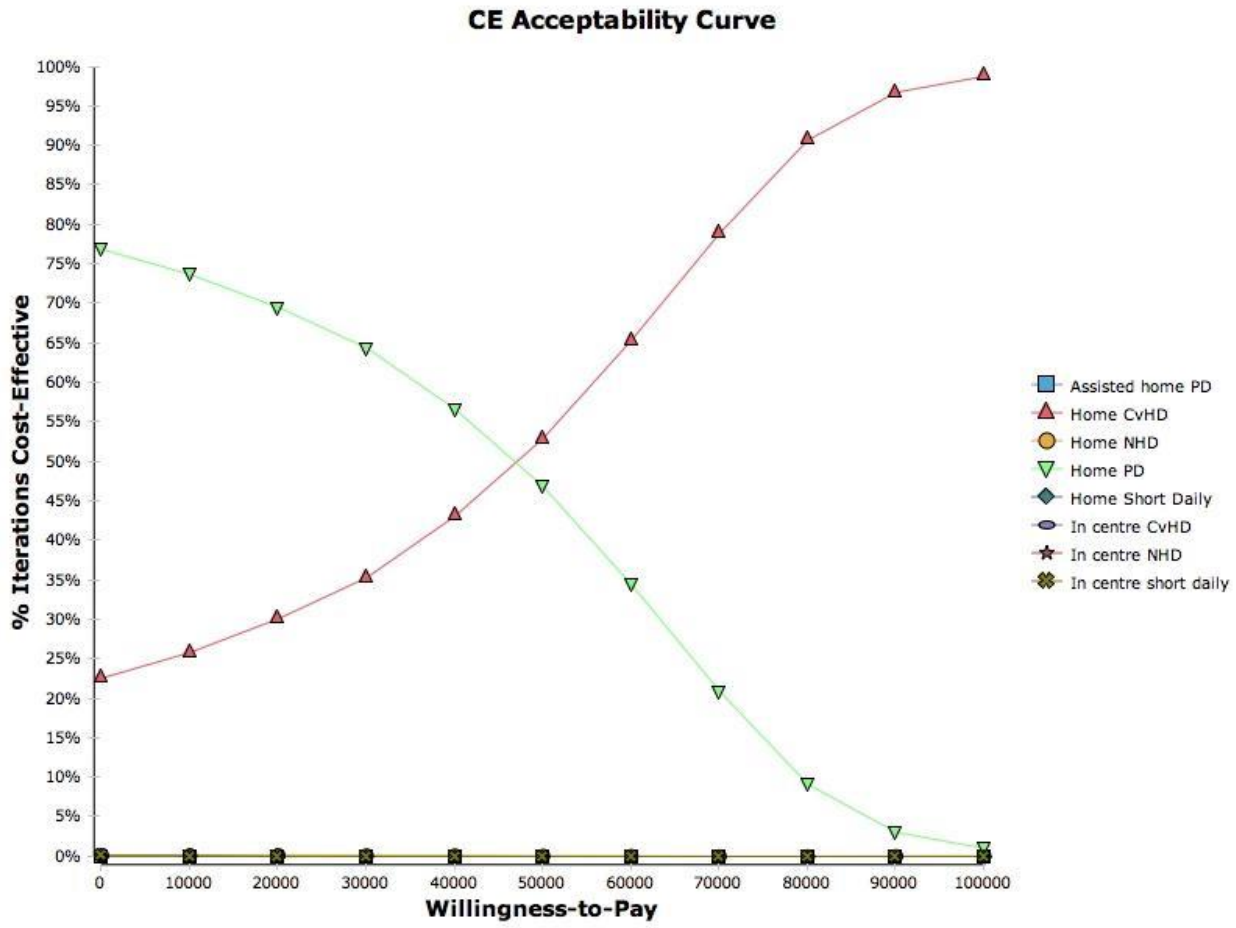
Cv = conventional; HHD = home hemodialysis; ICHD = in-centre hemodialysis; ICUR = incremental cost-utility ratio; NHHD = nocturnal home hemodialysis; PD = peritoneal dialysis; SDHHD = short-daily home hemodialysis; SD ICHD = in centre short-daily hemodialysis; QALY = quality-adjusted life-year.

Probabilistic analysis

The cost-effectiveness acceptability curve is shown for all modalities in Figure 2. Across all willingness-to-pay thresholds, PD and conventional HHD were the preferred modalities.[a] The probabilistic results should be interpreted with caution as no direct evidence exist comparing mortality between PD and conventional HHD, and the distributions may not reflect true differences. If the RR of death is removed, conventional HHD is preferred across all willingness-to-pay values. As such, the deterministic sensitivity analysis (SA) may be more relevant.

[a] The change in preference of PD versus conventional ICHD as willingness-to-pay values increase was a manifestation of using a range of values from clinical studies for the probability of death. The distribution included the 95% CI from included studies (hazard ratio of death of PD versus ICHD: 0.88 to 2.59); however, because of the triangular nature of this distribution, the median value from the 5,000 simulations was 1.52 (i.e., patients on PD has a RR of death that is 1.52 referenced to patients on ICHD). This explains why PD is less favoured than conventional HHD (the median hazard ratio of death for conventional HHD versus ICHD was 0.84) with higher willingness-to-pay thresholds as longer survival leads to greater QALYs gains, but also greater costs[100] (this is explained further in the PD versus conventional ICHD section).

Figure 2: Cost-Effectiveness Acceptability Curve With Triangular Distributions (Centred RR = 1)



CE = cost-effectiveness; CvHD = conventional hemodialysis; NHD = nocturnal hemodialysis; PD = peritoneal dialysis.

Sensitivity analyses

Time Horizon and Discounting: Over a range of discount rates and time horizons, the relative ordering of incremental costs remained the same with small differences observed (Appendix 16). Increasing the time horizon and decreasing the discount rate tended to increase absolute differences in costs.

Prevalent cohort: When prevalent patients were assessed, it had little impact on the results. (Appendix 17).

Older patient cohort: Consideration of an older cohort (average age of 65) had little impact on results (Appendix 16).

Scenario analyses

Alternate resource use and cost of dialysis: The reference case was based on costs data from Ontario. To explore the potential variation in costs that may occur in other jurisdictions and delivery models, sensitivity analyses were performed. Two approaches were taken to estimate the annual cost of dialysis provision: using the cost ratios from other identified studies, and applying it to the reference-case expected costs (from Ontario) (Table 20) and exploring the absolute costs from these studies (Table 21).

Both PD and conventional HHD were less costly compared with ICHD in all scenarios. The incremental annual cost of frequent HD, either short-daily HHD or nocturnal HHD, changed depending on the source of costs from either cost saving (–$11,000 to –$20,000) to more costly ($13,000 to $26,000) compared with ICHD.

As noted earlier in the methods, only the ORN was identified to have reported on the cost of assisted home dialysis in Canada. Consequently, non-Canadian studies were identified to explore the potential variability in the costs of assisted PD. Assisted PD delivered continuously was more costly than ICHD and all other home-based modalities in the reference case, although, if the relative costs from France were used, assisted PD would be cost saving compared with conventional ICHD. Further sensitivity analyses of assisted PD are conducted in subsequent sections.

There were very little data on the relative costs of alternate ICHD delivery (i.e., short-daily and nocturnal ICHD). The only alternate estimate in Canada for nocturnal ICHD came from a study by Wong et al.[101] in Northern Alberta. Adjusting the Ontario costs by the cost ratio from this study, the costs were similar to the reference case (incremental annual cost difference compared with conventional ICHD: $200,075 [reference case] versus $188,130 [estimates from Northern Alberta]).

Table 20: Annual Absolute and Incremental Costs of Each Dialysis Modality (Compared With Conventional ICHD) Using Cost Ratio Applied to the Reference-Case Costs

Source	Study Setting	CAPD or APD Home	CAPD or APD Home Assisted	HD (In Centre/ Satellite) Short Daily	HD (In centre/ Satellite) Nocturnal	HD (In centre/ Satellite) Conventional (Anchor: 50,076)	HD (Home) Short Daily Self	HD (Home) Nocturnal Self	HD (Home) Conven-tional Self
		(Cost Ratio) Incremental Cost							
ON reimbursement[91] (plus additional training and set up costs for home dialysis)	**Ontario**	**(0.73)** –37,125	**(1.15)** 34,098	**(1.67)** 200,075	**(1.67)** 200,075	(1)	**(0.73)** –19,578	**(0.73)** –19,578	**(0.48)** –74,216
Kroeker 2003[81]	London, ON					(1)	**(0.93)** 17,631	**(0.96)** 24,188	
Komenda 2012[83]	Manitoba					(1)	**(0.97)** 26,373	**(0.97)** 26,373	**(0.73)** –26,079
Klarenbach 2014[29]	Alberta					(1)		**(0.80)** –10,781	**(0.66)** –41,378
Wong 2014[14]	Northern Alberta				**(1.63)** 188,130	(1)			
Chui 2012[6]	Alberta	**(0.38)** –98,864				(1)			
McFarlane 2002[85]	Toronto					(1)		**(0.91)** 13,260	
Lee 2002[84]	Alberta	**(0.56)** –66,249				(1)			**(0.59)** –56,677
Laplante 2013[13] (Non-Canadian)	Netherlands		**(1.39)** 74,917			(1)			
Couillerot-Peyrondet 2016[96] (Non-Canadian)	France	**(0.60)** –59,235	**(0.94)** –1,619			(1)			**(0.66)** –34,876

APD = automated peritoneal dialysis; CAPD = continuous ambulatory peritoneal dialysis; HD = hemodialysis; ON = Ontario.

Table 21: Annual Cost of Dialysis Modalities (Actual Reported Costs) Compared With Conventional ICHD

Source	Study Setting	CAPD or APD Home	CAPD or APD Home Assisted	HD (In centre/ Satellite) Short Daily	HD (In centre/ Satellite) Nocturnal	HD (In centre/ Satellite) Conventional (anchor 50,076)	HD (Home) Short Daily Self	HD (Home) Nocturnal Self	HD (Home) Conven-tional Self
		Bolded = Annual Cost of Dialysis Provision; Unbolded = Incremental Expected cost (Compared With ICHD)							
ON reimbursement[91] (plus additional training and set up costs for home dialysis)	**Ontario**	**36,801** –36,292	**57,368** 33,351	**83,467** 199,122	**83,467** 199,122	**50,076**	**36,661** –19,117	**36,661** –19,117	**23,825** –75,139
Kroeker et al., 2003[81]	London, ON					**59,613**	**55,232** 16,204	**57,274** 25,116	
Komenda et al., 2012[83]	Manitoba					**35,086**	**34,055** 24,667	**34,055** 24,667	**25,577** –12,335
Klarenbach et al., 2014[29]	Alberta					**75,019**		**60,016** –26,288	**49,262** –73,223
McFarlane et al., 2002[85] (excludes retraining)	Toronto, Ontario					**57,407**		**52,524** 13,458	
Lee et al., 2002[84] (Exclude retraining)	Alberta	**32,015** –72,752				**56,818**			**33,666** –66,423
Laplante et al., 2013[13] (Non-Canadian)	Netherlands		**122,531** 142,556			**87,882**			
Couillerot-Peyrondet et al., 2016[96] (Non-Canadian)	France	**55,208** –99,282	**86,404** 6,673			**92,326**			**60,996** –93,200

APD = automated peritoneal dialysis; CAPD = continuous ambulatory peritoneal dialysis; HD = hemodialysis; ICHD = in-centre hemodialysis; ON = Ontario.

Settings (rural and remote ICHD): Provision of ICHD in rural and remote regions was associated with annual costs of dialysis provision that were estimated to be 1.6 to 2.5 times that of urban hemodialysis units (Table 14). When these costs are used for ICHD, the incremental cost of PD, assisted home PD, and all HHD modalities strategies were substantially lower than ICHD (Table 22).

Table 22: Sensitivity Analysis Comparing Home Modalities With Conventional ICHD in Remote and Rural Settings

Setting	CAPD or APD Home	CAPD or APD Home Assisted	HD (Home) Short Daily Self	HD (Home) Nocturnal Self	HD (Home) Conventional Self
	Incremental Annual Cost (Compared With ICHD)				
Urban facility HD (ratio =1), reference case (ICHD cost $55,076)	–36,292	33,351	–19,117	–19,117	–75,139
Remote facility: conventional ICHD low (ICHD dialysis ratio =1.59 and physician ratio =1.51)	–131,995	–62,352	–151,994	–151,994	–208,016
Remote facility: conventional ICHD high (ICHD dialysis ratio = 2.53 and physician ratio =1.51)	–271,592	–201,948	–345,616	–345,616	–401,638

APD = automated peritoneal dialysis; CAPD = continuous ambulatory peritoneal dialysis; HD = hemodialysis; ICHD = in-centre hemodialysis.
NOTE: Analysis based on data from Ferguson et al., 2015[95]

The reference case assumed that all patients in the cohort would be eligible for all modality types although, in reality, not all patients with ESKD may be suitable. Further, SA parameters come from studies that do not include all comparators; thus, they may be inappropriate to consider in the reference case. To better reflect the clinical data, comparison between two dialysis modalities were conducted and reported below.

2. PD versus ICHD

The reference analysis for PD versus conventional ICHD is shown in Table 23; PD dominates given its lower cost and similar efficacy. The cost-effectiveness acceptability curves and scatterplots are provided in Appendix 19.

Table 23: Reference Case (PD Versus ICHD)

Strategy	Cost ($)	Incremental Cost ($)	QALYs	Incremental QALYs	ICUR ($/QALY)
ICHD (Cv)	**637,101**	**-reference-**	**5.45**	**-reference-**	-
PD	600,808	–36,292	5.45	0	Dominant

Cv = conventional; ICHD = in-centre hemodialysis; ICUR = incremental cost-utility ratio; PD =peritoneal dialysis; QALY = quality-adjusted life-year.

Observational studies[64,79] reported on the risk of death over time, with PD associated with a lower risk of death initially that increased to unity or above unity (increased risk of death) over time in two studies that were thought to be of reasonable quality, including a study in Canada. The point estimates and 95% CI from these two studies were tested. These scenarios led to increased QALYs with PD, ranging from 0.15 to 0.57 (Table 46).

In some scenarios this also led to increased cost (due to prolonged survival while receiving relatively expensive ongoing treatment with dialysis)[100] with ICURs between $11,000 and $41,000 per QALY gained. Another study noted in the clinical review reported an increased risk of mortality with PD;[102] using this data led to greater QALYs with ICHD (1.1 to 1.7) and an ICUR of $121,000 to $138,000 for ICHD compared with PD (again driven by longer survival while receiving a relatively expensive ongoing treatment) (Table 46 in APPENDIX 19).

Examining an older age cohort or prevalent cases did not alter results. Similar results were demonstrated although it resulted in less incremental QALYs gains than in incident patients (incident patients have a greater risk of early mortality, and as such relative differences in mortality resulted in greater absolute benefits). If there is a quality of life benefit seen with PD that is similar to the (non-statistically significant) differences in nocturnal HHD to conventional ICHD, PD becomes more attractive (i.e., less costly and greater QALYs gained).

Additional sensitivity analyses (Table 47 in APPENDIX 19) conducted on the cost of access for ICHD, PD failure costs, and PD retraining did not alter conclusions, although the value of the incremental cost savings with PD were altered. The impact of using alternate estimates of costs from other settings was presented earlier (Table 20 [ratio approach] and Table 21 [absolute cost approach]).

PD versus ICHD societal perspective

There was no data to inform patient-borne and out-of-pocket productivity costs of PD (compared with any other modality). While a Canadian study to determine these costs for various modalities is under way,[103] results are not yet available. As such, patient-borne and productivity costs for frequent home HD (versus ICHD) were adapted. Home renovation and utility costs were excluded, but travel costs, and caregiver and patient time costs were used (time to perform frequent home NHD is likely much greater than PD; assumed to be 25% of home NHD). The results (Table 24) suggest that these accentuate cost savings of PD versus ICHD.

Table 24: PD Versus Conventional ICHD — Societal Perspective

Strategy	ICHD (Cv)	PD	Incremental Cost ($)
Health payer (base case)	**637,101**	**600,808**	**–36,292**
Utility cost	0	0	0
Travel cost if switched to ICHD	8,959	4,633	–4,326
Time and productivity cost (assumed 25% of setup and caregiver time for PD)	29,135	1,681	–27,454
Total	**675,194**	**607,123**	**–68,071**
Scenario Analysis: Time and productivity cost (if setup and caregiver for PD decreased by 50%)	*29,135*	*8,475*	*–20,660*
Total	***675,194***	***613,917***	***–61,278***

Cv = conventional; ICHD = in-centre hemodialysis; PD = peritoneal dialysis.

3. HHD versus ICHD

All HHD modalities were less costly in the reference case, with conventional being the least costly among the three types of HHD (Table 25). Appendix 20 contains the related cost-effectiveness acceptability curves and scatterplots. As noted above, using alternate costing sources from various Canadian papers resulted in similar results, although there were some scenarios where frequent home dialysis (short-daily or frequent nocturnal HHD) were more costly than ICHD (Table 20 and Table 21).

Table 25: Reference Case (HHD Versus ICHD)

Strategy	Cost ($)	Incremental Cost ($)	QALYs	Incremental QALYs	ICUR ($/QALY)
ICHD	**637,101**	**-reference-**	**5.45**	**-reference-**	**-**
HHD (Cv)	561,962	–75,139	5.45	0	Dominant
SDHHD	617,983	–19,117	5.45	0	Dominant
NHHD	617,983	–19,117	5.45	0	Dominant

Cv = conventional; ICHD = in-centre conventional hemodialysis; ICUR = incremental cost-utility ratio; HHD = home hemodialysis; NHHD = nocturnal home hemodialysis; SDHHD = short-daily home hemodialysis; QALY = quality-adjusted life-year.

Inclusion of utility cost (i.e., electricity and water) reduced the cost savings of HHD (Table 26). If the health care payer assumed the cost of household utilities, there were some scenarios (such as using data from Kroeker) where the cost advantage compared with conventional ICHD was lost, particularly for frequent HD (frequent short-daily and nocturnal). However, when a mix of home HD modalities was considered, HHD remained cost saving compared with ICHD when the health care payer assumed utility costs.

Results were largely unchanged when sensitivity analyses around retraining was performed (Table 48 in Appendix 20). If the annual modality failure rate was greater, HHD therapies became less attractive (due to the high upfront training costs that were not fully offset by a prolonged time on a less costly modality). If a difference in utility-based QoL was included (favouring nocturnal HHD) in a similar magnitude reported in an RCT (result non-significant),[43] nocturnal HHD

became even more favourable with cost savings and increased QALYs (incremental QALYs 0.31) (Table 48 in Appendix 20).

Most programs in Canada do not exclusively offer one type of HHD. Instead, a range of prescriptions are provided to patients. A mix of HHD modalities was evaluated based on current practices in Alberta (which are thought to be similar to other jurisdictions in Canada) with approximately 50% of patients performing HHD that approximates conventional HD, and the remainder performing more frequent dialysis. In this scenario, the incremental costs of HHD was –$47,000 compared with conventional ICHD; this cost saving was largely unchanged when the health care payer assumed household utility costs (Table 48 in Appendix 20).

Table 26: HHD Versus Conventional ICHD — Deterministic Sensitivity Analysis Assuming Utility Inputs Are Reimbursed

Sensitivity Analysis	Strategy	ICUR	Incremental Cost
Reference Case	**ICHD (Cv)** **HHD (Cv)** **SDHHD** **NHHD**	**-reference-** **Dominant** **Dominant** **Dominant**	**–75,139** **–19,117** **–19,117**
Electricity and Water Costs (Assumed Paid by Health Care Payer)			
Electricity cost by Klarenbach et al.[29] (492 NHHD)	ICHD (Cv) NHHD	-reference- Dominant	 –16,970
Water cost by Kroeker et al.[81] (4,623 SDHHD, 5,253 NHHD)	ICHD (Cv) SDHHD NHHD	-reference- Dominated Dominated	 1,059 3,809
Water and electricity by Komenda et al.[83] (4,020 DHHD, 2,412 HHD(Cv))	ICHD (Cv) HHD (Cv) DHHD	-reference- Dominant Dominant	 –64,612 –1,572
Water and electricity by Nickel et al.[99] (639 SDHHD, 998 NHHD, 427 HHD(Cv))	ICHD (Cv) HHD (Cv) SDHHD NHHD	-reference- Dominant Dominant Dominant	 –73,275 –16,328 –14,761
Cost Ratio and Electricity and Water Costs (assumed paid by health care payer)			
Cost factor low (0.48 HICHD and 0.73 DHHD) and Electricity cost by Klarenbach et al.[29] (492 HNHHD)	ICHD (Cv) NHHD	-reference- Dominant	 –23,932
Cost factor high (0.73 HICHD and 0.97 DHHD) and Electricity cost by Klarenbach et al.[29] (492 HNHHD)	ICHD (Cv) NHHD	-reference- Dominated	 28,520
Cost factor low and water cost by Kroeker et al.[81]	ICHD (Cv) SDHHD NHHD	-reference- Dominant Dominant	 –5,903 –3,153
Cost factor high and water cost by Kroeker et al.[81]	ICHD (Cv) SDHHD NHHD	-reference- Dominated Dominated	 46,550 49,299
Cost factor low and water and electricity cost by Komenda et al.[83]	ICHD (Cv) HHD (Cv) DHHD	-reference- Dominant Dominant	 –70,191 –8,535
Cost factor high and water and electricity cost by Komenda et al.[83]	ICHD (Cv) HHD (Cv) DHHD	-reference- Dominant Dominated	 –15,553 43,918

Sensitivity Analysis	Strategy	ICUR	Incremental Cost
Cost factor low and water and electricity cost by Nickel et al.[99]	ICHD (Cv) HHD (Cv) SDHHD NHHD	-reference- Dominant Dominant Dominant	 –78,854 –23,291 –21,724
Cost factor high and water and electricity cost by Nickel et al.[99]	ICHD (Cv) HHD (Cv) SDHHD NHHD	-reference- Dominant Dominated Dominated	 –24,216 29,162 30,729

Cv = conventional; DHHD = daily home hemodialysis; HHD = home hemodialysis; ICHD = in-centre hemodialysis; NHHD = nocturnal home hemodialysis; SDHHD = short-daily home hemodialysis.
Note: DHHD stands for daily home HD, which includes SDHHD or NHHD.

A scenario analysis was conducted exploring the RR of hospitalization reported from observational studies, considering the point estimate and 95% CI (Table 41 in Appendix 13). Conclusions were largely unchanged in most analyses (Table 27); nocturnal HHD was dominated by conventional HHD and conventional ICHD when the RR of hospitalization was greater for nocturnal HHD;[44] however, these results were from a study where the RR was not statistically significant.[44]

Table 27: HHD Versus Conventional ICHD — Scenario Analysis Varying the RR of Hospitalization

Sensitivity Analysis	Strategy	ICUR	Incremental Cost
RR Hospitalization (Reference Case, All HHD Versus Conventional ICHD = 1.0)			
RR hospitalization Rocco et al.[44] point estimates (NHHD vs. CvHHD; all-cause 1.42, cardiovascular 1.6, infection 2.04)	ICHD (Cv) HHD (Cv) NHHD	-reference- Dominant Dominated	 –75,139 16,089
RR hospitalization Rocco et al.[44] lower CI (NHHD vs. CvHHD; all-cause 0.69, cardiovascular 0.49, infection 0.8)	ICHD (Cv) HHD (Cv) NHHD	-reference- Dominant Dominant	 –75,139 –40,400
RR hospitalization Rocco et al.[44] upper CI (NHHD vs. CvHHD; all-cause 2.9, cardiovascular 5.22, infection 5.17)	ICHD (Cv) HHD (Cv) NHHD	-reference- Dominant Dominated	 –75,139 149,337
RR hospitalization Suri et al.[70] point estimates (DHHD* vs. ICHD; all-cause 0.92, cardiovascular 0.68, infection 1.04; base case 1)	ICHD (Cv) HHD (Cv) NHHD	-reference- Dominant Dominant	 –24,492 –24,492
RR hospitalization Suri et al.[70] lower CI (DHHD vs. ICHD; all-cause 0.85, cardiovascular 0.61, infection 1.29)	ICHD (Cv) SDHHD NHHD	-reference- Dominant Dominant	 –29,481 –29,481
RR hospitalization Suri et al.[70] upper CI (DHHD vs. ICHD; all-cause 1.00, cardiovascular 0.77, infection 1.15)	ICHD (Cv) DHHD (SDHHD or NHHD)	-reference- Dominant	 –18,562
RR hospitalization Ishani et al.[38] point estimates (DHHD vs. ICHD; all-cause 1.03, cardiovascular 0.83, infection 1.32; base case 1)	ICHD (Cv) DHHD	-reference- Dominant	 –16,302
RR hospitalization Ishani et al.[38] lower CI (DHHD vs. ICHD; all-cause 0.99, cardiovascular 0.78, infection 1.24)	ICHD (Cv) DHHD	-reference- Dominant	 –19,408
RR hospitalization Ishani et al.[38] upper CI (DHHD vs. ICHD; all-cause 1.08, cardiovascular 0.88, infection 1.40)	ICHD (Cv) DHHD	-reference- Dominant	 –12,724

CI = confidence interval; Cv = conventional; HHD = home hemodialysis; ICUR = incremental cost-utility ratio; DHHD = daily home hemodialysis; ICHD = in-centre hemodialysis; NHHD = nocturnal home hemodialysis; PD = peritoneal dialysis; RR = relative risk; SDHHD = short-daily home hemodialysis.

HHD versus ICHD societal costs

Patient-borne costs were considered. Water and electricity costs are borne by patients in most programs in Canada. A small RCT determined travel costs for ICHD versus frequent NHHD, as well as productivity costs (setup and caregiver times, as well as travel time).[29] Workforce productivity costs were also determined using the human capital approach. As noted, given the small sample size these estimates are uncertain; further it is unclear if they apply to conventional HHD (caregiver costs assumed to be 50%). Results show that, although utility costs are increased for patients on HHD, the utility costs are more than offset by the cost of travel and lost productivity (Table 28).

Table 28: HHD Versus ICHD — Societal Perspective

Strategy	ICHD (Cv)	HHD (Cv)		SDHHD/NHHD		HHD (Mix)	
		Absolute Cost	Incremental Cost ($) Versus ICHD (Cv)	Absolute Cost	Incremental Cost ($) Versus ICHD (Cv)	Absolute Cost	Incremental Cost ($) Versus ICHD (Cv)
Health payer (base case)	**637,101**	**561,962**	**–75,139**	**617,983**	**–19,117**	**589,972**	**–47,128**
Utility cost	0	8,115	8,115	13,525	13,525	10,820	10,820
Travel cost	8,959	2,886	–6,073	2,886	–6,073	2,886	–6,073
Time and productivity cost	29,135	22,080	–7,055	22,080	–7,055	32,008	2,873
Total	**675,194**	**595,043**	**–80,151**	**656,475**	**–18,719**	**635,687**	**–39,507**
Time and productivity cost (if setup and caregiver for HHD decreased by 50%)	*29,135*	*3,004*	*–26,131*			*17,506*	*–11,629*
Total	***675,194***	***575,967***	***–99,227***			***621,185***	***–54,009***

Cv = conventional; HHD = home hemodialysis; ICHD = in-centre hemodialysis; NHHD = nocturnal home hemodialysis; SDHHD = short-daily home hemodialysis.

.

4. Home Dialysis: HHD versus PD

The cost-effectiveness acceptability curves and scatterplots for the comparison of HHD and PD are provided in Appendix 21.

While evidence is weak, the clinical review did report studies indicating a possible survival benefit of HHD compared with PD. Similar to the PD versus ICHD analysis, a survival advantage led to increased QALYs, but also increased costs as patients lived longer on a costly therapy (Table 30). By varying the relative risk of mortality for HHD compared with PD, PD was the cheapest strategy but was associated with fewer QALYs given a shorter life expectancy. Technique failure rates, for HHD and PD were also examined in sensitivity analyses; these had minimal impact on conclusions.

Table 29: Reference Case (HHD Versus PD)

Strategy	Cost ($)	Incremental Cost ($)	QALYs	Incremental QALYs	ICUR ($/QALY)
PD	600,808	-reference-	5.45	-reference-	–
HHD (Cv)	561,962	–38,847	5.45	0	Dominant
SDHHD	617,983	17,175	5.45	0	Dominated
NHHD	617,983	17,175	5.45	0	Dominated

Cv = conventional; HHD = home hemodialysis; NHHD = nocturnal home hemodialysis; PD = peritoneal dialysis; SDHHD = short-daily home hemodialysis.

Table 30: HHD Versus PD — Scenario Analysis Varying RR of Death

Strategy	Cost ($)	Incremental Cost ($)	QALYs	Incremental QALYs	ICUR ($/QALY)
RR Death Nadeau-Fredette, 2015[104] (0.34, Base Case 1, Reversed in Model)					
PD	**329,602**	**-reference-**	**2.86**	**-reference-**	**—**
HHD (Cv)	561,962	232,360	5.45	2.59	89,660
SDHHD	617,983	288,382	5.45	2.59	111,277
NHHD	617,983	288,382	5.45	2.59	111,277
RR Death Nadeau-Fredette, 2015[104] Lower CI 0.28					
PD	**272,611**	**-reference-**	**2.32**	**-reference-**	**—**
HHD (Cv)	561,962	289,350	5.45	3.14	92,201
SDHHD	617,983	345,372	5.45	3.14	110,052
NHHD	617,983	345,372	5.45	3.14	110,052
RR Death Nadeau-Fredette, 2015[104] Upper CI 0.41					
PD	**383,511**	**-reference-**	**3.38**	**-reference-**	**—**
HHD (Cv)	561,962	178,450	5.45	2.08	85,997
SDHHD	617,983	234,472	5.45	2.08	112,995
NHHD	617,983	234,472	5.45	2.08	112,995
RR Death Nesrallah et al., 2016[67] (0.75, Base Case 1)					
PD	**539,759**	**-reference-**	**4.87**	**-reference-**	**—**
DHHD	617,983	78,224	5.45	0.58	134,446
RR Death Nesrallah et al., 2016[67] (0.68, Base Case 1)					
PD	**516,821**	**-reference-**	**4.65**	**-reference-**	**—**
DHHD	617,983	101,162	5.45	0.80	126,346
RR Death Nesrallah et al., 2016[67] (0.82, Base Case 1)					
PD	**559,715**	**-reference-**	**5.06**	**-reference-**	**—**
DHHD	617,983	58268	5.45	0.39	148,820

Cv = conventional; CI = confidence interval; DHHD = daily home hemodialysis; HHD = home hemodialysis; NHHD = nocturnal home hemodialysis; PD = peritoneal dialysis; QALY = quality-adjusted life-year; RR = relative risk; SDHHD = short-daily home hemodialysis.

5. PD Assist: ICHD versus assisted PD

In the reference case, assisted PD was more costly over a lifetime horizon than ICHD, with an incremental cost of $33,000 (Table 31). The related cost-effectiveness acceptability curves and scatterplots can be found in **Error! Reference source not found.**. Use of alternate (non-Canadian) cost sources was conflicting (depending on the source) as shown in Table 13. As noted previously, if the cost of provision of assisted PD in rural and remote areas is

similar to the costs when delivered in urban areas, it was less costly than remote and rural ICHD (as reported by Ferguson et al. [Table 14 and Table 22][95]).

Other sensitivity analyses are presented in Table 32 examining the cost of PD failure and the probability of technique failure. If assisted PD reduced the probability of technique failure, it became relatively more attractive compared with conventional ICHD.

The delivery of a care model for assisted PD may vary widely. In some settings it is used to initiate patients on PD only, or to support patients experiencing difficulties for finite periods of time. Further, depending on the number of patients served and the wage rate of the health care providing assisted PD, costs of delivery may vary. Sensitivity analysis examined use for the first 3 to 6 months only, or a range of average use (months) per year. In addition, a range of the cost of providing assisted PD (± 25% of ORN cost) was assessed. In many of these sensitivity analyses, assisted PD was less costly than ICHD; use of assisted PD for up to 6 months per year was less costly than ICHD (Table 33).

Table 31: Reference Case (Assisted PD Versus Conventional ICHD)

Strategy	Cost ($)	Incremental Cost ($)	QALYs	Incremental QALYs	ICUR ($/QALY)
ICHD (Cv)	**637,101**	**-reference-**	**5.45**	**-reference-**	**–**
Assisted PD	670,452	33,351	5.45	0	Dominated

Cv = conventional; ICHD = in-centre hemodialysis; ICUR = incremental cost-utility ratio; PD = peritoneal dialysis; QALY = quality-adjusted life-year.

Table 32: Assisted PD Versus Conventional ICHD — Deterministic Sensitivity Analysis

Sensitivity Analysis	Strategy	ICUR	Incremental Cost
Reference Case	ICHD (Cv) Assisted PD	-reference- Dominated	33,351
Costs			
Cost of assisted PD –25% of reference	ICHD (Cv) Assisted PD	-reference- Dominated	15,360
Add retraining cost (88, base case 0)	ICHD (Cv) Assisted PD	-reference- Dominated	33,562
Access cost lower CI (3,093, base case 8,632)	ICHD (Cv) Assisted PD	-reference- Dominated	49,777
Access cost upper CI (9,520, base case 8,632)	ICHD (Cv) Assisted PD	-reference- Dominated	30,715
No access cost (0, base case 8,632)	ICHD (Cv) Assisted PD	-reference- Dominated	58,949
PD failure cost lower CI (1,948, base case 8,663)	ICHD (Cv) Assisted PD	-reference- Dominated	30,458
PD failure cost upper CI (15,378, base case 8,663)	ICHD (Cv) Assisted PD	-reference- Dominated	36,244
No PD failure cost (0, base case 8,663)	ICHD (Cv) Assisted PD	-reference- Dominated	29,619
Technique Failure Rate			
PD failure rate +50% (0.267, base case 0.178)	ICHD (Cv) Assisted PD	-reference- Dominated	42,012
PD failure rate –50% (0.089, base case 0.178)	ICHD (Cv) Assisted PD	-reference- Dominated	19,686
PD failure rate –75% (0.044, base case 0.178)	ICHD (Cv) Assisted PD	-reference- Dominated	9,347
PD failure rate –90% (0.018, base case 0.178)	ICHD (Cv) Assisted PD	-reference- Dominated	1,238
PD failure rate –95% (0.009, base case 0.178)	ICHD (Cv) Assisted PD	-reference- Dominant	–1,898
No PD failure rate (0, base case 0.178)	ICHD (Cv) Assisted PD	-reference- Dominant	–5,296

Cv = conventional; CI = confidence interval; ICHD = in-centre hemodialysis; ICUR = incremental cost-utility ratio; PD = peritoneal dialysis.

Table 33: Assisted PD (Provided Intermittently) Versus ICHD

Sensitivity Analysis	Strategy	ICUR	Incremental Cost
Alternate Delivery of Assisted PD			
Initial 3 months of assisted PD	ICHD (Cv)	-reference-	
	Assisted PD	Dominant	–31,151
+25% assisted PD cost	ICHD (Cv)	-reference-	
	Assisted PD	Dominant	–27,565
–25% assisted PD cost	ICHD (Cv)	-reference-	
	Assisted PD	Dominant	–34,736
Initial 6 months of assisted PD	ICHD (Cv)	-reference-	
	Assisted PD	Dominant	–26,009
+25% assisted PD cost	ICHD (Cv)	-reference-	
	Assisted PD	Dominant	–18,838
–25% assisted PD cost	ICHD (Cv)	-reference-	
	Assisted PD	Dominant	–33,180
1 month of assisted PD per year	ICHD (Cv)	-reference-	
	Assisted PD	Dominant	–30,471
+25% assisted PD cost	ICHD (Cv)	-reference-	
	Assisted PD	Dominant	–26,412
–25% assisted PD cost	ICHD (Cv)	-reference-	
	Assisted PD	Dominant	–34,530
3 month of assisted PD per year	ICHD (Cv)	-reference-	
	Assisted PD	Dominant	–18,829
+25% assisted PD cost	ICHD (Cv)	-reference-	
	Assisted PD	Dominant	–6,651
–25% assisted PD cost	ICHD (Cv)	-reference-	
	Assisted PD	Dominant	–31,007
6 month of assisted PD per year	ICHD (Cv)	-reference-	
	Assisted PD	Dominant	–1,365
+25% assisted PD cost	ICHD (Cv)	-reference-	
	Assisted PD	Dominant	22,991
–25% assisted PD cost	ICHD (Cv)	-reference-	
	Assisted PD	Dominant	–25,721
9 month of assisted PD per year	ICHD (Cv)	-reference-	
	Assisted PD	Dominated	16,099
+25% assisted PD cost	ICHD (Cv)	-reference-	
	Assisted PD	Dominated	52,632
–25% assisted PD cost	ICHD (Cv)	-reference-	
	Assisted PD	Dominant	–20,435

Cv = conventional; ICHD = in-centre hemodialysis; ICUR = incremental cost-utility ratio; PD = peritoneal dialysis.

Summary of results of the economic analysis

While the clinical overview of reviews identified several SRs that compared the efficacy and safety among the dialysis modalities, there was a lack of high-quality data, and the evidence from lower quality (non-RCT) data were not definitive. Given that it was stated *a priori* that unity in the relative treatment effects would be assumed if no RCT data were available, a cost comparison of lifetime costs for each dialysis modality under the Canadian health care payer perspective was considered for the reference case. The least costly modality was conventional HHD ($561,962). Other home-based dialysis modalities (with the exception of assisted PD, depending on how it is delivered) were found to be less costly than ICHD. Assisted PD may be economically attractive compared with ICHD, if delivered in a non-continuous fashion (at initiation, or for respite).The economic findings were found to remain relatively robust through most sensitivity analyses.

Results were largely unchanged when a societal perspective was assumed; however, patients on HHD, particularly frequent (short-daily and nocturnal) hemodialysis may be associated with considerable home utility costs. The increased utility costs were found to be offset by the reduced costs associated with travel and lost productivity (compared with ICHD). Yet, it is important to interpret this finding with caution as the costs for travel and productivity are uncertain (as opposed to utility cost), as such utility costs may not be fully offset by the cost savings from reduced travel and increased productivity.

Limitations of this analysis include the use of data from a single province for the estimates of cost. In addition, while ORN data are based on direct resources use, supplemented by micro-costing, it did include expert opinion. Further, like other provinces, Ontario is attempting to grow home therapies and, as such, it is possible that the cost of home therapies may be overestimated in an attempt to avoid a disincentive from inadequate reimbursement. However, alternate costs of dialysis from other settings in Canada were used, which largely did not alter conclusions. Another limitation is the lack of data on societal costs, particularly patient and caregiver-borne costs. While a Canadian study is currently being conducted by the Kidney Foundation of Canada, results are not yet available; conclusions of these analyses should be revisited when these data are available.

The strengths of this analysis are that the estimates on effectiveness and harms were informed by an overview of reviews, even though this was limited by the lack of high-quality clinical evidence available. Further, multiple Canadian costing sources were identified and incorporated. This analysis considers all dialysis modalities, unlike many other economic evaluations and provides specific scenarios that might be relevant for decision-making (e.g., assisted PD versus ICHD, consideration of rural and remote HD). Rigorous and extensive scenario and sensitivity analysis were also conducted.

In summary, this economic analysis suggests that home-based therapies, including PD and HHD modalities, are the most attractive for eligible patients. Based on available data, assisted PD may be associated with greater costs of provision, if provided continuously. However, it may be economically attractive compared with ICHD when provided at initiation or as respite. Furthermore, only one Canadian estimate was found on assisted PD[91] and some literature from non-Canadian jurisdictions suggest that the costs of provision of assisted PD can be lower than ICHD.[96] More frequent or nocturnal ICHD is likely to be substantially more costly than any other modality, with little evidence to indicate superior outcomes.

Patient Perspectives and Experiences Review

This section addressed the following Research Question:

Research question 6: What are the experiences and perspectives of adults with ESKD, their family members, and their caregivers regarding dialysis care?

Methods

An overview of SRs and a thematic synthesis of the literature relevant to the research question on patient experience and perspectives was conducted. The protocol was written a priori, with amendments to the protocol documented in the Protocol Amendments table.

Search strategy

The literature search was performed by an information specialist, using a peer-reviewed search strategy.

Published literature was identified by searching the following bibliographic databases: MEDLINE (1946–), Embase (1974–), and PsycINFO (1967–) via Ovid; Cumulative Index to Nursing and Allied Health Literature (CINAHL) via EBSCO; PubMed and the Social Sciences and Humanities segment in Scopus. The search strategy was comprised of both controlled vocabulary, such as the National Library of Medicine's MeSH (Medical Subject Headings), and keywords. The main search concepts were dialysis and ESKD.

Methodological filters were applied to limit retrieval to qualitative studies. Retrieval was limited to documents published since January 1, 2000. The search was also limited to English- or French-language publications. Conference abstracts were excluded from the search results. See Appendix 2 for the detailed search strategy.

The initial search was completed on May 18, 2016. Regular alerts were established to update the searches until the publication of the final report. Regular search updates were performed on databases that do not provide alert services.

Grey literature (literature that is not commercially published) was identified by searching the *Grey Matters* checklist (https://www.cadth.ca/grey-matters), which includes the websites of HTA agencies, clinical guideline repositories, SR repositories, economics-related resources, patient-related groups, and professional associations. Google and other Internet search engines were used to search for additional web-based materials. These searches were supplemented by reviewing the bibliographies of key papers and through contacts with appropriate experts and industry.

Selection criteria

SRs published in English or French that included studies of any qualitative design that explored or assessed perspectives of adults being treated with dialysis for ESKD, or waiting for treatment, as well as the perspectives of their family members or other non-clinical caregivers were eligible. To be eligible, SRs must have included the term "systematic review" in the title or elsewhere in the text; included a detailed description of comprehensive selection criteria and search methods (i.e., as described in AMSTAR checklist item #3); and assessed the quality of included studies. Further, to be eligible, reviews had to explore or assess participants' own perspectives directly. Reviews that provided information collected only indirectly (e.g., clinician perspectives) were excluded. The following types of publications were excluded: theses and dissertations, data presented in abstract form only, book chapters, editorials, and letters to the editor. Selection criteria are presented in Table 34.

Table 34: Inclusion Criteria Patient Preferences Review

Population	Adults (≥ 18 years) with ESKD of any cause who need dialysis treatment, either as lifetime treatment or while waiting for kidney transplantation, as well as their family members, partners, and personal caregivers.
Intervention	Hemodialysis (HD) • In-centre conventional hemodialysis (ICHD) • Home conventional hemodialysis (HHD) • Short-daily hemodialysis (short- daily HHD) • Nocturnal hemodialysis (nocturnal HHD) Peritoneal dialysis (PD) • Continuous ambulatory peritoneal dialysis (CAPD) • Automated peritoneal dialysis (APD)
Comparator	Not applicable
Outcome	Perspectives and experiences regarding dialysis, including such issues as preferences and beliefs about self-care dialysis or assisted dialysis, experiences waiting for dialysis, experiences with shared decision-making regarding dialysis, experiences complying or not complying with specific dialysis modalities, reasons for complying and not complying with specific dialysis modalities, and other issues of importance to patients that emerge in the analysis.
Study Design	Systematic reviews of qualitative studies of any design
Date Limits	2000 or later

ESKD = end-stage kidney disease.

Selection method

Two reviewers independently screened the titles and abstracts of all citations retrieved from the literature search, and excluded reports that clearly did not meet the inclusion criteria. The full texts of all potentially relevant reports were ordered for detailed review. Two reviewers independently reviewed the full-text articles based on the detailed eligibility criteria. Any disagreements among reviewers were resolved through discussion.

Article sampling

After screening 792 studies, 13 SRs were retrieved. After reviewing these in full text, six SRs met all eligibility criteria. The remaining seven SRs were excluded because they were focused on a different research question,[105,106] the intervention was wrong or unclear,[107,108] or they reported a non-systematic methodology.[109-111]

Data collection and extraction

Descriptive data were extracted by one reviewer into an a priori developed standardized electronic form. Descriptive data included such items as first author, article title, study objectives, number and types of included primary studies, characteristics of eligible participants, descriptions of eligible interventions, and results reported regarding quality assessments of included studies. The extracted data were verified by a second reviewer. Discrepancies were resolved through discussion or referral to a third party if necessary.

Result statements from the six included SRs were captured for analysis, or coded, using NVivo qualitative data analysis software (QSR International Pty Ltd. Version 11,2015).[112] For further detail, refer to the Thematic Analysis section. Result statements are typically presented within the “results” section of a report, and are characterized as data-driven and integrated findings based on participant experiences. Before being coded, each result statement was assessed to ensure it was differentiated from raw data, methods, external data, and researchers’ own conclusions and implications. Researchers’ own conclusions and implications were not coded. Only results presented within the main report were coded. Data from figures were not used unless data points were explicitly labelled.

Quality assessment

The quality assessment of the included studies is summarized in Appendix 28. One reviewer independently assessed the quality of each included study using the JBI Critical Appraisal Checklist for Systematic Reviews and Research Syntheses.[113] The second reviewer verified those assessments. Disagreements were resolved by discussion or referral to a third party. The results of the quality assessment process are reported narratively and summarized in a table to highlight the strengths and limitations of each study. Quality assessment was not used as a basis for excluding any studies deemed to be of low quality.

Data analysis methods

Descriptive analysis

A descriptive analysis of study characteristics was conducted, with the goal to characterize the set of included SRs in terms of important study and patient characteristics (e.g., PICOS). This involved summarizing study characteristics in tables as presented in Appendix 27.

Thematic analysis

We conducted a thematic analysis comprising three stages: coding, developing descriptive themes, and developing analytic themes. The analysis was conducted using QSR International's NVivo 11 Software.[112]

Coding (stage 1)

The results section of each included SR was coded line by line for meaning and content. Coding began with an a priori "start list" of codes, for example; beliefs, preferences, support, challenges, and decision-making, which were based on the research question and emerging concepts from discussions with the team and clinical experts. As coding progressed, other codes not on the start list were added inductively to capture unexpected content. As new codes emerged, all data were re-coded to search for further instances of that code. Codes were assigned to results data from all the SRs in a consistent manner of inductive and iterative coding.

Through a staged coding process, two researchers independently coded the first three reviews. They independently assigned codes to concepts, ideas, and categories to the results reported within each study report. The two researchers then compared and discussed their code assignments for the selected reviews. This discussion allowed for the organization of codes, the resolution of discrepancies in applications of codes, and helping to refine the meaning of emerging codes. Following this discussion, the remaining three articles were coded independently, with reviewers subsequently meeting to compare and discuss coding assignments, and refine the final coding template accordingly. When all codes were applied to the full sample of results, they were assessed for consistency in interpretation and application. At this point, the data associated with each code were narratively summarized by one reviewer then reviewed by the second reviewer and a reviewer who was not involved in the coding, to compare the summaries with the individual result statements coded in NVivo to ensure all concepts were captured and the summary was representative of the data. Some codes were removed at this stage, such as the code "quality of life improvements" because it lacked explanation and detail. The data were re-coded to more specific codes such as "desire to maintain usual activities" or "personal autonomy."

Descriptive themes (stage 2)

In the second stage of the analysis, the codes developed in the prior stage were organized into related areas to construct "descriptive" themes. In this process, two reviewers independently assessed similarities and differences between codes. New codes were created and some were removed during this process. The information from removed codes was re-coded to more specific or accurate codes in order to capture the meaning of groups of initial codes. Examples of the some of the refinements that were made were categorizing beliefs and feelings about end-of-life care as "decision-making" rather than "feeling vulnerable." "Feeling vulnerable" was removed because did not adequately represent the concept inherent in the data. Data related to "feeling vulnerable" were captured in other codes such as "confronting mortality." "Relying on others" was captured as part of the concept of "being a burden."

Reviewers assessed whether emergent themes were transferable across different study contexts. When they were found to be not transferable, they discussed whether the differences were a result of methods or sample characteristics.

Once descriptive themes were identified, a draft summary of the results across the studies organized by each theme was written by one reviewer and subsequently reviewed by a second reviewer. A group discussion between the two reviewers, and a third reviewer (who was not involved in the coding and theme analysis) took place to review and discuss the emergent themes. The final version was agreed upon by all review team members[114,115] and represented a synthesis that remains close to the original results of the SRs, with minimal interpretation.

Analytic themes (stage 3)

During the final stage, the "data-driven" descriptive themes from the prior stage were analyzed through the theoretical structure provided by the policy question to develop "theory-driven" analytic themes. In this stage, two reviewers used the descriptive themes to independently infer an answer to the question about the optimal use of dialysis modalities. After each reviewer made these inferences independently, the two reviewers reviewed their results. A group discussion including all three team members was held to discuss the analytic themes in the context of the policy issue. This cyclical process of theme development resulting from group discussions continued until a set of themes emerged that was inclusive of all of the initial descriptive themes and answered the policy question.[114] As in the prior

stage, throughout this process, reviewers considered the applicability of the theme to all subgroups and found that information on rural and remote populations, on Indigenous populations, and on considerations regarding some ethnic and religious issues was less adequately covered by the main themes.

Throughout all stages of the analysis, regular meetings between members of the research team took place to discuss emerging results, and analytic ideas. Explicit notes were kept using MS Word to record decisions made regarding coding and theme development, to help demonstrate rigour in the analysis.

Results

A total of 792 citations were identified from the initial electronic database, alerts and search updates. Of those, 779 were deemed ineligible and the full-text of the remaining 13 reviews were retrieved for eligibility screening. Seven were identified as ineligible because they were not relevant to our particular research questions,[105,106] the intervention was ineligible or unclear,[107,108] or they reported a non-systematic methodology.[109-111] Six SRs were ultimately included in the thematic synthesis.

The study selection process is presented in a PRISMA flow diagram (Appendix 24). A list of included studies is provided in Appendix 25, and a list of excluded studies is provided in Appendix 26.

Descriptive analysis

Study characteristics

Of the six included SRs, three used a thematic synthesis methodology,[116-118] and three described a meta-synthesis approach.[119-121] Five were reviews of qualitative studies[116,117,119-121] and one reviewed both qualitative and mixed method studies.[118] Patient perspectives were reported in all of the reviews, while caregiver views and experiences were reported in two.[116,118]

All modalities were reviewed in at least one of the studies; HHD in three studies,[116-118,120] ICHD in four studies,[116,118,120,121] and PD in four studies.[116,117,120,121] Palliative care[116] and conservative treatment[117] were each examined in one review. The modality was not specified in one review.[119]

All studies were published between 2010 and 2016. Three reviews had search dates of 2013;[117,118,121] one had a search date of 2008,[116] one had a search date of 2009,[122] and one did not report the search date.[119]

The following countries were reported as the setting for the included studies of 4 reviews:[116-118,120] Australia,[116-118] Canada,[116-118] China,[118] Denmark,[116] Hong Kong,[116] Ireland,[117] Italy,[118] Netherlands,[117] New Zealand,[118] Norway,[118] Sweden,[117,118] Taiwan,[116] Thailand,[117] UK,[117,118] and US.[116-118] Two reviews did not report the countries where the included studies took place.[119,121]

The characteristics of the included studies are summarized in **Error! Reference source not found.**.

Quality assessment

Despite some limitations the SRs had strong methodology. Some studies had more quality concerns than others, but the body of literature provides insights into the perspectives and experiences of patients and family caregivers about dialysis.

In all six SRs the authors clearly reported their objectives and justification for their reviews, and an adequate number and choice of databases was used for the literature searches.[116-121] Explicit inclusion criteria were described in five reviews.[116-118,120,121] One review did not report clear inclusion criteria.[119] A full, replicable search strategy was reported in two of the reviews,[120,121] while appropriate methods and search concepts were described in four reviews.[116-119]

The method for appraising the included studies in each review was appropriate. Three reviews used the Consolidated Criteria for Reporting Qualitative Research (COREQ);[116-118] one used the Critical Appraisal Skills Programme (CASP) criteria;[120] and one used the Joanna Briggs Institute-Qualitative Appraisal and Review Instrument (JBI-QARI).[121] A published method of critical appraisal was not used in one study, but authors assessed the key aspects related to quality in the included studies.[119] Critical appraisal was done by two or more reviewers in five of the SRs.[116-118,120,121]

Methods to minimize extraction errors were not described in the reviews, apart from one review,[120] which described extraction by one reviewer and verification by another. Publication bias was not assessed in any of the reviews.

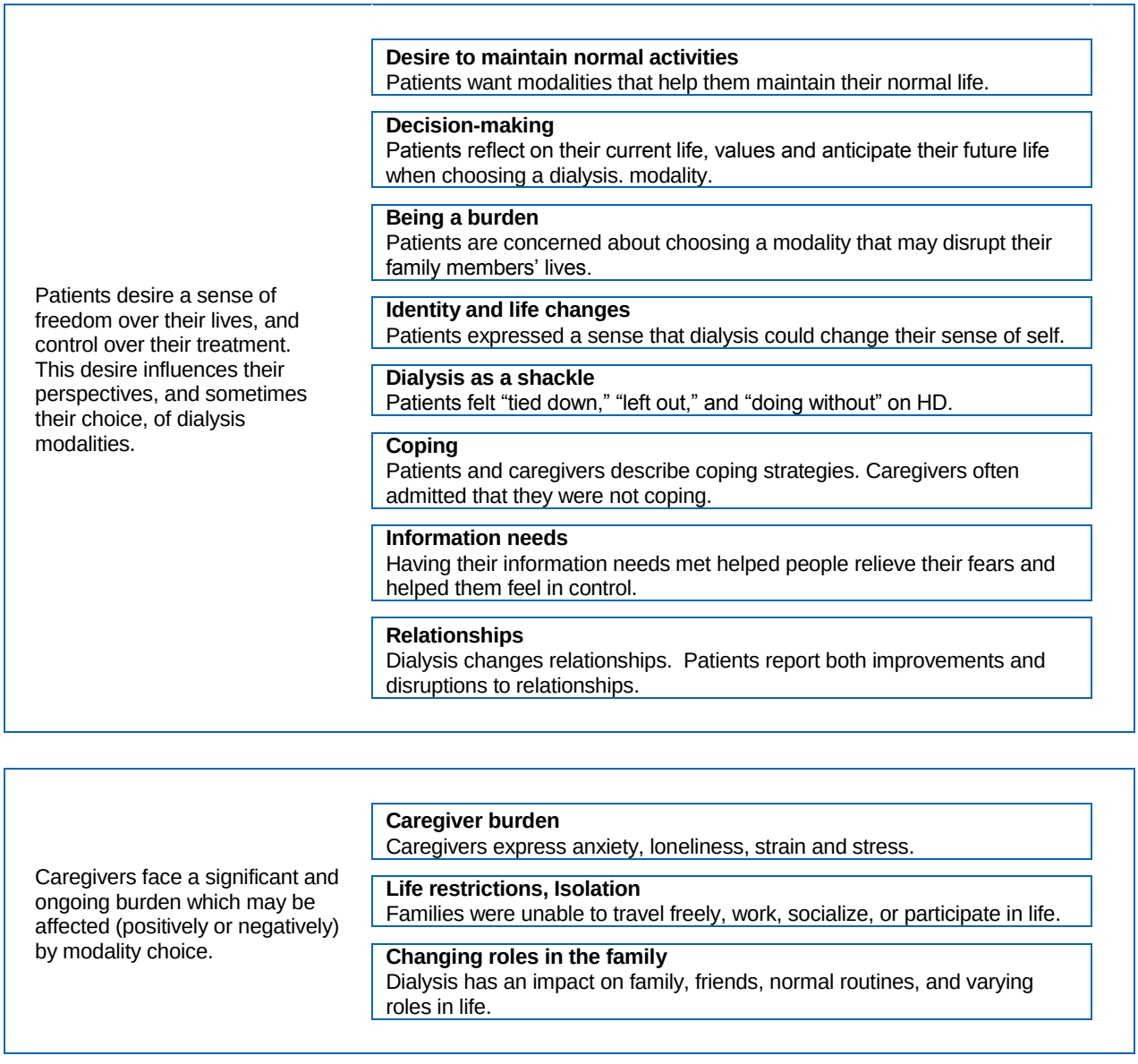
The methods used to combine included studies were appropriate in all reviews, and the data supported the conclusions made in each.

The quality assessment of the included SR studies is summarized in Appendix 23.

Thematic synthesis

The following sections explore the results of the thematic synthesis, organized by the analytic themes and using results from the descriptive categories as supporting evidence. For this report, the analytic themes represent the meaning of those experiences and perspectives of ESKD patients and their caregivers regarding dialysis modalities that impact on their optimal use. Three analytic themes emerged from the data. Figure 3 shows the emergent analytic structure, and includes both the analytic and their descriptive themes. Table 35 represents the emergent categories, their relationship to the descriptive themes and the dialysis modalities related to those themes.

Figure 3: Analytic Themes and Related Categories



A range of factors influence people's perspectives and experiences with different dialysis modalities.	**Perspectives and experiences specific to modality** For HHD, there was a sense among patients that taking treatment at home was better. For ICHD patients found the routine of an in-centre option to be convenient and less burdensome. For PD, people appreciated the freedom PD gave them over their activities. **Having no choice** Many patients perceived they had limited choices in treatment.

Table 35: Emergent Data Categories, Descriptive Themes, and Interventions Included in Categories

Descriptive Themes	Categories	Modalities Included in Category
Desire to maintain normal activities	Uncertainty	ICHD, HHD, PD
	Comfort	
	Feeling of improved health at home	
	Time burden	
	Hope	
Decision-making	Interaction with medical staff	ICHD, HD
	Treatment accessibility or availability	
	Choosing freedom or death	
	Loss of control	
	Treatment choice	
Being a burden	Relying on others	HHD, ICHD
	New role as caregiver	
	Treatment burden	
Identity and life changes	Economic consequences	ICHD HHD
	Desire to avoid identifying as a sick person	
	Changes in personality	
	Body deterioration	
Dialysis as a shackle	Feeling tied down, left out, and doing without	ICHD, HHD, PD
	Life restrictions	
	Home as a medical place	
	Isolation	
	Lack of freedom	
	Loss of control	
	Relationship with machine	
Coping	Feeling vulnerable	ICHD, HHD
	Feeling unqualified	
	Treatment-related fear	
Information needs	Caregiver stress	ICHD, HHD, PD
	Gaining confidence in ability to self-care	
	Timing of information delivery	
	Content of information	
	Source of information	
	Training for self-care dialysis	
	Isolation	
Relationships	Opinions of friends and family	ICHD, HHD, PD
	Protecting family members and friends	

Descriptive Themes	Categories	Modalities Included in Category
	Strengthening family relationships	
	Relationship disruptions	
	Changing roles in the family	
	Anxiety	
Caregiver burden	Loneliness	HHD
	Strain and stress	
	Lack of freedom	
Life restrictions, isolation	Loss of control	ICHD, HHD, PD
	Family/friends becoming caregivers	
Changing roles in the family	Impact on normal routines and household duties	ICHD, HHD
	Impact on income earning role	
	Preference of HHD	
Perspectives and experiences specific to modality	Sense of freedom with PD	ICHD, HHD, PD
	Convenience and less burden with ICHD	
	The sense of having limited or no choice in modality	

HHD = home hemodialysis; ICHD = in-centre hemodialysis; PD = peritoneal dialysis.

Analytic theme 1: Patients desire a sense of freedom over their lives, and control over their treatment. This desire influences their perspectives, and sometimes choice, of dialysis modalities.

Patient choice and an individual's need for a sense of freedom within their lives appears important when considering the optimal use of dialysis modalities. "Freedom" varies based on individual preferences for setting, duration, and frequency of dialysis treatment, or whether dialysis treatment is something the patient wishes to pursue at all.

Desire to maintain normal activities

No single ideal or best dialysis modality for all ESKD patients emerged through our analysis. Instead, the decision between modalities, where relevant, appears to be dependent on personal preferences, values, and a belief that dialysis should not only prolong life but also allow the patient to have a good quality of life. Hence, minimizing the intrusiveness of dialysis was the central element guiding decisions over preferred modalities and was the concept that most influenced decision-making. As reported in one SR examining patient and caregiver experiences with treatment and end-of-life care on PD and HD, decision-making was strongly influenced by which type of dialysis patients believed to be least disruptive or intrusive for their quality of life.[120] The SR examining decision-making with respect to dialysis modality reported that patients felt that participating actively in life and contributing as much as possible in remaining roles or to new ones were especially valuable.[117]

Treatment choices were based on minimizing disruption to usual activities, upholding responsibilities, and maintaining personal interests.[116] As one patient described, *"I'd like to stay as normal as I possibly can, . . .(hemodialysis) would be less disruptive of our life."*[120] For many patients, HHD enabled them to live a more normal lifestyle because they would not need to travel to the hospital and depend on medical staff.[118] The flexibility of treatment times with HD allowed patients to engage in employment, social outings, or travel.[118] This was not the case, however, for all ESKD patients. Some people felt that other modalities better fit their lifestyle, as illustrated by one person who felt that ICHD, as opposed to PD, would enable her to return to work; "*I planned on going back to work, and I couldn't see carrying around those bags with me and doing it four times a day. With the hemo treatment, it's three hours, three times a week. I'm working and this seemed like it would be much better for my schedule.*"[120]

Other patients felt they were restricted by the schedule of ICHD and they guarded the days in between dialysis sessions in order to have a "normal" life.[121]

Patients valued having freedom and control over the setting and timing of their treatments; *"Being able to self-manage I think enables me to maintain and retain a high degree of control over my life."*[118] *"I have free rein of whatever days I want to take off. They don't tell me when I have to dialyze or when I can't dialyze. Everything is under my control. That's what I like."*[118] *"I have control over what I'm doing. I'm not putting myself in somebody else's hands and saying, go ahead and do it."*[118]

Most often, the health outcomes of treatment were perceived as less important than the effect of the treatment on the patient's lifestyle. Patients appeared to be more concerned about their QoL rather than longevity.[116] Some patients, however, described accepting dialysis treatment for a longer life, even if it was restricted. In the words of one patient; "*Being severely ill and living with hemodialysis when nearing end of life means living with feelings of sorrow as old*

age does not turn out as planned. It means having to accept and endure a restricted and heavy life for the chance of living a bit longer."[117]

Patients with a strong preference for transplantation wanted to resume a "normal life," and those who opted for palliative management were not prepared to undertake the rigours of dialysis but wanted supportive end-of-life care. Overall, more patients appeared to be less concerned about their longevity with a specific treatment and more concerned about its impact on their quality of life.[116]

Life restrictions, Isolation

The perspective that dialysis meant restrictions on people's lives was reported.[119,121] People were unable to travel freely as they were restricted by the dialysis therapy and they guarded the days in between dialysis sessions in order to have a "normal" life.[121]

Changing roles in the family

Physical limitations led to the inability to participate in activities and perform roles and responsibilities.[119] The physical limitations caused restrictions in social life and dependency upon others, including family members, relatives, and friends.[119]

Some patients felt useless to society and their families.[117] *"I was very down because I feel kind of too young to feel useless in society and even to my family. I want to be with my young granddaughter that I love dearly and I don't have the energy to babysit her as often as I'd like to and play with her on the floor, and now with my access I can't even lift her up."*[117] Patients were saddened at being unable to support and provide help to their families.[117]

Decision-making

Making decisions about dialysis was stressful for patients.[120] It forced them to reflect on their current life, values and anticipated future life when on dialysis. Patients reported being ''shocked, fearful and bewildered at the prospect of dialysis.''[120]

When making decisions regarding dialysis modality, patients relied on information from friends and family members,[116,120] and patients were influenced by the experiences of other patients.[116] When they interacted with people who were successful on dialysis, patients described being inspired to carry out dialysis themselves.[116] Conversely, some patients refused a particular therapy after seeing complications in other patients, such as deciding against HD after seeing a swollen and disfigured arm following a fistula operation.[116]

Support and involvement of family was a factor in patients choosing HHD. Patients emphasized the need for "strong partnership" with their family, especially caregivers, in the success of remaining on HHD.[118] Some patients decided to do HHD at the "suggestion of their spouse;"[118] whereas, other ICHD patients said not having family support was a reason for choosing HHD.[118] However some people were determined to undertake HHD despite hesitation from their family members regarding their ability to manage at home.[118] Having access to information about the different options helped clarify patients' choice. As one man explained; *"Me and my wife went to all the classes and everything, and so they showed us all the options and everything, but I wanted to do the home dialysis*."[118] Education for family members was also described as important, as it was expressed the decision-making was collaborative between patient and family.[120]

Some patients described feeling that they did not have the option to choose between treatments, including modalities, and felt that instead the choice was based on physician preference or what was available near them.[116] They did not know the rationale for why they were on a certain modality, and thought it might be medical contraindications or physician preference.[116] There was a sense that treatment decisions were being made for them because of physiological reasons, difficulty with vascular access, or physician preference.[116]

Some patients were willing to accept a physician choice of modality, particularly when the rationale was explained to them.[116] Some patients gained an understanding of treatment options from their nephrologist or renal nurse and felt that the way this information was framed influenced their decision-making.[116] Some viewed this clinician-patient interaction favourably and even perceived they had a choice in renal replacement therapy even when their involvement was limited in choosing their treatment.[116] Some patients entrusted decision-making to their physicians and depended on them to provide timely and relevant information.[117]

Sometimes having the doctor's recommendation validated a patient's decision to start HHD therapy.[118] As with other decisions, patients relied on information from clinicians about the advantages and disadvantages of HHD. Some patients felt reassured and confident in undertaking HHD when clinicians supported their decision and affirmed their

ability to handle it.[118] In some cases, however, patients thought their physicians had inadequate knowledge or experience with HHD and this may have been why they did not use the home modality.[118]

Patients and family caregivers highlighted the difficulty in changing modality, particularly if they started ICHD but preferred another modality.[116] For many patients, there was a preference for maintaining the status quo. These patients expressed reluctance to change treatment once it was established. This reluctance included switching from HD to PD and from dialysis to transplantation.[116] In these cases, patients perceived that there was a risk associated with changing treatments and they were fearful of additional surgery or potential complications resulting in infection or death. Many described how they learned to accept and adjust to the treatment they were on regardless of their initial preference.[116]

Uncertainty affects decision-making ability

Patients reported ongoing uncertainty of life on dialysis.[119] There is uncertainty about waiting for a transplant or uncertainty about the future in general. Patients talked about not knowing how long they would have to continue with dialysis before a kidney was available and this influenced their decision on whether to go on the transplant waiting list.[116] Patients receiving palliative care were unsure how long they would live, and this made them doubt the medical information they were receiving and to reconsider whether they were making the right choice.[116]

Uncertainty was described as "living in limbo" and the "inertia" that both patients and caregivers felt not knowing when end-stage kidney failure would occur, and this resulted in a difficulty making clear decisions,[116] such as selling their assets and moving into assisted care accommodations.[116]

"They can't tell you, you know, how long you have to go. You see this is quite true, they don't know. With all the modern stuff and all that, they still don't know."[116]

Sometimes, uncertainty led to doubts about dialysis. Some believed their friends died because of dialysis or were unconvinced about dialysis, particularly if their nephrologists could not guarantee benefits.[117]

Survival and prognostic uncertainty were perplexing to patients. Some patients believed they had lived beyond their time, yet wanted to prolong life because thinking about death was too difficult. The acute awareness of "living on borrowed time" meant that they lived day by day without making plans for the future.[117]

Access to treatment

Limited access to centre-based dialysis, due to factors such as distance, or lack of openings at a centre, was a consistent reason for choosing home-based PD.[116] Constraints on resources at their renal centre were also described as part of the patients' and caregivers' lack of treatment choice.[116]

Many patients described feeling a positive sense of accountability for their decision to choose HHD and maintain their ongoing well-being.[118] As one patient described; "*Everybody should be offered [home HD]. I think it's fantastic. I would sing its praises dear and daily. But it's not for everybody. If you have the right frame of mind, it's great. From a mental health point of view, if you do things right, you'll feel better health-wise and you'll feel better mentally as well.*"[118]

Being a burden

Many patients described being concerned about being an emotional, physical, and financial burden to their families and were reluctant to choose a modality that may disrupt their family members' lives.[116-118]

The concern about being a burden may originate in aspects of ESKD even before dialysis. Often patients had been in poor health for some time, and the option of undertaking dialysis was seen as too much. One male patient discussed with his wife and decided; *"I didn't want to put that on [my wife] because she had enough putting up with me as it was."*[116] Among older patients, the feeling of being a burden may lead people to decide to withdraw from dialysis or to initially refuse treatment.[117] One perspective was *"older patients believed that choosing dialysis would be wasting community resources."*[117]

Particularly for people choosing against HHD modalities, patients wished to shield their family caregivers from the technical aspects of dialysis at home. Some agreed to at-home dialysis on the condition that their family would not have to take responsibility for the treatment. One woman explained; "*my mother is petrified…I said I will only do it on the condition that my mum is not a co-dialyzer…because I wouldn't want her to have any responsibility if something was to go wrong, I know…she would feel as though it were her fault*."[118]

Patients' awareness of the emotional strain that HHD placed on family members was why some patients did not choose HHD. There was a sense of relentlessness of living with dialysis; "*Well at times it gets very strained. He gets tired…He needs a break and I can't give him one. I need a break but can't have it either.*"[118] Caregivers revealed that the strain due to increased demands and responsibilities can lead to resentment of the ill patient.[118] Some patients were aware of this when they were choosing their dialysis modality; whereas, others did not expect that it would be such a large burden on their families.[118]

The opinions of families can influence patient choices; *"They [my family] don't have the same faith in me that I have in me that I can control the machine."*[118]Another man described wanting home dialysis but was unable to get his wife to agree; *"I wanted to do the home dialysis, right, but my wife refused, and so I came to dialysis because I thought I could handle that."*[118]

For ICHD, the travel to the centre was mentioned as a particular burden. As one patient remarked; "*My brother is 70! I can't ask him to bring me up here every day and then come and get me. I wouldn't. It's not fair*."[117] In another case, it was the effort and sacrifice that others would have to make to support ICHD which lead some people to choose palliative care instead.[116] As a 97-year-old gentleman put it; "*I don't want to be a nuisance to anybody…so it's not really worth it for [the] sake of the few months which it would give me. So I decided I wouldn't have it under any circumstances.*"[117]

Some people mentioned that dialysis limited their ability to work. With a limited income and high medical costs, patients were concerned about the financial burden on their families.[119] In some cases, people described feeling forced to retire early. The subsequent economic consequences also affected their self-image as a provider of the family, as well as their ability to purchase things they had previously been able to.[117] Caregivers described how dialysis negatively affected family income, recreational activities, vacations, and living arrangements.[118] Caring for someone on HHD therapy was also perceived by some caregivers to be a financial strain.[118]

Patients from three US studies included in one SR mentioned the importance of having health insurance that paid for dialysis.[116]

Identity and life changes

Some patients expressed a sense that dialysis changed their sense of self. When undergoing dialysis they were confronted with the reality of their illness and their identity as a sick person. Some expressed that HHD made them feel less confronted by their illness and these people gained confidence and independence from mastering HHD.[118] They choose dialysis at home to maintain their normal activities rather than being around other people who are ill;[118] *"You'd feel freer I think, staying at home, in your environment where you live [instead of] in an environment where you see other sick people. Your frame of mind is much better [at home]."*[118] Limiting interaction with the health care system also allowed some people to identify as a healthier person; *"The more appointments you have, the more sick you feel. You have enough interference in your life. You realize you are not normal and your morale goes down. Every day you have appointments. For me, I live like this, I feel good. I'm healthy. I don't have to see the doctor."*[118]

Other people expressed their desire to avoid identifying as a sick person as a reason for choosing ICHD; *"I don't want it at home. I don't want to be reminded of having an illness. When I come here (dialysis centre), when I enter that door, I am ill — at home I am not ill."*[120]

For some, the desire not to be identified as an ill person was a reason to refuse dialysis initiation; *"I just didn't want to live with a machine attached to me...I'm never sick - it just doesn't fit my vision of me."*[120]

It appears that most people sought to select a modality that best fit with their values and identity.[120] For some, HHD was described as enabling them to regain self-worth, since they felt their life was less dominated by dialysis.[118] Some patients described this as facing the world of renal failure, dialysis treatment and the limitations that it involves; as examining the requirements of fitting dialysis into their lifestyle.[121]

Life restrictions, "dialysis as a shackle"[119]

In one SR, the idea of having a physical shackle (any physical limitation or physically restriction that made a person feel physically tied down because of their dialysis treatment) was described by patients on hemodialysis.[119] These physical limitations appeared to be caused by lack of energy and weakness, food and fluid intake restrictions, excess bodily fluid, or increased metabolism waste in the patient's body. Physical problems related to symptoms of uremic syndrome or inadequate hemodialysis that create physical limitations were also described by patients on hemodialysis.[119]

Physical problems were expressed in various ways, such as “tied down,” “left out,” and “doing without” to express what patients on hemodialysis missed, lost, or could no longer do. One patient said; *“What I used to do I can’t do anymore;” “I feel tied down — shackled.”*[119]

The sense of having a restricted life was also due to limited ability to travel, strict schedule, strict diet (food and fluid intake), limited income, and high medical costs.[119] The hemodialysis machine was seen as a lifeline despite also representing a loss of freedom — dependence on the dialysis machine, dependence on the caregiver, and a disrupted marital, family, and social life.[119]

Other features of life with dialysis included putting plans on hold, having limited social contact, not participating in activities, the time consuming nature of dialysis, and being dependent on others.[119]

Physical symptoms of weakness and fatigue, an inability to participate in activities and perform typical roles and responsibilities, psychosocial symptoms of uncertainty, worthlessness, hopelessness, fear, and the dialysis treatments themselves, are life changes that patients encounter while undergoing dialysis treatment.[119] In addition, patients mentioned dietary restrictions as a major life change. In addition to the physical symptoms of fatigue, weakness, and pain, some participants also reported changes to their body image, particularly relating to the placement of the dialysis access and the symptoms of uremia.[121]

These life physical and psychological changes were reported to limit social life and lead to dependency upon family members, relatives, friends, nurses, physicians, or other significant people.[119] Hemodialysis has an impact on what people perceive to be the routines of home life, and their varying roles in the lives of family and friends.[121]

Caregivers observed how their family members thought that dialysis threatened their identity because they did not “make any effort to try and accept that this is the way life has to be.”[117] Caregivers made efforts to help patients maintain their sense of self which involved helping them choose to participate in life, find new roles, help and contribute as much as they could, take chances, and bear responsibility for themselves.[117] Caregivers were also involved in being optimistic and helping make ESKD patients feel they were “beating the odds and discovering meaning.”[117] It was important for patients to understand how treatment interventions could enable them to preserve their individuality, roles, and relationships.[117]

Home as a medical place

There was a recognition that choosing at-home dialysis means that your home becomes a medical place to some extent; “*Look at my private hospital,*”[118] said one patient.

Patients believed that the dialysis machine could be too confronting to family and visitors, but at the same time, worried about being isolated.[118] Some patients expressed how medicalizing the home created a constant reminder of their disease.[118] “*Every night you know you have to go home and do eight hours or seven hours, six hours of dialysis. Your freedom is really…the moment you go on home dialysis, it’s pretty well taken over by the machine and the requirements.*”[118] Dialysis reminders were everywhere in the home: *“My mother will come up, take the blood tubing [vial], put it into a cup and put into the fridge until the next morning.”*[118] This was a reason some patients declined home-based treatment; *“If I should have that machine at home, it wouldn’t be the same, I’d always remember my sickness.”*[118]

The need for dialysis-related space and home modifications deterred some patients from considering HHD, particularly those with small houses or in rented homes.[118]

Coping

Patients reported that support from family, friends, God, prayer, church, and support groups of other patients helped them to cope and attempt to manage their restricted lives.[119] Meeting and talking to other patients helped patients cope. As one patient explained, *‘‘You think you’re the only one in the world and I found there were lots of other people and people that were younger than me. I know it sounds awful, but it helped me, you know they’ve got a longer period to do this kinda thing (dialysis).’’*[120]

Patients described psychological approaches to coping. Acceptance (of illness and dialysis as part of life), hope (for a transplant or stable health from dialysis), and gaining a sense of autonomy and optimism help people cope.[119] Some feel it helps if they do not focus or dwell on physical aspects of their illness so they can improve their view of dialysis to feel better.[119]

Sometimes efforts to improve the physical or practical challenges of dialysis, including managing a restricted lifestyle or dealing with fatigue, can help with coping. Patients develop strategies to help them cope or to gain a physical outcome.[123] This includes getting support and love from family, friends, or support groups.[123]

At the other end of the coping spectrum, patients felt a lost sense of control and felt unable to cope and had "reached the end of the tether." For some, this led to a resolute decision to cease dialysis treatment. Dialysis would worsen their agonizing existence. Some wished for their lives to end or were "waiting for death."[117]

Empowerment and participation in treatment decision-making were important to patients and caregivers. Being knowledgeable and prepared about the prognosis and treatment options enabled them to cope.[117]

Information needs

Knowledge of the various modalities was used to assess how particular dialysis modalities would impact their future life. Patients derived knowledge about dialysis mostly from family, health care professionals, and other patients on dialysis[120] Acquiring more knowledge about dialysis was seen by patients as being essential to decrease misunderstandings about treatments.[120] Receiving inadequate information led to a "sense of losing control and feeling objectified."[117] Patients may feel that their health care providers are keeping information from them; "*They didn't tell me what I was going to expect or what to look for, or what to do."*[118]

Some patients expressed doubt in their physician; some patients thought their physicians had inadequate knowledge or experience with HHD.[118]

Patients reported a lack of information for both the available options and the practical aspects of each modality as sometimes hindering their ability to make choices.[116] In addition to dialysis options, other information that was consistently deemed important were details regarding each modality.[116] Requirements such as frequency, location, risks, use of needles, who performs the dialysis, and time requirements were important to patients,[120] and gaining knowledge about the available options influenced decision-making.[116] As one patient recounted*; "When I went on dialysis I was automatically put on hemodialysis. I was not even told about CAPD [continuous ambulatory peritoneal dialysis]."*[116]

Patients also reported receiving limited information on potential harms of treatment. One person said*; "They don't tell you everything you need to know . . . I just took the pills (prednisolone) and I was told a few things, but I don't feel nearly enough things. I was not aware of the fact that your vision could be affected."*[116] Another patient would have wanted to know; "*what are the medications, the side effects … when is the disease reaching the end? It would have been empowering to have known."*[117]

Information was particularly important when patients were considering HHD. One patient explained simply*; "Not knowing enough about it, I'm not too comfortable doing it."* Patients attributed their apprehension about HHD to a lack of adequate information and understanding about the modality.[118]

The timing of the information delivery about treatment options was important. Patients recalled being too unwell to absorb the information presented. For example, one patient described; *"The doctor might have mentioned it [continuous ambulatory peritoneal dialysis] but I was so sick at the time I didn't catch on to it."*[116]

Patients said they needed time to process or "make sense" of the information they were given.[116] They may have felt too rushed into making a decision without having time to discuss the options with their families. Information about kidney transplantation was commonly introduced to patients after dialysis had been established. For some patients, information about treatment options came after undergoing surgery for vascular access.[116]

Patients mentioned difficulty understanding the content of some information as one patient described; *"I received the book [patient booklet from Kidney Foundation], which explained things quite well. But [I] didn't absorb the information. [It was] difficult to grasp."*[116]

Content should include information about the disease as well as information about the treatment, as one person described; *"I can't fathom it. I can't look at my kidney, put it in my hand, and examine it myself. Why do I have to be on dialysis? What is kidney disease? How much of it [the disease] do I have to have before I need to be on dialysis?"*[117] Patients expressed a desire to know about kidney disease, the course of the illness, and what will happen both in the near future and in the long-term.[117]

To make decisions that aligned with their values, patients needed to be informed about the their health status, prognosis, pain management, advanced care planning options, recognizing and managing their symptoms, different treatment options, and side effects.[117]

Having their information needs met helped patients relieve their fears and helped them feel in control of the day-to-day aspects of life. "By providing information, health professionals helped patients to imagine possibilities for a future that were consistent with their values, which in turn gave hope."[117]

Understanding the physical, psychological, and lifestyle impact of the illness and the treatment reinforced their ability to cope.[117]

Peer influence was a powerful and persuasive method for patients to gain knowledge of their treatment options. Meeting other patients and listening to their experiences helped patients and their carers to conceptualize the reality of dialysis and transplantation. Peers may have been more influential than clinicians in decision-making.[116] If friends or family members had direct experience with dialysis, this could also influence patient's decision-making, for example; *"My nephew, also on CAPD, told me about CAPD, which I am now on" and "I decided to take it (dialysis) with the machine because I already knew what it was like."* Such opinions can reassure patients, for example; *"My mother asked a 70-year-old neighbour about the treatment. She was told that there was nothing to fear. Gradually I accept it."*[120] They also knew from these opinions and experiences that their choice about dialysis would also affect their families and possibly the levels of support they would require.[120]

Analytic theme 2: Caregivers face a significant and ongoing burden which may be affected (positively or negatively) by modality choice.

Providing care to family members or friends on dialysis is burdensome. Caregivers are faced with lifestyle, relationship, and family role changes when providing care — some of which can feel isolating and overwhelming. Many caregivers are faced with major fears and anxieties with respect to providing care, regardless of dialysis modality.

Psychological burden: anxiety, loneliness, strain and stress

Caregivers described how drastically their lives changed after their family member began dialysis treatment*; "My life has changed (work, school, job, position, responsibilities) I do everything in the house now."*[118]

Family caregivers were distraught as they observed their relatives experience debilitating exhaustion.[117] They were uncomfortable with bearing the responsibility for end-of-life decisions.[117] A caregiver explained how dialysis at home helped the family adjust to the treatment; *"Autonomy is very important for him because he can decide to do dialysis when it is most convenient for him. He can decide independently."*[118] Control over one's time was also important; *"Before, your whole day was taken up with coming to [hospital],whereas now you're not being held back."*[118]

Caregivers felt obligated and sometimes guilty for needing "a break" from their partners on dialysis therapy. However, when they had time away, they frequently worried about their partner.[118] *"I had a meltdown. I got to the point where I didn't think I could go on."*[118] Caregivers revealed that the strain due to increased demands and responsibilities can lead to resentment of the ill patient.[118]

Relationships, relationship changes, relationship disruptions

Some patients experienced improved relationships with family, friends, and caregivers as HHD enabled patients to participate more in day-to-day household and social activities.

A patient described the experience of HHD as helping to bring the family closer; *"When on hospital [HD] you were away from home, and my daughter and I grew apart during that time, because I was never there for her and only through the home hemo we have got back together again and we have a life together."*[118]

Some patients reported that the experience of HHD strengthened family relationships: *"The experience has actually drawn the family closer together. I value more fully each moment with my family."*[118]

For some, dialyzing at home strengthened family connections — patients and caregivers sometimes called themselves "a team."[118] Others thought that ICHD offered social support and strong relationships with other patients.[118]

Opinions of friends and family

When treatment options were presented, patients' decisions were influenced by a desire to "maintain their pre-existing lifestyle" and were shaped by opinions of family and friends.[116] Spouses, children, neighbours, colleagues, and friends may have positive or negative responses to the patients. If a significant other expresses a negative view, perception, or response, it may cause negative effects in their relationship with the patients, and disruptions in some relationships occur.[119]

The positive opinions of friends and family can boost the confidence of patients to undertake self-care. As one patient explained*; "So between those members of my extended family. . .and between what I believe in the word of God, the two coming together made me decide that I could take the CAPD."*[120]

There were a range of family influences from driving patients to their place of dialysis, or offers of living kidney donation, to censoring of information on-treatment options not congruent with the family's wishes.[116]

Family influence was not always supportive. Family discord such as arguments, hassles, perceived difficulties in fulfilling patient wishes, and family members disagreeing were reported. Other barriers were related to disparate religious beliefs, reluctance to voice questions, failure of family members to follow through on promises, and family members not caring.[117]

One patient described the difficulty discussing her choices with her son; *"I do not want dialysis. My kids are [generally] fine with it, but one, he's taking it very badly and he thinks that I'm a coward because I won't go on dialysis, but I don't see it that way. He won't talk about it. I want to talk about it. Inside I'm hurting like mad, but I can't get that out."*[117]

Analytic theme 3: There are a range of characteristics and factors that influence people's perspectives and experiences of different dialysis modalities.

Convenience, familiarity with modality, previous belief or experience with the modality, and the opinions of family and friends all contribute to how patients perceive their dialysis experience and their dialysis choice. Whether at home or in a dialysis centre, if patients believed better outcomes were achieved there, they were more likely to have a positive view of the dialysis modality or setting. Some patients felt that they had the choice between modalities, settings, or starting dialysis at all, whereas others did not.

Perspectives and experiences for home dialysis

HHD enabled some patients to live a more normal lifestyle because they would not need to travel to the hospital and depend on medical staff. The flexibility of treatment times with HHD allowed patients to engage in employment, social outings, and travel.[118] Ability to maintain a work schedule was important; *"I was up for anything new that would improve my health and let me get back to work because I work a full schedule, it's not invasive in my life and I can balance my life a lot better."*[118]

Patients chose treatment in the home for several reasons. For some it was freedom; *"Mainly because it [home dialysis] gives me a bit more freedom. It would allow me if I wanted to take a trip, to go somewhere and basically do it myself."*[120] A long travel distance to the dialysis centre was a prominent factor in selecting home dialysis over hospital-based dialysis.[120]

In one case where patients were presented with options, they were allowed to discuss them and weigh them with family members; *"Me and my wife went to all the classes and everything, and so they showed us all the options and everything, but I wanted to do the home dialysis."*[118]

There was a sense among some patients that taking treatment at home was better and led to health improvements; *"The other thing about dialyzing at home is that you can do more hours. So, the more treatment that you're getting, the better the quality of [dialysis]. Obviously, your blood is cleaner and you're not carrying the same toxins, and your well-being should be a lot better because you're getting better dialysis."*[118]

Others felt that their mood was also improved by treatment at home; *"If I had continued with hospital dialysis, I would had been dead. In part, I would die from physical disease, in part I would die of depression."*[118]

Patients believed that HHD offered better health outcomes compared with ICHD. *"I saw others on home hemodialysis and they looked better."*[118] Some people who had previously received ICHD noticed significant improvement in their physical and psychological health on HHD therapy.[118] Some patients believed HHD offered increased survival, and the ability to increase their hours or frequency on dialysis enabled benefits such as fewer dietary restrictions.[118]

Perspective and experiences for ICHD

Reasons for choosing ICHD included preferring having others caring for them, preferring a planned schedule, free days with no dialysis, perception of ICHD as a "better" therapy, previous knowledge of ICHD from family member, the ability to go swimming, and convenience.[116] *"I'd like to stay as normal as I possibly can, . . .(hemodialysis) would be less disruptive of our life."*[120] When deciding between ICHD and PD, a patient explained: *"You can't go swimming with that damn thing [peritoneal dialysis catheter]. This way, I don't have no openings, I can go swimming anytime I want, I don't have to worry about dirty water or whatever getting into it."*[116]

Some patients found the routine of an in-centre option to be convenient*; "Since I usually control the scheduling of my job, the time to spend in the hospital is OK for me. [Hemodialysis] would be less disruptive of our life. Two, three hours a day, every other day, and then you can go on with your life in between times."*[116] As another patient explained; *"The hemodialysis centre's right close to my home. It's real convenient."*[116]

Trust in their health care provider was also mentioned as a reason for choosing ICHD. As one patient explained; *"I know we couldn't do CAPD [continuous ambulatory peritoneal dialysis]. No, I sooner trust the girls, because they're supposed to know about it."*[116]

Familiarity with ICHD was also a reason for choosing that modality. As one patient explained; *"I suppose the blood one is probably the proper one, I don't know…I decided to take it with the machine because I already knew what it was like."*[116]

Reasons for not choosing ICHD included needle phobia, "looking like a patient;" and fear of cross infection.[116] *"Hemo is pretty dangerous because you don't know whose blood is where. What assurance would I have that somebody else's blood was not in the machine somewhere."*[116]

Perspective and experiences for PD

Reasons for choosing PD included having self-capability versus depending on care from strangers, managing illness in the privacy of one's own home, having more freedom or flexibility, less time in the hospital, greater ability to travel, ability to work part-time, and ability to continue caregiving for children.[116] One patient felt that the ability to travel was easier with PD; *"It would allow me if I wanted to take a trip, to go somewhere and basically do it myself, instead of having to try to find a facility that could accommodate me."*[116]

Patients who were working appreciated the freedom PD gave them over their activities. As one patient explained; "*Mainly because it [peritoneal dialysis] gives me a little bit more freedom. Being able to do it at home I wouldn't have to come to the hospital. I am a pharmacist . . . worked eight hours in the hospital. I did not want to spend the rest of my time in hospital again."*[116] Another mentioned; *"I need flexibility to go where the meetings are and to get up and move around. CAPD [continuous ambulatory peritoneal dialysis] seemed like it would allow me to function in those capacities."*[116]

PD lessened the burden on the family member for one patient; *"Peritoneal dialysis is better because I can work all day and my husband can stay at home; whereas, with hemodialysis you would have to go every other day."*[120] Another patient felt that PD would lessen the impact on her role as a parent; *"I have a son and I would have to go to the hospital every other day for haemo. It was real hard for me. With peritoneal, I could be in my own surroundings at home."*[116]

Spiritual reflection and discussions with family helped support the decision to initiate PD; *"So between those members of my extended family. . .and between what I believe in the word of God, the two coming together made me decide that I could take the CAPD."*[120] Another patient felt PD allowed her greater responsibility for her own care, she also valued the privacy of PD: "*With [in-centre] hemodialysis there's no partition, no privacy. I couldn't even meditate."*[116]

Reasons for not choosing PD included concerns about having Tenckhoff catheter, concerns about sterility in the home resulting in infection, and the inability to store dialysis supplies.[116] As one patient explained; *"Peritoneal dialysis is sterile and can't be done at my home." Another described his living situation, "Where we were living previously there was no space [for peritoneal dialysis supplies]. We couldn't get one iota of anything else in that place."*

One patient disliked the abdominal access point of PD: *"It makes me feel uncomfortable to see that thing that comes out of your stomach. It gives me a funny feeling like someone scratching a chalkboard."*[116]

The perspective and experience of having no choice (to have dialysis or to choose between modalities)

Many patients perceived they had limited choices in treatment. When choice was offered, preferences for PD were based around privacy, freedom, and flexibility; whereas, preferences for HD were attributed to a planned schedule, regular social contact, and previous knowledge of the therapy.[116]

Sometimes patients felt they had no choice of whether or not to initiate dialysis. *"You all ask us like we took this by choice. We didn't have any control over this. I was afraid but I wanted to live. That's what it comes down to."*[120] This reduced the sense of "real choice" or the illusion of choice patients perceived, for example, patients expressed *"I had no choice, or I would be dying slowly."* Even when a choice was reportedly offered, it could be perceived that there was not a true choice in the situation if the patient wanted to live; *"I have no choice. . .I wanted to live."*[120]

Others described not having a choice between modalities; *"When I went on dialysis, I was automatically put on hemodialysis. I was not even told about CAPD. The doctor might have mentioned it, but I was so sick at the time I didn't catch on to it. My response was that if I had been told about something like that, I would have wanted to go with it."*[120] Unforeseen medical considerations also forced dialysis choices to be made by the family or physician*; "the doctors pretty much made the decision and my son agreed."*[120]

Summary of results

Patients with ESKD usually have been suffering from chronic illness for a period of months or years. At the point of considering dialysis treatment, they are in poor health and often their caregivers have been under strain for some time. To patients, initiating dialysis treatment or changing modalities often represents a worsening of their condition, and it represents an increasingly invasive treatment. They understand that dialysis will not cure their disease, and that choosing a dialysis modality is not choosing to get better.

In spite of the dire position patients find themselves in, it is nonetheless clear that choice is important to patients when considering dialysis modalities. They desire control over the place and timing of their treatment, and choosing a modality that optimizes freedom over their day-to-day activities. It was also found that for each patient, "freedom" has a different meaning depending on their situation.

Caregiver burden can be overwhelming, guilt inducing, difficult, and stressful. Patients held a positive view about patient education. Patients report feeling more empowered to make choices, and more comfortable with their treatment when they have information about all treatment options and what they can expect. The content, timing, and source of patient information was found to be important. Most patients trust their doctors to help them make a decision, so doctors also need to have accurate and current information regarding all available modalities.

Our review found there is no clear preference among patients between modalities, but what is consistent is the desire for a modality that is the least disruptive to their lives, and their caregiver's lives. For some, that means home-based modalities, for others that is in-centre.

Ethical Issues

This section addressed the following Research Question:

Research Question 7: What are the main ethical issues that ought to be considered when considering expanding the offer of self-care or assisted home dialysis (peritoneal or hemodialysis), and self-care in-centre HD for patients with ESKD?

Introduction

The purpose of this analysis was to identify and reflect upon key ethical, legal, and social considerations that may be relevant when recommending a treatment modality for ESKD. Though the other sections of this HTA often touch upon broadly ethical concerns, the aim of this analysis was to make such issues explicit and to identify others that may be relevant to any decisions in this regard.

The issues raised in this section go beyond narrowly defined ethical concerns to encompass broader legal and social considerations. It is common in the ethics literature, across a broad range of health-related issues, to refer to ethical, legal, and social issues (ELSI) when addressing broader values-related considerations.

Generally, HTAs are directed either at novel technologies that have not been previously implemented, or at new or refined applications of previously existing technologies. The goal of such analyses is to assess the relative cost and effectiveness of emerging technologies or novel applications. In the current case, however, the various modalities for the management of ESKD have been available for decades and relative costs and clinical effectiveness associated with these modalities are generally well understood, in the other sections of this report attest to this fact. Indeed the authors of one recent major Canadian study conclude: “increases in use of peritoneal dialysis achieved through health policy interventions could lead to substantial yearly cost savings to the health care system without diminishing and possibly improving patient outcomes. Coordinated plans to standardize and optimize implementation of peritoneal dialysis should be considered.”[9] Nevertheless, this ELSI analysis begins with the assumption that the question of modality choice is still open and aims to understand the systemic factors that might lead to favouring some modalities while leading to underutilization of others.

The primary question then is, “Why aren’t equally clinically effective and more cost efficient modalities being utilized more widely?” This ELSI analysis aims to inform discussion of this question. In particular this ELSI analysis aims to address the following:

1. Which dialysis modalities for ESKD should be recommended for usage? Should some modalities be prioritized over others?
2. What are the main ethical issues that need to be considered when using various modalities?
3. What ethical, legal, and social issues are raised by the implementation (or failure to implement) a particular modality for ESKD?
4. What are the potential drivers and barriers (from an ELSI perspective) to the adoption of one modality versus another?

The focus of this discussion will be modality selection for ESKD patients deemed eligible for dialysis and will not address directly the issue of selection of eligible patients in the first place. While the question of the ethical criteria by which to select patients for any dialysis modality continues to be a debated topic, especially in light of our aging population,[124,125] that issue will not figure directly in the analysis offered here. This is not to suggest that this issue is not relevant to the question of modality selection. Inasmuch as the elderly are the largest and fastest-growing group with ESKD and the frail elderly in particular may not be candidates for some dialysis modalities, the question of selection criteria is indirectly relevant to the issue of modality choice. Nevertheless, for present purposes we assume that all ESKD patients are appropriately selected and eligible for dialysis. Hence, the key ELSI considerations explored here focus on which modality is most appropriate, all things being equal.

Methods

This ELSI analysis draws on the other sections of the HTA that have systematically reviewed the literature on various aspects of modality selection and use with regard to ESKD. The Clinical, Economic, and Patient Preferences and Experiences Reviews in particular have analyzed the available evidence and the present analysis draws upon those reviews. In addition, a variety of other sources that were identified through a separate electronic search of articles from the ethics and clinical science literature that raised ELSI related to modality selection for ESKD were examined. Related materials found through the writer’s own searches of both indexed and grey literature also inform this analysis. While no attempt has been made to work systematically through a list of relevant issues identified prior to

the analysis, such as Hofmann's 32 morally relevant questions for HTA,[126] the present analysis is informed by such tools.

The literature search was performed by an information specialist, using a peer-reviewed search strategy.

Published literature was identified by searching the following bibliographic databases: MEDLINE database (1946-), and PsycINFO (1967-) via Ovid; Cumulative Index to Nursing and Allied Health Literature (CINAHL) via EBSCO; and PubMed. The search strategy was comprised of both controlled vocabulary, such as the National Library of Medicine's MeSH (Medical Subject Headings), and keywords. The main search concepts were dialysis and end-stage renal disease.

Methodological filters were applied to limit retrieval to studies of ethics, legal, and social issues. Retrieval was limited to documents published since January 1, 2000. The search was also limited to English- or French-language publications. Conference abstracts were excluded from the search results. Appendix 2 reports the detailed search strategy.

The search was completed on May 30, 2016. Regular alerts were established to update the searches until the publication of the final report. Regular search updates were performed on databases that do not provide alert services.

Grey literature (literature that is not commercially published) was identified by searching the *Grey Matters* checklist (https://www.cadth.ca/grey-matters), which includes the websites of HTA agencies, clinical guideline repositories, SR repositories, economics-related resources, patient-related groups, and professional associations. Google and other Internet search engines were used to search for additional web-based materials. These searches were supplemented by reviewing the bibliographies of key papers and through contacts with appropriate experts and industry.

Analytic approach

This analysis draws most directly on two classic perspectives that are well-established in the health ethics literature, namely the utilitarian/consequentialist approach, and the deontological/duty based approach.[127] The former focuses more directly on the overall consequences of a particular course of action and deals with questions of individual rights and duties and considerations of social justice only indirectly. Conversely, the deontological approach gives priority to considerations of individual rights and concomitant duties while treating overall utility (i.e., the greatest good for the greatest number) as only a secondary importance. Put otherwise, from a deontological perspective, the most important consequence is whether individual rights are properly honoured and accounted for irrespective of whether some supposedly greater good might be accomplished by ignoring or overriding the rights of certain individuals. While these two theoretical approaches are often treated as contrary there is a well-established tradition within contemporary health care ethics that treats them as complementary.[127]

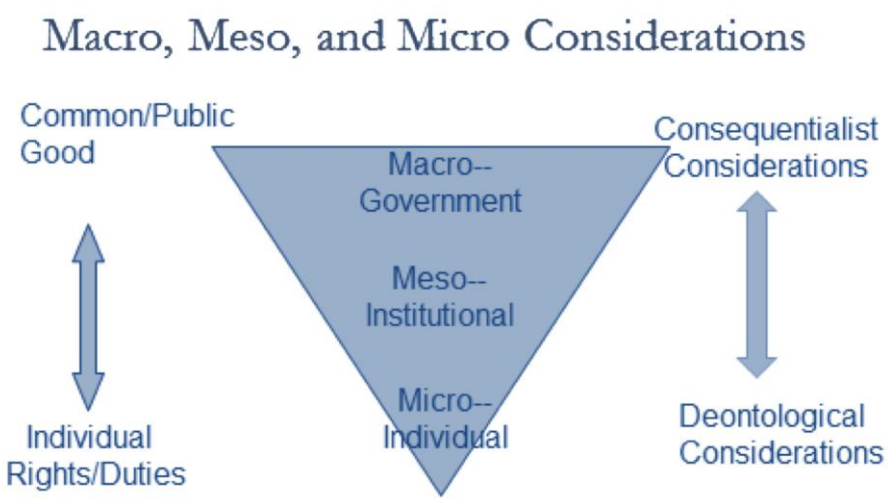
In practice, whether one relies primarily on consequentialist or deontological considerations is often dictated by the context in which a particular issue arises. Consequentialist considerations generally take priority in the public health domain, where the overall good of the population as a whole is the focus. For example, Public Health Ontario has developed a discussion paper titled "An Ethical Framework for Public Health Projects" that "adopts an explicit 'public health lens' which reflects collective interests, broader concerns for justice, and the common good."[128] A public health policy that requires mandatory reporting of certain communicable diseases, for example, gives priority to the overall good (utility) of society while treating considerations of any individual's right to privacy and confidentiality of only secondary importance. Conversely, in the clinical context deontological considerations concerning the rights of individual patients to make their own autonomous decisions, to maintain their privacy and confidentiality and so forth, and the concomitant duties of health care worker's to respect such individual rights, generally take priority over what they or others might believe to be in the patient's or society's best interests. This tension is particularly evident in the current context when attempting to balance the overall costs to society for the provision of ESKD care with the rights of individuals to choose a preferred treatment modality based on their individual values and preferences irrespective of considerations of the common good. For example, while there could be ample evidence that a "Peritoneal Dialysis First" policy should be introduced and/or enforced as the default modality for any ESKD patient that meets the criteria for PD, such a policy may appear to contrary to individual values and preferences regarding the ability to choose conventional hospital-based HD if it was an individual's preferred modality. This ELSI review aims to explore such values tensions and the factors that might inform one policy decision as opposed to another.

As the foregoing indicates, an ELSI analysis of ESKD modalities raises a variety of issues ranging from social justice concerns with regard to the allocation of health care resources in a publicly funded health care system, to those involving individual patient rights and the concomitant duties of health care providers in administering and delivering

any ESKD modality. For the purposes of analysis and reporting, this broad range of issues will be divided into macro, meso, and micro concerns. Macro concerns are generally policy-related issues that are handled at a population level through legislation such as the Canada Health Act (CHA) or by a government agency such as Health Canada or provincial health ministries. Meso-level considerations are those that concern institutions such as regional health authorities or health care facilities in which various modalities for ESKD care are provided and supported. Here considerations about the availability and appropriate use of institutional resources such as hospital-based HD units and the allocation of personnel for either hospital or community-based treatment programs are assessed primarily along consequentialist lines, but insofar as institutional decisions can have a direct impact on provider practice patterns and the availability of services for individual patients or groups of patients, deontological considerations will often play a role. At the micro level we consider the impact that various ESKD modalities might have on individual patients with regard to such issues as shared decision-making and informed consent, patient preferences with regard to a particular kind of treatment, and the concomitant duties of health care providers in adequately informing patients and in providing appropriate care. These latter issues are generally assessed primarily along deontological lines. This structure mirrors, to some degree, the results reported in the "Implementation Issues" section of this HTA where summary findings are reported as they relate to the "policy level" (macro), "organizational level" (meso), and the "health care provider level" (micro).

Figure 4 illustrates the analytical process and the dynamic relationship between consequentialist and deontological considerations. The inverted pyramid captures the idea that the issues under consideration range from broad public policy concerns to more narrow concerns of individual patients and practitioners.

Figure 4: Levels of Decision-Making and Types of Ethical Consideration



Background and context

In order to appreciate the ELSI related to ESKD and dialysis modality selection, it is necessary to reflect briefly on the broader historical and cultural context that informs past and current practices with regard to the care and management of ESKD patients. ESKD is, in many respects, a unique historical and cultural phenomenon in international health care policy, especially in the North American context.

Advances in both medicine and engineering in the early 1960s led to the development of dialysis. Before this, a diagnosis of ESKD was a virtual death sentence as little could be offered by way of management and treatment. But like almost every innovative technology, dialysis was an expensive and scarce resource and health administrators had to make difficult decisions about who would have access to this life saving intervention. The dialysis allocation issue became a national phenomenon in the US in 1962 when *Life* magazine published a major article titled "They decide who lives, who dies: medical miracle puts a moral burden on a small committee." The article described the process by which a small committee at the Seattle Artificial Kidney Center made decisions about access to dialysis[129] That committee settled on "social worth" — an assessment of a patient's potential future contribution to society — as the criterion for determining who would receive dialysis and live or who would be denied access and die. Ethicists were quick to condemn this criterion as overly subjective, and the process of selection was deemed highly

discriminatory.[130-132] Indeed, some now trace the birth of modern bioethics to the introduction of artificial kidney dialysis in the 1960s and the allocation controversy it created.[133]

Notwithstanding the criticisms of the Seattle criterion, the *Life* magazine article and the controversy it created made the problem of access to dialysis a national concern in the US. Advocates pressed for a national treatment plan and Congress responded, initially by funding dialysis centres in hospitals operated under the Veteran's Administration (VA) as well as in a number of demonstration programs through the Public Health Service. Only the VA had legal authority to pay for direct patient care, while the Public Health Service had authority only to support research, training, and demonstration projects.[134] But as the number of ESKD patients continued to outstrip the limited supply of dialysis places available, the pressure on Congress mounted. In response, a Committee on Chronic Kidney Disease was convened in 1967, led by renowned nephrologist Carl Gottschalk. That committee recommended that the federal government fund treatment for all patients with ESKD, endorsing home dialysis over centre dialysis on the basis of both clinical and cost-effectiveness. It was not until 1972, however, that the Medicare system, which had been established in 1965 for the elderly, was amended to extend benefits to the disabled. A special provision declared that persons with ESKD who required dialysis or transplantation would be deemed to be disabled.[132,134] Hence for over four decades in the US, Medicare has effectively provided universal coverage for ESKD treatment, the only chronic health condition in the US to receive such support.

The foregoing account of the establishment of the Medicare ESKD program in the US is instructive on several levels for this ELSI analysis of dialysis modalities in Canada. First, it points to what might be described as "ESKD exceptionalism" in that this particular chronic disease has been singled out from the outset as one demanding special consideration. It has been observed that policies implemented in the US have a way of making their way into other countries over time,[135] and the pattern of ESKD modality utilization in Canada has largely mirrored that of the US. Although the organization of our health care system at the macro level is fundamentally different from that of the US (notwithstanding ongoing attempts in some quarters to introduce greater privatization into the Canadian system), program development and delivery of services at the meso level, as well as patient values and expectations at the micro level are influenced greatly by what occurs south of the border. ESKD exceptionalism continues to animate discussions concerning modality availability and patient preferences around treatment choice even in Canada, a matter to which we will return later.

Second, the unique funding model within the US health environment has affected the manner in which dialysis programs were established, and has dictated to some extent the modalities that were promoted at different periods of time. While a federally funded dialysis program would no doubt lead to wider availability, there were fears that the rush to establish more programs would undermine the "then successful home hemodialysis ethic in the US."[136] This latter fear was not unfounded as more than 40% of US patients were doing dialysis at home when the Medicare ESKD program was established, that number shrunk to less than 0.5% by 2004.[136] Much of this was due to the funding model established by the Centers for Medicare and Medicaid Services (CMS) in 1983. The fee-for-service model effectively rewarded providers on a procedure basis including reimbursement for drugs prescribed. Inasmuch as conventional ICHD offered in clinic required more procedures and more drugs in the management of ESKD patients, there was a financial disincentive to put patients on home dialysis.[135] Another apparent consequence of the initial CMS fee-for-service payment structure can be seen in the diagnosis of ESKD patients in the first place. While the population of the US is approximately nine times greater than that of Canada, by 2002 the chronic dialysis population in the US was more than 20 times that of Canada.[137] While population demographics might explain some of this discrepancy, assuming that diagnostic criteria for ESKD are consistent on both sides of the border, it seems that non-medical factors have affected ESKD diagnosis in the US historically.

In an effort to contain costs, in 2008 the CMS proposed a new "bundled payment" for ESKD care that focused on outcomes rather than procedures. This relatively new model has effectively reversed the financial incentives as PD is a much less expensive modality.[135] The key reasons are summarized as follows:

> First, the supplies are cheaper and the patient or family provides the labour. Second, far fewer parenteral medications are given to PD patients than to HD patients, given the more convenient oral route of administration for this home-based population. Third, significantly fewer ESAs are given to PD patients based upon more efficient ESA effect (presumably related to better marrow response in PD and subcutaneous dosing), preserved residual renal function, and less blood loss (no obligate HD loss or ongoing phlebotomy). . . Thus, this newly developed, simple single-payment strategy is a strong incentive for the dialysis provider to encourage home PD. Greater utilization of PD would be expected to result in greater profitability under the new bundle payment structure. (p.13)[135]

Lui et al.[138] report that this new funding structure is having an impact: "Under the new bundle, the growth of PD utilization has been accelerated compared with the utilization of HD, and the use of expensive drugs, especially ESA, has declined substantially."

Summing up, while the organization of the health care system in the US is fundamentally different from that of Canada, lessons from the US experience could nevertheless prove instructive for an ELSI analysis of ESKD modality selection in the Canadian context. It is clear from the foregoing, for example, that funding structures provide financial incentives and disincentives to service providers in the promotion (or failure to promote) particular modalities. Under the US system of privatized delivery of health care, for the most part such incentives affect private providers. In Canada (at least for now) ESKD services are provided through publicly funded facilities. Nevertheless, financial incentives could still play a significant role at the macro level, for example, if federal transfer payments of health care dollars to the provinces were tied in some way to particular outcomes with regard to ESKD services, a policy option consistent with the spirit of some recommendations proposed by the *Advisory Panel on Healthcare Innovation* that acknowledges the importance of efficiency and value for money in ensuring system sustainability[139] At the provincial level similar policy initiatives might dictate target outcomes for home-based modalities for regional health authorities assuming such modalities are equally effective clinically and more cost-effective.

At the meso and micro levels it is worth mentioning that even in Canada's publicly funded health care system, many physician providers of ESKD services work effectively as private contractors who are paid on a fee-for-service basis.[138] Lui et al. (2015) observe: "Financial reimbursement policies are the most important non-medical factor contributing to modality selection worldwide, and pro-PD reimbursement policies have been associated with varying, yet positive outcomes in many countries . . ." and "Different reimbursement policy could impact PD utilization dramatically. . ."[138] That being said, the role of reimbursement on modality selection in the Canadian context has been explored previously,[140] and it was concluded that in the Ontario context at least, simply emphasizing the benefits of PD coupled with a PD preferred reimbursement policy were not sufficient to offset a "pervasive HD infrastructure."[138] This suggests the factors affecting modality selection for ESKD are complex and systemic, and any efforts toward a cultural shift in this regard will occur only with a sustained effort at multiple levels and over an extended period of time. In the remainder of this ELSI analysis we consider in more detail some of those factors.

Macro-level considerations

Key values considerations at the macro level include considerations of ethical stewardship and the just allocation of scarce health care resources so as to achieve the best outcomes for society. While considerations of individual rights are not irrelevant to discussion of ELSI at the macro level, they do not figure prominently in the analysis at this point.

The primary value consideration at the macro-level concerns social justice and the responsibility of federal and provincial bodies to allocate health care resources in a fair, equitable and cost-effective manner.

As noted previously, although the US Medicaid system effectively provides universal coverage for ESKD, the mode of delivery has been predominantly through privately owned clinics. As such, the financial incentives provided through the CMS's original funding formula inadvertently promoted predominantly conventional ICHD while discouraging home-based HD and PD. Only recently has that formula been revamped and early indications are that the use of PD as the preferred dialysis modality is now expanding. While the CHA ensures universal coverage for basic health care including ESKD, the Act has historically curtailed the delivery of health services through private clinics. As such, the kind of financial incentives that have played a significant role in the US system both in the original development of a pervasive HD infrastructure and then in the ongoing reform of that system, are largely absent in Canada. In the absence of similar financial incentives, why did Canada follow the US in developing its own pervasive conventional ICHD infrastructure in the first place?

Part of the answer here can be traced to the CHA itself. While the CHA ensures universal coverage, it is predominantly for hospital-based services. As such, the structural incentives created by the CHA have encouraged hospital-based care. Another factor has to do with the availability and distribution of nephrology specialists. Up until the early 2000s the majority of Canadian patients undergoing dialysis did so in academic university-affiliated centres under the care of nephrologists with university appointments.[141] While this trend has been changing as the number of specialists has increased, especially in larger urban centres, it could still have an impact on the distribution of services in more rural regions of the country. The evidence in this regard is mixed; although some rural regions in Canada tend to have higher use of PD due to the challenges of accessing regional conventional ICHD facilities, aboriginal communities, which are often remote, tend to have lower use.[9] Any macro-level policy initiatives aimed at increasing home-based dialysis will need to take regional, community, and perhaps even ethnic disparities into account.

Once conventional ICHD capacity has been developed together with a supporting infrastructure, it is difficult to switch to home-based modalities. When centre-based capacity is available, the marginal cost of adding a new HD patient to an empty spot is relatively low, while the costs of switching to a home-based modality are initially greater, especially if the supporting infrastructure to effect such a transition are either unavailable, or poorly developed, or inadequately resourced. Lui et al. (2015)[138] speculates that this in part explains Ontario's failure to achieve its target of 30% PD by the end of 2010, despite attempts to promote the benefits of PD, while adjusting the reimbursement policy for physicians to make PD a more attractive option.

The US and Canada have each developed pervasive conventional ICHD infrastructures although by quite different means. Inasmuch as the US system relies more heavily on market forces in effecting social change, recent adjustments in the funding formula for ESKD services has resulted in relatively rapid adjustments by private providers in order to take advantage of these new market realities. Although many Canadian physicians are paid on a fee-for-service basis, they also work in publicly administered facilities that are less directly affected by market forces and thus less nimble than private providers in their ability to change. Public systems are more cumbersome such that a targeted adjustment in one area necessarily entails a broad range of systemic adjustments that can hamper such change initiatives. For example, under the CHA most pharmaceuticals are covered only if administered in hospital. Patients without private insurance will either need to bear the cost themselves, or go to a health centre to receive care.[138,142] So even though a given patient might desire home HD or PD services, he or she might be unable or unwilling to absorb the cost of drugs related to home-based care if that same care is fully covered in the hospital or clinic.

In order to increase the uptake of HHD and PD modalities more rapidly, a potential macro-level policy option for Canada would be to enlist market forces more directly by moving toward private provision of dialysis services. In theory, by moving services out of publicly administered facilities into privately run clinics and adjusting reimbursement provisions along the lines of the US CMS, private providers in Canada would be incentivized to deliver home-based dialysis services. Given the Supreme Court decision in Chaoulli 2005[143] and the current legal challenge launched by BC physician Dr. Brian Day that is now before the Supreme Court,[144] this could be a very real possibility in the not too distant future. The Fraser Institute notwithstanding,[145] the overwhelming evidence is that Canada's publicly funded health care system represents a significantly lower percentage of GDP annually than does the US's largely private system (figures that even the Fraser Institute acknowledges) while performing better on a number of key measures.[146] Another policy option would be to adjust the provisions of the CHA to cover a greater portion of home-based costs for dialysis services out of the public purse. Provinces might in turn add incentives to nudge regional health authorities toward greater utilization of home HD and PD services. While the latter would be more consistent with the more egalitarian conception of social justice that has underwritten Canadian health care policy for almost 60 years, it would only be one aspect of the systemic changes necessary to effect lasting change in this regard.

A federal advisory panel on health care in Canada recently acknowledged that although the programmatic structure of Canada's Medicare system initially achieved universal access to high-quality hospital and physician services, that structure has now become one of the major barriers to transformation of the system.[139] Macro-level policy options that support home-based EKSD services while preserving the fundamental values underlying the CHA could serve as one example of how some of the systemic barriers that have evolved in Canada's publicly funded health care structure can be overcome. But any such policies must be sensitive to regional disparities and should be accompanied by structural adjustments in other areas if the pervasive culture that supports conventional ICHD is to be altered. Inasmuch as "the success of a given country's PD-favoured policy [is] inversely associated with the extent of HD infrastructure,"[138] significant efforts will be required at multiple levels in order to effect positive change. As noted previously, one potential policy option would be to tie federal transfer payments for ESKD services to outcomes with regard to modality selection (an outcomes-based approach), which would mirror to some degree the recent changes implemented by the CMS in the US.

Meso-level considerations

Considerations of social justice, responsible stewardship, and the just allocation of scarce resources remain relevant when examining meso-level ELSI related to ESKD modality choice. However, inasmuch as institutional policies bear more directly on the activities and practices of individual health care providers (physicians, nurses, etc.) considerations of professional obligations and the rights and responsibilities of these providers vis-à-vis their professional roles will figure more prominently in the discussion.

Similar to what was discussed previously under macro-level considerations, public officials and health care administrators at the meso level have a fiduciary responsibility to ensure that the public funds they administer are utilized in the most cost-effective manner available without compromising patient care. If home-based modalities for the management of ESKD meet these requirements, then public officials and senior administrators should direct more

resources in that direction and away from conventional ICHD. The foregoing notwithstanding, it is acknowledged that a variety of systemic barriers must be overcome in order to achieve gains in this regard.

Provider reimbursement bears some further discussion at the meso level, as pro-PD reimbursement has been associated with positive outcomes (i.e., greater PD uptake) in various jurisdictions.[138] While Ontario's experiment was unsuccessful, reimbursement policies could still be important drivers for effecting change. However, any adjustments in this regard must guard against the possibility that providers will "game the system" to take advantage of the new reimbursement structure. Such practices have been reported under the pay for performance plan in the US where concerns have been raised about "cherry picking" patients. That is, depending on the clinical end points tied to a particular fee structure, physicians may be tempted to exclude patients that are considered high risk due to age, comorbidities, poor compliance, and so forth.[147] Conversely, if the fee structure simply rewards physicians based on the percentage of patients enrolled on a particular modality, some might be tempted to expand inclusion criteria and direct patients toward a modality for which they are not good candidates. Further evidence of the impact of funding is found in the patterns of referral for transplantation in the US where private clinics are reported to refer less often than publicly funded programs.[148]

Again, while Canada's publicly funded universal health care system is ostensibly not as vulnerable to such market forces, the fact remains that the fee-for-service structure under which the majority of Canadian physicians still operate effectively puts them in a conflict-of-interest situation when their level of remuneration is tied directly to the kinds of treatments they recommend and provide. While there is a tradition in the economics (laissez-faire) and ethics (ethical egoism) literature that suggests that as each individual attends to his or her own rational self-interest it will lead eventually to the overall benefit of the whole,[149] there is plenty of evidence to suggest otherwise. Furthermore, individual self-interest flies in the face of a professional ethic that purports to put the interests of patients first. No doubt the vast majority of physicians adhere to the highest professional and ethical standards but it would be naïve to ignore the influence that reimbursement policies have on physician practice. As noted previously, financial considerations are the single most influential non-medical factor affecting modality selection for ESKD.[138]

Aside from physician reimbursement, a variety of other meso-level factors have been identified as influencing modality selection for ESKD including local expertise, individual physician's opinions and knowledge about home-based modalities, size of the local dialysis program, presence and duration of pre-dialysis care, and standardized education.[9] Other sections of this HTA have reported on many of these barriers and others. This section will take up some of these factors as they pertain to various ELSI in more detail.

Lack of health care provider education regarding home dialysis is identified as a primary factor in the underutilization of these modalities.[137,148,150,151] In Canada, Sood et al. (2014)[9] reported a small but steady decline in use of PD between 2001 and 2010 although not as large as was observed in other jurisdictions globally. Somewhat paradoxically, among the factors they report as contributing to the slower decline in Canada is strong education about PD during residency and fellowship training for Canadian physicians. One would hope that strong education would result in positive gains as opposed to not quite so negative losses. Again this points to the broader systemic barriers affecting efforts to bring about this cultural shift when the conventional ICHD infrastructure is so firmly entrenched. Such challenges are evidenced in the aforementioned Ontario project that failed to meet its PD targets. Meanwhile, although the US bundled system of reimbursement is ostensibly shifting the emphasis away from conventional ICHD to HHD and PD, there are still concerns that the shift is slow and that there is a need for continuing education of both patients and staff.[152,153] As is reported elsewhere in this HTA (Patient Perspectives and Experiences Review) some patients report never being properly informed about various modalities by their health care providers and/or believed that their providers lacked adequate knowledge of the various treatment options available. Indeed, if physicians and other care providers are to meet their ethical obligations to their patients including the minimal standard of obtaining a patient's informed consent to treatment, it is incumbent on professional education programs to ensure that their members are adequately educated on the full spectrum of EKSD care.

Another potential barrier includes perceived ethical concerns of some physicians about a lack of RCTs that demonstrate the clinical effectiveness of home-based dialysis modalities.[9] This issue was raised by Anantharaman and Moss in 2007,[154] as the US CMS was gearing up to introduce its outcomes based payment system. Anantharaman and Moss (2007)[154] argued that an application of ethical criteria for evaluating a limited resource like Medicare funding for dialysis indicates there are not yet sufficient grounds to recommend daily dialysis, and insisted on the need for carefully controlled studies before supporting a move in that direction. Interestingly, a recent SR of ethical issues in ESKD[148] reaches a similar conclusion, stating: "In examining the evidence base on daily dialysis according to . . . ethical criteria we find that there are not yet sufficient grounds to recommend funding of daily dialysis by the Medicare ESRD program." Medicare in the US has been funding daily dialysis for some time now, so this statement is inconsistent with practice.[150] Also, while the SR of Kahrass et al. (2016)[148] cites 10 articles in support of this general conclusion including the one by Anantharaman and Moss (2007),[154] none are recent and only the

Anantharaman and Moss article is on point. Elsewhere in the same review these authors reach a somewhat contradictory conclusion observing that “the low PD utilization in most countries indicates that many patients were either not given true free choice for PD or they were not given unbiased information and education before making a choice,”[148] implying that such information is available but underutilized.

Given the current climate of evidence-based medicine it is understandable that some would raise the lack of RCT evidence as a potential ethical concern. But many conventional therapies including ICHD were introduced without the benefit of RCT evidence. There were 40% of patients in the US on HD when the Medicaid entitlement was introduced, but there was a steady move toward ICHD during the next two decades without the benefit of RCT evidence.[136] It seems the RCT is too stringent a standard to invoke, especially as it pertains to a complex chronic condition like ESKD and a complex decision like dialysis modality selection with so many uncontrollable variables.[136] explains the many problems of setting up RCTs for head-to-head comparisons of ESKD modalities:

> As a trial attempts to dissect the differences, good or bad, between home and facility or between variations in duration and frequency, the difficulties become clear: How *can* there be true, untainted, and random allocation to either home or facility, to self-care or care of, to night or day, to long or short, to more or less frequent? Each choice impacts upon individual lifestyle, capacity, and practicality — for the patient, for the family, for the workplace, and for delivering renal services. (p.54)[136]

Further complicating the picture is the problem of ensuring that any research conducted in this domain remains unbiased as the corporatization of ESKD services in the US has led some to question the findings of research funded by corporate sponsors.[155]

Although a head-to-head trial of modality choice may be lacking, this has not impaired funding decisions such as that of the US CMS, nor has it curtailed the development of support systems for either modality.[136] There appears to be significant historical data supporting the clinical and cost-effectiveness of HHD and PD. Nevertheless, by many measures these modalities continue to be underutilized.

Patient education or the lack thereof represents another key factor as it is associated with better outcomes.[156] Although Lui et al. (2015)[138] maintain that insufficient PD uptake results largely from poor patient education, it seems this is only one among many factors as was noted previously with regard to provider education, physician remuneration, and so forth. Several factors combine to prevent widespread implementation of comprehensive education for ESKD patients including the complex nature of the medical information, the level of health literacy required for comprehension, and the lack of readily accessible educational materials.[151] All of this is compounded by the lack of time for health care professionals to provide adequate education to ESKD patients, assuming they themselves are adequately informed in this regard in the first place.[151]

Professional and patient education are two sides of the same coin, as both are required if we are to meet the ethical demands of ensuring a fully informed decision. Factors that could lead to increasing education efficiency for patients with EKSD includes establishing interdisciplinary care management, including community health workers, and providing education in group settings.[153] Although new educational approaches are being developed through research and quality improvement efforts, evaluating public awareness and patient education programs proves challenging, which in turn inhibits the identification of successful strategies for broader implementation. Nevertheless growing interest in improving patient-centered outcomes may provide new approaches to effect the way people are educate people with ESKD.[153] At the meso level, these considerations point to the ethical need to reallocate resources to education at various levels if we are to achieve hoped for gains in this area. Indeed education of both providers and recipients of ESKD services will be essential in effecting a cultural shift with regard to ESKD modality choice.

Other systemic barriers include the already well-established technical infrastructure that supports ICHD. As noted elsewhere, there are inherent costs associated with moving from conventional ICHD to a policy that encourages HHD and PD. Ensuring an appropriate supply of community nurses to support patients in their homes is but one such challenge.[156] Unless and until such supports are available it will be difficult to accurately and fairly assess clinical outcomes, or to ensure that patients are able to make properly informed and unbiased decisions with regard to a modality choice. For example, while there is some evidence that patients on PD do better initially but have worse outcomes over the long-term, one possible explanation is that there is closer oversight and monitoring by health care professionals when patients start PD and patients are more attentive as well initially. As the procedure becomes routinized and professional oversight is less intense, patients may become complacent and less attentive to the details of daily care resulting in poorer outcomes. Although this last is speculative, it points again to the complexity of the process and the difficulty in ensuring that patients are fully informed about their decisions in the first place, and then properly supported over the long-term.

Summing up, a variety of systemic issues must be addressed if a significant cultural shift with regard to modality selection for ESKD is to occur. Some of this cultural shift may occur naturally as a younger cohort of health care providers replaces older clinicians who are more firmly entrenched in their attitudes. All things considered, however, given the still dominant culture of conventional ICHD in Canada, leveraging the financial incentives that are already part of the system may be the most likely way to achieve significant gains in this regard in the near term, although the success of any strategy will be contingent on addressing simultaneously the other systemic barriers identified. As one recent study concludes: "In Canada, substantial variability in the use of peritoneal dialysis attributable to facility and geographic region was not explained by differences in patient case mix. An opportunity exists to optimize the use of this cost-effective therapy through changes in policy and standardization of criteria for initiation of peritoneal dialysis."[9]

Micro-level considerations

ELSI considerations at this level focus more directly on issues of individual rights, especially as they relate to patients. In particular we want to consider the factors that contribute both to respecting patient's rational autonomy as it pertains to making informed choices about their ESKD care, and how those choices either extend or curtail their personal autonomy with regard to lifestyle. At the same time, considerations of social justice remain relevant as modality choice could disproportionately move the burden of care (financial or otherwise) away from the public system and onto patients and their private support networks.

Some of these issues have been touched upon in previous discussions about health care provider and patient education, provider bias with regard to particular modalities, and so forth. As noted, if patients are going to make informed choices about any modality they must be properly educated and informed; this requires that health care providers are both well-informed and share information in an open and unbiased manner.

There is a background consideration in this regard, however, which pertains to the nature and extent of individual rights to choose a particular mode of health care delivery in a publicly funded health care system in the first place. Unlike some other jurisdictions with publicly funded health care systems, Canada still allows patients who are medically suitable for any modality to select their dialysis modality. Hong Kong, for example, has limited patient choice by implementing a "peritoneal dialysis first" strategy, whereby the government covers the costs of dialysis therapy only if patients choose peritoneal dialysis.[9] Here we return to the notion of "ESKD exceptionalism," which was introduced early in this ELSI analysis. The underlying question we want to explore is whether ESKD is treated differently from other chronic diseases both in terms of the infrastructure that has been created to manage this disease, and then with regard to the extent to which individual patients are extended rights to choose their preferred mode of therapy.

While Canadians by and large appreciate that they have access to basic health care services and need not fear the economic consequences of health care costs associated with developing a chronic illness, they accept that their ability to demand a certain level or kind of care will be limited. This is the trade-off we make for having a publicly funded universal health care system. Assuming for the sake of argument that the various ESKD modalities available achieve equally effective outcomes in terms of disease management overall, we must ask whether extending to ESKD patients a right to choose a more expensive modality because it better suits their lifestyle preferences extends to them a right not enjoyed by Canadians in general, or by other patients who suffer from chronic diseases in particular.

Other sections of this HTA (particularly the Patient Perspectives and Experiences Review) have examined the literature on patient preferences in detail. It is evident that individual patient preferences vary considerably. While it would be nice to accommodate such preferences, there is no strong duty to do so if equally effective and less costly alternatives are available. Such considerations are important factors in any policy decision in regard to ESKD.

Nothing in the foregoing should be taken to suggest individual patient autonomy is irrelevant or that the duty to educate patients is weakened. Given the still dominant conventional ICHD culture, the effort to provide unbiased information about other modalities should be redoubled. From an ethical perspective in general it is always preferable that individuals choose a particular course of action rather than being forced to do something they aren't convinced is in their best interests. A large Spanish study[157] reported a higher mortality risk for patients forced to accept PD, although those findings have been disputed.[158,159] It is nevertheless important to respect individual patients by ensuring first that they are properly educated and fully informed about their disease, and second by ensuring that the necessary community and related supports are available to assist them in their care. In a 2006 survey of Canadian nephrologists, 80% of respondents strongly or somewhat agreed that information should be presented in such a way as to promote home dialysis for suitable patients.[160] Inasmuch as the still dominant culture regarding ESKD appears to favour ICHD as the default modality for both clinicians and patients, it may be inappropriate to propose a

mandatory home dialysis policy at this time. Nevertheless, suitable candidates for dialysis should be empowered with sufficient knowledge to make autonomous choices even as home dialysis is actively promoted.[159] Absolute free choice with regard to modality choice is neither possible nor ethically desirable.[158]

Considerations about the limitations of patient choice within a publicly funded health care system notwithstanding, the issue of social justice with regard to the financial costs incurred by patients and their families depending on modality selection must remain clearly in view. As noted in both the economic analysis and implementation sections of this HTA as well as elsewhere in this ELSI analysis, shifting ESKD out of the clinic and into the home could place a disproportionate financial burden on patients and their support networks. This problem could be exacerbated if the population most directly affected are of lower socioeconomic status and/or retired seniors on fixed incomes. For the latter in particular who are no longer in the workforce, any out-of-pocket costs will not be offset by productivity gains (see Table 16). Again, the underlying value priority that has informed the CHA from the outset as that we as Canadians are prepared collectively to share the burden of disease. Hence any policy recommendations and/or decisions with regard to modality selection for ESKD must not shift the burden of care disproportionately onto individuals, especially the most vulnerable.

Finally, we must touch on the special ethical considerations with regard to Canada's Indigenous peoples. Aside from the special concerns regarding compensatory justice which have been central to attempts to make reparations to Canada's First Nation's peoples in recognition of historical injustices,[161] special considerations should be made with regard to ESKD. Indigenous peoples in Canada who are more likely to receive treatment for ESKD when compared with others in Canada, are younger and more likely to have diabetes and to be obese, more likely to live in remote areas and must travel further for treatment, and less likely to receive renal transplant, and tend to have lower survival rates in the period following initial dialysis treatment.[162]

Generally, patients from different ethnic/racial backgrounds may perceive their ESKD differently.[163] Such differences in perception may be exacerbated by the levels of distrust endemic to minority groups who have been marginalized or have otherwise suffered systemic injustice. Engaging family and community members as trusted sources of information will be essential in overcoming sociocultural barriers and institutional and medical mistrust.[153]

Summary of results

The factors affecting modality selection for ESKD are complex and systemic, and any efforts to affect a cultural shift in this regard will occur only with a sustained effort at multiple levels and over an extended period of time. A summary of ELSI considerations is provided in Table 36.

Table 36: Summary of ELSI Considerations for Modality Selection for ESKD

Macro Level	
ESKD exceptionalism	The history of ESKD and its treatment has been exceptional particularly as it has developed in the US. While the Canadian context is different, what occurs in US health care often affects practices in Canada. It is worth keeping this in view when considering other ELSI of this HTA.
Universal funding of health care	While Canada's universal system of health care ensures that all ESKD patients receive appropriate care, the monolithic nature of the system makes it cumbersome when attempting to implement systemic change. This publicly funded and administered system is potentially less nimble than the US health care system, which relies more directly on market forces. One potential macro-level policy option would be to encourage wider privatization of the health care system so as to utilize market forces more effectively toward systemic change as has been evident recently in the US. Pending challenges in the Supreme Court of Canada may make this a serious possibility. The foregoing notwithstanding, fee-for-service physician remuneration within the current publicly funded Canadian system could serve as a catalyst for change with regard to modality selection for ESKD. However, its effectiveness will depend upon other systemic changes affecting supportive care for community/home-based options.
Canada Health Act	The Canada Health Act (CHA) is structured to pay for hospital-based services, thus inadvertently promoting institutional based care while discouraging community-based care. The current funding formulas supported by the CHA could be one systemic barrier to effective change with regard to ESKD modality selection.

Pervasive conventional ICHD culture	Over the past several decades Canada has developed a pervasive culture that favours conventional ICHD as the modality of choice for ESKD. This culture is supported by a technological infrastructure that favours institutional-based care. Inasmuch as cultural transformation generally occurs over an extended period of time, wide spread and systemic changes within Canada's current health care environment could require sustained and concerted efforts at a variety of levels over the long-term.
Social justice	From the perspective of social justice, if equally clinically effective and more cost efficient health care options are available, all other things being equal, these less expensive options should be promoted. In other words, public officials have a moral obligation to ensure that scarce health care resources are utilized in the most cost-effective manner available while ensuring patient care is not compromised.
Meso Level	
Social justice and resource allocation	Health care officials and administrators have a fiduciary responsibility for ensuring health care resources entrusted to them are utilized in the most cost-effective manner while achieving appropriate clinical outcomes.
Physician remuneration	Physician remuneration can serve as a useful tool in effecting behavioural change. However it must be introduced strategically while making systemic adjustments to support effective change.
Reallocation of resources	Any efforts supporting systemic change with regard to modality choice for ESKD will require a reallocation of resources away from hospital/clinic based programs toward community-based care. Given the entrenched technological and supportive infrastructure for conventional ICHD this could be challenging.
Education	Evidence suggests that many health care providers are poorly educated with regard to available modalities including relative strengths and weaknesses of each. Significant educational efforts will be required for physicians, nurses and other supportive care providers, as well as for patients and their family and members of their community support systems.
Micro Level	
ESKD exceptionalism and patient choice	Given the exceptional history of ESKD in North America, do ESKD patients expect a wider range of choice and individual autonomy with regard to treatment choice than other patients who suffer from other chronic diseases?
Limitations on autonomy in a publicly funded health care system	While patient preferences with regard to modality choice should not be ignored, a patient's right to choose a type or place of treatment is constrained within a publicly funded system.
Patient autonomy and informed consent	Patients deserve to be well-informed about available treatments including the impact of various modalities on quality of life. Informed consent to any treatment assumes that patients receive accurate and unbiased information about all available options.
Economic impact	Given that many of the direct costs of ESKD treatment are absorbed by the public system when delivered in hospital, any efforts to increase use of home-based HD or PD should ensure that patients do not assume a heavier financial burden in using these modalities.

ELSI = ethical, legal, and social issues; ESKD = end-stage kidney disease; ICHD = in-centre hemodialysis; HD = hemodialysis; PD = peritoneal dialysis.

Implementation Issues

This section addressed the following Research Questions:

Research Question 8: What strategies and processes have been used to implement home-based and self-care in-centre dialysis programs for eligible patients with ESKD?

Research Question 9: What contextual factors contribute to the successful implementation of home-based and self-care dialysis programs for eligible patients with ESKD?

Methods

Surveys

Two surveys of a cross-Canada network of stakeholders (administrators and clinicians) were conducted as part of a CADTH Environmental Scan[98] that had the objectives to explore the range of dialysis programs in use across Canada, the range of strategies that have been used to establish or increase the uptake of home and self-care ICHD programs in Canada, as well as patient reimbursement strategies.

The first survey targeted national stakeholders involved in dialysis care. Stakeholders were identified by CADTH's Knowledge Mobilization and Liaison Officer (KMLO) team in collaboration with the clinical experts (MS and PK).The survey was distributed in the form of a questionnaire using the Fluid Surveys online platform. Stakeholders received an initial invitation and two follow-up reminders to participate in the survey.

Stakeholders were asked to respond to questions about the type and details of strategies they have used or are aware of, barriers and supports to implementation, and contextual issues they believe can influence or have influenced the success (or not) of those strategies (Appendix 29). The questionnaire was first pilot-tested by the clinical experts and was edited according to their feedback before it was distributed to the wider group of stakeholders.

The second survey was based on a previously unpublished survey, first administered in May 2013,[1] which was modified and distributed to nephrologists across Canada. While the original survey included a series of questions on Canadian nephrologists' perceptions, attitudes, and beliefs around barriers and facilitators around the use of HHD and PD, the updated, follow-up survey aimed to provide more information on supports to implementation strategies, as well as potential resources that could be of use to nephrologists (Appendix 29).

The survey was distributed to nephrologists by the Canadian Society of Nephrologists in the form of a questionnaire using the Fluid Surveys online platform. Nephrologists received an initial invitation and two follow-up reminders to participate in the survey.

Both surveys (national stakeholders and nephrologists) included specific questions regarding implementation considerations for rural or and remote patient populations.

Targeted literature search

In conjunction with the surveys, a narrative literature review was conducted to identify information on issues relevant to implementation of home-based and self-care ICHD in Canada.

Search strategy

The literature search was performed by an information specialist, using a peer-reviewed search strategy.

Published literature was identified by searching the following bibliographic databases: MEDLINE (1946-) and Embase (1974-) via Ovid; Cumulative Index to Nursing and Allied Health Literature (CINAHL) via EBSCO; PubMed and Scopus. The search strategy was comprised of both controlled vocabulary, such as the National Library of Medicine's MeSH (Medical Subject Headings), and keywords. The main search concepts were home dialysis, peritoneal dialysis, self-care in-centre dialysis and implementation issues.

A filter was applied to limit retrieval to Canadian studies. Retrieval was limited to documents published since January 1, 2000. The search was limited to English- or French-language publications. Conference abstracts were excluded from the search results. See Appendix 2 for the detailed search strategy.

The search was completed on August 17, 2016. Regular alerts were established to update the searches until the publication of the final report. Regular search updates were performed on databases that do not provide alert services.

Grey literature (literature that is not commercially published) was identified by searching the *Grey Matters* checklist (https://www.cadth.ca/grey-matters), which includes the websites of HTA agencies, clinical guideline repositories, SR repositories, economics-related resources, patient-related groups, and professional associations. Google and other Internet search engines were used to search for additional web-based materials. These searches were supplemented by reviewing the bibliographies of key papers and through contacts with appropriate experts and industry.

Screening and selecting articles for inclusion and data extraction

Citations arising from the literature searches conducted to address Research Questions 8 and 9

were screened independently in duplicate for information related to implementation issues. Articles were deemed relevant and included for further review if they reported information on any of the four main implementation domains as per the INTEGRATE-HTA model (i.e., provider, organization and structure, funding and policy).[164] From each relevant article, the bibliographic details (i.e., authors, year of publication, and country of origin), implementation issue under review, population of interest, and other relevant study information including special population considerations were captured by one reviewer. The information from the identified literature was used to supplement and augment the information provided by the national dialysis stakeholder surveys and address any potential information gaps around implementation.

Descriptive analysis and synthesis

The survey data were sorted into categories to identify themes related to the strategies used to establish or increase the uptake of home-based and self-care in-centre dialysis programs as well as to the common barriers and facilitators for implementing these programs. After an initial familiarization with the data and developing initial coding categories, the INTEGRATE-HTA framework four domains of implementation, i.e., ”provider,” “organization and structure,” “policy,” and “funding,” as well as the additional domain of “patient” were used to further guide the taxonomy of the identified strategies, barriers and facilitators as they relate to the various levels of the health care services delivery system.[165] In cases where data fit in more than one of these domains, appropriate categorization (applying more than one domain) was followed. Once all data were coded by one researcher, a second researcher verified the coding assignments.

Strategies, barriers, and facilitators, as identified from relevant studies, were also organized according to the INTEGRATE-HTA four implementation domains, i.e., ”provider,” “organization and structure,” “policy,” and “funding,” as well as the additional domain of “patient.” This information was summarized narratively. The summary included a description of the domain, and its subcategories where relevant, and how the issue identified relates to the implementation of dialysis programs.

Results

Survey — national stakeholders

Of the 117 potential respondents (email sent out with survey link), 34 (29.0%) respondents provided complete or incomplete responses. Responses on all or some of the questions were received from all provinces; no responses were received from the Canadian Territories (Appendix 29).

Of the respondents, thirteen (38.2%) provided information on some aspect of implementation for HHD, PD, ICHD (i.e., current strategies, barriers, and facilitators).

Twenty respondents (58.8%) identified themselves as administrators (nurse manager, manager of renal care program, medical lead, lead unit coordinators, director, and director of renal programs, nurse supervisor, manager of clinical services, provincial coordinator, strategy lead), while other respondents included nurses (n = 4) (11.8%), and other physicians and nephrologists (n = 5) (14.7%).

HHD and PD

Strategies, policies or interventions with the goal to increase the uptake of home-based dialysis modalities, including home hemodialysis or home peritoneal dialysis

As reported by the participating respondents, a number of provincial initiatives have been implemented to increase the uptake of home-based dialysis modalities. These include the establishment of provincial home therapies research groups, provincial programs that examine barriers to adopting home therapies, as well as using provincial outcomes databases that provide data to the Ministry of Health to support home therapies.

At the health care funding level, strategies include following an activity-based funding model (i.e., programs are funded for the activities and not the number of patients on these treatments given that HHD and PD have high attrition rates), a centralized and provincial approach to funding home therapies including provincial contracts for supplies and equipment as well as financial support by the provincial renal agency (e.g., allocated funds for home therapies).

Establishing a strong "home first" philosophy at a provincial level and adopting provincial initiatives for assigning medical directors and other human resources dedicated to HHD were also reported as established strategies for promoting these dialysis modalities. Another strategy included having provincial home therapies committees with representation from all disciplines and health authority renal programs.

Some Canadian jurisdictions are in the process of trying to gain provincial government support to promote and establish the "PD first" policy (a policy where all patients eligible for PD are started on PD as their first dialysis modality).[166]

Developing new or updating existing HHD modality education modules and programs with a provincial focus rather than just an organizational focus was one of the reported adopted educational strategies for promoting HHD modalities.

Standardizing practices for HHD nurses, as well as establishing specific goals for HHD training for patients were reported as other strategies adopted at the organization and practice level in some dialysis centres in Canada. Education initiatives aiming to change the perceptions of ICHD nurses regarding home-based dialysis have also been shown to improve nurse attitudes toward perceived benefits, comfort with explaining home modalities, and promotion of home dialysis to patients, as well as alleviate concerns and misconceptions about patient eligibility.[167]

At the patient level, it has been reported that multidimensional patient education initiatives that provide information about the transfer from ICHD to HHD, training, and support may lead to increased interest in exploring and adopting home dialysis treatment.[168-171]

Barriers to successfully implementing home-based dialysis

The barriers identified at the **health care provider level** included nephrologist preference for ICHD as well as potential ethical concerns for promoting HHD more than in-centre treatment. Lack of enthusiasm for endorsing home modalities has also been reported in the literature;[156] however, this may be due to lack of education for dialysis staff regarding HHD options, or to financial disincentives (e.g., technical or physician fees that are lower for home modalities).[156]

At the **organization and structure level**, lack of resources was reported as a barrier in the establishment of a new home-based program. This issue was also corroborated in the literature; particularly in cases of small dialysis programs with limited resources.[172] An established local culture favouring ICHD was also a barrier.[156] In addition, changes in management within the organization may delay necessary and appropriate changes for promoting HHD programs. Respondents also mentioned that lack of collaboration between administrators and clinicians and experts may impede the successful implementation of these modalities.

Lack of **funding** for staffing resources as well as other requirements for establishing a new home-based program was reported as a challenge to implementation by the survey respondents as well as in the literature.[156]

At the **policy level,** respondents mentioned that the lack of appropriate policies for promoting the implementation of HHD may be due to a gap in knowledge among government and other upper level decision-makers regarding the effectiveness and cost-effectiveness of these dialysis modalities as well as due to the challenge of government processes for establishing new policies.

At the **patient level**, respondents mentioned barriers such as the cost of power and water, housing availability, and other social barriers for adopting HHD. Social barriers such as lack of social support,[170,173] reluctance due to increasing care burden to family members, or homelessness with no access to community housing were also mentioned in the literature.[156,168] While lack of adequate space within the house or an unsanitary home environment may impede home dialysis implementation,[168] some patients have reported lack of interest in having their dialysis treatment at home,[170,173] reluctance to medicalize home,[156] or concerns about safety and complications while they receive their treatment at home.[168] Other barriers respondents faced included cases of elderly patients with multiple comorbidities who require special support that may not be available in their home environment and, as such, HHD may not be an appropriate option. Significant comorbidities, medical conditions, disabilities, and substance abuse disorders have also been reported as important barriers to home dialysis (including PD) in the literature;[156,173,174] however, in some situations, some of these barriers were considered modifiable (e.g., with caregiving in place, those with certain medical conditions or comorbidities can still do dialysis at home).[156]

Additional barriers identified in the literature include lack of education to help patients understand home modalities and become aware of their effectiveness and safety,[156] patient preference for dependence on health care professionals for decision-making,[156] and nonadherence.[156] (Illiteracy or lack of understanding of the language of care was also reported as a barrier for some patients.)[156] PD-specific patient barriers include non-preference for PD; negative PD bias; perceived task difficulty as well as specific medical conditions (e.g., obesity, abdominal scarring); having started dialysis as an inpatient; and social barriers such as a lack of social/family support, housing, and/or employment conditions that do not permit PD.[173,174]

Facilitators to home-based dialysis implementation

Respondents identified a number of factors that have supported or have the potential to support the implementation of HHD programs in their jurisdictions. Additional facilitating factors were identified in the literature.

At the **organization level**, respondents reported that it is essential for all levels of the health administration (particularly senior leadership) and medical staff to be confident and supportive of offering the home-based treatment options to patients (i.e., health administration and staff buy-in).

Providing appropriate infrastructure (e.g., staff, training space, etc.) was identified as a requirement for successful implementation, especially for PD. Developing an appropriate staffing model to support training for medical staff and providing education and support to all staff, including nurses and physicians, were also identified as potential supports, as those strategies may facilitate medical staff in providing patients with consistent messaging regarding home therapies. In addition, having a program in place to support patient preference for modality choice was also mentioned as a facilitator to implementing these treatment modalities. According to Osterlund et al.,[156] education initiatives that include primary caregivers and patient peers, that are at a pace and style appropriate for the learning ability of the patients, that provide a consistent message, and that are offered in multiple languages (when needed) may facilitate the successful implementation of home dialysis modalities.

Researching other successful models of HHD and sharing information with other provinces across Canada was identified as a factor that may facilitate the implementation of programs in areas where this option is not yet available. Models of care conducive to home modalities may include a primary nurse model in pre-dialysis clinic and/or transition care (education aimed to transition patients from ICHD start to HHD.[156]

In some cases, it was reported that the site was participating in research that assessed outcomes of home-based treatments and, as such, mandatory reporting and data collection was required. This was reported as a facilitator for implementing HHD for those sites.

At the **health care provider level**, education initiatives for nurses have been reported to improve nurse attitudes toward the perceived benefits barriers to home-based dialysis, and to improve comfort with explaining and promotion of HHD to patients.[167]

At a **policy level**, it was suggested that having a national directive may facilitate the promotion and adoption of these therapies. This is also corroborated by Osterlund et al.,[156] who found that having established policies that require the availability of modality education for all patients and that all patients be reviewed for eligibility for home therapy were facilitators to the implementation of HHD.

For patients, specific needs such as significant travel time were reported as factors that supported the adoption of HHD. Patient education regarding home modalities and providing patients with the option of connecting with patients

who have been successful with home dialysis were reported as other potential supports for patients before making a treatment decision.

These facilitators, as reported by the survey respondents, are also supported by findings in the literature.[156,168-171] Additionally, education and decisional support may improve patient self-determination.[169] An ongoing trial is examining the impact of an interactive health communication application to increase the utilization of home-based therapy; however, at the time of this publication, it is still recruiting patients and results are not yet available.[175]

Other supports for the uptake of HHD include patients with strong self-management ability, health literacy, and a desire for independence;[156] patients who require a flexible dialysis schedule for reasons such as employment, school, or childcare;[156] family and other social support;[156,168,174] and availability of space at home for accommodating the dialysis equipment.[168]

Self-care ICHD

Strategies, policies, or interventions with the goal to increase the uptake of self-care ICHD

The survey provided one response regarding self-care ICHD; one jurisdiction in Canada was in the early stages of exploring the option. It was indicated that researching what other similar programs were doing, initiating education for staff, and screening patients for the option of self-care dialysis were the strategies used at this early stage of implementing self-care ICHD.

Barriers to successfully implementing self-care ICHD

At the provider level, it was reported that unfavourable staff perceptions regarding self-care act as a barrier to implementation. Lack of financial support to develop such programs and lack of resources for training staff and patients were mentioned as implementation barriers at the organization and funding level. It was also reported that lack of patient interest to initiate self-care ICHD or wanting to return to standard model of care when "the novelty of the self-care model wears off" are encountered as implementation barriers at the patient level.

In the literature, factors such as lack of knowledge about the modality, patient negative attitudes toward dialysis without direct medical supervision, and patient fear of failure to perform self-care dialysis adequately were also reported as barriers to implementation.[176]

Facilitators (supports) to self-care ICHD implementation

It was reported that patient interest and interest on behalf of patients (in the form of a patient advocacy committee) in pursuing self-care can be important supports for implementing an in-centre self-care model.

Dialysis in satellite centres

It was reported that self-care in some dialysis centres in Canada is facilitated by using video links to nephrologists at the main dialysis centre.

Survey — Nephrologists

Of the 249 potential respondents (email sent out with survey link), 28 (11.2%) provided responses. Responses on all or some of the questions were received from Alberta, British Columbia, Manitoba, New Brunswick, Newfoundland and Labrador, Nova Scotia, Ontario and Quebec. No responses were received from nephrologists in Prince Edward Island, Saskatchewan, and the Northwest Territories.[98]

The majority of respondents (approximately 90%) provided information on their level of support for a number of proposed interventions that have the potential to support and promote the optimal use of home-based or self-care ICHD.

As a group, nephrologists were "extremely" or "very" supportive of **personnel and infrastructure interventions**, such as the establishment of local or regional long-term care facilities with the capacity for providing HD and PD; the provision of funding for formal caregivers to provide full-care HD or PD for patients at home and iii) funding for electrical and water costs associated with home HD.

In terms of **policy interventions** to optimize the use of HHD modalities, nephrologists were generally either "extremely" or "very" supportive of mandatory modality education for patients approaching dialysis (all patients are offered the opportunity to receive HHD or PD). On the other hand, mixed responses ("extremely," "very," and "moderately" supportive) were received in terms of the level of support for quality improvement initiatives and regular external panel reviews that aim to include and improve centre-specific targets for HHD and PD rates.

With respect to **decision support tools** aimed at nephrologists (to assist with patient selection for independent dialysis), most respondents provided mixed responses. However, nephrologists were much more supportive of patient education tools about the different dialysis modalities and the provision of information about dialysis care.

As a group, nephrologists were less supportive of **training and continuing education** options including HD or PD certification programs through the Canadian Society of Nephrology as well as of **external support systems** such as regional centres of excellence and 24-hour regional on-call support for home HHD to promote the optimal use of home-based dialysis modalities.

Additional recommendations from nephrologists for supporting the optimal use of HHD, PD, and self-care ICHD included:

- Availability of financial support for patient costs that occur during their stay for training away from home
- Availability of facilities for self-care ICHD
- Availability of personal support workers to assist with HHD
- Availability of 24-hour on-call nursing support
- Adaptation of existing training to include more information for HHD
- Availability of nurse educators to assist patients with modality decisions.

Table 37 presents nephrologists' support for various interventions as they relate to each of the INTEGRATE-HTA domains of implementation.

Table 37: Nephrologists' Support for Various Interventions to Promote the Optimal Use of Home-Based Dialysis (INTEGRATE-HTA Framework)

Implementation Level	What Nephrologists Support
Provider	• Clinical decision support tools to assist with patient selection for home-based dialysis.
Organization and structure	• Establishment of a local or regional long-term care facility with capacity for HD and PD provision • Quality improvement programs that include feedback for improving local PD and HHD adoption rates and specific centre targets
Funding	• Funding for a formal caregiver (nurse) to provide full-care HD or PD at home • Funding for nurse-assisted HHD to assist patients specifically with cannulation • Funding for utility costs (electricity, water) for HHD
Policy	• Policies for mandatory modality education for all patients approaching dialysis (all patients are offered the opportunity to receive HHD or PD).
Patient	• Patient education tools about dialysis care and the different dialysis modalities

HD = hemodialysis; HHD = home-based hemodialysis; PD = peritoneal dialysis.

Remote and rural populations

A few responses were received regarding specific strategies and issues with implementing HHD programs for remote and rural populations as many jurisdictions either do not have programs in place focusing specifically on these patients or they do not have resources for providing support and assistance for patients on PD outside of urban areas.

Reported strategies targeting these populations included the assessment of individual needs, abilities and knowledge of these patients by the renal team, and providing appropriate education and assignment to home care or in-centre care based on assessment outcomes. In one jurisdiction it was reported that training for home-based care is provided centrally at the regional renal centre and supplies, equipment, and renovation costs are covered by the government health program. In cases of remote patients, "patients receive a backup machine as a safeguard." In jurisdictions where established programs serve patients in urban, rural, and remote settings, the delivery of supplies and technical support are included in the existing treatment plan and vendor contract.

According to Osterlund et al.,[156] geography or climate of a region can be a challenge for HHD, as remote settings and weather conditions can make shipping supplies to patients more difficult.[156] Zacharias et al.[177] examined implementation challenges for PD in remote northern Manitoba. Contextual issues such as water quality (not meeting drinking standards, lack of running water, varied water pressure), frozen pipes in the winter and difficulty accessing plumbers, poor road access for home delivery of supplies (some northern communities are only accessible by air for most of the year), crowded housing without enough room for equipment, lack of warm storage for supplies, and lack of emergency medical service (no laboratories or hospital service) were reported. These barriers were not considered insurmountable to implementation, but rather they are challenges to consider when planning for implementation of PD in remote communities.

A first-person account by a dialysis nurse who delivered PD support to a remote Ontario community[178] described some facilitators to the success of remote PD. Seven days a week (day and evening) telephone nephrologist support for both patients and caregivers; weekly well-being telephone calls between patients and nurses; yearly home visits; comprehensive initial training for both caregivers and patients; flexibility and adaptability of the nurses providing dialysis support despite barriers such as difficult transportation, lack of running water to wash hands when providing in-home patient care, or generators as the only source of electricity; and having well-established plans and procedures regarding medical evacuation and emergent care were all listed as important to the success of their particular remote PD program. Telehealth consultations, using audio-visual teleconferencing with both rural nurses and urban nephrology specialists, were also listed as supports to remote PD.[178]

Table 38 presents strategies for supporting implementation of home-based and self-care ICHD in rural or remote settings, as suggested by the nephrologists who responded to the CADTH survey.

Table 38: Nephrologists' Recommended Strategies for Supporting Implementation of Home-based or Self-Care ICHD in Rural and Remote Settings

Implementation Level	Recommended Strategies
Provider	• Optimal timing for getting PD access placed
Organization and structure	• Support services, technical (backup) support, increase ease for having dialysis at home • Telehealth, clinic visits using telemedicine • Having dedicated secure and well-heated storage space for dialysis supplies to avoid service and access interruption during difficult weather conditions • Availability of cluster/community dialysis centres (small self-care units). They may also serve as centres where training to patients is offered closer to home (minimizing time needed to be away)
Funding	• Financial assistance/support for travel and accommodation for stays away from home during training • Cover expenses for increased utility costs
Policy	• Water quality, access to clean water (running water must be addressed for remote settings)
Patient	• Patient education and training (that would include training of family or community members)

PD = peritoneal dialysis.

Special populations

Participating survey respondents working with the incarcerated population emphasized that patients from these populations are unique given the security concerns. In these cases, "home" therapies are considered therapies provided within the institution. It was reported that in some facilities, a satellite dialysis unit within the Institution has been established in collaboration with a community dialysis program to provide PD therapies for patients. Trained nurses are available to support and manage patients as required. However, it was also reported that in some cases it is difficult to obtain qualified individuals for providing this service in the institutional facilities. Based on provincial principles and guidelines, the program offered is customized to the inmate population for the required needs. It was reported that offenders needing dialysis would not be placed in remote correctional facilities. In cases where transfer to the satellite unit within the correctional facility is required but is not possible, offenders attend community-based

dialysis programs. When patients are released from the correctional facilities, the program facilitates transfer of these patients to the community dialysis programs that would then assess suitability for home treatment modalities.

The needs of patients requiring dialysis while in long-term care are also considered in the literature. In these settings, providing training programs for the long-term care facility personnel and the availability of a dedicated nephrology dialysis staff were reported to facilitate the implementation of dialysis within the facility.[179] Osterlund et al.[156] also confirms that patient access to a formal or informal caregiver is a support to the implementation of “home-based“ (where the home is the long-term care facility) HD or PD.[156] Nephrologists who responded to the CADTH survey also indicated that they were highly supportive of the establishment of local or regional long-term care facilities with capacity for HD and PD provision and care.[98]

A first-person account by a dialysis nurse who delivered PD support to a remote Ontario community[178] listed having an Indigenous liaison worker (assisting with the translation of patient education materials and patient advocacy) and the incorporation of traditional Indigenous lifestyle aspects (such as the inclusion of wild game in diet plans) as supportive to delivering PD to Indigenous patients in remote northern Ontario.

Summary of results

This section of the HTA report provides information about strategies used in Canadian jurisdictions to implement home-based and self-care ICHD modalities, as well as possible barriers and supports to implementation.

The review of implementation issues and strategies around HHD and self-care ICHD identified several important barriers, facilitators, and strategies that will influence the ultimate knowledge mobilization strategy around this work. Central to the findings is the importance of patient choice in decision-making, while considering the various perspectives of stakeholders including at policy and clinical levels. Education, to address knowledge gaps at various levels of health care decision-making, as well as sharing successful strategies already under way will be central to implementation support in all jurisdictions across Canada.

Detailed information about the survey data can be found in the CADTH Environmental Scan.[98]

Discussion

Integration of findings

This HTA report examines the clinical, economic, patient, ethical, and implementation dimensions of home-based or in-centre self-care dialysis programs. It aims to inform and support the establishment and/or improvement of existing processes at a local level and provide support for evidence-informed decision-making at all levels of dialysis care. Evidence was reviewed across multiple disciplines: clinical, economic, patient experience and perspectives, ethics, and implementation of the intervention at a system level. A summary of the results for each discipline appears at the end of the relevant section (pages 48, 77, 94, 104, 113). In this discussion, we integrate several themes of interest.

Freedom and autonomy

The results of the clinical review suggest that HHD is similar to traditional ICHD for clinical outcomes in settings where HHD is supported, and for eligible patients. The findings for PD may be more equivocal over the long-term, although studies produce inconsistent results, and allows patients significantly more independence.

This economic analysis demonstrates that in general, HHD therapies are more attractive than ICHD, primarily due to the lower cost of provision. Patients who prefer to travel less frequently may find PD more preferable while patients with significant dietary restrictions due to hyperphosphatemia or volume overload may find frequent HHD to be advantageous. As noted, to date, no high-quality evidence indicates clear evidence of a survival benefit or quality of life advantage with any specific dialysis modality. However, to incorporate the concept of a preference for autonomy and freedom, sensitivity analyses were conducted in the economic evaluation varying the relative quality of life difference between HHD modalities. When a non-significant quality of life benefit observed in a RCT of conventional ICHD versus nocturnal HHD was incorporated into the model,[29] this was found to further increase the attractiveness of HHD (i.e., less costly, more clinical benefit).

From a patient perspective, choice was identified as paramount. Patients desire control over the place and timing of their treatment, and choosing a modality that optimizes freedom over their day-to-day activities. Freedom has a different meaning for each patient, depending on their situation.

Patient factors, such the ability to perform dialysis procedures, can limit the choice of a home modality; however, there may be ways to introduce the ability for freedom and autonomy in other ways, such as choice regarding the timing of treatment. Geographical, funding, and infrastructure constraints greatly affect freedom of choice and autonomy. This may be particularly relevant in the Canadian setting, where these factors vary so widely across the country.

Supporting patients' choice, whether HHD, home PD, or self-care ICHD requires that appropriate infrastructure is in place to support this decision. This includes education for all decision-makers involved (policy-makers, nephrologists, nephrology nurses, patients, and caregivers) and the availability of resources (staff, infrastructure, monetary) for these dialysis modalities.

Caregiving and caregivers

Availability and access to appropriate caregivers (either formal or informal) and family or other social support are reported as facilitators to patients' decision to receive dialysis at home. However, reluctance to inflict caregiving burden on family was found to be a barrier to choosing home care. Caregiving to a HHD patient can be overwhelming, guilt inducing, difficult, and stressful. Non-professional caregivers and family members of the dialysis patient need to be prepared for that. Caregivers need support and respite.

Patient-borne costs

From a system perspective, the HHD modalities are less expensive, with an estimated lifetime cost for conventional HHD of $561,962 and PD of $577,509, compared with $637,152 for ICHD. However, moving the site of dialysis to the home means that patients may have to assume costs formerly absorbed by the health care system, such as increased utility charges for power and water, costs of modifications to their homes to accommodate the equipment and supplies for dialysis (although in most circumstances these costs are borne by the health payer). The need for assistance may be an additional cost or be a source of financial loss if a family caregiver has to decrease or cease employment.

In our review of Canadian costing studies, only one study was found to have reported patient-borne costs in terms of travel, training time, caregiver time and productivity expenses.[29] This trial-based economic evaluation used a micro-costing approach to calculate the patient-borne costs associated with conventional ICHD and NHHD and reported that total annual out-of-pocket expenditure was $8,099 and $5,922 respectively. Training for HHD is many weeks

long, which may be challenging for patients. Further, while there may be advantages with respect to travel and productivity costs when patients are on HHD, utility costs are substantial. NHHD was therefore associated with higher out-of-pocket and training time costs that were offset by gains in productivity. These findings align to a recent analysis from New Zealand that reported that long training for HHD and substantial ongoing utility costs were barrier to uptake;[180] further, lower socioeconomic status may also act as a barrier (i.e., lack of stable or suitable home environment). The economic findings remained robust when incorporating these indirect costs into the model for the conventional ICHD and NHHD comparison (Table 26). As only a single Canadian study reported on out-of-pocket and productivity costs, assumptions were made to extrapolate the potential cost from a societal perspective for the remaining dialysis modalities and prescriptions, if possible. The economic findings remained robust under a societal perspective. More accurate Canadian estimates are expected in the near future from a survey that is seeking to measure patient financial burden and their families experience and may complement the findings of this report.[103]

Costs associated with dialysis that are covered may vary across jurisdictions. The data for patient-borne costs for home renovation are incomplete, but as an example, in one study from 2010, costs were variable depending on the regional centre: $1,470 for University of Toronto; $4,018 for Western Ontario; $2,000 for Humber River.[181] Although the economic analysis found these costs to be a minor contributor from a societal perspective, for an individual patient they could prove decisive and be a barrier to access.

Self-care dialysis

We did not find Canadian data that enumerated the costs of self-care ICHD. One study from Finland[182] suggested that the cost of provision of dialysis was similar between HHD and self-care ICHD, although further enumeration of the constituent costs was not provided. Furthermore, while it was suggested that self-care ICHD was less costly than the traditional nurse-delivered ICHD, there were no direct comparisons conducted.

One of the primary cost drivers of ICHD in high income nations is nursing wage rates.[8] If the same number of patients can be treated with much less nursing time per patient, it is possible that the ongoing costs of self-care ICHD would be lower. However, there would be an upfront training cost of patients; these costs may be similar to training for HHD and are not trivial (Table 16). Furthermore, many dialysis units are functioning at capacity, delivering care for three shifts of patients per day. If self-care ICHD is less efficient than a nursing-run model, the throughput of patients may potentially be reduced, with efficiency implications.

Assisted PD

For patients who cannot do PD at home on their own or with a caregiver, it is unclear what the other relevant alternatives may be (e.g., long-term care where PD is provided versus transitioning to conventional ICHD). Assisted PD is emerging as an option in some jurisdictions, but is not available uniformly across Canada. Data are limited, and no clinical evidence exists suggesting differences in outcomes compared with ICHD.[68] On the economic side, this seems to be an important issue that is influenced by the intensity and delivery model of assisted PD. The economic analysis suggests that assisted PD may be more expensive than providing ICHD in urban sites if assistance is continuous. However, intermittent assistance, such as providing temporarily after PD initiation, for intermittent respite, or providing in a way that is less costly (lower wage rate caregivers) may make it attractive. Other putative benefits of assisted PD include allowing patients to stay on their preferred modality longer and perhaps in facilitating growth in PD or reducing the need for PD patients to switch to ICHD, which may lead to reduced costs from a program perspective. However, currently it is difficult to draw definitive conclusions given the paucity of data available.

Indigenous Canadian patients

The clinical and patient perspective and experiences reviews did not identify any studies specifically for outcomes for Indigenous patients. No specific information was identified in the included implementation studies, and limited information was identified in the survey regarding Indigenous Canadians.

The findings from the supplemental review[37] suggest that Indigenous Canadian patients seem less likely to initiate PD, have higher mortality rates on PD, have greater rates of technique failure and switches to HD, and have higher rates of and are quicker to experience peritonitis than their non-Indigenous counterparts. Additionally, they are less likely to receive a kidney transplant. The findings of the supplemental review[37] were based on limited evidence from seven Canadian studies that included Indigenous patients from British Columbia, the Northern Territories, Ontario, and the Maritime provinces, which may limit the generalizability of our results to the entire Indigenous population of Canada. There was limited information in the supplemental review[37] comparing the outcomes of patients undergoing PD versus those undergoing HD. Likewise, the economic evaluation was unable to conduct an analysis specific to the context of Indigenous patients. As noted though, the cost-effectiveness of dialysis modalities and prescriptions may differ based on several factors including: reimbursement of utility costs for HHD modalities that patients and caregiver may not be able to pay; adequate setting including water suitable for HD; and the setting in which patients reside

(e.g., in rural and remote areas, the annual cost of ICHD provision was estimated to be 1.6 to 2.5 times that of urban HD provision). In some very remote settings, some Indigenous patients are transported to ICHD (covered by the ministry of health) and costs can be extremely high. It is, therefore, expected that the cost-effectiveness of different dialysis modalities for Indigenous Canadian patients may differ depending on the setting, the accessibility to a local ICHD unit, the reimbursement of and availability of infrastructure requirements for HHD modalities (e.g., access to appropriate electricity and water) and patient preferences.

The challenges and implementation issues identified for remote and rural communities (discussed below) will also be pertinent for Indigenous communities.

Factors that may contribute to successful ESKD outcomes are community ownership and integration within existing social system; support for autonomous decision-making; the presence of Indigenous health workers within a supportive environment; and a flexible approach which can provide care according to the unique cultural, social, and physical needs of individuals and communities.[183]

Telehealth dialysis can be successfully delivered to Indigenous patients in remote communities and was not shown to have a negative impact on mortality, quality of care, or health care utilization.[184] As such, it may be one model of care that is worth exploring in order to aid in the delivery of HHD to Indigenous patients, particularly in remote communities. This may improve access to nephrology care, as Indigenous patients tend to be less likely to see those specialists.[185]

Education, early screening, and early prevention programs may be particularly relevant to Indigenous Canadians, as they tend to be younger when initiating dialysis. Younger patients are more likely to require a more flexible treatment schedule in order to participate in work or the care of their children. As PD tends to provide patients with a more flexible schedule, and choosing PD does not seem to negatively affect mortality in Indigenous patients,[186] initiatives encouraging Indigenous Canadians to choose or have better access to PD may be warranted. Additionally, interventions to reduce the number of infections (e.g., peritonitis) in Indigenous Canadians may be helpful. Crucially, for Indigenous patients living in remote or rural areas, access to PD would enable them to choose their place of residence during treatment.

Rural areas and remote settings

One of the potential advantages of HHD modalities is to reduce the requirement for central facilities and therefore the mandate for patients living outside urban centres to travel long distances or even to move their place of residence to be closer to HD facilities. This may be particularly important in Canada, where many patients may live in remote settings or rural areas. A recent article published by Ferguson et al[95] showed that non-urban HD units are associated with a much greater cost of providing dialysis than urban centres. As such, in these areas, HHD dialysis therapies may become even more attractive. However, it should be noted that there are no data on the relative costs of providing HHD in rural settings (although many studies of HHD do include patients in rural settings). While the infrastructure requirements for PD are likely to be minimal, HHD patients often require ICHD for intermittent supportive care, which may necessitate travel or temporary relocation closer to a dialysis unit, with attendant costs.

At the moment there is a paucity of information about the experience of patients living in remote areas, or living in areas considered rural but still without ready access to dialysis facilities (see Section 0).

Many jurisdictions in Canada either do not have programs in place focusing specifically on remote settings or rural areas or they do not have resources for providing support and assistance for patients on PD outside of urban areas. In jurisdictions where such programs are available, patients in rural and remote areas are assessed for suitability for HHD care, training tends to be provided centrally at the regional renal centre and supplies, equipment, and renovation costs are often covered by the government health program. The delivery of supplies and technical support (e.g., backup dialysis equipment) being included in the existing treatment plan may ease implementation.

Concerns such as transportation challenges, storage of supplies, and difficulty with the water supply are not insurmountable barriers to providing patients in remote communities with dialysis treatment at home. As some satellite dialysis centres are already using video conferencing to link nephrologists with patients — teledialysis may be a viable option for increasing the use of HHD and HPD or self-care dialysis in remote satellite centres.[187]

Generalizability of findings

The focus of our report was patients with ESKD receiving renal replacement therapy with home dialysis, with particular interest in results applicable to the Canadian context. We reviewed research from Canada and from other countries including, the US, Australia, New Zealand, Europe and the rest of the world. Studies that focused

specifically on Canadian settings, including Yeates et al. 2012,[79] revealed either no difference in mortality for PD, or lower mortality for PD over the long-term, compared with ICHD. Clinically, the findings from Western countries are expected to be generalizable to Canada, given the prevalent causes of ESKD and comorbidity profiles of patients in these countries. Patients receiving HHD were younger, were more likely to be male, and were more likely to have fewer comorbidities than those receiving ICHD. Those studies that analyzed matched cohorts reflected that profile, but there were no consistent differences in results between the different analytic methods. The available subgroup data did not suggest that results for HHD differed across subgroups of age, sex, and comorbidity, but the data were relatively sparse. Subgroup data suggested that results for PD might be poorer than for ICHD for patients who were elderly and/or had a higher burden of comorbidity. Data are not available for the comparison of HHD and PD in subgroups.

In terms of the economics report, the costs of dialysis provision were taken from a variety of Canadian sources, when possible, in order to highlight the potential variation in the lifetime costs of providing dialysis to adult patients with ESKD across Canadian jurisdictions. While data from Ontario were used in the reference case, alternate sources from other Canadian jurisdictions were assessed in sensitivity analysis (with largely similar results). However, as noted, there were limited Canadian data on assisted PD and short-daily ICHD. Costs from other countries supplemented the analysis for assisted PD and different findings were reached when using data from France. The findings of assisted PD must be cautiously interpreted given that costs are typically less generalizable from one country's setting to another.

While the different methods of delivering HHD are presented separately (conventional, short daily, nocturnal, as per clinical and costing studies), the current practice in most HHD programs across Canada is that a range of different prescriptions for HHD is offered to suit the patients' needs. In Northern Alberta, for example, there are approximately 50% of patients on HHD who approximate a conventional dialysis regimen (either 3.0 or 3.5 dialysis runs per week) with the remaining patients doing a range of prescriptions, from 3 to 6 times per week nocturnal or short-daily dialysis. Prescriptions are tailored to the patients' medical needs, lifestyle, and preferences given the flexibility that HHD affords. As such, it is likely more relevant to consider this blend of different HHD modalities. While some cost data indicate that frequent HHD maybe similar or more costly than ICHD, conventional HHD is less costly (due to less use of disposables for the dialysis regimen itself). Using a more relevant blend of HHD modalities suggests that, as a whole, these are less costly than ICHD.

At a system level, support for HHD and PD varies widely even between Western countries, and system factors may not translate internationally. Countries vary widely in the adoption of, experience with, funding models for, and health care support of HHD and PD.[188] In New Zealand, for example, where HHD is widely supported, 73% of patients initiating HD in 2014 were started on HHD,[189] compared with 10.2% of patients in the US, where HHD is less supported.[188] Patients in a system that provides wide support to HHD would be expected to fare better overall than those in a system that only provides HHD to a select few. From an implementation perspective, identified strategies to support uptake of HHD and self-care ICHD modalities could be applicable to the overall Canadian HD care setting.

Limitations

Evidence gaps

Data for the primary end point of quality of life are sparse and indeterminate. Few studies included a baseline, to allow for calculation of change for baseline, or adjusted for covariates; those that did include this used different scales and reported them variously. Standardized QoL scales, e.g., SF-36, or kidney disease specific scales may not capture the impact of the dialysis intervention itself on quality of life; dialysis-specific measures may be required. Although most of the standardized scales had been validated, few estimates of minimal clinically important difference were available, making the assessment of clinically meaningful difference difficult.

Two of our four clinical research questions remain unanswered because a lack of data. The data did not allow us to determine if any of the three HHD prescriptions was preferable, either for all or a subgroup of patients (Question 3). Previous SRs pooled (narratively or meta-analytically) all prescriptions of HHD into a single category rendering comparisons difficult. Few primary studies compared or allowed comparison of dialysis prescriptions, and some of those that did, used variable categorizations of dialysis prescriptions. Standard definitions of dialysis exposures would aid in comparison across research studies.

The data also did not allow us to assess whether assistance or self-care affected outcomes for HHD, or whether self-care affected outcomes in ICHD (Question 4).

Aside from major adverse events leading to death or hospitalization, adverse events were inconsistently reported. There was no consistent safety signal, but case reports that might potentially capture rare, catastrophic adverse

events were not included. Some articles reported multiple adverse events, or multiple papers described the same database, meaning that the evidence base was less diverse than the number of papers suggested.

Comparative evidence for several of the clinical subgroups identified as important is lacking, particularly around setting and geography. One SR that examined satellite settings used different definitions of setting to the present study, and there were no studies examining the effect of setting for HHD. Papers that specifically compared modalities for rural or remote settings were not identified, and as indicated in the section on generalizability, the evidence was dominated by the urban setting. A separate review was undertaken for evidence to inform dialysis in Canadian Indigenous populations..

Given the limitations with the clinical data, the economic analyses were similarly hindered by the lack of data on clinical efficacy. Given this, the reference case of the economic evaluation set the relative treatment effects to unity and focused the analysis primarily on the differences in lifetime costs of alternate dialysis therapies. The economic evaluation was unable to examine subgroups of patients that may benefit from certain types of therapy as no clear subgroup effects were identified from the review. Despite this, it is important to note that not all patients are eligible for all modalities and the economic evaluation presents comparisons among modalities types and prescriptions that may be relevant treatment options for different groups of patients. The findings from these analyses were found to align with the findings of the reference case.

Multiple Canadian studies were available that enumerated the cost of the various dialysis modalities, allowing for an assessment of the variation in costs that might be realized in different Canadian jurisdictions. However, only one Canadian source was identified that provided the costs of all modalities and prescriptions of interest to this review (ORN). While these data were based on costing information (direct costs), some elements were obtained from expert opinion. As these were developed in a context where home-based therapies were being promoted, it is possible that reimbursement for home-based therapies may have been more generous as an inducement; if so the attractiveness of home-based therapies may be greater than in the reference case. In addition, there was a lack of Canadian cost data from more than one source for some modalities, including in-centre frequent dialysis as well as assisted PD. The former may be less of an issue given the lack of evidence of clear benefit and data that indicated it is likely more costly than any other dialysis modality.

The economic evaluation allowed the assessment of the relative costs in rural and remote areas. Only one Canadian study was identified to have compared the cost of ICHD provision across settings. Despite this, the findings remained robust for most modalities in sensitivity analysis that varied the cost ratio across the reported range, with the exception of assisted PD.

The review of patient perspectives and experiences included a range of perspectives on dialysis modalities and ensures that a diversity of experiences was represented from six SRs. Findings from this review include the views of both patients and caregivers for at-home HD, ICHD, and PD. It also includes perspectives of patients who chose to decline or discontinue dialysis treatment. However, the findings are limited as an overview of reviews was conducted, which may not have allowed for the same depth of data or range of experiences as a full review.

In this review, the perspectives of Indigenous patients were not represented. In addition, financial issues as they relate to housing and the home setting are not fully explored. It is unclear if there were patients who did not choose HHD because of a lack of financial resources to make their home suitable for dialysis (there was mention of cleanliness and lack of space, but not specifically about how financial resources would change that perspective). Similarly, due to a lack of information, it is difficult to support recommendations about the optimal use of dialysis modalities for patients residing in remote locations.

Issues of sexuality, dating, and romantic relationships are not explored in this review, but may be relevant because of problems of isolation, the importance of social support, the desire to maintain a normal lifestyle, and caregiver burden. Challenges and difficulty with dietary restrictions were mentioned, but not related to other themes about burden or the desire to maintain normal routines. It is unclear how those difficulties affected participation in religious, cultural, and family celebrations that may involve food (e.g., Chinese New Year celebrations; birthday parties; Seder; communion; Eid).

Although the perspectives of changing roles within the family are described, there were no specific discussions of the effect on gender roles among patients or caregivers. No positive experiences of caregiving were reported, but this does not necessarily mean that at least some caregivers do not experience their role as positive.

This review was also limited by the scope of the question. While “experiences and perspectives” about dialysis treatment covers a wide range of possible findings, this review did not explore what it was like to undergo a transplant

or the experience of a failed transplant. It does not cover experiences and perspectives on end-of-life decision-making, although patients and caregivers do confront their mortality in this stage of their disease.

For the implementation questions, the generalizability of findings based on the survey responses is limited by the low response rate to the survey. However, the identified literature augmented the survey responses with additional information to be considered regarding implementation of such programs. As such, a more complete picture of the Canadian landscape regarding potential strategies, barriers, and supports to be considered for dialysis treatments decision-making was established.

Limited information on self-care ICHD was identified both from the survey and literature. These programs seem rare, and therefore there is limited information regarding their implementation and barriers to that. However, information relevant to implementing other self-care models such as HHD may be applicable to some extent to barriers and supports to implementing self-care ICHD.

Inconsistency of results

Our review strategy involved appraising the SRs, identifying evidence gaps, and extending the evidence where we thought it insufficient, imprecise, or inconsistent. This proved the case for most questions, since results were generally indicated by the reviewers to be of low quality, whether consistent or inconsistent.[4,38] Even when the studies retrieved in our update search were included, the inconsistencies of findings persisted. Some of the inconsistencies might be attributed to design choices the study authors made in handling the assignment of exposure, particularly during the initial period of dialysis, or the handling of transplant as a competing risk. In the absence of precise, randomized data, it is not possible to know which provides the least biased estimate.

Study design and quality

The principal limitation of the clinical evidence base is that it is dominated by non-randomized studies in which patients are self- and system-selected for the modalities they receive. The few RCTs are small (usually < 100), having faced challenges in recruitment and conduct, and therefore do not have the power to detect smaller but still clinically significant differences.[44,190] Patients tend to have a preference as to modality, given the substantial impact on their quality of life. Many patients are not willing to be randomized, and therefore, the subset recruited into the trial may not represent those who decline participation. RCT follow-up has generally been limited to six months or a year, and studies have used composite end points to accommodate important end points (e.g., death and quality of life).

From a pragmatic clinical perspective, conducting RCTs with long-term follow-up may simply not be feasible. While the design and nature of observational studies included in this review pose limitations and should be interpreted with caution, evidence from these studies should not be completely discounted. The methodology of these non-randomized cohort studies in the contemporary era have evolved and include sophisticated matching techniques and may provide the best available data.

Kidney disease and dialysis registries include large numbers of patients and collect kidney disease specific covariate data, thereby allowing the use of modern methods of covariate adjustment. Adjustment for clinical factors generally included the major confounders and many of the minor confounders, but socioeconomic variables such as patient educational status, housing status, economic status, independence/frailty, or family support were rarely represented in the data set, or therefore in the adjustment models.

The pool of studies was clinically and statistically heterogeneous. Study populations were drawn from different countries and health care systems. Studies consistently selected adult patients with ESKD who were receiving dialysis, but differed in their exclusions of patients with very short dialysis durations or who received transplant, and in their definitions of exposure and handling of competing risks, particularly of death or transplant in studying adverse events. Results from studies drawn from the same data set suggest that the findings could be sensitive to these assumptions.

Assumptions

A number of articles did not specify the setting for HD in the HD comparator group. In these cases, which were generally from regions with a low uptake of HHD, it was assumed that all patients had received ICHD. In studies, where the majority of patients (> 80%) were reported as receiving ICHD, the papers were included as ICHD.

Directions for future research

Future research could be directed toward filling the evidence gaps that are particularly pertinent to the Canadian context, given the geographical spread of the Canadian population, and the need to provide care in diverse settings and to people with diverse expectations and cultural backgrounds. From a clinical perspective, it would be worthwhile

to add to the collection of clinical and socioeconomic covariates that which would be expected to influence outcomes. The social determinants of health seem especially important in the success of at-home dialysis care: income and social status; social support networks; education; employment/working conditions; social environments; physical environments; personal health practices and coping skills; healthy child development; sex; and culture are well-established to influence health. Through the course of this review, most of these determinants have been identified as factors that may influence the management of ESKD; the clinical effectiveness of the various dialysis modalities; as well as factors that determine for whom HHD may be most effective and how to successfully implement HHD programs to best serve those patients. While this report was able to identify those factors as important, further research initiatives may be successful in determining, with greater precision, which subgroups of patients and under which conditions, self and HHD are the most successful. In addition, research priorities in the field have expanded to include patient quality of life and patient satisfaction as important outcomes, so there is a need to explore these more comprehensively.

From an economic perspective, there was a paucity of Canadian cost data on some of the modalities, specifically assisted PD and frequent ICHD. This may reflect the fact that the rates of utilization for these modalities were low or unavailable at the time of the publication of the costing studies. It is known that population density and geography may impact health expenditures, especially in the territories.[191] One Manitoba costing study[95] was identified that looked at the potential cost variation across settings and reported that the cost of ICHD provision in rural and remote setting can be 1.6 to 2.5 times greater than in urban ICHD units. Given that the findings of the economic evaluation were found to be sensitive to the setting, a better characterization of the potential cost variation between settings in Canada may result in more tailored economic findings. Further, sensitivity analyses conducted on delivery options for assisted PD suggest that it may be a feasible option in many scenarios, however further information is required to confirm and define this.

The scope of this project was limited to comparing the economic value of different dialysis modalities and did not specifically assess the cost-effectiveness of establishing and constructing a new rural satellite dialysis centre, compared with providing only HHD or requiring patients to relocate. It is suggested that, if all patients are suitable and eligible for HHD, this is likely to be preferred even if the provision costs are greater in rural and remote setting. However, one must note that the “suitability and eligibility” component for each patient is a key factor for selecting a modality.

Implementation considerations for patients needing dialysis in rural and remote populations in Canada need further exploration. An intriguing possibility is the use of telehealth for the provision of dialysis support. Telehealth has been shown to be successful in helping to manage cardiac conditions, metal health conditions, diabetes, and chronic obstructive pulmonary disease (COPD), and a small study included in the supplemental review indicated that it could be used to successfully manage remote dialysis treatment as well.

Regarding care for Indigenous Canadians, culturally appropriate investigation regarding CKD screening and prevention; education initiatives; culturally appropriate care initiatives; the reasons Indigenous patients seem to have a higher frequency of technique failure and lower PD use; are important going forward. As it is unclear why indigenous Canadians have lower rates of kidney transplantation, further investigation is also warranted.

Conclusions

An increasing number of patients with ESKD are being initiated on long-term dialysis every year in Canada. ICHD and PD are the two main types of dialysis provided under Canadian renal care programs. The literature and jurisdictional input suggest growing interest in other dialysis delivery models, namely, self-care ICHD, assisted PD, and HHD.

The primary outcome of quality of life did not show any consistent difference in quality of life between HHD and ICHD or PD. For the secondary outcomes, evidence suggests that for the appropriately selected, motivated patient in a supportive setting, HHD may offer a potential survival benefit compared with ICHD, but it shows no difference in the other secondary outcomes. Older patients may benefit less from HHD, but patients with diabetes and other comorbidities have similar survival on HHD as patients on ICHD. Evidence for outcomes relating to race and sex is lacking or conflicting. Hospitalization risk does not differ between HHD and ICHD, and adverse event information is relatively limited. Patients are more likely to transfer from HHD to ICHD, which is not unexpected, since patients who fail a home-based treatment typically default to in-centre treatment.

Results of studies comparing PD with ICHD are mixed: studies in Canadian settings show either no difference in survival, or better survival for PD, while studies in other settings vary, with some showing poorer results for PD. Experience with the interventions and clinical practice for selection and management of patients varies widely across health care systems, and will affect generalizability. Mortality for elderly patients, patients with diabetes, and patients with cardiovascular disease tends to be higher on PD than ICHD. More patients transfer from PD to ICHD than in the reverse. Overall, the evidence suggests that for the appropriately selected, motivated patient in a supportive setting, PD is an appropriate dialysis modality, with substantial benefit in patient independence.

Few studies compared HHD with PD. Those that did, suggested equivalent or lower mortality for patients with HHD, although residual confounding cannot be excluded. Limited clinical evidence was found for assisted PD, thus further research is warranted.

There is no definitive evidence as to which HHD prescription might be preferable, although limited evidence suggests that more intensive dialysis may reduce mortality. No studies were identified that compare self-care with assisted HD, either in the home or in-centre.

The economic analysis suggests that home-based therapies, including HHD and PD, are the most attractive for eligible patients. Cost differences are accentuated in rural and remote settings (i.e., ICHD is more costly to deliver in rural and remote areas than in urban centres). Assisted PD may be associated with greater costs of provision if delivered continuously, although may be less costly compared with ICHD if provided intermittently. More frequent or nocturnal ICHD is likely to be substantially more costly than any other modality, with little evidence to indicate superior outcomes. The findings from the economic evaluation support the initiatives that are occurring in many jurisdictions in Canada to promote and increase the number of patients on dialysis with home-based therapies.

Patients desire control over the place and timing of their treatment, and choosing a modality that optimizes freedom over their day-to-day activities, although the concept of “freedom” has a different meaning depending on a person’s situation. Patients report that they consistently involve others (physicians, nurses, and family members) to make decisions. Most patients trust their doctors to help them make a decision, so doctors also need to have accurate and current information regarding all available modalities. Patients held a positive view about patient education, feeling more empowered to make choices, and more comfortable with their treatment when educated about their treatment options and what they can expect. The content, timing, and source of patient information was found to be important. Caregiver burden can be overwhelming, guilt inducing, difficult, and stressful. Non-professional caregivers and family members of the dialysis patient need to be prepared for that. Caregivers need support and respite.

The review of ethical issues concluded that the factors affecting modality selection for ESKD are complex and systemic, and any efforts to affect a cultural shift in this regard will occur only with a sustained effort at multiple levels and over an extended period of time.

The review of implementation issues and strategies around HHD and self-care ICHD identified several important barriers, facilitators, and strategies that will influence the ultimate knowledge mobilization strategy around this work. Central to the findings is the importance of patient choice in decision-making, while considering the various perspectives of stakeholders, including policy and clinical levels.

Based on the overall evidence from the assessment of the clinical effectiveness, cost-effectiveness, patient experiences and perspectives, ethical issues, and implementation issues, home-based dialysis (HHD and PD) are appropriate modality options for the treatment of ESKD and could be more widely implemented in Canadian jurisdictions. Education, to address knowledge gaps at various levels of health care decision-making, as well as sharing successful strategies already under way, will be central to implementation support in all jurisdictions across Canada.

References

1. Nesrallah GE. Understanding determinants of home dialysis use in Canada: a mixed-methods study [master's thesis on the Internet]. Hamilton: McMaster University; 2013 Sep. [cited 2016 Aug 11]. Available from: https://macsphere.mcmaster.ca/bitstream/11375/13410/1/fulltext.pdf

2. Canadian organ replacement register annual report: treatment of end-stage organ failure in Canada, 2004 to 2013 [Internet]. Ottawa: CIHI; 2015 Apr. [cited 2015 Nov 24]. Available from: https://secure.cihi.ca/free_products/2015_CORR_AnnualReport_ENweb.pdf

3. Couchoud C, Bolignano D, Nistor I, Jager KJ, Heaf J, Heimburger O, et al. Dialysis modality choice in diabetic patients with end-stage kidney disease: a systematic review of the available evidence. Nephrol Dial Transplant [Internet]. 2015 Feb [cited 2015 Nov 6];30(2):310-20. Available from: http://ndt.oxfordjournals.org/content/30/2/310.full.pdf+html

4. Pike E, Hamidi V, Ringerike T, Wisløff T, Desser A, Harboe I, et al. Health technology assessment of the different dialysis modalities in Norway [Internet]. Oslo, Norway: Norwegian Knowledge Centre for the Health Services; 2013. [cited 2015 Nov 5]. Available from: http://www.kunnskapssenteret.no/en/publications/health-technology-assessment-of-the-different-dialysis-modalities-in-norway

5. Karopadi AN, Mason G, Rettore E, Ronco C. The role of economies of scale in the cost of dialysis across the world: a macroeconomic perspective. Nephrol Dial Transplant. 2014 Apr;29(4):885-92.

6. Chui BK, Manns B, Pannu N, Dong J, Wiebe N, Jindal K, et al. Health care costs of peritoneal dialysis technique failure and dialysis modality switching. Am J Kidney Dis. 2013 Jan;61(1):104-11.

7. Walker R, Marshall MR, Morton RL, McFarlane P, Howard K. The cost-effectiveness of contemporary home haemodialysis modalities compared with facility haemodialysis: a systematic review of full economic evaluations. Nephrology (Carlton). 2014 Aug;19(8):459-70.

8. Klarenbach SW, Tonelli M, Chui B, Manns BJ. Economic evaluation of dialysis therapies. Nat Rev Nephrol. 2014 Nov;10(11):644-52.

9. Sood MM, Tangri N, Hiebert B, Kappel J, Dart A, Levin A, et al. Geographic and facility-level variation in the use of peritoneal dialysis in Canada: a cohort study. CMAJ Open [Internet]. 2014 Jan [cited 2015 Nov 5];2(1):E36-E44. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3985977

10. Ghaffari A, Kalantar-Zadeh K, Lee J, Maddux F, Moran J, Nissenson A. PD First: peritoneal dialysis as the default transition to dialysis therapy. Semin Dial. 2013 Nov;26(6):706-13.

11. Dimkovic N, Aggarwal V, Khan S, Chu M, Bargman J, Oreopoulos DG. Assisted peritoneal dialysis: what is it and who does it involve? Adv Perit Dial. 2009;25:165-70.

12. Dratwa M. Costs of home assistance for peritoneal dialysis: results of a European survey. Kidney Int Suppl. 2008 Apr;(108):S72-S75.

13. Laplante S, Krepel H, Simons B, Nijhoff A, van LR, Simons M. Offering assisted peritoneal dialysis is a cost-effective alternative to the current care pathway in frail elderly Dutch patients. Int J Healthc Manag [Internet]. 2013 Apr [cited 2016 Nov 3];6(1):27-36. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3991312

14. Wong B, Courtney M, Pauly RP, Jindal K, Klarenbach S. Cost analysis of in-centre nocturnal compared with conventional hemodialysis. Can J Kidney Health Dis [Internet]. 2014 [cited 2016 Jan 5];1:14. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4349597

15. Frazao CM, de Sa JD, Medeiros AB, Fernandes MI, Lira AL, Lopes MV. The adaptation problems of patients undergoing hemodialysis: socio-economic and clinical aspects. Rev Lat Am Enfermagem

[Internet]. 2014 Nov [cited 2016 Mar 31];22(6):966-72. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4309231/pdf/0104-1169-rlae-22-06-00966.pdf

16. Griva K, Ng HJ, Loei J, Mooppil N, McBain H, Newman SP. Managing treatment for end-stage renal disease--a qualitative study exploring cultural perspectives on facilitators and barriers to treatment adherence. Psychol Health. 2013;28(1):13-29.

17. Your guide to home hemodialysis. Module 1: introduction [Internet]. Toronto (ON): Ontario Renal Network; 2015. [cited 2016 Oct 5]. Available from: http://www.renalnetwork.on.ca/common/pages/UserFile.aspx?fileId=332590

18. Nesrallah GE, Lindsay RM, Cuerden MS, Garg AX, Port F, Austin PC, et al. Intensive hemodialysis associates with improved survival compared with conventional hemodialysis. J Am Soc Nephrol [Internet]. 2012 Apr [cited 2016 May 16];23(4):696-705. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3312510/?report=printable

19. Marshall MR, Hawley CM, Kerr PG, Polkinghorne KR, Marshall RJ, Agar JW, et al. Home hemodialysis and mortality risk in Australian and New Zealand populations. Am J Kidney Dis. 2011 Nov;58(5):782-93.

20. Your guide to home hemodialysis. Module 2: how peritoneal dialysis works [Internet]. Toronto (ON): Ontario Renal Network; 2015. [cited 2016 Oct 5]. Available from: http://www.renalnetwork.on.ca/common/pages/UserFile.aspx?fileId=257558

21. Peritoneal dialysis [Internet]. Montreal (QC): The Kidney Foundation of Canada; [cited 2016 Oct 5]. Available from: http://www.kidney.ca/peritoneal-dialysis

22. Mendelssohn DC, Mujais SK, Soroka SD, Brouillette J, Takano T, Barre PE, et al. A prospective evaluation of renal replacement therapy modality eligibility. Nephrol Dial Transplant [Internet]. 2009 Feb [cited 2016 Oct 5];24(2):555-61. Available from: http://ndt.oxfordjournals.org/content/24/2/555.full.pdf+html

23. Liu FX, Treharne C, Culleton B, Crowe L, Arici M. The financial impact of increasing home-based high dose haemodialysis and peritoneal dialysis. BMC Nephrol [Internet]. 2014 [cited 2015 Nov 5];15:161. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4194367

24. Kidney disease: peritoneal dialysis. Costing report: implementing NICE guidance [Internet]. London: National Institute for Health and Care Excellence; 2011 Jul. [cited 2016 Oct 5]. (NICE clinical guideline; no. 125). Available from: http://www.nice.org.uk/guidance/cg125/resources/costing-report-183087181

25. Ortiz A, Covic A, Fliser D, Fouque D, Goldsmith D, Kanbay M, et al. Epidemiology, contributors to, and clinical trials of mortality risk in chronic kidney failure. Lancet. 2014 May 24;383(9931):1831-43.

26. Manns BJ, Mendelssohn DC, Taub KJ. The economics of end-stage renal disease care in Canada: incentives and impact on delivery of care. Int J Health Care Finance Econ. 2007 Sep;7(2-3):149-69.

27. Zelmer JL. The economic burden of end-stage renal disease in Canada. Kidney Int [Internet]. 2007 Nov [cited 2016 Oct 5];72(9):1122-9. Available from: http://ac.els-cdn.com/S0085253815527932/1-s2.0-S0085253815527932-main.pdf?_tid=d9b46dba-8b0d-11e6-ba93-00000aab0f01&acdnat=1475680408_9ed2bde5a86e701cbd49310cd8032c80

28. Agar JW, Perkins A, Heaf JG. Home hemodialysis: infrastructure, water, and machines in the home. Hemodial Int. 2015 Apr;19 Suppl 1:S93-S111.

29. Klarenbach S, Tonelli M, Pauly R, Walsh M, Culleton B, So H, et al. Economic evaluation of frequent home nocturnal hemodialysis based on a randomized controlled trial. J Am Soc Nephrol. 2014 Mar [cited 2016 Apr 13];25(3):587-94. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3935585

30. Liberati A, Altman DG, Tetzlaff J, Mulrow C, Gotzsche PC, Ioannidis JP, et al. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions:

explanation and elaboration. BMJ [Internet]. 2009 [cited 2016 Jun 17];339:b2700. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2714672

31. Robinson KA, Whitlock EP, Oneil ME, Anderson JK, Hartling L, Dryden DM, et al. Integration of existing systematic reviews into new reviews: identification of guidance needs. Syst Rev [Internet]. 2014 [cited 2016 Jun 16];3:60. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4066698

32. Whiting P, Savovic J, Higgins JP, Caldwell DM, Reeves BC, Shea B, et al. ROBIS: A new tool to assess risk of bias in systematic reviews was developed. J Clin Epidemiol [Internet]. 2016 Jan [cited 2016 May 25];69:225-34. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4687950

33. Dialysis modalities for the treatment of end-stage kidney disease: a health technology assessment — project protocol [Internet]. Ottawa: CADTH; 2016 Nov 3. (CADTH optimal use report; vol.6, no.2a). Available from: https://www.cadth.ca/dv/dialysis-modalities-treatment-end-stage-kidney-disease-project-protocol

34. Scottish Intercollegiate Guidelines Network (SIGN). Methodology checklist 2: randomised controlled trials [Internet]. Edinburgh: SIGN; 2015. [cited 2016 Apr 4]. Available from: http://www.sign.ac.uk/methodology/checklists/20150417SRchecklist.doc

35. Scottish Intercollegiate Guidelines Network (SIGN). Methodology checklist 3: cohort studies [Internet]. Edinburgh: SIGN; 2015. [cited 2016 Apr 4]. Available from: http://www.sign.ac.uk/methodology/checklists/20121210_Checklist_for_cohort_studies.rtf

36. Scottish Intercollegiate Guidelines Network (SIGN). Methodology checklist 4: case-control studies [Internet]. Edinburgh: SIGN; 2015. [cited 2016 Apr 4]. Available from: http://www.sign.ac.uk/methodology/checklists/20121210_Checklist_for_case_control_studies.rtf

37. Dialysis for the treatment of end stage kidney disease in indigenous patients in Canada: A review of clinical effectiveness [Internet]. Ottawa: CADTH; 2016 Jun 12. [cited 2016 Dec 12]. (CADTH Rapid response report: peer-reviewed summary with critical appraisal). Available from: https://www.cadth.ca/sites/default/files/pdf/htis/2017/RD0033%20Dialysis%20for%20ESKD%20in%20Indigenous%20Patients%20Final.docx.pdf

38. Ishani A, Slinin Y, Greer N, MacDonald R, Messana J, Rutks I, et al. Comparative Effectiveness of Home-Based Kidney Dialysis Versus In-Center or Other Outpatient Kidney Dialysis Locations - A Systematic Review [Internet]. Washington (DC): Department of Veterans Affairs (US); 2015 Apr. [cited 2016 May 16]. (VA Evidence-based Synthesis Program Reports). Available from: http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0085118/pdf/PubMedHealth_PMH0085118.pdf

39. Han SS, Park JY, Kang S, Kim KH, Ryu DR, Kim H, et al. Dialysis Modality and Mortality in the Elderly: A Meta-Analysis. Clin J Am Soc Nephrol [Internet]. 2015 Jun 5 [cited 2016 Jun 16];10(6):983-93. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4455206/?report=printable

40. Palmer SC, Palmer AR, Craig JC, Johnson DW, Stroumza P, Frantzen L, et al. Home versus in-centre haemodialysis for end-stage kidney disease. Cochrane Database Syst Rev. 2014;11:CD009535.

41. Vale L, Cody JD, Wallace SA, Daly C, Campbell MK, Grant AM, et al. Continuous ambulatory peritoneal dialysis (CAPD) versus hospital or home haemodialysis for end-stage renal disease in adults. Cochrane Database of Syst Rev. 2004 Oct 18;(4):CD003963. Assessed as up-to-date: 12 Jan 2012.

42. Culleton BF, Walsh M, Klarenbach SW, Mortis G, Scott-Douglas N, Quinn RR, et al. Effect of frequent nocturnal hemodialysis vs conventional hemodialysis on left ventricular mass and quality of life: a randomized controlled trial. JAMA [Internet]. 2007 Sep 19 [cited 2016 Jul 19];298(11):1291-9. Available from: http://jama.jamanetwork.com/article.aspx?articleid=208864

43. Manns BJ, Walsh MW, Culleton BF, Hemmelgarn B, Tonelli M, Schorr M, et al. Nocturnal hemodialysis does not improve overall measures of quality of life compared to conventional hemodialysis. Kidney Int. 2009;75(5):542-9.

44. Rocco MV, Lockridge RS, Jr., Beck GJ, Eggers PW, Gassman JJ, Greene T, et al. The effects of frequent nocturnal home hemodialysis: the Frequent Hemodialysis Network Nocturnal Trial. Kidney Int [Internet]. 2011 Nov [cited 2016 May 5];80(10):1080-91. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3569086

45. Rocco MV, Daugirdas JT, Greene T, Lockridge RS, Chan C, Pierratos A, et al. Long-term Effects of Frequent Nocturnal Hemodialysis on Mortality: The Frequent Hemodialysis Network (FHN) Nocturnal Trial. Am J Kidney Dis. 2015 Sep;66(3):459-68.

46. Unruh ML, Larive B, Chertow GM, Eggers PW, Garg AX, Gassman J, et al. Effects of 6-times-weekly versus 3-times-weekly hemodialysis on depressive symptoms and self-reported mental health: Frequent Hemodialysis Network (FHN) Trials. Am J Kidney Dis [Internet]. 2013 May [cited 2016 Jan 16];61(5):748-58. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4552179/pdf/nihms436843.pdf

47. Unruh ML, Larive B, Eggers PW, Garg AX, Gassman JJ, Finkelstein FO, et al. The effect of frequent hemodialysis on self-reported sleep quality: Frequent Hemodialysis Network Trials. Nephrol Dial Transplant. 2016 Jun;31(6):984-91.

48. de Abreu MM, Walker DR, Sesso RC, Ferraz MB. Health-related quality of life of patients recieving hemodialysis and peritoneal dialysis in Sao Paulo, Brazil: a longitudinal study. Value Health [Internet]. 2011 Jul [cited 2016 May 20];14(5 Suppl 1):S119-S121. Available from: http://ac.els-cdn.com/S109830151101432X/1-s2.0-S109830151101432X-main.pdf?_tid=4a2cd7ca-1ebd-11e6-901f-00000aacb35e&acdnat=1463771082_17859d32edbedba4093b698bea5203b2

49. Frimat L, Durand PY, Loos-Ayav C, Villar E, Panescu V, Briancon S, et al. Impact of first dialysis modality on outcome of patients contraindicated for kidney transplant. Perit Dial Int [Internet]. 2006 Mar;26(2):231-9. Available from: http://www.pdiconnect.com/content/26/2/231.long

50. Harris SA, Lamping DL, Brown EA, Constantinovici N, North Thames Dialysis Study (NTDS) Group. Clinical outcomes and quality of life in elderly patients on peritoneal dialysis versus hemodialysis. Perit Dial Int [Internet]. 2002 Jul [cited 2016 Jun 16];22(4):463-70. Available from: http://www.pdiconnect.com/content/22/4/463.long

51. Jeloka T, Sanwaria P, Periera A, Pawar S. Survival of elderly dialysis patients is not dependent on modality or "older" age. Indian J Nephrol. 2016 Jan [cited 2016 Jun 21];26(1):23-6. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4753737

52. Kim H, An JN, Kim DK, Kim MH, Kim H, Kim YL, et al. Elderly Peritoneal Dialysis Compared with Elderly Hemodialysis Patients and Younger Peritoneal Dialysis Patients: Competing Risk Analysis of a Korean Prospective Cohort Study. PLoS ONE [Internet]. 2015 [cited 2016 Jun 16];10(6):e0131393. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4488000

53. Lee JH, Park SH, Lim JH, Park YJ, Kim SU, Lee KH, et al. Impact of dialysis modality on technique survival in end-stage renal disease patients. Korean J Intern Med [Internet]. 2016 Jan [cited 2016 Jun 16];31(1):106-15. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4712414

54. Lockridge R, Ting G, Kjellstrand CM. Superior patient and technique survival with very high standard Kt/V in quotidian home hemodialysis. Hemodial Int. 2012 Jul;16(3):351-62.

55. Manns B, Johnson JA, Taub K, Mortis G, Ghali WA, Donaldson C. Quality of life in patients treated with hemodialysis or peritoneal dialysis: what are the important determinants? Clin Nephrol. 2003 Nov;60(5):341-51.

56. Moldovan D, Rusu C, Kacso IM, Potra A, Patiu IM, Gherman-Caprioara M. Mineral and bone disorders, morbidity and mortality in end-stage renal failure patients on chronic dialysis. Clujul med [Internet]. 2016;89(1):94-103. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4777475

57. Wu AW, Fink NE, Marsh-Manzi JV, Meyer KB, Finkelstein FO, Chapman MM, et al. Changes in quality of life during hemodialysis and peritoneal dialysis treatment: generic and disease specific measures. J Am Soc Nephrol [Internet]. 2004 Mar [cited 2016 Jun 16];15(3):743-53. Available from: http://jasn.asnjournals.org/content/15/3/743.full.pdf+html

58. Habib A, Durand AC, Brunet P, Delaroziere JC, Devictor B, Sambuc R, et al. Comparison of peritoneal dialysis and hemodialysis survival in Provence-Alpes-Cote d'Azur. Nephrol Ther. 2016 Jul;12(4):221-8. French.

59. Kasza J, Wolfe R, McDonald SP, Marshall MR, Polkinghorne KR. Dialysis modality, vascular access and mortality in end-stage kidney disease: A bi-national registry-based cohort study. Nephrology (Carlton). 2016 Oct;21(10):878-86.

60. Kim H, Kim KH, Ahn SV, Kang SW, Yoo TH, Ahn HS, et al. Risk of major cardiovascular events among incident dialysis patients: A Korean national population-based study. Int J Cardiol. 2015 Nov 1;198:95-101.

61. Lee YC, Hung SY, Wang HH, Wang HK, Lin CW, Chang MY, et al. Different risk of common gastrointestinal disease between groups undergoing hemodialysis or peritoneal dialysis or with non-end stage renal disease: a nationwide population-based cohort study. Medicine (Baltimore) [Internet]. 2015 Sep [cited 2016 Jun 21];94(36):e1482. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4616635

62. Lin YT, Wu PH, Kuo MC, Chen CS, Chiu YW, Yang YH, et al. Comparison of dementia risk between end stage renal disease patients with hemodialysis and peritoneal dialysis--a population based study. Sci Rep [Internet]. 2015 [cited 2016 Jun 16];5:8224. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4340159

63. Lin CS, Chen SJ, Sung CC, Lin CL, Lin SH, Cheng SM, et al. Hemodialysis Is Associated With Increased Peripheral Artery Occlusive Disease Risk Among Patients With End-Stage Renal Disease: A Nationwide Population-Based Cohort Study. Medicine (Baltimore) [Internet]. 2015 Jul [cited 2016 Jun 21];94(28):e1164. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4617093

64. Marshall MR, Polkinghorne KR, Kerr PG, Hawley CM, Agar JW, McDonald SP. Intensive hemodialysis and mortality risk in Australian and New Zealand populations. Am J Kidney Dis. 2016 Apr;67(4):617-28.

65. Nadeau-Fredette AC, Chan CT, Cho Y, Hawley CM, Pascoe EM, Clayton PA, et al. Outcomes of integrated home dialysis care: a multi-centre, multi-national registry study. Nephrol Dial Transplant. 2015 Nov;30(11):1897-904.

66. Nadeau-Fredette AC, Hawley CM, Pascoe EM, Chan CT, Clayton PA, Polkinghorne KR, et al. An incident cohort study comparing survival on home hemodialysis and peritoneal dialysis (Australia and New Zealand Dialysis and Transplantation Registry). Clin J Am Soc Nephrol. 2015 Aug 7;10(8):1397-407.

67. Nesrallah GE, Li L, Suri RS. Comparative effectiveness of home dialysis therapies: a matched cohort study. Can J Kideny Health Dis [Internet]. 2016 [cited 2016 May 16];3:19. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4802626/pdf/40697_2016_Article_105.pdf

68. Oliver MJ, Al-Jaishi AA, Dixon SN, Perl J, Jain AK, Lavoie SD, et al. Hospitalization rates for patients on assisted peritoneal dialysis compared with in-center hemodialysis. Clin J Am Soc Nephrol. 2016 Jul 9;11(9):1606-14.

69. Shen CH, Zheng CM, Kiu KT, Chen HA, Wu CC, Lu KC, et al. Increased risk of atrial fibrillation in end-stage renal disease patients on dialysis: A nationwide, population-based study in Taiwan. Medicine (Baltimore) [Internet]. 2016 Jun [cited 2016 Aug 5];95(25):e3933.

70. Suri RS, Li L, Nesrallah GE. The risk of hospitalization and modality failure with home dialysis. Kidney Int [Internet]. 2015 Aug [cited 2016 May 16];88(2):360-8. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4526768/pdf/ki201568a.pdf

71. Wang IK, Cheng YK, Lin CL, Peng CL, Chou CY, Chang CT, et al. Comparison of Subdural Hematoma Risk between Hemodialysis and Peritoneal Dialysis Patients with ESRD. Clin J Am Soc Nephrol. 2015 Jun 5 [cited 2016 Jun 21];10(6):994-1001. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4455210/?report=printable

72. Wang IK, Wang CY, Muo CH, Yen TH, Sung FC. Risk of sudden sensorineural hearing loss in patients with end-stage renal disease undergoing dialysis. Nephrology (Carlton). 2016 Apr 15. Epub ahead of print.

73. Wang IK, Lin CL, Cheng YK, Chou CY, Liang CC, Yen TH, et al. Increased risk of hydrocephalus in long-term dialysis patients. Nephrology Dialysis Transplantation. 2016;31(5):807-13.

74. Wang IK, Shen TC, Muo CH, Yen TH, Sung FC. Risk of pulmonary embolism in patients with end-stage renal disease receiving long-term dialysis. Nephrol Dial Transplant. 2016 Jul 22. Epub ahead of print.

75. Weinhandl ED, Gilbertson DT, Collins AJ. Mortality, hospitalization, and technique failure in daily home hemodialysis and matched peritoneal dialysis patients: a matched cohort study. Am J Kidney Dis [Internet]. 2016 Jan [cited 16 A.D. Feb 16];67(1):98-110. Available from: http://ac.els-cdn.com/S0272638615010185/1-s2.0-S0272638615010185-main.pdf?_tid=b18412a4-1b92-11e6-a58b-00000aab0f26&acdnat=1463422933_5465c6487b474e1fb2aea5c04af07394

76. Wolfgram DF, Szabo A, Murray AM, Whittle J. Risk of dementia in peritoneal dialysis patients compared with hemodialysis patients. Perit Dial Int [Internet]. 2015 Mar [cited 2016 Jun 16];35(2):189-98. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4406314

77. Yang F, Khin LW, Lau T, Chua HR, Vathsala A, Lee E, et al. Hemodialysis versus peritoneal dialysis: A comparison of survival outcomes in south-east Asian patients with end-stage renal disease. PLoS ONE [Internet]. 2015 [cited 2016 Jun 22];10(10). Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4622046/pdf/pone.0140195.pdf

78. Yang JY, Chen L, Chao CT, Peng YS, Chiang CK, Kao TW, et al. Comparative Study of Outcomes among Patients with Polycystic Kidney Disease on Hemodialysis and Peritoneal Dialysis. Sci Rep [Internet]. 2015;5:12816. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4526846

79. Yeates K, Zhu N, Vonesh E, Trpeski L, Blake P, Fenton S. Hemodialysis and peritoneal dialysis are associated with similar outcomes for end-stage renal disease treatment in Canada. Nephrol Dial Transplant [Internet]. 2012 Sep [cited 2016 May 5];27(9):3568-75. Available from: http://ndt.oxfordjournals.org/content/27/9/3568.full.pdf+html

80. Kawada T. Risk of Peptic Ulcer Bleeding in Patients with Chronic Kidney Disease and End-Stage Renal Disease Receiving Peritoneal or Hemodialysis. Dig Dis Sci. 2014;59(12):3131-2.

81. Kroeker A, Clark WF, Heidenheim AP, Kuenzig L, Leitch R, Meyette M, et al. An operating cost comparison between conventional and home quotidian hemodialysis. Am J Kidney Dis. 2003 Jul;42(1 Suppl):49-55.

82. McFarlane PA, Bayoumi AM, Pierratos A, Redelmeier DA. The impact of home nocturnal hemodialysis on end-stage renal disease therapies: a decision analysis. Kidney Int [Internet]. 2006 Mar [cited 2016 Oct 18];69(5):798-805. Available from: http://ac.els-cdn.com/S0085253815515597/1-s2.0-S0085253815515597-main.pdf?_tid=26c5f96a-9564-11e6-a939-00000aab0f6c&acdnat=1476816986_4fb177045e2f3cb2506a92e0f2f0e0bf

83. Komenda P, Gavaghan MB, Garfield SS, Poret AW, Sood MM. An economic assessment model for in-center, conventional home, and more frequent home hemodialysis. Kidney Int [Internet]. 2012 Feb [cited 2016 Oct 5];81(3):307-13. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3258566

84. Lee H, Manns B, Taub K, Ghali WA, Dean S, Johnson D, 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 Dis. 2002 Sep;40(3):611-22.

85. McFarlane PA, Pierratos A, Redelmeier DA. Cost savings of home nocturnal versus conventional in-center hemodialysis. Kidney Int [Internet]. 2002 Dec [cited 2016 Oct 18];62(6):2216-22. Available from: http://ac.els-cdn.com/S0085253815487915/1-s2.0-S0085253815487915-main.pdf?_tid=4d3f4204-9564-11e6-a0a7-00000aab0f26&acdnat=1476817050_143619c94f0061eb62b7aab21374829a

86. Manns B, Hemmelgarn B, Tonelli M, Au F, Chiasson TC, Dong J, et al. Population based screening for chronic kidney disease: cost effectiveness study. BMJ [Internet]. 2010 [cited 2016 Apr 13];341:c5869. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2975430

87. CORR pre-formatted ESKD tables and figures: 2005 to 2014 data. Ottawa: Canadian Institute for Health Information; 2015.

88. CANSIM [Internet]. Ottawa: Statistics Canada; 2016 May 18. Table 053-0003 Elements of the life table, Canada, provinces and territories. [cited 2016 Oct 13]. Available from: http://www5.statcan.gc.ca/cansim/a26?lang=eng&id=530003

89. Lafrance JP, Rahme E, Iqbal S, Elftouh N, Laurin LP, Vallee M. Trends in infection-related hospital admissions and impact of length of time on dialysis among patients on long-term dialysis: a retrospective cohort study. CMAJ Open [Internet]. 2014 Apr [cited 2016 Jun 21];2(2):E109-E114. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4084745

90. Pauly RP, Maximova K, Coppens J, Asad RA, Pierratos A, Komenda P, et al. Patient and technique survival among a Canadian multicenter nocturnal home hemodialysis cohort. Clin J Am Soc Nephrol [Internet]. 2010 Oct [cited 2016 May 5];5(10):1815-20. Available from: http://cjasn.asnjournals.org/content/5/10/1815.full.pdf+html

91. 2016/17 Chronic kidney disease amalgamated funding guide: hospital and community funding. Toronto: Cancer Care Ontario; 2016 Apr 1.

92. Laupacis A, Keown P, Pus N, Krueger H, Ferguson B, Wong C, et al. A study of the quality of life and cost-utility of renal transplantation. Kidney Int [Internet]. 1996 Jul [cited 2016 Oct 13];50(1):235-42. Available from: http://www.sciencedirect.com/science/article/pii/S0085253815596014

93. Consumer Price Index, by province (Canada) [Internet]. Ottawa: Statistics Canada; 2016 Jan 22. [cited 2016 Oct 13]. Available from: http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/econ09a-eng.htm

94. Annual average exchange rates [Internet]. Ottawa: Bank of Canada; 2016. [cited 2016 Oct 13]. Available from: http://www.bankofcanada.ca/rates/exchange/annual-average-exchange-rates/

95. Ferguson TW, Zacharias J, Walker SR, Collister D, Rigatto C, Tangri N, et al. An Economic Assessment Model of Rural and Remote Satellite Hemodialysis Units. PLoS ONE [Internet]. 2015 [cited 2016 Aug 22];10(8):e0135587. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4540589/pdf/pone.0135587.pdf

96. Couillerot-Peyrondet AL, Sambuc C, Sainsaulieu Y, Couchoud C, Bongiovanni-Delaroziere I. A comprehensive approach to assess the costs of renal replacement therapy for end-stage renal disease in France: the importance of age, diabetes status, and clinical events. Eur J Health Econ. 2016 May 5. [Epub ahead of print].

97. Manns B, Tonelli M, Yilmaz S, Lee H, Laupland K, Klarenbach S, et al. Establishment and maintenance of vascular access in incident hemodialysis patients: a prospective cost analysis. J Am Soc Nephrol [Internet]. 2005 Jan [cited 2016 Oct 13];16(1):201-9. Available from: http://jasn.asnjournals.org/content/16/1/201.full.pdf+html

98. Dialysis programs in Canada: implementation considerations and funding practices. Ottawa: CADTH. Forthcoming 2017.

99. Nickel M, Rideout W, Reintjes F, Chen J, Burrell R, Pauly R. Predicting patient-borne water and electrical costs in home hemodialysis: a regional Canadian perspective. Abstract presented at: 48th AGM for Canadian Society of Nephrology; May 12-14, 2016. 2016; Halifax (NS).

100. Manns B, Meltzer D, Taub K, Donaldson C. Illustrating the impact of including future costs in economic evaluations: an application to end-stage renal disease care. Health Econ. 2003 Nov;12(11):949-58.

101. Ravenscroft EF. Diabetes and kidney failure: how individuals with diabetes experience kidney failure. Nephrol Nurs J. 2005 Sep;32(5):502-10.

102. Yang A, Lee WY, Hocking K. Survival comparison of daily home hemodialysis vs. conventional in the nursing home setting. Nephrol News Issues. 2015 Feb;29(2):25-7.

103. Financial burden survey [Internet]. Montreal: The Kidney Foundation of Canada; 2015. [cited 2016 Dec 16]. Available from: https://www.kidney.ca/news?=&storyid15353=4791&ncs15353=3

104. Nadeau-Fredette AC. An incident cohort study comparing survival on home hemodialysis and peritoneal dialysis (Australia and New Zealand Dialysis and Transplantation Registry) (supplementary data). Clin J Am Soc Nephrol. 2015 Aug 7;10.

105. Murtagh FEM, Addington-Hall J, Higginson IJ. The prevalence of symptoms in end-stage renal disease: a systematic review. Adv Chronic Kidney Dis. 2007;14(1):82-99.

106. Noble H, Meyer J, Bridges J, Kelly D, Johnson B. Patient experience of dialysis refusal or withdrawal--a review of the literature. J Ren Care. 2008 Jun;34(2):94-100.

107. Tong A, Sainsbury P, Craig JC. Support interventions for caregivers of people with chronic kidney disease: A systematic review. Nephrology Dialysis Transplantation [Internet]. 2008 [cited 2016 May 27];23(12):3960-5. Available from: http://ndt.oxfordjournals.org/content/23/12/3960.full.pdf+html

108. Hussain JA, Flemming K, Murtagh FE, Johnson MJ. Patient and health care professional decision-making to commence and withdraw from renal dialysis: a systematic review of qualitative research. Clin J Am Soc Nephrol. 2015 Jul 7;10(7):1201-15.

109. Wadd K, King L, Bennett P, Grant J. Being a parent on dialysis: a literature review. J Ren Care. 2011 Dec;37(4):208-15.

110. Moustakas J, Bennett PN, Nicholson J, Tranter S. The needs of older people with advanced chronic kidney disease choosing supportive care: a review. Renal Society of Australasia Journal [Internet]. 2012 Jul [cited 2016 May 27];8(2):70-5. Available from: http://www.renalsociety.org/public/6/files/documents/RSAJ/2012.07/moustakas.pdf

111. Sinclair PM. Home haemodialysis: a literature review. Renal Society of Australasia Journal [Internet]. 2009 Jun 12 [cited 2016 May 17];5(1):9-15. Available from: http://www.renalsociety.org/public/6/files/documents/RSAJ/2009.03/sinclair.pdf

112. NVIVO 11 for Windows [computer program]. Melbourne, Australia: QSR International; 2016.

113. Checklist for systematic reviews and research syntheses [Internet]. Adelaide (AU): Joanna Briggs Institute; 2016. Available from: http://joannabriggs.org/assets/docs/critical-appraisal-tools/JBI_Critical_Appraisal-Checklist_for_Systematic_Reviews.pdf

114. Harden A, Garcia J, Oliver S, Rees R, Shepherd J, Brunton G, et al. Applying systematic review methods to studies of people's views: an example from public health research. J Epidemiol Community Health [Internet]. 2004 Sep [cited 2016 Feb 12];58(9):794-800. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1732892

115. Thomas J, Harden A. Methods for the thematic synthesis of qualitative research in systematic reviews. BMC Med Res Methodol [Internet]. 2008 [cited 2016 Mar 8];8:45. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2478656

116. Morton RL, Tong A, Howard K, Snelling P, Webster AC. The views of patients and carers in treatment decision making for chronic kidney disease: systematic review and thematic synthesis of qualitative studies. BMJ [Internet]. 2010 [cited 2016 May 26];340:c112. Available from: http://www.bmj.com/content/bmj/340/bmj.c112.full.pdf

117. Tong A, Cheung KL, Nair SS, Kurella Tamura M, Craig JC, Winkelmayer WC. Thematic synthesis of qualitative studies on patient and caregiver perspectives on end-of-life care in CKD. Am J Kidney Dis. 2014 Jun;63(6):913-27.

118. Walker RC, Hanson CS, Palmer SC, Howard K, Morton RL, Marshall MR, et al. Patient and caregiver perspectives on home hemodialysis: a systematic review. Am J Kidney Dis. 2015 Mar;65(3):451-63.

119. Bayhakki, Hatthakit U. Lived experiences of patients on hemodialysis: a meta-synthesis. Nephrol Nurs J. 2012 Jul;39(4):295-304.

120. Harwood L, Clark AM. Understanding pre-dialysis modality decision-making: A meta-synthesis of qualitative studies. Int J Nurs Stud. 2013;50(1):109-20.

121. Burns T, Fernandez R, Stephens M. The experiences of adults who are on dialysis and waiting for a renal transplant from a deceased donor: a systematic review. JBI Database System Rev Implement Rep. 2015;13(2):169-211.

122. López-Oliva MO, Rivas B, Pérez-Férnandez E, Ossorio M, Ros S, Chica C, et al. Pretransplant peritoneal dialysis relative to hemodialysis improves long-term survival of kidney transplant patients: a single-center observational study. Int Urol Nephrol. 2014 Apr;46(4):825-32.

123. Castillo J. Why peritoneal dialysis works for me [Birmingham, Alabama]. Nephrology News & Issues [Internet]. 2015 Aug 15 [cited 2016 May 27];29(9):24. Available from: http://www.nephrologynews.com/peritoneal-dialysis-works/

124. Thorsteinsdottir B, Swetz KM, Tilburt JC. Dialysis in the frail elderly--a current ethical problem, an impending ethical crisis. J Gen Intern Med [Internet]. 2013 Nov [cited 2016 Nov 1];28(11):1511-6. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3797329

125. Muthalagappan S, Johansson L, Kong WM, Brown EA. Dialysis or conservative care for frail older patients: ethics of shared decision-making. Nephrol Dial Transplant [Internet]. 2013 Nov [cited 2016 Jul 29];28(11):2717-22. Available from: http://ndt.oxfordjournals.org/content/28/11/2717.full.pdf+html

126. Hofmann B, Droste S, Oortwijn W, Cleemput I, Sacchini D. Harmonization of ethics in health technology assessment: a revision of the Socratic approach. Int J Technol Assess Health Care. 2014 Jan;30(1):3-9.

127. Beauchamp TL, Childress JF. Principles of biomedical ethics. 6th ed. New York: Oxford University Press; 2012.

128. An ethical framework for public health projects. A discussion paper [Internet]. Toronto: Public Health Ontario; 2011 Jun. [cited 2016 Nov 2]. Available from: https://www.publichealthontario.ca/en/eRepository/Ethical%20Framework%20for%20Public%20Health%20Projects_Disucssion%20Paper%20%20June%2030.pdf

129. Alexander S. They decide who lives, who dies: medical miracle puts a moral burden on a small committee. Life. 1962;53(19):102-04, 06, 08, 110, 115, 118, 123-24.

130. Jonsen AR. The god squad and the origins of transplantation ethics and policy. J Law Med Ethics. 2007;35(2):238-40.

131. Blagg CR. The early history of dialysis for chronic renal failure in the United States: a view from Seattle. Am J Kidney Dis. 2007 Mar;49(3):482-96.

132. Ross W. God panels and the history of hemodialysis in America: a cautionary tale. Virtual Mentor [Internet]. 2012 Nov 1 [cited 2016 Nov 2];14(11):890-6. Available from: http://journalofethics.ama-assn.org/2012/11/pdf/mhst1-1211.pdf

133. 1961: the birth of modern bioethics. In: UW showcase: a century of excellence in the arts, humanities and professional schools at the University of Washington [Internet]. Seattle (WA): University of Washington; 2016 [cited 2016 Nov 3]. Available from: https://www.washington.edu/research/showcase/1961b.html

134. Rettig RA. Special treatment--the story of Medicare's ESRD entitlement. N Engl J Med. 2011 Feb 17;364(7):596-8.

135. Golper TA, Guest S, Glickman JD, Turk J, Pulliam JP. Home dialysis in the new USA bundled payment plan: implications and impact. Perit Dial Int. 2011 Jan;31(1):12-6.

136. Agar JW. Should the Medicare ESRD program fund daily and nocturnal hemodialysis? Nephrol News Issues. 2007 Dec;21(12):48, 51, 54.

137. Mehrotra R, Blake P, Berman N, Nolph KD. An analysis of dialysis training in the United States and Canada. Am J Kidney Dis. 2002 Jul;40(1):152-60.

138. Liu FX, Gao X, Inglese G, Chuengsaman P, Pecoits-Filho R, Yu A. A Global Overview of the Impact of Peritoneal Dialysis First or Favored Policies: An Opinion. Perit Dial Int. 2015 Jul;35(4):406-20.

139. Unleashing innovation: excellent healthcare for Canada. Report of the Advisory Panel on Healthcare Innovation [Internet]. Ottawa: Health Canada; 2015 Jul. [cited 2016 Oct 26]. Available from: http://www.healthycanadians.gc.ca/publications/health-system-systeme-sante/report-healthcare-innovation-rapport-soins/alt/report-healthcare-innovation-rapport-soins-eng.pdf

140. Mendelssohn DC. Empowerment of patient preference in dialysis modality selection. Am J Kidney Dis. 2004 May;43(5):930-2.

141. Mehrotra R, Blake P, Berman N, Nolph KD. An analysis of dialysis training in the United States and Canada. Am J Kidney Dis. 2002 Jul;40(1):152-60.

142. Taylor DW. Benefits outweigh costs in universal healthcare: business case for reimbursement of take-home cancer medicines in Ontario and Atlantic Canada. Am J Med Med Sci [Internet]. 2014 [cited 2016 Oct 27];4(4):126-38. Available from: http://www.cancerdurein.ca/media/926488/10.5923.j.ajmms.20140404.05.pdf

143. Flood CM. Chaoulli's legacy for the future of Canadian health care policy. Osgoode Hall Law Review. 2006;44(2):273-310.

144. The legal attack on public health care [Internet]. Vancouver (BC): BC Health Coalition; 2016. [cited 2016 Nov 3]. Available from: http://www.bchealthcoalition.ca/what-we-do/protect-medicare/case-backgound

145. Graham JR. The reality of U.S. and Canadian health-care spending. In: Fraser Forum [blog on the Internet]. Vancouver: Fraser Institute; 2016 Mar 31 [cited 2016 Oct 26]. Available from: https://www.fraserinstitute.org/blogs/the-reality-of-us-and-canadian-health-care-spending

146. O'Neill JE, O'Neill DM. Health status, health care and inequality: Canada vs. the U.S. [Internet]. Cambridge (MA): National Bureau of Economic Research; 2007. [cited 2016 Oct 27]. (NBER working paper series no. 13429). Available from: http://www.nber.org/papers/w13429.pdf

147. Parker JC. Cherry picking in ESRD: an ethical challenge in the era of pay for performance. Semin Dial. 2011 Jan;24(1):5-8.

148. Kahrass H, Strech D, Mertz M. The Full Spectrum of Clinical Ethical Issues in Kidney Failure. Findings of a Systematic Qualitative Review. PLoS ONE. 2016;11(3):e0149357. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4777282

149. Gauthier D. Morals by agreement. Oxford, United Kingdom: Clarendon Press; 1986.

150. Rivara MB, Mehrotra R. The changing landscape of home dialysis in the United States. Curr Opin Nephrol Hypertens [Internet]. 2014 Nov [cited 2016 Oct 26];23(6):586-91. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4414038

151. Metzger S. Home Dialysis Modalities: Educational Barriers to Utilization. Nephrol Nurs J. 2016 May;43(3):251-4.

152. Koester L. Exploring the reasons for the tiny percentage of patients on home hemodialysis. Nephrol Nurs J. 2013 Jan;40(1):43-8.

153. Narva AS, Norton JM, Boulware LE. Educating Patients about CKD: The Path to Self-Management and Patient-Centered Care. Clin J Am Soc Nephrol. 2016 Apr 7;11(4):694-703. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4822666

154. Anantharaman P, Moss AH. Should the medicare ESRD program pay for daily dialysis? An ethical analysis. Adv Chronic Kidney Dis. 2007 Jul;14(3):290-6.

155. Bennett WM. Ethical conflicts for physicians treating ESRD patients. Semin Dial. 2004 Jan;17(1):1-3.

156. Osterlund K, Mendelssohn D, Clase C, Guyatt G, Nesrallah G. Identification of facilitators and barriers to home dialysis selection by canadian adults with ESRD. Semin Dial. 2014 Mar;27(2):160-72.

157. Portoles J, Del PG, Fernandez-Reyes MJ, Bajo MA, Lopez-Sanchez P, GCDP. Previous comorbidity and lack of patient free choice of technique predict early mortality in peritoneal dialysis. Perit Dial Int. 2009 Mar;29(2):150-7.

158. Lo WK. Absolute free choice for dialysis modality selection -- is it possible? Perit Dial Int [Internet]. 2009 Mar [cited 2016 Aug 8];29(2):142-3. Available from: http://www.pdiconnect.com/content/29/2/142.full.pdf+html

159. Mendelssohn DC. Increasing PD utilization: should suitable patients be forced? Perit Dial Int [Internet]. 2009 Mar [cited 2016 Nov 2];29(2):144-6. Available from: http://www.pdiconnect.com/content/29/2/144.full.pdf+html

160. Mendelssohn DC, Toffelmire EB, Levin A. Attitudes of Canadian nephrologists toward multidisciplinary team-based CKD clinic care. Am J Kidney Dis. 2006 Feb;47(2):277-84.

161. Truth and Reconciliation Commission of Canada: Calls to action [Internet]. Winnipeg: Truth and Reconciliation Commission of Canada; 2015. [cited 2016 Apr 11]. Available from: http://www.trc.ca/websites/trcinstitution/File/2015/Findings/Calls_to_Action_English2.pdf

162. End-stage renal disease among Aboriginal Peoples in Canada: treatment and outcomes [Internet]. Ottawa: Canadian Institute for Health Information; 2016. [cited 2016 Apr 11]. Available from: https://secure.cihi.ca/free_products/EndStageRenalDiseaseAiB-ENweb.pdf

163. Kim Y, Evangelista LS, Phillips LR, Pavlish C, Kopple JD. Racial/ethnic differences in illness, perceptions in minority patients undergoing maintenance hemodialysis. Nephrol Nurs J [Internet]. 2012 Jan [cited 2016 Jul 29];39(1):39-48. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3390251

164. Anderson C, Blagg CR, Mailloux LU. Organization and elements of a home hemodialysis program. In: Post TW, editor. UpToDate [Internet]. Waltham (MA): UpToDate; 2014 Jul 25 [cited 2016 Apr 13]. Available from: www.uptodate.com Subscription required.

165. Pfadenhauer L, Pohwer A, Burns J, Both A, Lysdahl LB, Hofmann B. Guidance for the assessment of context and implementation in health technology assessments (HTA) and systematic reviews of complex interventions: the Context and implementation of Complex Interventions (CICI) framework [Internet]. Bremen (DE): Integrate-HTA; 2016 Feb 1. [cited 2016 Apr 4]. Available from: http://www.integrate-hta.eu/wp-content/uploads/2016/02/Guidance-for-the-Assessment-of-Context-and-Implementation-in-HTA-and-Systematic-Reviews-of-Complex-Interventions-The-Co.pdf

166. Chaudhary K, Sangha H, Khanna R. Peritoneal dialysis first: rationale. Clin J Am Soc Nephrol. 2011 Feb;6(2):447-56.

167. Phillips M, Wile C, Bartol C, Stockman C, Dhir M, Soroka SD, et al. An education initiative modifies opinions of hemodialysis nurses towards home dialysis. Can J Kidney Health Dis [Internet]. 2015 [cited 2016 Mar 28];2:16. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4411822/pdf/40697_2015_Article_51.pdf

168. Motiwala SS, McFarlane PA. Standardized preplanned patient education to encourage transfer from hospital hemodialysis to home dialysis. Perit Dial Int [Internet]. 2008 Jul [cited 2016 Aug 23];28(4):403-7. Available from: http://www.pdiconnect.com/content/28/4/403.long

169. Watson D. Acute start--chronic needs: education and support for adults who have had acute start dialysis. Semin Dial. 2013 Mar;26(2):184-7.

170. Zhang AH, Bargman JM, Lok CE, Porter E, Mendez M, Oreopoulos DG, et al. Dialysis modality choices among chronic kidney disease patients: identifying the gaps to support patients on home-based therapies. Int Urol Nephrol. 2010 Sep;42(3):759-64.

171. Watson D. Post-dialysis "pre-dialysis" care: the cart before the horse--advanced practice nurse intervention and impact on modality selection. CANNT J. 2008 Jan;18(1):30-3.

172. Chenitz KB, Fernando M, Shea JA. In-center hemodialysis attendance: Patient perceptions of risks, barriers, and recommendations. Hemodial Int. 2014;18(2):364-73.

173. Prakash S, Perzynski AT, Austin PC, Wu CF, Lawless ME, Paterson JM, et al. Neighborhood socioeconomic status and barriers to peritoneal dialysis: A mixed methods study. Clin J Am Soc Nephrol [Internet]. 2013 [cited 2016 Aug 23];8(10):1741-9. Article. Available from: http://cjasn.asnjournals.org/content/8/10/1741.full.pdf+html

174. Oliver MJ, Garg AX, Blake PG, Johnson JF, Verrelli M, Zacharias JM, et al. Impact of contraindications, barriers to self-care and support on incident peritoneal dialysis utilization. Nephrol Dial Transplant [Internet]. 2010 Aug [cited 2016 Aug 23];25(8):2737-44. Available from: http://ndt.oxfordjournals.org/content/25/8/2737.full.pdf+html

175. Harvey A, Walsh M, Jain AK, Bosch E, Moreau C, Garland J, et al. The WISHED Trial: implementation of an interactive health communication application for patients with chronic kidney disease. Can J Kidney Health Dis [Internet]. 2016 [cited 2016 Aug 22];3:29. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4908673/pdf/40697_2016_Article_120.pdf

176. McLaughlin K, Manns B, Mortis G, Hons R, Taub K. Why patients with ESRD do not select self-care dialysis as a treatment option [Philadelphia, Pennsylvania]. Am J Kidney Dis. 2003 Feb;41(2):380-5.

177. Zacharias J, Komenda P, Olson J, Bourne A, Franklin D, Bernstein K. Home hemodialysis in the remote Canadian north: treatment in Manitoba fly-in communities. Semin Dial. 2011 Nov;24(6):653-7.

178. Buob-Corbett S, Blundon E. Challenges of providing PD to the remote northwest of Ontario. CANNT J. 2007 Apr;17(2):55-6.

179. Wang T, Izatt S, Dalglish C, Jassal SV, Bargman J, Vas S, et al. Peritoneal dialysis in the nursing home. Int Urol Nephrol. 2002;34(3):405-8.

180. Walker RC, Howard K, Tong A, Palmer SC, Marshall MR, Morton RL. The economic considerations of patients and caregivers in choice of dialysis modality. Hemodial Int. 2016 Oct;20(4):634-42.

181. Pipkin M, Eggers PW, Larive B, Rocco MV, Stokes JB, Suri RS, et al. Recruitment and training for home hemodialysis: experience and lessons from the Nocturnal Dialysis Trial. Clin J Am Soc Nephrol [Internet]. 2010 Sep [cited 2016 Aug 23];5(9):1614-20. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2974402

182. Malmström RK, Roine RP, Heikkilä A, Räsänen P, Sintonen H, Muroma-Karttunen R, et al. Cost analysis and health-related quality of life of home and self-care satellite haemodialysis. Nephrol Dial Transplant [Internet]. 2008 Jun [cited 2016 Oct 31];23(6):1990-6. Available from: http://ndt.oxfordjournals.org/content/23/6/1990.full.pdf+html

183. Reilly R, Evans K, Gomersall J, Gorham G, Peters MD, Warren S, et al. Effectiveness, cost effectiveness, acceptability and implementation barriers/enablers of chronic kidney disease management programs for Indigenous people in Australia, New Zealand and Canada: a systematic review of mixed evidence. BMC Health Serv Res [Internet]. 2016 [cited 2016 Aug 22];16:119, 2016. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4822249/pdf/12913_2016_Article_1363.pdf

184. Rix EF, Barclay L, Stirling J, Tong A, Wilson S. The perspectives of Aboriginal patients and their health care providers on improving the quality of hemodialysis services: a qualitative study. Hemodial Int [Internet]. 2015 Jan [cited 2016 Mar 31];19(1):80-9. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4309474/pdf/hdi0019-0080.pdf

185. Rioux JP, Marshall MR, Faratro R, Hakim R, Simmonds R, Chan CT. Patient selection and training for home hemodialysis. Hemodial Int. 2015 Apr;19(Suppl 1):S71-9.

186. Van Biesen, van der Veer SN, Murphey M, Loblova O, Davies S. Patients' perceptions of information and education for renal replacement therapy: an independent survey by the European Kidney Patients' Federation on information and support on renal replacement therapy. PLoS ONE [Internet]. 2014 [cited 2016 Mar 31];9(7):e103914. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4117591/pdf/pone.0103914.pdf

187. Sinnema J. Mobile dialysis unit saves rural patients time, money. Edmonton J [Internet]. 2008 Jan 10 [cited 2016 Oct 21];Cityplus:B4. Available from: http://www.aci-arch.com/about/awards/renal-dialysis-bus/

188. Karopadi AN, Mason G, Rettore E, Ronco C. Cost of peritoneal dialysis and haemodialysis across the world. Nephrol Dial Transplant [Internet]. 2013 Oct;28(10):2553-69. Available from: http://ndt.oxfordjournals.org/content/28/10/2553.full.pdf+html

189. 38th annual ANZDATA report [Internet]. Adelaide (AU): Australia & New Zealand Dialysis & Transplant Registry; 2015. [cited 2016 Oct 5]. Available from: http://www.anzdata.org.au/v1/report_2015.html

190. Korevaar JC, Feith GW, Dekker FW, van Manen JG, Boeschoten EW, Bossuyt PM, et al. Effect of starting with hemodialysis compared with peritoneal dialysis in patients new on dialysis treatment: a randomized controlled trial. Kidney Int [Internet]. 2003 Dec [cited 2016 May 20];64(6):2222-8. Available from:

http://ac.els-cdn.com/S0085253815495924/1-s2.0-S0085253815495924-main.pdf?_tid=dfe9a788-1ebe-11e6-8dce-00000aab0f02&acdnat=1463771763_65bdfe7fba46f305fcd0effbcbd49f5a

191. National health expenditure trends, 1975 to 2015 [Internet]. Ottawa: Canadian Institute for Health Information; 2015. [cited 2016 Oct 28]. Available from: https://www.cihi.ca/sites/default/files/document/nhex_trends_narrative_report_2015_en.pdf

192. Quinn RR, Hux JE, Oliver MJ, Austin PC, Tonelli M, Laupacis A. Selection bias explains apparent differential mortality between dialysis modalities. J Am Soc Nephrol [Internet]. 2011 Aug;22(8):1534-42. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3148708

193. EuroQol Group. EuroQol--a new facility for the measurement of health-related quality of life. Health Policy. 1990 Dec;16(3):199-208.

194. Brooks R. EuroQol: the current state of play. Health Policy. 1996 Jul;37(1):53-72.

195. Sinnott PL, Joyce WR, Barnett PG. Guidebook: preference measurement in economic analysis [Internet]. Menlo Park (CA): Health Economics Resource Center; 2007 [cited 2016 Feb 17]. Available from: http://www.herc.research.va.gov/files/BOOK_419.pdf

196. Ware JE, Sherbourne CD. The MOS 36-item short-form health survey (SF-36). I. conceptual framework and item selection. Med Care. 1992 Jun;30(6):473-83.

197. Mease PJ, Menter MA. Quality-of-life issues in psoriasis and psoriatic arthritis: outcome measures and therapies from a dermatological perspective. J Am Acad Dermatol. 2006 Apr;54(4):685-704.

198. Khan IH, Garratt AM, Kumar A, Cody DJ, Catto GR, Edward N, et al. Patients' perception of health on renal replacement therapy: evaluation using a new instrument. Nephrol Dial Transplant. 1995;10(5):684-9.

199. Hays RD, Morales LS. The RAND-36 measure of health-related quality of life. Ann Med. 2001 Jul;33(5):350-7.

200. Samsa G, Edelman D, Rothman ML, Williams GR, Lipscomb J, Matchar D. Determining clinically important differences in health status measures: a general approach with illustration to the Health Utilities Index Mark II. Pharmacoeconomics. 1999 Feb;15(2):141-55.

201. Strand V, Singh JA. Improved health-related quality of life with effective disease-modifying antirheumatic drugs: evidence from randomized controlled trials. Am J Manag Care. 2008 Apr;14(4):239-53.

202. Medical outcomes study: 36-item short form survey scoring instructions [Internet]. Santa Monica (CA): Rand Corporation; 2015. [cited 2015 Dec 11]. Available from: http://www.rand.org/health/surveys_tools/mos/mos_core_36item_scoring.html

203. Hays RD, Kallich JD, Mapes DL, Coons SJ, Carter WB. Development of the kidney disease quality of life (KDQOL) instrument. Qual Life Res. 1994 Oct;3(5):329-38.

204. Korevaar JC, Merkus MP, Jansen MA, Dekker FW, Boeschoten EW, Krediet RT, et al. Validation of the KDQOL-SF: a dialysis-targeted health measure. Qual Life Res. 2002 Aug;11(5):437-47.

205. Hedayati SS, Minhajuddin AT, Toto RD, Morris DW, Rush AJ. Validation of depression screening scales in patients with CKD. Am J Kidney Dis [Internet]. 2009 Sep [cited 2016 Nov 23];54(3):433-9. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3217720/pdf/nihms-142092.pdf

206. Grant D, Almond MK, Newnham A, Roberts P, Hutchings A. The Beck Depression Inventory requires modification in scoring before use in a haemodialysis population in the UK. Nephron. 2008;110(1):c33-c38.

207. Watnick S, Wang PL, Demadura T, Ganzini L. Validation of 2 depression screening tools in dialysis patients. Am J Kidney Dis. 2005 Nov;46(5):919-24.

208. Wu AW, Fink NE, Cagney KA, Bass EB, Rubin HR, Meyer KB, et al. Developing a health-related quality-of-life measure for end-stage renal disease: The CHOICE Health Experience Questionnaire. Am J Kidney Dis. 2001 Jan [cited 2016 Nov 23];37(1):11-21.

209. Aiyasanon N, Premasathian N, Nimmannit A, Jetanavanich P, Sritippayawan S. Validity and reliability of CHOICE Health Experience Questionnaire: Thai version. J Med Assoc Thai. 2009 Sep;92(9):1159-66.

210. Hays RD, Stewart AL. Sleep measures. In: Stewart AL, Ware JE, editors. Measuring functioning and well being. Durham (NC): Duke University Press; 2016. p. 235-59.

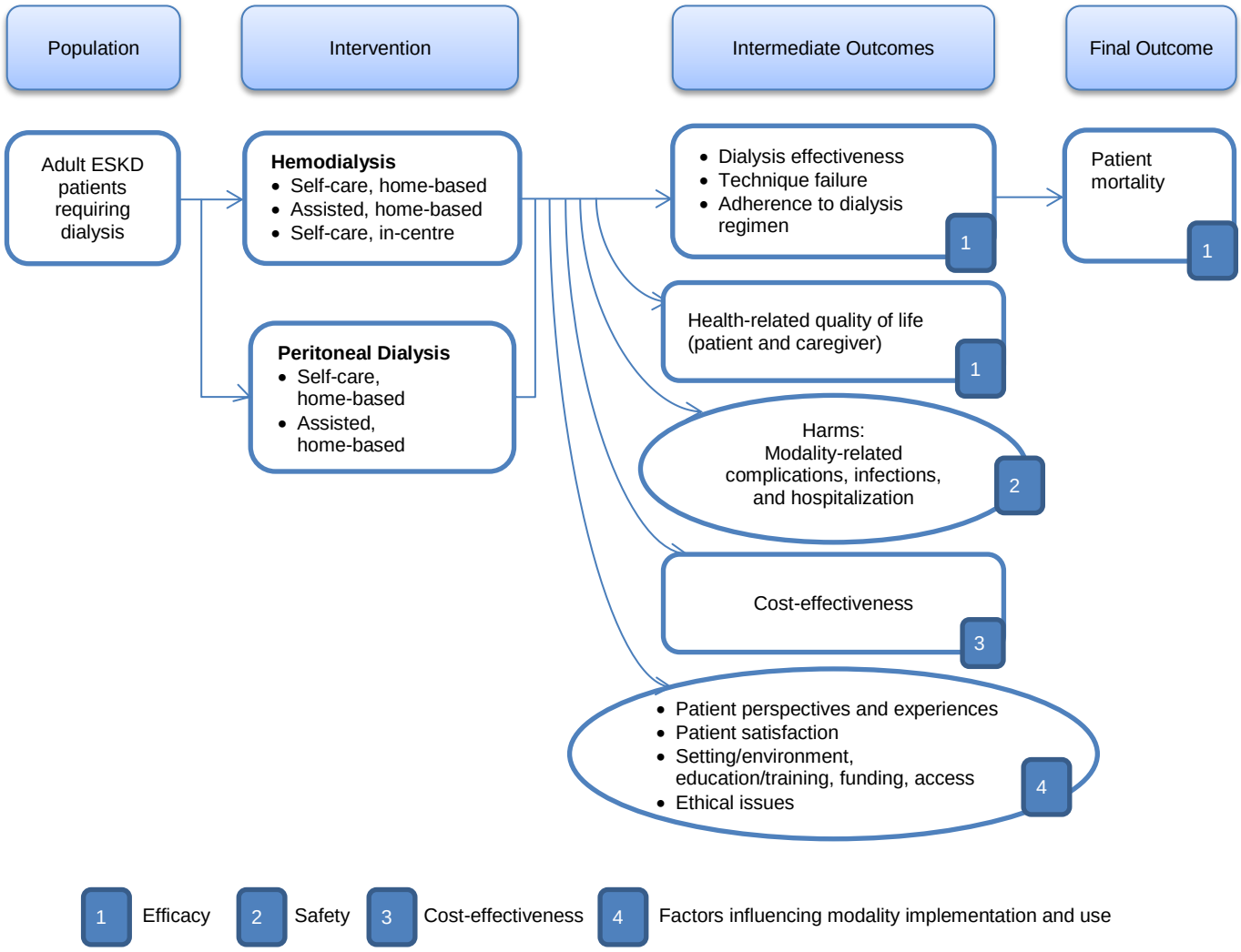
211. Patient cost estimator [Internet]. Ottawa: Canadian Institute for Health Information; 2016. [cited 2016 Oct 18]. Available from: https://www.cihi.ca/en/spending-and-health-workforce/spending/patient-cost-estimator

212. Barnieh L, Yilmaz S, McLaughlin K, Hemmelgarn BR, Klarenbach S, Manns BJ, et al. The cost of kidney transplant over time. Prog Transplant. 2014 Sep;24(3):257-62.

213. CMG+ client tables [Internet]. Ottawa: Canadian Institute for Health Information; 2014 Mar 26. [cited 2016 Oct 18]. Available from: https://secure.cihi.ca/estore/productFamily.htm?pf=PFC2544&lang=en&media=0

214. Cesario S, Morin K, Santa-Donato A. Evaluating the level of evidence of qualitative research. J Obstet Gynecol Neonatal Nurs. 2002 Nov;31(6):708-14.

Appendix 1: Analytical Framework



Appendix 2: Literature Search Strategy

Clinical Database Search

Overview	
Interface:	Ovid
Databases:	Embase MEDLINE Daily and MEDLINE MEDLINE In-Process & Other Non-Indexed Citations **Note:** Subject headings have been customized for each database. Duplicates between databases were removed in Ovid.
Date of Search:	June 2016
Alerts:	Monthly search updates until project completion
Study Types:	Health technology assessments; systematic reviews; meta-analyses; network meta-analyses; randomized controlled trials; non-randomized studies
Limits:	Date limit: 2000-present Language limit: English- and French-language Conference abstracts: excluded
Syntax Guide	
/	At the end of a phrase, searches the phrase as a subject heading
exp	Explode a subject heading
*	Before a word, indicates that the marked subject heading is a primary topic; or, after a word, a truncation symbol (wildcard) to retrieve plurals or varying endings
adj	Requires words are adjacent to each other (in any order)
.ti	Title
.ab	Abstract
.hw	Heading word; usually includes subject headings and controlled vocabulary
.pt	Publication type
.kw	Author keyword (Embase)
.kf	Author keyword heading word (MEDLINE)
.mp	Mapped term
.yr	Year
.jw	Journal title word
pmez	Ovid database code; MEDLINE In-Process & Other Non-Indexed Citations, MEDLINE Daily and Ovid MEDLINE 1946 to Present
oemezd	Ovid database code; Embase 1974 to present, updated daily

Multi-Strategy Search	
#	**Searches**
1	Renal Dialysis/
2	exp Peritoneal Dialysis/
3	Artificial Kidneys/
4	dialy*.ti,kf.
5	(h?emodialy* or peritonealdialy* or h?emodiafiltrat* or acetate free biofiltration* or artificial kidney* or h?emorenodialy* or h?emo-dialy* or h?emo-diafiltrat* or h?emo-renodialy*).ti,ab,kf.

Multi-Strategy Search	
6	or/1-5
7	(dialy* or h?emofiltration or h?emo-filtration).ti,ab,kf. or exp Hemofiltration/ or exp Dialysis/
8	(kidney* or renal* or ESRD or ESKD or peritoneal*).ti,ab,kf. or exp Kidney Diseases/
9	7 and 8
10	6 or 9
11	Home care services/ or exp Community Health Nursing/ or Home Health Nursing/ or Home Nursing/
12	(home or homes or homecare or house or houses or domicil* or residence* or residential or out center or out centre or outcenter or outcentre).ti,ab,kf.
13	exp Nursing homes/ or Homes for the aged/ or Long term care/ or Housing for the Elderly/
14	((long term or longterm or residential) adj care).ti,ab,kf.
15	((retirement or aged care or continuing care or extended care or intermediate care or skilled nursing or assisted living) adj3 (centre* or center* or facilit*)).ti,ab,kf.
16	(convalescent hospital* or convalescent care).ti,ab,kf.
17	exp prisoners/ or exp Prisons/
18	(prison* or imprison* or jail* or incarcerat* or inmate or inmates or offender* or custody).ti,ab,kf.
19	(Penitentiar* or correctional or penal).ti,ab,kf.
20	or/11-19
21	10 and 20
22	Home hemodialysis/
23	21 or 22
24	exp peritoneal dialysis/
25	((peritoneal adj4 dialy*) or peritonealdialy* or CAPD).ti,ab,kf.
26	or/24-25
27	Self care/ or Self Efficacy/ or Social Support/
28	Caregivers/
29	Patient participation/ or self administration/
30	(self care or selfcare or self administration or self administer* or self manag* or self efficacy or self treat* or self support* or selfadministration or selfadminister* or selfmanag* or selfefficacy or selftreat* or selfsupport*).ti,ab,kf.
31	(self adj3 (care or manag* or administ* or efficacy or treat* or support)).ti,kf.
32	(family or families or familial or friend* or nurse* or helper* or help or technician* or relatives or care-giver* or caregiver* or carer or carers or spous* or partner or partners or support person? or support people).ti,ab,kf.
33	((patient or patients) adj3 (participat* or involv* or empower* or engag* or activation or ownership or support)).ti,ab,kf.
34	assist*.ti,ab,kf.
35	or/27-34
36	26 and 35
37	exp hospitals/ or Self-Care Units/ or Ambulatory Care Facilities/ or Community Health Centers/ or Outpatient clinics, Hospital/ or Hospitals, Satellite/ or Hospital units/
38	(hospital* or clinic or clinics or unit* or centre or centres or center or centers or satellite or facility or facilities or incentre or incenter).ti,ab,kf.
39	or/37-38
40	10 and 35 and 39

Multi-Strategy Search	
41	((dialy* or h?emodialy* or h?emo-dialy* or peritonealdialy*) adj7 (self or selfcare or share*)).ti,ab,kf.
42	23 or 36 or 40 or 41
43	42 use pmez
44	renal replacement therapy/
45	peritoneal dialysis/
46	continuous ambulatory peritoneal dialysis/
47	exp continuous renal replacement therapy/
48	extended daily dialysis/
49	hemodiafiltration/
50	hemodialysis/
51	artificial kidney/
52	hemodialysis patient/
53	(h?emodialy* or peritonealdialy* or h?emodiafiltrat* or acetate free biofiltration* or artificial kidney* or h?emorenodialy* or h?emo-dialy* or h?emo-diafiltrat* or h?emo-renodialy*).ti,ab,kw.
54	dialy*.ti,kw.
55	or/44-54
56	(dialy* or h?emofiltration or h?emo-filtration).ti,ab,kf. or exp Hemofiltration/ or exp Dialysis/
57	(kidney* or renal* or ESRD or ESKD or peritoneal*).ti,ab,kw. or exp Kidney Disease/
58	56 and 57
59	55 or 58
60	community health nursing/ or exp home care/ or community care/ or home environment/
61	(home or homes or homecare or house or houses or domicil* or residence* or residential or out centre or out center or outcentre or outcenter).ti,ab,kw.
62	Nursing home/ or long term care/ or nursing home patient/ or long term care facility/ or “home for the aged”/
63	((retirement or aged care or continuing care or extended care or intermediate care or skilled nursing or assisted living) adj3 (centre* or center* or facilit*)).ti,ab,kw.
64	((long term or longterm or residential) adj care).ti,ab,kw.
65	(convalescent hospital* or convalescent care).ti,ab,kw.
66	Prisoner/ or prison/
67	(prison* or imprison* or jail* or incarcerat* or inmate or inmates or offender* or custody).ti,ab,kw.
68	(Penitentiar* or correctional or penal).ti,ab,kw.
69	or/60-68
70	59 and 69
71	home dialysis/
72	70 or 71
73	peritoneal dialysis/ or continuous ambulatory peritoneal dialysis/
74	((peritoneal adj4 dialy*) or peritonealdialy* or CAPD).ti,ab,kw.
75	or/73-74
76	exp self care/ or patient participation/
77	caregiver/ or caregiver support/ or caregiver burden/
78	(self care or selfcare or self administration or self administer* or self manag* or self efficacy or self treat* or

Multi-Strategy Search	
	self support* or selfadministration or selfadminister* or selfmanag* or selfefficacy or selftreat* or selfsupport*).ti,ab,kw.
79	(self adj3 (care or manag* or administ* or efficacy or treat* or support)).ti,kw.
80	(family or families or familial or friend* or nurse* or helper* or help or technician* or relatives or care-giver* or caregiver* or carer or carers or spous* or partner or partners or support person? or support people).ti,ab,kw.
81	((patient or patients) adj3 (participat* or involv* or empower* or engag* or activation or ownership or support)).ti,ab,kw.
82	assist*.ti,ab,kw.
83	or/76-82
84	75 and 83
85	“hospital subdivisions and components”/
86	exp hospital/ or ambulatory care/ or health center/ or outpatient department/
87	(hospital* or clinic or clinics or unit* or centre or centres or center or centers or satellite or facility or facilities or incentre or incenter).ti,ab,kw.
88	or/85-87
89	59 and 83 and 88
90	((dialy* or h?emodialy* or h?emo-dialy* or peritonealdialy*) adj7 (self or selfcare or share*)).ti,ab,kw.
91	72 or 84 or 89 or 90
92	91 use oemezd
93	92 not conference abstract.pt.
94	43 or 93
95	peritoneal dialysis/
96	continuous ambulatory peritoneal dialysis/
97	(peritoneal adj4 dialy*).ti,ab,kw.
98	(peritonealdialysis or peritonealdialyses or CAPD).ti,ab,kw.
99	or/95-98
100	exp continuous renal replacement therapy/ or extended daily dialysis/ or hemodiafiltration/ or hemodialysis/ or home dialysis/
101	(h?emodialy* or h?emodiafiltrat* or h?emorenodialy* or h?emo-dialy* or h?emo-diafiltrat* or h?emo-renodialy*).ti,ab,kw.
102	100 or 101
103	99 and 102
104	103 use oemezd
105	104 not conference abstract.pt.
106	exp peritoneal dialysis/
107	(peritoneal adj4 dialy*).ti,ab,kf.
108	(peritonealdialysis or peritonealdialyses or CAPD).ti,ab,kf.
109	or/106-108
110	renal dialysis/
111	hemodiafiltration/
112	home hemodialysis/
113	(h?emodialy* or h?emodiafiltrat* or h?emorenodialy* or h?emo-dialy* or h?emo-diafiltrat* or h?emo-

Multi-Strategy Search	
	renodialy*).ti,ab,kf.
114	or/110-113
115	109 and 114
116	115 use pmez
117	meta-analysis.pt.
118	meta-analysis/ or systematic review/ or meta-analysis as topic/ or “meta analysis (topic)”/ or “systematic review (topic)”/ or exp technology assessment, biomedical/
119	((systematic* adj3 (review* or overview*)) or (methodologic* adj3 (review* or overview*))).ti,ab,kf,kw.
120	((quantitative adj3 (review* or overview* or synthes*)) or (research adj3 (integrati* or overview*))).ti,ab,kf,kw.
121	((integrative adj3 (review* or overview*)) or (collaborative adj3 (review* or overview*)) or (pool* adj3 analy*)).ti,ab,kf,kw.
122	(data synthes* or data extraction* or data abstraction*).ti,ab,kf,kw.
123	(handsearch* or hand search*).ti,ab,kf,kw.
124	(mantel haenszel or peto or der simonian or dersimonian or fixed effect* or latin square*).ti,ab,kf,kw.
125	(met analy* or metanaly* or technology assessment* or HTA or HTAs or technology overview* or technology appraisal*).ti,ab,kf,kw.
126	(meta regression* or metaregression*).ti,ab,kf,kw.
127	(meta-analy* or metaanaly* or systematic review* or biomedical technology assessment* or bio-medical technology assessment*).mp,hw.
128	(medline or cochrane or pubmed or medlars or embase or cinahl).ti,ab,hw.
129	(cochrane or (health adj2 technology assessment) or evidence report).jw.
130	(meta-analysis or systematic review).md.
131	(comparative adj3 (efficacy or effectiveness)).ti,ab,kf,kw.
132	(outcomes research or relative effectiveness).ti,ab,kf,kw.
133	((indirect or indirect treatment or mixed-treatment or bayesian) adj comparison*).ti,ab,kf,kw.
134	(network adj3 (meta-analys* or metaanalys*)).ti,ab,kf,kw.
135	(multi* adj3 treatment adj3 comparison*).ti,ab,kf,kw.
136	umbrella review*.ti,ab,kf,kw.
137	nma.ti,ab,kf,kw.
138	(Multi* adj2 paramet* adj2 evidence adj2 synthesis).ti,ab,kw,kf.
139	(Multiparamet* adj2 evidence adj2 synthesis).ti,ab,kw,kf.
140	(multi-paramet* adj2 evidence adj2 synthesis).ti,ab,kw,kf.
141	MPES.ti,ab,kw,kf.
142	or/117-141
143	(Randomized Controlled Trial or Controlled Clinical Trial or Pragmatic Clinical Trial).pt.
144	Randomized Controlled Trial/
145	exp Randomized Controlled Trials as Topic/
146	“Randomized Controlled Trial (topic)”/
147	Controlled Clinical Trial/
148	exp Controlled Clinical Trials as Topic/
149	“Controlled Clinical Trial (topic)”/

Multi-Strategy Search	
150	Randomization/
151	Random Allocation/
152	Double-Blind Method/
153	Double Blind Procedure/
154	Double-Blind Studies/
155	Single-Blind Method/
156	Single Blind Procedure/
157	Single-Blind Studies/
158	Placebos/
159	Placebo/
160	Control Groups/
161	Control Group/
162	(random* or sham or placebo*).ti,ab,hw,kf,kw.
163	((singl* or doubl*) adj (blind* or dumm* or mask*)).ti,ab,hw,kf,kw.
164	((tripl* or trebl*) adj (blind* or dumm* or mask*)).ti,ab,hw,kf,kw.
165	(control* adj3 (study or studies or trial*)).ti,ab,kf,kw.
166	(Nonrandom* or non random* or non-random* or quasi-random* or quasirandom*).ti,ab,hw,kf,kw.
167	allocated.ti,ab,hw.
168	((open label or open-label) adj5 (study or studies or trial*)).ti,ab,hw,kf,kw.
169	or/143-168
170	Epidemiologic Methods/
171	exp Epidemiologic Studies/
172	Observational Studies as Topic/
173	Clinical Studies as Topic/
174	(Observational Study or Validation Studies or Clinical Study).pt.
175	(observational adj3 (study or studies or design or analysis or analyses)).ti,ab,kf.
176	cohort*.ti,ab,kf.
177	(prospective adj7 (study or studies or design or analysis or analyses)).ti,ab,kf.
178	((follow up or followup) adj7 (study or studies or design or analysis or analyses)).ti,ab,kf.
179	((longitudinal or longterm or (long adj term)) adj7 (study or studies or design or analysis or analyses or data)).ti,ab,kf.
180	(retrospective adj7 (study or studies or design or analysis or analyses or data or review)).ti,ab,kf.
181	((case adj control) or (case adj comparison) or (case adj controlled)).ti,ab,kf.
182	(case-referent adj3 (study or studies or design or analysis or analyses)).ti,ab,kf.
183	(population adj3 (study or studies or analysis or analyses)).ti,ab,kf.
184	(descriptive adj3 (study or studies or design or analysis or analyses)).ti,ab,kf.
185	((multidimensional or (multi adj dimensional)) adj3 (study or studies or design or analysis or analyses)).ti,ab,kf.
186	(cross adj sectional adj7 (study or studies or design or research or analysis or analyses or survey or findings)).ti,ab,kf.
187	((natural adj experiment) or (natural adj experiments)).ti,ab,kf.
188	(quasi adj (experiment or experiments or experimental)).ti,ab,kf.

Multi-Strategy Search	
189	((non experiment or nonexperiment or non experimental or nonexperimental) adj3 (study or studies or design or analysis or analyses)).ti,ab,kf.
190	(prevalence adj3 (study or studies or analysis or analyses)).ti,ab,kf.
191	or/170-190
192	191 use pmez
193	observational study/
194	cohort analysis/
195	longitudinal study/
196	follow up/
197	retrospective study/
198	exp case control study/
199	cross-sectional study/
200	quasi experimental study/
201	prospective study/
202	(observational adj3 (study or studies or design or analysis or analyses)).ti,ab,kw.
203	cohort*.ti,ab,kw.
204	(prospective adj7 (study or studies or design or analysis or analyses)).ti,ab,kw.
205	((follow up or followup) adj7 (study or studies or design or analysis or analyses)).ti,ab,kw.
206	((longitudinal or longterm or (long adj term)) adj7 (study or studies or design or analysis or analyses or data)).ti,ab,kw.
207	(retrospective adj7 (study or studies or design or analysis or analyses or data or review)).ti,ab,kw.
208	((case adj control) or (case adj comparison) or (case adj controlled)).ti,ab,kw.
209	(case-referent adj3 (study or studies or design or analysis or analyses)).ti,ab,kw.
210	(population adj3 (study or studies or analysis or analyses)).ti,ab,kw.
211	(descriptive adj3 (study or studies or design or analysis or analyses)).ti,ab,kw.
212	((multidimensional or (multi adj dimensional)) adj3 (study or studies or design or analysis or analyses)).ti,ab,kw.
213	(cross adj sectional adj7 (study or studies or design or research or analysis or analyses or survey or findings)).ti,ab,kw.
214	((natural adj experiment) or (natural adj experiments)).ti,ab,kw.
215	(quasi adj (experiment or experiments or experimental)).ti,ab,kw.
216	((non experiment or nonexperiment or non experimental or nonexperimental) adj3 (study or studies or design or analysis or analyses)).ti,ab,kw.
217	(prevalence adj3 (study or studies or analysis or analyses)).ti,ab,kw.
218	217 use oemezd
219	142 or 169 or 192 or 218
220	94 or 105 or 116
221	219 and 220
222	limit 221 to (english or french)
223	limit 222 to yr="2000 -Current"
224	limit 223 to yr="2000 - 2010"
225	remove duplicates from 224

Multi-Strategy Search	
226	limit 223 to yr="2011 -Current"
227	remove duplicates from 226
228	225 or 227

Other Databases	
PubMed	Searched to capture records not indexed in MEDLINE. Same MeSH, keywords and limits used as per MEDLINE search, with appropriate syntax used.
Cochrane Database of Systematic Reviews (CDSR) Database of Abstracts of Reviews of Effects (DARE) Cochrane Central Register of Controlled Trials	Searched to capture records not indexed in MEDLINE. Same MeSH, keywords and limits used as per MEDLINE search, with appropriate syntax used.
CINAHL	Searched to capture records not indexed in MEDLINE. Same MeSH, keywords and limits used as per MEDLINE search, with appropriate syntax used, including the addition of CINAHL headings.

Patient experiences and preferences database search

Overview	
Interface:	Ovid
Databases:	Embase MEDLINE Daily and MEDLINE MEDLINE In-Process & Other Non-Indexed Citations PsycINFO **Note:** Subject headings have been customized for each database. Duplicates between databases were removed in Ovid.
Date of Search:	May 2016
Alerts:	Monthly search updates until project completion
Study Types:	Qualitative studies
Limits:	Date limit: 2000-present Language limit: English- and French-language Conference abstracts: excluded

Syntax Guide	
/	At the end of a phrase, searches the phrase as a subject heading
exp	Explode a subject heading
*	Before a word, indicates that the marked subject heading is a primary topic; or, after a word, a truncation symbol (wildcard) to retrieve plurals or varying endings
adj	Requires words are adjacent to each other (in any order)
.ti	Title
.ab	Abstract
.hw	Heading word; usually includes subject headings and controlled vocabulary
.pt	Publication type
.kw	Author keyword (Embase); Keyword (CDSR and DARE)
.kf	Author keyword heading word (MEDLINE)
.mp	Mapped term

Syntax Guide	
.yr	Year
.jw	Journal title word
pmez	Ovid database code; MEDLINE In-Process & Other Non-Indexed Citations, MEDLINE Daily and Ovid MEDLINE 1946 to Present
oemezd	Ovid database code; Embase 1974 to present, updated daily
psyb	Ovid database code; PsycINFO 1967 to present
freq=2	Frequency (must appear at least two times)

Multi-Search Strategy	
#	Searches
1	Kidney Failure, Chronic/
2	((end stage or endstage or stage 5 or stage five) adj4 (renal or kidney)).ti,ab,kf.
3	(chronic adj3 (renal failure or kidney failure or renal insufficiency or kidney insufficiency)).ti,ab,kf.
4	or/1-3
5	renal dialysis/
6	exp *peritoneal dialysis/
7	artificial kidneys/
8	dialy*.ti,ab,kf.
9	(h?emodialy* or peritonealdialy* or h?emodiafiltrat* or acetate free biofiltration* or artificial kidney* or h?emorenodialy* or h?emo-dialy* or h?emo-diafiltrat* or h?emo-renodialy*).ti,ab,kf.
10	or/5-9
11	4 and 10
12	11 use pmez
13	End Stage Renal Disease/
14	Chronic Kidney Disease/
15	((end stage or endstage or stage 5 or stage five) adj4 (renal or kidney)).ti,ab,kw.
16	(chronic adj3 (renal failure or kidney failure or renal insufficiency or kidney insufficiency)).ti,ab,kw.
17	or/13-16
18	Peritoneal dialysis/
19	exp continuous renal replacement therapy/
20	extended daily dialysis/
21	hemodiafiltration/
22	hemodialysis/
23	artificial kidney/
24	hemodialysis patient/
25	dialy*.ti,ab,kw.
26	(h?emodialy* or peritonealdialy* or h?emodiafiltrat* or acetate free biofiltration* or artificial kidney* or h?emorenodialy* or h?emo-dialy* or h?emo-diafiltrat* or h?emo-renodialy*).ti,ab,kw.
27	or/18-26
28	17 and 27
29	28 use oemezd
30	29 not conference abstract.pt.
31	exp dialysis/

Multi-Search Strategy	
32	dialy*.ti,ab,id.
33	(h?emodialy* or peritonealdialy* or h?emodiafiltrat* or acetate free biofiltration* or artificial kidney* or h?emorenodialy* or h?emo-dialy* or h?emo-diafiltrat* or h?emo-renodialy*).ti,ab,id.
34	or/31-33
35	34 use psyb
36	12 or 30 or 35
37	exp Empirical Research/
38	Nursing Methodology Research/
39	Interviews as Topic/
40	Focus Groups/
41	(qualitative or ethnon* or emic or etic or ethnograph* or hermeneutic* or heidegger* or husserl* or colaizzi* or fiorgi* or van kaam* or van manen or participant observ* or constant compar* or focus group* or grounded theory or narrative analysis or lived experience* or life experience* or theoretical samp* or in-depth interview* or purposive sampl* or action research or indepth interview*).ti,ab,kf.
42	(merleau* or ricoeur* or spiegelberg*).ti,ab,kf.
43	(glaser adj2 strauss).ti,ab,kf.
44	or/37-43
45	44 use pmez
46	qualitative analysis/
47	exp qualitative research/
48	exp interview/
49	(qualitative or ethnon* or emic or etic or ethnograph* or hermeneutic* or heidegger* or husserl* or colaizzi* or fiorgi* or van kaam* or van manen or participant observ* or constant compar* or focus group* or grounded theory or narrative analysis or lived experience* or life experience* or theoretical samp* or in-depth interview* or purposive sampl* or action research or indepth interview*).ti,ab,kw.
50	(merleau* or ricoeur* or spiegelberg*).ti,ab,kw.
51	(glaser adj2 strauss).ti,ab,kw.
52	or/46-51
53	52 use oemezd
54	qualitative research/ or grounded theory/ or exp interviews/
55	group discussion/
56	(qualitative or ethnon* or emic or etic or ethnograph* or hermeneutic* or heidegger* or husserl* or colaizzi* or fiorgi* or van kaam* or van manen or participant observ* or constant compar* or focus group* or grounded theory or narrative analysis or lived experience* or life experience* or theoretical samp* or in-depth interview* or purposive sampl* or action research or indepth interview*).ti,ab.
57	(merleau* or ricoeur* or spiegelberg*).ti,ab.
58	(glaser adj2 strauss).ti,ab.
59	or/54-58
60	59 use psyb
61	45 or 53 or 60
62	36 and 61
63	limit 62 to yr="2000 -Current"
64	limit 63 to (english or french)
65	remove duplicates from 64

Other Databases	
PubMed	Searched to capture records not indexed in MEDLINE. Same MeSH, keywords and limits used as per MEDLINE search, with appropriate syntax used.
CINAHL	Searched to capture records not indexed in MEDLINE. Same MeSH, keywords and limits used as per MEDLINE search, with appropriate syntax used, including the addition of CINAHL headings.
Scopus (Social Science & Humanities)	Searched to capture records not indexed in MEDLINE. Same MeSH, keywords and limits used as per MEDLINE search, with appropriate syntax used.

Ethics implications database search

Overview	
Interface:	Ovid
Databases:	MEDLINE Daily and MEDLINE MEDLINE In-Process & Other Non-Indexed Citations PsycINFO **Note:** Duplicates between databases were removed in Ovid.
Date of Search:	May 2016
Alerts:	Monthly search updates until project completion
Study Types:	Ethics/Legal/Social
Limits:	Date limit: 2000-present Language limit: English- and French-language Conference abstract and dissertations excluded

Syntax Guide	
/	At the end of a phrase, searches the phrase as a subject heading
exp	Explode a subject heading
*	Before a word, indicates that the marked subject heading is a primary topic; or, after a word, a truncation symbol (wildcard) to retrieve plurals or varying endings
adj	Requires words are adjacent to each other (in any order)
.ti	Title
.ab	Abstract
.hw	Heading word; usually includes subject headings and controlled vocabulary
.kf	Author keyword heading word
.fs psyb pmez	Floating subheading Ovid database code; PsycINFO 1967 to present Ovid database code; MEDLINE In-Process & Other Non-Indexed Citations, MEDLINE Daily and Ovid MEDLINE 1946 to Present

Multi-Strategy Search	
#	Searches
1	Kidney Failure, Chronic/
2	((end stage or endstage or stage 5 or stage five) adj4 (renal or kidney)).ti,ab,kf.
3	(chronic adj3 (renal failure or kidney failure or renal insufficiency or kidney insufficiency)).ti,ab,kf.
4	or/1-3
5	renal dialysis/
6	exp peritoneal dialysis/

Multi-Strategy Search	
7	artificial kidneys/
8	dialy*.ti,ab,kf.
9	(h?emodialy* or peritonealdialy* or h?emodiafiltrat* or acetate free biofiltration* or artificial kidney* or h?emorenodialy* or h?emo-dialy* or h?emo-diafiltrat* or h?emo-renodialy*).ti,ab,kf.
10	or/5-9
11	4 and 10
12	11 use pmez
13	exp dialysis/
14	dialy*.ti,ab,id.
15	(h?emodialy* or peritonealdialy* or h?emodiafiltrat* or acetate free biofiltration* or artificial kidney* or h?emorenodialy* or h?emo-dialy* or h?emo-diafiltrat* or h?emo-renodialy*).ti,ab,id.
16	or/13-15
17	16 use psyb
18	exp Ethics/
19	exp Privacy/
20	exp Sociology/
21	exp Jurisprudence/
22	Morale/
23	exp Morals/
24	Paternalism/
25	exp Prejudice/
26	Social Values/
27	Social Norms/
28	“Legislation & Jurisprudence”.fs.
29	ethics.fs.
30	exp Geography, Medical/
31	Medically Underserved Area/
32	((Healthcare or Health Care or nonclinical or Community Based) adj (Deliver* or Distribution* or System*)).ti,ab,kf.
33	(geographic adj (region* or area*)).ti,ab,kf.
34	(remote or urban or rural).ti,ab,kf.
35	(ethic or ethics or ethical or moral* or bioethic*).ti,ab,hw,kf.
36	(legal* or liabilit* or litigation* or constitutional or justice or law or laws or jurisprudence or complicit*).ti,ab,hw,kf.
37	(lawsuit* or lawyer* or lawmaker*).ti,ab,kf.
38	human right*.ti,ab,kf.
39	civil right*.ti,ab,kf.
40	(prejudice* or stigma or stigmas or stigmatization or stigmatize or stigmatise or stigmatisation or inequalit* or fairness).ti,ab,kf.
41	((care or treatment) adj2 (duty or obligat*)).ti,ab,kf.
42	(social* adj (responsibl* or obligat*)).ti,ab,kf.
43	(communitarian* or beneficence or nonmaleficence or maleficence or accountability).ti,ab,kf.

Multi-Strategy Search	
44	harm.ti,ab,kf.
45	(distributive justice or precautionary principle or solidarity or equity).ti,ab,kf.
46	(privacy or private or confidential*).ti,ab,hw,kf.
47	((informed or presumed or shared) adj2 (consent or choice or decision making)).ti,ab,kf.
48	autonomy.ti,ab,hw,kf.
49	transparency.ti,ab,kf.
50	or/18-49
51	50 use pmez
52	exp ethics/
53	exp “law (government)”/
54	privacy/
55	exp social influences/
56	morality/
57	((Healthcare or Health Care or nonclinical or Community Based) adj (Deliver* or Distribution* or System*)).ti,ab,id.
58	(geographic adj (region* or area*)).ti,ab,id.
59	(remote or urban or rural).ti,ab,id.
60	(ethic or ethics or ethical or moral* or bioethic*).ti,ab,id.
61	(legal* or liabilit* or litigation* or constitutional or justice or law or laws or jurisprudence or complicit*).ti,ab,id.
62	(lawsuit* or lawyer* or lawmaker*).ti,ab,id.
63	human right*.ti,ab,id.
64	civil right*.ti,ab,id.
65	(prejudice* or stigma or stigmas or stigmatization or stigmatize or stigmatise or stigmatisation or inequalit* or fairness).ti,ab,id.
66	((care or treatment) adj2 (duty or obligat*)).ti,ab,id.
67	(social* adj (responsibl* or obligat*)).ti,ab,id.
68	(communitarian* or beneficence or nonmaleficence or maleficence or accountability).ti,ab,id.
69	harm.ti,ab,id.
70	(privacy or private or confidential*).ti,ab,id.
71	(distributive justice or precautionary principle or solidarity or equity).ti,ab,id.
72	((informed or presumed or shared) adj2 (consent or choice or decision making)).ti,ab,id.
73	autonomy.ti,ab,hw,id.
74	transparency.ti,ab,id.
75	or/52-74
76	75 use psyb
77	12 or 17
78	51 or 76
79	77 and 78
80	limit 79 to yr=“2000 -Current”
81	limit 80 to (english or french)
82	remove duplicates from 81

Other Databases	
PubMed	Searched to capture records not indexed in MEDLINE. Same MeSH, keywords and limits used as per MEDLINE search, with appropriate syntax used.
CINAHL	Searched to capture records not indexed in MEDLINE. Same MeSH, keywords and limits used as per MEDLINE search, with appropriate syntax used, including the addition of CINAHL headings.

Implementation database search

Overview	
Interface:	Ovid
Databases:	Embase MEDLINE Daily and MEDLINE MEDLINE In-Process & Other Non-Indexed Citations **Note:** Subject headings have been customized for each database. Duplicates between databases were removed in Ovid.
Date of Search:	Aug 17, 2016
Alerts:	Monthly search updates until project completion
Study Types:	Limited to Canadian articles
Limits:	Date limit: 2000-present Language limit: English- and French-language Conference abstracts: excluded
Syntax Guide	
/	At the end of a phrase, searches the phrase as a subject heading
exp	Explode a subject heading
*	Before a word, indicates that the marked subject heading is a primary topic; or, after a word, a truncation symbol (wildcard) to retrieve plurals or varying endings
adj	Requires words are adjacent to each other (in any order)
.ti	Title
.ab	Abstract
.hw	Heading word; usually includes subject headings and controlled vocabulary
.pt	Publication type
.kw	Author keyword (Embase)
.kf	Author keyword heading word (MEDLINE)
.mp	Mapped term
.yr	Year
.jw	Journal title word
pmez	Ovid database code; MEDLINE In-Process & Other Non-Indexed Citations, MEDLINE Daily and Ovid MEDLINE 1946 to Present
oemezd	Ovid database code; Embase 1974 to present, updated daily

Multi-Strategy Search	
#	Searches
1	Renal Dialysis/
2	exp Peritoneal Dialysis/
3	Artificial Kidneys/
4	dialy*.ti,kf.

Multi-Strategy Search	
5	(h?emodialy* or peritonealdialy* or h?emodiafiltrat* or acetate free biofiltration* or artificial kidney* or h?emorenodialy* or h?emo-dialy* or h?emo-diafiltrat* or h?emo-renodialy*).ti,ab,kf.
6	or/1-5
7	(dialy* or h?emofiltration or h?emo-filtration).ti,ab,kf. or exp Hemofiltration/ or exp Dialysis/
8	(kidney* or renal* or ESRD or ESKD or peritoneal*).ti,ab,kf. or exp Kidney Diseases/
9	7 and 8
10	6 or 9
11	Home care services/ or exp Community Health Nursing/ or Home Health Nursing/ or Home Nursing/
12	(home or homes or homecare or house or houses or domicil* or residence* or residential or out center or out centre or outcenter or outcentre).ti,ab,kf.
13	exp Nursing homes/ or Homes for the aged/ or Long term care/ or Housing for the Elderly/
14	((long term or longterm or residential) adj care).ti,ab,kf.
15	((retirement or aged care or continuing care or extended care or intermediate care or skilled nursing or assisted living) adj3 (centre* or center* or facilit*)).ti,ab,kf.
16	(convalescent hospital* or convalescent care).ti,ab,kf.
17	exp prisoners/ or exp Prisons/
18	(prison* or imprison* or jail* or incarcerat* or inmate or inmates or offender* or custody).ti,ab,kf.
19	(Penitentiar* or correctional or penal).ti,ab,kf.
20	or/11-19
21	10 and 20
22	Home hemodialysis/
23	21 or 22
24	Self care/ or Self Efficacy/ or Social Support/
25	Caregivers/
26	Patient participation/ or self administration/
27	(self care or selfcare or self administration or self administer* or self manag* or self efficacy or self treat* or self support* or selfadministration or selfadminister* or selfmanag* or selfefficacy or selftreat* or selfsupport*).ti,ab,kf.
28	(self adj3 (care or manag* or administ* or efficacy or treat* or support)).ti,kf.
29	(family or families or familial or friend* or nurse* or helper* or help or technician* or relatives or care-giver* or caregiver* or carer or carers or spous* or partner or partners or support person? or support people).ti,ab,kf.
30	((patient or patients) adj3 (participat* or involv* or empower* or engag* or activation or ownership or support)).ti,ab,kf.
31	assist*.ti,ab,kf.
32	or/24-31
33	10 and 32
34	exp hospitals/ or Self-Care Units/ or Ambulatory Care Facilities/ or Community Health Centers/ or Outpatient clinics, Hospital/ or Hospitals, Satellite/ or Hospital units/
35	(hospital* or clinic or clinics or unit* or centre or centres or center or centers or satellite or facility or facilities or incentre or incenter).ti,ab,kf.
36	or/34-35
37	10 and 32 and 36
38	((dialy* or h?emodialy* or h?emo-dialy* or peritonealdialy*) adj7 (self or selfcare or share*)).ti,ab,kf.
39	23 or 33 or 37 or 38
40	39 use ppez
41	renal replacement therapy/
42	peritoneal dialysis/
43	continuous ambulatory peritoneal dialysis/
44	exp continuous renal replacement therapy/
45	extended daily dialysis/
46	hemodiafiltration/
47	hemodialysis/
48	artificial kidney/
49	hemodialysis patient/
50	(h?emodialy* or peritonealdialy* or h?emodiafiltrat* or acetate free biofiltration* or artificial kidney* or h?emorenodialy* or h?emo-dialy* or h?emo-diafiltrat* or h?emo-renodialy*).ti,ab,kw.

Multi-Strategy Search	
51	dialy*.ti,kw.
52	or/41-51
53	(dialy* or h?emofiltration or h?emo-filtration).ti,ab,kf. or exp Hemofiltration/ or exp Dialysis/
54	(kidney* or renal* or ESRD or ESKD or peritoneal*).ti,ab,kw. or exp Kidney Disease/
55	53 and 54
56	52 or 55
57	community health nursing/ or exp home care/ or community care/ or home environment/
58	(home or homes or homecare or house or houses or domicil* or residence* or residential or out centre or out center or outcentre or outcenter).ti,ab,kw.
59	Nursing home/ or long term care/ or nursing home patient/ or long term care facility/ or “home for the aged”/
60	((retirement or aged care or continuing care or extended care or intermediate care or skilled nursing or assisted living) adj3 (centre* or center* or facilit*)).ti,ab,kw.
61	((long term or longterm or residential) adj care).ti,ab,kw.
62	(convalescent hospital* or convalescent care).ti,ab,kw.
63	Prisoner/ or prison/
64	(prison* or imprison* or jail* or incarcerat* or inmate or inmates or offender* or custody).ti,ab,kw.
65	(Penitentiar* or correctional or penal).ti,ab,kw.
66	or/57-65
67	56 and 66
68	home dialysis/
69	67 or 68
70	exp self care/ or patient participation/
71	caregiver/ or caregiver support/ or caregiver burden/
72	(self care or selfcare or self administration or self administer* or self manag* or self efficacy or self treat* or self support* or selfadministration or selfadminister* or selfmanag* or selfefficacy or selftreat* or selfsupport*).ti,ab,kw.
73	(self adj3 (care or manag* or administ* or efficacy or treat* or support)).ti,kw.
74	(family or families or familial or friend* or nurse* or helper* or help or technician* or relatives or care-giver* or caregiver* or carer or carers or spous* or partner or partners or support person? or support people).ti,ab,kw.
75	((patient or patients) adj3 (participat* or involv* or empower* or engag* or activation or ownership or support)).ti,ab,kw.
76	assist*.ti,ab,kw.
77	or/70-76
78	56 and 77
79	“hospital subdivisions and components”/
80	exp hospital/ or ambulatory care/ or health center/ or outpatient department/
81	(hospital* or clinic or clinics or unit* or centre or centres or center or centers or satellite or facility or facilities or incentre or incenter).ti,ab,kw.
82	or/79-81
83	56 and 77 and 82
84	((dialy* or h?emodialy* or h?emo-dialy* or peritonealdialy*) adj7 (self or selfcare or share*)).ti,ab,kw.
85	69 or 78 or 83 or 84
86	85 use oemezd
87	86 not conference abstract.pt.
88	policy/ or delivery of health care/ or health policy/ or Health Services Accessibility/
89	(implementation or implementer* or barrier* or facilitator* or enabler*).ti,ab,kf.
90	implementation science.jn.
91	(adopt* or sustainability or acceptability or appropriateness or feasibility or uptake).ti,kf.
92	(water or training or trained or train or travel* or cultur* or socio* or social* or society or supply or supplies or education*).ti,ab,kf.
93	(geography or geographic or pd first or home first or renovation* or transportation or staff or electricity or reimbursement or equipment or technical support or homeless).ti,ab,kf.
94	(physician* adj2 knowledge).ti,ab,kf.
95	Decision Support Techniques/ or (decision rule* or decision support or decision aid* or decision analys?s or decision model*).ti,ab,kf.
96	or/88-95

Multi-Strategy Search	
97	96 use ppez
98	40 and 97
99	health care policy/ or policy/ or health care delivery/
100	(implementation or implementer* or barrier* or facilitator* or enabler*).ti,ab,kw.
101	(adopt* or sustainability or acceptability or appropriateness or feasibility or uptake).ti,kw.
102	(water or training or trained or train or travel* or cultur* or socio* or social* or society or supply or supplies or education*).ti,ab,kw.
103	(geography or geographic or pd first or home first or renovation* or transportation or staff or electricity or reimbursement or equipment or technical support or homeless).ti,ab,kw.
104	(physician* adj2 knowledge).ti,ab,kw.
105	Decision Making/ or (decision rule* or decision support or decision aid* or decision analys?s or decision model*).ti,ab,kw.
106	or/99-105
107	106 use oemezd
108	87 and 107
109	exp Canada/
110	(canadian* or canada* or british columbia* or alberta* or saskatchewan* or manitoba* or ontario* or quebec* or new brunswick* or prince edward island* or nova scotia* or labrador* or newfoundland* or nunavut* or northwest territor* or yukon* or toronto* or montreal* or vancouver* or ottawa* or calgary* or edmonton* or winnipeg* or first nation* or metis).ti,ab,hw.
111	(canadian* or canada* or british columbia* or alberta* or saskatchewan* or manitoba* or ontario* or quebec* or new brunswick* or prince edward island* or nova scotia* or labrador* or newfoundland* or nunavut* or northwest territor* or yukon* or toronto* or montreal* or vancouver* or ottawa* or calgary* or edmonton* or winnipeg* or first nation* or metis).jw,jx.
112	or/109-111
113	98 and 112
114	108 and 112
115	113 or 114
116	remove duplicates from 115
117	limit 116 to english language
118	limit 117 to yr="2000 -Current"

Other Databases	
PubMed	Searched to capture records not indexed in MEDLINE. Same MeSH, keywords and limits used as per MEDLINE search, with appropriate syntax used.
CINAHL	Searched to capture records not indexed in MEDLINE. Same MeSH, keywords and limits used as per MEDLINE search, with appropriate syntax used, including the addition of CINAHL headings.
Scopus (Social Science & Humanities)	Searched to capture records not indexed in MEDLINE. Same MeSH, keywords and limits used as per MEDLINE search, with appropriate syntax used.

Grey literature

Dates for Search:	June 2016
Keywords:	Home dialysis, self-care in-centre dialysis, peritoneal dialysis, in-centre hemodialysis
Limits:	Publication years: 2000 to present

Relevant websites from the following sections of the CADTH grey literature checklist, "Grey matters: a practical tool for searching health-related grey literature" (https://www.cadth.ca/grey-matters) will be searched:

- Health Technology Assessment Agencies
- Health Economics
- Clinical Practice Guidelines
- Databases (free)
- Internet Search
- Open Access Journals.

Appendix 3: List of Included Studies — Clinical Review

Included and synthesized

Couchoud C, Bolignano D, Nistor I, Jager KJ, Heaf J, Heimburger O, et al. Dialysis modality choice in diabetic patients with end-stage kidney disease: a systematic review of the available evidence. Nephrol Dial Transplant [Internet]. 2015 Feb [cited 2015 Nov 6];30(2):310-20. Available from: http://ndt.oxfordjournals.org/content/30/2/310.full.pdf+html

Culleton BF, Walsh M, Klarenbach SW, Mortis G, Scott-Douglas N, Quinn RR, et al. Effect of frequent nocturnal hemodialysis vs conventional hemodialysis on left ventricular mass and quality of life: a randomized controlled trial. JAMA [Internet]. 2007 Sep 19 [cited 2016 Jul 19];298(11):1291-9. Available from: http://jama.jamanetwork.com/article.aspx?articleid=208864

de Abreu MM, Walker DR, Sesso RC, Ferraz MB. Health-related quality of life of patients recieving hemodialysis and peritoneal dialysis in Sao Paulo, Brazil: a longitudinal study. Value Health [Internet]. 2011 Jul [cited 2016 May 20];14(5 Suppl 1):S119-S121. Available from: http://ac.els-cdn.com/S109830151101432X/1-s2.0-S109830151101432X-main.pdf?_tid=4a2cd7ca-1ebd-11e6-901f-00000aacb35e&acdnat=1463771082_17859d32edbedba4093b698bea5203b2

Frimat L, Durand PY, Loos-Ayav C, Villar E, Panescu V, Briancon S, et al. Impact of first dialysis modality on outcome of patients contraindicated for kidney transplant. Perit Dial Int [Internet]. 2006 Mar;26(2):231-9. Available from: http://www.pdiconnect.com/content/26/2/231.long

Habib A, Durand AC, Brunet P, Delaroziere JC, Devictor B, Sambuc R, et al. Comparison of peritoneal dialysis and hemodialysis survival in Provence-Alpes-Cote d'Azur. Nephrol Ther. 2016 Jul;12(4):221-8. French.

Han SS, Park JY, Kang S, Kim KH, Ryu DR, Kim H, et al. Dialysis Modality and Mortality in the Elderly: A Meta-Analysis. Clin J Am Soc Nephrol [Internet]. 2015 Jun 5 [cited 2016 Jun 16];10(6):983-93. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4455206/?report=printable

Harris SA, Lamping DL, Brown EA, Constantinovici N, North Thames Dialysis Study (NTDS) Group. Clinical outcomes and quality of life in elderly patients on peritoneal dialysis versus hemodialysis. Perit Dial Int [Internet]. 2002 Jul [cited 2016 Jun 16];22(4):463-70. Available from: http://www.pdiconnect.com/content/22/4/463.long

Ishani A, Slinin Y, Greer N, MacDonald R, Messana J, Rutks I, et al. Comparative Effectiveness of Home-Based Kidney Dialysis Versus In-Center or Other Outpatient Kidney Dialysis Locations - A Systematic Review [Internet]. Washington (DC): Department of Veterans Affairs (US); 2015 Apr. [cited 2016 May 16]. (VA Evidence-based Synthesis Program Reports). Available from: http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0085118/pdf/PubMedHealth_PMH0085118.pdf

Jeloka T, Sanwaria P, Periera A, Pawar S. Survival of elderly dialysis patients is not dependent on modality or “older” age. Indian J Nephrol. 2016 Jan [cited 2016 Jun 21];26(1):23-6. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4753737

Kasza J, Wolfe R, McDonald SP, Marshall MR, Polkinghorne KR. Dialysis modality, vascular access and mortality in end-stage kidney disease: A bi-national registry-based cohort study. Nephrology (Carlton). 2016 Oct;21(10):878-86.

Kim H, An JN, Kim DK, Kim MH, Kim H, Kim YL, et al. Elderly Peritoneal Dialysis Compared with Elderly Hemodialysis Patients and Younger Peritoneal Dialysis Patients: Competing Risk Analysis of a Korean Prospective Cohort Study. PLoS ONE [Internet]. 2015 [cited 2016 Jun 16];10(6):e0131393. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4488000

Kim H, Kim KH, Ahn SV, Kang SW, Yoo TH, Ahn HS, et al. Risk of major cardiovascular events among incident dialysis patients: A Korean national population-based study. Int J Cardiol. 2015 Nov 1;198:95-101.

Lee JH, Park SH, Lim JH, Park YJ, Kim SU, Lee KH, et al. Impact of dialysis modality on technique survival in end-stage renal disease patients. Korean J Intern Med [Internet]. 2016 Jan [cited 2016 Jun 16];31(1):106-15. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4712414

Lee YC, Hung SY, Wang HH, Wang HK, Lin CW, Chang MY, et al. Different risk of common gastrointestinal disease between groups undergoing hemodialysis or peritoneal dialysis or with non-end stage renal disease: a nationwide population-based cohort study. Medicine (Baltimore) [Internet]. 2015 Sep [cited 2016 Jun 21];94(36):e1482. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4616635

Lin CS, Chen SJ, Sung CC, Lin CL, Lin SH, Cheng SM, et al. Hemodialysis Is Associated With Increased Peripheral Artery Occlusive Disease Risk Among Patients With End-Stage Renal Disease: A Nationwide Population-Based Cohort Study. Medicine (Baltimore) [Internet]. 2015 Jul [cited 2016 Jun 21];94(28):e1164. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4617093

Lin YT, Wu PH, Kuo MC, Chen CS, Chiu YW, Yang YH, et al. Comparison of dementia risk between end stage renal disease patients with hemodialysis and peritoneal dialysis--a population-based study. Sci Rep [Internet]. 2015 [cited 2016 Jun 16];5:8224. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4340159

Lockridge R, Ting G, Kjellstrand CM. Superior patient and technique survival with very high standard Kt/V in quotidian home hemodialysis. Hemodial Int. 2012 Jul;16(3):351-62.

Manns B, Johnson JA, Taub K, Mortis G, Ghali WA, Donaldson C. Quality of life in patients treated with hemodialysis or peritoneal dialysis: what are the important determinants? Clin Nephrol. 2003 Nov;60(5):341-51.

Manns BJ, Walsh MW, Culleton BF, Hemmelgarn B, Tonelli M, Schorr M, et al. Nocturnal hemodialysis does not improve overall measures of quality of life compared to conventional hemodialysis. Kidney Int. 2009;75(5):542-9.

Marshall MR, Hawley CM, Kerr PG, Polkinghorne KR, Marshall RJ, Agar JW, et al. Home hemodialysis and mortality risk in Australian and New Zealand populations. Am J Kidney Dis. 2011 Nov;58(5):782-93.

Marshall MR, Polkinghorne KR, Kerr PG, Hawley CM, Agar JW, McDonald SP. Intensive hemodialysis and mortality risk in Australian and New Zealand populations. Am J Kidney Dis. 2016 Apr;67(4):617-28.

Moldovan D, Rusu C, Kacso IM, Potra A, Patiu IM, Gherman-Caprioara M. Mineral and bone disorders, morbidity and mortality in end-stage renal failure patients on chronic dialysis. Clujul med [Internet]. 2016;89(1):94-103. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4777475

Nadeau-Fredette AC, Chan CT, Cho Y, Hawley CM, Pascoe EM, Clayton PA, et al. Outcomes of integrated home dialysis care: a multi-centre, multi-national registry study. Nephrol Dial Transplant. 2015 Nov;30(11):1897-904.

Nadeau-Fredette AC, Hawley CM, Pascoe EM, Chan CT, Clayton PA, Polkinghorne KR, et al. An incident cohort study comparing survival on home hemodialysis and peritoneal dialysis (Australia and New Zealand Dialysis and Transplantation Registry). Clin J Am Soc Nephrol. 2015 Aug 7;10(8):1397-407.

Nesrallah GE, Li L, Suri RS. Comparative effectiveness of home dialysis therapies: a matched cohort study. Can J Kideny Health Dis [Internet]. 2016 [cited 2016 May 16];3:19. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4802626/pdf/40697_2016_Article_105.pdf

Oliver MJ, Al-Jaishi AA, Dixon SN, Perl J, Jain AK, Lavoie SD, et al. Hospitalization rates for patients on assisted peritoneal dialysis compared with in-center hemodialysis. Clin J Am Soc Nephrol. 2016 Jul 27.

Palmer SC, Palmer AR, Craig JC, Johnson DW, Stroumza P, Frantzen L, et al. Home versus in-centre haemodialysis for end-stage kidney disease. Cochrane Database Syst Rev. 2014;11:CD009535.

Pike E, Hamidi V, Ringerike T, Wisløff T, Desser A, Harboe I, et al. Health technology assessment of the different dialysis modalities in Norway [Internet]. Oslo, Norway: Norwegian Knowledge Centre for the Health Services; 2013. [cited 2015 Nov 5]. Available from: http://www.kunnskapssenteret.no/en/publications/health-technology-assessment-of-the-different-dialysis-modalities-in-norway

Rocco MV, Daugirdas JT, Greene T, Lockridge RS, Chan C, Pierratos A, et al. Long-term Effects of Frequent Nocturnal Hemodialysis on Mortality: The Frequent Hemodialysis Network (FHN) Nocturnal Trial. Am J Kidney Dis [Internet]. 2015 Sep;66(3):459-68.

Rocco MV, Lockridge RS, Jr., Beck GJ, Eggers PW, Gassman JJ, Greene T, et al. The effects of frequent nocturnal home hemodialysis: the Frequent Hemodialysis Network Nocturnal Trial. Kidney Int [Internet]. 2011 Nov [cited 2016 May 5];80(10):1080-91. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3569086

Shen CH, Zheng CM, Kiu KT, Chen HA, Wu CC, Lu KC, et al. Increased risk of atrial fibrillation in end-stage renal disease patients on dialysis: A nationwide, population-based study in Taiwan. Medicine (Baltimore) [Internet]. 2016 Jun [cited 2016 Aug 5];95(25):e3933.

Suri RS, Li L, Nesrallah GE. The risk of hospitalization and modality failure with home dialysis. Kidney Int [Internet]. 2015 Aug [cited 2016 May 16];88(2):360-8. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4526768/pdf/ki201568a.pdf

Unruh ML, Larive B, Chertow GM, Eggers PW, Garg AX, Gassman J, et al. Effects of 6-times-weekly versus 3-times-weekly hemodialysis on depressive symptoms and self-reported mental health: Frequent Hemodialysis Network (FHN) Trials. Am J Kidney Dis [Internet]. 2013 May [cited 2016 Jan 16];61(5):748-58. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4552179/pdf/nihms436843.pdf

Unruh ML, Larive B, Eggers PW, Garg AX, Gassman JJ, Finkelstein FO, et al. The effect of frequent hemodialysis on self-reported sleep quality: Frequent Hemodialysis Network Trials. Nephrol Dial Transplant. 2016 Jun;31(6):984-91.

Vale L, Cody JD, Wallace SA, Daly C, Campbell MK, Grant AM, et al. Continuous ambulatory peritoneal dialysis (CAPD) versus hospital or home haemodialysis for end-stage renal disease in adults. Cochrane Database of Syst Rev. 2004 Oct 18;(4):CD003963. Assessed as up-to-date: 12 Jan 2012.

Wang IK, Cheng YK, Lin CL, Peng CL, Chou CY, Chang CT, et al. Comparison of Subdural Hematoma Risk between Hemodialysis and Peritoneal Dialysis Patients with ESRD. Clin J Am Soc Nephrol. 2015 Jun 5 [cited 2016 Jun 21];10(6):994-1001. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4455210/?report=printable

Wang IK, Lin CL, Cheng YK, Chou CY, Liang CC, Yen TH, et al. Increased risk of hydrocephalus in long-term dialysis patients. Nephrology Dialysis Transplantation. 2016;31(5):807-13.

Wang IK, Shen TC, Muo CH, Yen TH, Sung FC. Risk of pulmonary embolism in patients with end-stage renal disease receiving long-term dialysis. Nephrol Dial Transplant. 2016 Jul 22.

Wang IK, Wang CY, Muo CH, Yen TH, Sung FC. Risk of sudden sensorineural hearing loss in patients with end-stage renal disease undergoing dialysis. Nephrology (Carlton). 2016 Apr 15.

Weinhandl ED, Gilbertson DT, Collins AJ. Mortality, hospitalization, and technique failure in daily home hemodialysis and matched peritoneal dialysis patients: a matched cohort study. Am J Kidney Dis [Internet]. 2016 Jan [cited 16 A.D. Feb 16];67(1):98-110. Available from: http://ac.els-cdn.com/S0272638615010185/1-s2.0-S0272638615010185-main.pdf?_tid=b18412a4-1b92-11e6-a58b-00000aab0f26&acdnat=1463422933_5465c6487b474e1fb2aea5c04af07394

Wolfgram DF, Szabo A, Murray AM, Whittle J. Risk of dementia in peritoneal dialysis patients compared with hemodialysis patients. Perit Dial Int [Internet]. 2015 Mar [cited 2016 Jun 16];35(2):189-98. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4406314

Wu AW, Fink NE, Marsh-Manzi JV, Meyer KB, Finkelstein FO, Chapman MM, et al. Changes in quality of life during hemodialysis and peritoneal dialysis treatment: generic and disease specific measures. J Am Soc Nephrol [Internet]. 2004 Mar [cited 2016 Jun 16];15(3):743-53. Available from: http://jasn.asnjournals.org/content/15/3/743.full.pdf+html

Yang F, Khin LW, Lau T, Chua HR, Vathsala A, Lee E, et al. Hemodialysis versus peritoneal dialysis: A comparison of survival outcomes in south-east Asian patients with end-stage renal disease. PLoS ONE [Internet]. 2015 [cited 2016 Jun 22];10(10). Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4622046/pdf/pone.0140195.pdf

Yang JY, Chen L, Chao CT, Peng YS, Chiang CK, Kao TW, et al. Comparative Study of Outcomes among Patients with Polycystic Kidney Disease on Hemodialysis and Peritoneal Dialysis. Sci Rep [Internet]. 2015;5:12816. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4526846

Included but not synthesized

Abbott KC, Agodoa LY. Hospitalizations for bacterial endocarditis after initiation of chronic dialysis in the United States. Nephron. 2002;91(2):203-9.

Abbott KC, Glanton CW, Trespalacios FC, Oliver DK, Ortiz MI, Agodoa LY, et al. Body mass index, dialysis modality, and survival: analysis of the United States Renal Data System Dialysis Morbidity and Mortality Wave II Study. Kidney Int. 2004 Feb;65(2):597-605.

Andrikos E, Tseke P, Balafa O, Pappas M. Five-year survival in comparable HD and PD patients: one center's experience. Int J Artif Organs. 2008 Aug;31(8):737-41.

Ardalan M, Etemadi J, Ghabili K, Ghojazadeh M, Ghafari A, Khosroshahi HT. Effect of dialysis modality on transplantation outcome in living-donor renal transplantation. Nephro-Urology Monthly. 2011;3(4):202-7.

Aslam N, Bernardini J, Fried L, Burr R, Piraino B. Comparison of infectious complications between incident hemodialysis and peritoneal dialysis patients. Clin J Am Soc Nephrol [Internet]. 2006 Nov [cited 2016 Jun 16];1(6):1226-33. Available from: http://cjasn.asnjournals.org/content/1/6/1226.full.pdf+html

Badve SV, Paul SK, Klein K, Clayton PA, Hawley CM, Brown FG, et al. The association between body mass index and mortality in incident dialysis patients. PLoS ONE [Internet]. 2014 [cited 2016 Jun 21];9(12):e114897. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4267775

Berger A, Edelsberg J, Inglese GW, Bhattacharyya SK, Oster G. Cost comparison of peritoneal dialysis versus hemodialysis in end-stage renal disease. Am J Manag Care [Internet]. 2009 Aug [cited 2016 Jun 16];15(8):509-18. Available from: https://ajmc.s3.amazonaws.com/_media/_pdf/AJMC_09augBerger_509to518.pdf

Bergman A, Fenton SS, Richardson RM, Chan CT. Reduction in cardiovascular related hospitalization with nocturnal home hemodialysis. Clin Nephrol. 2008 Jan;69(1):33-9.

Bose B, McDonald SP, Hawley CM, Brown FG, Badve SV, Wiggins KJ, et al. Effect of dialysis modality on survival of hepatitis C-infected ESRF patients. Clin J Am Soc Nephrol [Internet]. 2011 Nov [cited 2016 Jun 16];6(11):2657-61. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3359577

Chang JH, Sung JY, Ahn SY, Ko KP, Ro H, Jung JY, et al. Hemodialysis leads to better survival in patients with diabetes or high comorbidity, compared to peritoneal dialysis. Tohoku J Exp Med. 2013;229(4):271-7.

Chang YK, Hsu CC, Hwang SJ, Chen PC, Huang CC, Li TC, et al. A comparative assessment of survival between propensity score-matched patients with peritoneal dialysis and hemodialysis in Taiwan. Medicine (Baltimore) [Internet]. 2012 [cited 2016 Jun 22];91(3):144-51. Available from: http://ir.cmu.edu.tw/retrieve/36557/AA-DA00_20120809150233.pdf

Chang YS, Liu CJ, Wu TH, Chaou CH, Lin KC, Ou SM, et al. Survival analysis in systemic lupus erythematosus patients on maintenance dialysis: a nationwide population-based study in Taiwan. Rheumatology (Oxford) [Internet]. 2013 Jan [cited 2016 Jun 16];52(1):166-72. Available from: http://rheumatology.oxfordjournals.org/content/52/1/166.full.pdf+html

Chen YJ, Kung PT, Wang YH, Huang CC, Hsu SC, Tsai WC, et al. Greater risk of hip fracture in hemodialysis than in peritoneal dialysis. Osteoporos Int. 2014 May;25(5):1513-8.

Chen YT, Ou SM, Chao PW, Li SY, Chen TJ, Tsai LW, et al. Acute cholecystitis in end-stage renal disease patients: a nation-wide longitudinal study. Dig Liver Dis. 2013 Feb;45(2):142-6.

Chien CC, Wang JJ, Sun YM, Sun DP, Sheu MJ, Weng SF, et al. Long-term survival and predictors for mortality among dialysis patients in an endemic area for chronic liver disease: a national cohort study in Taiwan. BMC Nephrol [Internet]. 2012 [cited 2016 Jun 21];13:43. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3422197

Choi JY, Jang HM, Park J, Kim YS, Kang SW, Yang CW, et al. Survival advantage of peritoneal dialysis relative to hemodialysis in the early period of incident dialysis patients: A nationwide prospective propensity-matched study in Korea. PLoS ONE [Internet]. 2013 [cited 2016 Jun 17];8(12). Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3875495/pdf/pone.0084257.pdf

Choi SR, Lee SC, Kim BS, Yoon SY, Park HC, Kang SW, et al. Comparative study of renal replacement therapy in Korean diabetic end-stage renal disease patients: a single center study. Yonsei Med J [Internet]. 2003 Jun 30 [cited 2016 Jun 16];44(3):454-62. Available from: http://www.eymj.org/Synapse/Data/PDFData/0069YMJ/ymj-44-454.pdf

Contreras G, Pagan J, Chokshi R, Virmani S, Diego JM, Byers P, et al. Comparison of mortality of ESRD patients with lupus by initial dialysis modality. Clin J Am Soc Nephrol [Internet]. 2014 Nov 7 [cited 2016 Jun 16];9(11):1949-56. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4220755

de Jonge H, Bammens B, Lemahieu W, Maes BD, Vanrenterghem Y. Comparison of peritoneal dialysis and haemodialysis after renal transplant failure. Nephrol Dial Transplant [Internet]. 2006 Jun [cited 2016 Jun 16];21(6):1669-74. Available from: http://ndt.oxfordjournals.org/content/21/6/1669.long

Freitas C, Fructuoso M, Martins LS, Almeida M, Pedroso S, Dias L, et al. Posttransplant outcomes of peritoneal dialysis versus hemodialysis patients. Transplant Proc. 2011 Jan;43(1):113-6.

Ghaffari A, Kalantar-Zadeh K, Lee J, Maddux F, Moran J, Nissenson A. PD First: peritoneal dialysis as the default transition to dialysis therapy. Semin Dial. 2013 Nov;26(6):706-13.

Goldfarb-Rumyantzev AS, Hurdle JF, Scandling JD, Baird BC, Cheung AK. The role of pretransplantation renal replacement therapy modality in kidney allograft and recipient survival. Am J Kidney Dis. 2005 Sep;46(3):537-49.

Haapio M, Helve J, Kyllonen L, Gronhagen-Riska C, Finne P. Modality of chronic renal replacement therapy and survival-a complete cohort from Finland, 2000-2009. Nephrology Dialysis Transplantation [Internet]. 2013 [cited 2016 May 17];28(12):3072-81. Available from: http://ndt.oxfordjournals.org/content/28/12/3072.full.pdf+html

Heaf JG, Lokkegaard H, Madsen M. Initial survival advantage of peritoneal dialysis relative to haemodialysis. Nephrol Dial Transplant. 2002 Jan;17(1):112-7.

Heaf JG, Wehberg S. Relative survival of peritoneal dialysis and haemodialysis patients: effect of cohort and mode of dialysis initiation. PLoS ONE [Internet]. 2014 [cited 2016 Jun 16];9(3):e90119. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3948631

Heidenheim AP, Muirhead N, Moist L, Lindsay RM. Patient quality of life on quotidian hemodialysis. Am J Kidney Dis. 2003 Jul;42(1 Suppl):36-41.

Helal I, Abderrahim E, Ben Hamida F, Zouaghi K, Ounissi M, Barbouche S, et al. Impact of dialysis modality on posttransplantation results in kidney transplantation. Transplant Proc. 2007 Oct;39(8):2547-9.

Hou F, Jiang J, Chen J, Yu X, Zhou Q, Chen P, et al. China collaborative study on dialysis: a multi-centers cohort study on cardiovascular diseases in patients on maintenance dialysis. BMC Nephrology [Internet]. 2012 [cited 2016 Jun 21];13:94. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3502162/pdf/1471-2369-13-94.pdf

Huang CC, Cheng KF, Wu HD. Survival analysis: comparing peritoneal dialysis and hemodialysis in Taiwan. Perit Dial Int [Internet]. 2008 Jun [cited 2016 Jun 16];28 Suppl 3:S15-20. Available from: http://www.pdiconnect.com/content/28/Supplement_3/S15.long

Huang KW, Leu HB, Luo JC, Chan WL, Hou MC, Lin HC, et al. Different peptic ulcer bleeding risk in chronic kidney disease and end-stage renal disease patients receiving different dialysis. Dig Dis Sci. 2014 Apr;59(4):807-13.

Inrig JK, Sun JL, Yang Q, Briley LP, Szczech LA. Mortality by dialysis modality among patients who have end-stage renal disease and are awaiting renal transplantation. Clin J Am Soc Nephrol [Internet]. 2006 Jul;1(4):774-9. Available from: http://cjasn.asnjournals.org/content/1/6/1226.full.pdf+html

Jaar BG, Coresh J, Plantinga LC, Fink NE, Klag MJ, Levey AS, et al. Comparing the risk for death with peritoneal dialysis and hemodialysis in a national cohort of patients with chronic kidney disease. Ann Intern Med. 2005 Aug 2;143(3):174-83.

Jin HM, Guo LL, Zhan XL, Pan Y. Effect of prolonged Weekly hemodialysis on survival of maintenance hemodialysis patients: A meta-analysis of studies. Nephron - Clinical Practice. 2013;123(3-4):220-8.

Johansen KL, Zhang R, Huang Y, Chen SC, Blagg CR, Goldfarb-Rumyantzev AS, et al. Survival and hospitalization among patients using nocturnal and short daily compared to conventional hemodialysis: a USRDS study. Kidney Int [Internet]. 2009 Nov [cited 2016 May 16];76(9):984-90. Available from: http://ac.els-cdn.com/S0085253815541008/1-s2.0-S0085253815541008-main.pdf?_tid=9f4a62b8-1b9d-11e6-b4ae-00000aacb360&acdnat=1463427627_a1d2e3662fb02241128bacce7d68be6d

Johnson DW, Dent H, Hawley CM, McDonald SP, Rosman JB, Brown FG, et al. Associations of dialysis modality and infectious mortality in incident dialysis patients in Australia and New Zealand. Am J Kidney Dis. 2009 Feb;53(2):290-7.

Joseph JT, Jindal RM. Influence of dialysis on post-transplant events. Clin Transplant. 2002 Feb;16(1):18-23.

Kang SH, Chung BH, Choi SR, Lee JY, Park HS, Sun IO, et al. Comparison of clinical outcomes by different renal replacement therapy in patients with end-stage renal disease secondary to lupus nephritis. Korean J Intern Med [Internet]. 2011 Mar [cited 2016 Jun 16];26(1):60-7. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3056257

Kim H, Kim KH, Park K, Kang SW, Yoo TH, Ahn SV, et al. A population-based approach indicates an overall higher patient mortality with peritoneal dialysis compared to hemodialysis in Korea. Kidney Int. 2014 Nov;86(5):991-1000.

Koch M, Kohnle M, Trapp R, Haastert B, Rump LC, Aker S. Comparable outcome of acute unplanned peritoneal dialysis and haemodialysis. Nephrol Dial Transplant. 2012 Jan [cited 2016 Jun 16];27(1):375-80. Available from: http://ndt.oxfordjournals.org/content/27/1/375.full.pdf+html

Korevaar JC, Feith GW, Dekker FW, van Manen JG, Boeschoten EW, Bossuyt PM, et al. Effect of starting with hemodialysis compared with peritoneal dialysis in patients new on dialysis treatment: a randomized controlled trial. Kidney Int [Internet]. 2003 Dec [cited 2016 May 20];64(6):2222-8. Available from: http://ac.els-cdn.com/S0085253815495924/1-s2.0-S0085253815495924-main.pdf?_tid=dfe9a788-1ebe-11e6-8dce-00000aab0f02&acdnat=1463771763_65bdfe7fba46f305fcd0effbcbd49f5a

Kraus M, Burkart J, Hegeman R, Solomon R, Coplon N, Moran J. A comparison of center-based vs. home-based daily hemodialysis for patients with end-stage renal disease. Hemodial Int. 2007 Oct;11(4):468-77.

Krishnasamy R, Badve SV, Hawley CM, McDonald SP, Boudville N, Brown FG, et al. Daily variation in death in patients treated by long-term dialysis: comparison of in-center hemodialysis to peritoneal and home hemodialysis. Am J Kidney Dis. 2013 Jan;61(1):96-103.

Kumar VA, Ledezma ML, Idroos ML, Burchette RJ, Rasgon SA. Hospitalization rates in daily home hemodialysis versus peritoneal dialysis patients in the United States. Am J Kidney Dis. 2008 Oct;52(4):737-44.

Kumar VA, Sidell MA, Jones JP, Vonesh EF. Survival of propensity-matched incident peritoneal and hemodialysis patients in a United States health care system. Kidney Int. 2014 Nov;86(5):1016-22.

Lafrance JP, Rahme E, Iqbal S, Elftouh N, Vallee M, Laurin LP, et al. Association of dialysis modality with risk for infection-related hospitalization: a propensity score-matched cohort analysis. Clin J Am Soc Nephrol [Internet]. 2012 Oct [cited 2016 Jun 21];7(10):1598-605. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3463202

Lee S, Ryu JH, Kim H, Kim KH, Ahn HS, Hann HJ, et al. An assessment of survival among Korean elderly patients initiating dialysis: a national population-based study. PLoS ONE [Internet]. 2014 [cited 2016 May 24];9(1):e86776. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3899356

Liberek T, Renke M, Skonieczny B, Kotewicz K, Kowalewska J, Chmielewski M, et al. Therapy outcome in peritoneal dialysis patients transferred from haemodialysis. Nephrol Dial Transplant [Internet]. 2009 Sep [cited 2016 Jun 21];24(9):2889-94. Available from: http://ndt.oxfordjournals.org/content/24/9/2889.full.pdf+html

Lindsay RM, Leitch R, Heidenheim AP, Kortas C, London Daily/Nocturnal Hemodialysis Study. The London Daily/Nocturnal Hemodialysis Study--study design, morbidity, and mortality results. Am J Kidney Dis. 2003 Jul;42(1 Suppl):5-12.

Lukowsky LR, Mehrotra R, Kheifets L, Arah OA, Nissenson AR, Kalantar-Zadeh K. Comparing mortality of peritoneal and hemodialysis patients in the first 2 years of dialysis therapy: a marginal structural model analysis. Clin J Am Soc Nephrol [Internet]. 2013 Apr [cited 2016 May 24];8(4):619-28. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3613949

Madziarska K, Weyde W, Penar J, Zukowska-Szczechowska E, Krajewska M, Golebiowski T, et al. Different mortality predictor pattern in hemodialysis and peritoneal dialysis diabetic patients in 4-year prospective observation. Postepy Hig Med Dosw (Online). 2013;67:1076-82.

Maier A, Stocks F, Pommer W, Zidek W, Tepel M, Scholze A. Hemodialysis versus peritoneal dialysis: a case control study of survival in patients with chronic kidney disease stage 5. Therap Apher Dial. 2009 Jun;13(3):199-204.

Marshall MR, van der Schrieck N, Lilley D, Supershad SK, Ng A, Walker RC, et al. Independent community house hemodialysis as a novel dialysis setting: an observational cohort study. Am J Kidney Dis [Internet]. 2013 Apr [cited 2016 May 24];61(4):598-607. Available from: http://ac.els-cdn.com/S0272638612014011/1-s2.0-S0272638612014011-main.pdf?_tid=b6a24e04-21af-11e6-8ef6-00000aacb35d&acdnat=1464095104_6b14d600bcec6cd0b92344403d28f20b

Marshall MR, Walker RC, Polkinghorne KR, Lynn KL. Survival on home dialysis in New Zealand. PLoS ONE [Internet]. 2014 [cited 2016 May 17];9(5). Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4013072/pdf/pone.0096847.pdf

Mathew AT, Hazzan A, Jhaveri KD, Block GA, Chidella S, Rosen L, et al. Increasing hip fractures in patients receiving hemodialysis and peritoneal dialysis. Am J Nephrol. 2014;40(5):451-7.

McCormick BB, Pierratos A, Fenton S, Jain V, Zaltzman J, Chan CT. Review of clinical outcomes in nocturnal haemodialysis patients after renal transplantation. Nephrol Dial Transplant [Internet]. 2004 Mar [cited 2016 May 16];19(3):714-9. Available from: http://ndt.oxfordjournals.org/content/19/3/714.full.pdf+html

Mehrotra R, Chiu YW, Kalantar-Zadeh K, Bargman J, Vonesh E. Similar outcomes with hemodialysis and peritoneal dialysis in patients with end-stage renal disease. Arch Intern Med. 2011 Jan 24;171(2):110-8.

Mircescu G, Garneata L, Florea L, Cepoi V, Capsa D, Covic M, et al. The success story of peritoneal dialysis in Romania: analysis of differences in mortality by dialysis modality and influence of risk factors in a national cohort. Perit Dial Int [Internet]. 2006 Mar [cited 2016 Jun 22];26(2):266-75. Available from: http://www.pdiconnect.com/content/26/2/266.long

Mircescu G, Stefan G, Garneata L, Mititiuc I, Siriopol D, Covic A. Outcomes of dialytic modalities in a large incident registry cohort from Eastern Europe: the Romanian Renal Registry. Int Urol Nephrol. 2014 Feb;46(2):443-51.

Molnar MZ, Mehrotra R, Duong U, Bunnapradist S, Lukowsky LR, Krishnan M, et al. Dialysis modality and outcomes in kidney transplant recipients. Clin J Am Soc Nephrol. 2012 Feb [cited 2016 Jun 16];7(2):332-41. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3280027

Murphy SW, Foley RN, Barrett BJ, Kent GM, Morgan J, Barre P, et al. Comparative hospitalization of hemodialysis and peritoneal dialysis patients in Canada. Kidney Int. 2000 Jun;57(6):2557-63.

Murphy SW, Foley RN, Barrett BJ, Kent GM, Morgan J, Barre P, et al. Comparative mortality of hemodialysis and peritoneal dialysis in Canada. Kidney Int. 2000 Apr;57(4):1720-6.

Najafi I, Hosseini M, Atabac S, Sanadgol H, Majelan NN, Seirafian S, et al. Patient outcome in primary peritoneal dialysis patients versus those transferred from hemodialysis and transplantation. Int Urol Nephrol. 2012 Aug;44(4):1237-42.

Neovius M, Jacobson SH, Eriksson JK, Elinder CG, Hylander B. Mortality in chronic kidney disease and renal replacement therapy: a population-based cohort study. BMJ Open [Internet]. 2014 [cited 2016 Jun 21];4(2):e004251. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3931988

Nesrallah GE, Lindsay RM, Cuerden MS, Garg AX, Port F, Austin PC, et al. Intensive hemodialysis associates with improved survival compared with conventional hemodialysis. J Am Soc Nephrol [Internet]. 2012 Apr [cited 2016 May 16];23(4):696-705. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3312510/?report=printable

Nitsch D, Steenkamp R, Tomson CR, Roderick P, Ansell D, MacGregor MS. Outcomes in patients on home haemodialysis in England and Wales, 1997-2005: a comparative cohort analysis. Nephrol Dial Transplant [Internet]. 2011 May [cited 2016 May 16];26(5):1670-7. Available from: http://ndt.oxfordjournals.org/content/26/5/1670.full.pdf+html

Noshad H, Sadreddini S, Nezami N, Salekzamani Y, Ardalan MR. Comparison of outcome and quality of life: haemodialysis versus peritoneal dialysis patients. Singapore Med J [Internet]. 2009 Feb [cited 2016 Jun 16];50(2):185-92. Available from: http://smj.sma.org.sg/5002/5002a11.pdf

Panagoutsos S, Kantartzi K, Passadakis P, Yannatos E, Mourvati E, Theodoridis M, et al. Timely transfer of peritoneal dialysis patients to hemodialysis improves survival rates. Clin Nephrol. 2006 Jan;65(1):43-7.

Pauly RP, Asad RA, Hanley JA, Pierratos A, Zaltzman J, Chery A, et al. Long-term clinical outcomes of nocturnal hemodialysis patients compared with conventional hemodialysis patients post-renal transplantation. Clin Transplant. 2009 Jan;23(1):47-55.

Perl J, Dong J, Rose C, Jassal SV, Gill JS. Is dialysis modality a factor in the survival of patients initiating dialysis after kidney transplant failure? Perit Dial Int. 2013 Nov [cited 2016 Jun 16];33(6):618-28. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3862091

Perl J, Hasan O, Bargman JM, Jiang D, Na Y, Gill JS, et al. Impact of dialysis modality on survival after kidney transplant failure. Clin J Am Soc Nephrol [Internet]. 2011 Mar [cited 2016 Jun 21];6(3):582-90. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3082417

Perl J, Wald R, McFarlane P, Bargman JM, Vonesh E, Na Y, et al. Hemodialysis vascular access modifies the association between dialysis modality and survival. J Am Soc Nephrol [Internet]. 2011 Jun [cited 2016 Jun 21];22(6):1113-21. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3103730

Piccoli GB, Bermond F, Mezza E, Burdese M, Fop F, Mangiarotti G, et al. Vascular access survival and morbidity on daily dialysis: A comparative analysis of home and limited care haemodialysis. Nephrology Dialysis Transplantation [Internet]. 2004 [cited 2016 May 24];19(8):2084-94. Available from: http://ndt.oxfordjournals.org/content/19/8/2084.full.pdf+html

Piccoli GB, Mezza E, Quaglia M, Bermond F, Bechis F, Burdesse M, et al. Flexibility as an implementation strategy for a daily dialysis program. J Nephrol. 2003;16(3):365-72.

Quinn RR, Ravani P, Zhang X, Garg AX, Blake PG, Austin PC, et al. Impact of modality choice on rates of hospitalization in patients eligible for both peritoneal dialysis and hemodialysis. Perit Dial Int [Internet]. 2014 Jan [cited 2016 Jun 16];34(1):41-8. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3923691

Quintaliani G, Buoncristiani U, Fagugli R, Kuluiranu H, Ciao G, Rondini L, et al. Survival of vascular access during daily and three times a week hemodialysis. Clin Nephrol. 2000 May;53(5):372-7.

Ridao Curty NF, da Silva Martins LF, Sanches Ito CA, Schafranski M, Brites DA, Busato CR. Morbimortality study of infection in patients undergoing different types of dialysis in a renal replacement therapy center. Braz J Infect Dis. 2014 May;18(3):281-6.

Sanabria M, Munoz J, Trillos C, Hernandez G, Latorre C, Diaz CS, et al. Dialysis outcomes in Colombia (DOC) study: a comparison of patient survival on peritoneal dialysis vs hemodialysis in Colombia. Kidney Int Suppl. 2008 Apr;(108):S165-S172.

Sands JJ, Lacson E, Ofsthun NJ, Kay JC, Diaz-Buxo JA. Home hemodialysis: a comparison of in-center and home hemodialysis therapy in a cohort of successful home hemodialysis patients. ASAIO J. 2009 Jul;55(4):361-8.

Saner E, Nitsch D, Descoeudres C, Frey FJ, Uehlinger DE. Outcome of home haemodialysis patients: a case-cohort study. Nephrol Dial Transplant [Internet]. 2005 Mar [cited 2016 May 16];20(3):604-10. Available from: http://ndt.oxfordjournals.org/content/20/3/604.full.pdf+html

Schwenger V, Dohler B, Morath C, Zeier M, Opelz G. The role of pretransplant dialysis modality on renal allograft outcome. Nephrol Dial Transplant [Internet]. 2011 Nov [cited 2016 Jun 16];26(11):3761-6. Available from: http://ndt.oxfordjournals.org/content/26/11/3761.full.pdf+html

Sens F, Schott-Pethelaz AM, Labeeuw M, Colin C, Villar E, REIN Registry. Survival advantage of hemodialysis relative to peritoneal dialysis in patients with end-stage renal disease and congestive heart failure. Kidney Int [Internet]. 2011 Nov [cited 2016 May 24];80(9):970-7. Available from: http://ac.els-cdn.com/S0085253815551569/1-s2.0-S0085253815551569-main.pdf?_tid=e7b3cdd8-21af-11e6-bc9a-00000aab0f6b&acdnat=1464095187_4cb8ad8e17f780692ab1fb3eea9e354f

Serafinceanu C, Neculaescu C, Cimponeriu D, Timar R, Covic AC. Impact of gender and dialysis modality on early mortality risk in diabetic ESRD patients: data from a large single center cohort. Int Urol Nephrol. 2014 Mar;46(3):607-14.

Sezer S, Karakan S, Ozdemir Acar FN, Haberal M. Dialysis as a bridge therapy to renal transplantation: comparison of graft outcomes according to mode of dialysis treatment. Transplant Proc. 2011 Mar;43(2):485-7.

Song YS, Jung H, Shim J, Oh C, Shin GT, Kim H. Survival analysis of Korean end-stage renal disease patients according to renal replacement therapy in a single center. J Korean Med Sci [Internet]. 2007 Feb [cited 2016 Jun 16];22(1):81-8. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2693574

Stack AG, Molony DA, Rahman NS, Dosekun A, Murthy B. Impact of dialysis modality on survival of new ESRD patients with congestive heart failure in the United States. Kidney Int. 2003 Sep;64(3):1071-9.

Stack AG, Murthy BV, Molony DA. Survival differences between peritoneal dialysis and hemodialysis among “large” ESRD patients in the United States. Kidney Int. 2004 Jun;65(6):2398-408.

Stolic R, Trajkovic G, Jovanovic A, Peric V, Stolic D, Sovtic S, et al. Association of metabolic changes with mortality of patients treated by peritoneal dialysis or hemodialysis. Ren Fail. 2010;32(7):778-83.

Suzuki K, Konta T, Ichikawa K, Ikeda A, Niino H, Hoshikawa M, et al. Comparison of Mortality between Japanese Peritoneal Dialysis and Hemodialysis Patients: A 5-Year Multicenter Follow-Up Study. Int J Nephrol [Internet]. 2012 [cited 2016 Jun 16];2012:231018. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3369474

Suzuki T, Kanno Y, Nakamoto H, Okada H, Sugahara S, Suzuki H. Peritoneal dialysis versus hemodialysis: a five-year comparison of survival and effects on the cardiovascular system, erythropoiesis, and calcium metabolism. Adv Perit Dial. 2003;19:148-54.

Termorshuizen F, Korevaar JC, Dekker FW, van Manen JG, Boeschoten EW, Krediet RT, et al. Hemodialysis and peritoneal dialysis: comparison of adjusted mortality rates according to the duration of dialysis: analysis of The Netherlands Cooperative Study on the Adequacy of Dialysis 2. J Am Soc Nephrol. 2003 Nov [cited 2016 Jun 16];14(11):2851-60.

Trespalacios FC, Taylor AJ, Agodoa LY, Bakris GL, Abbott KC. Heart failure as a cause for hospitalization in chronic dialysis patients. Am J Kidney Dis. 2003 Jun;41(6):1267-77.

Tse KC, Lui SL, Lo WK. Comparison of long-term survival (beyond 12 years) in patients on peritoneal dialysis and on hemodialysis. Perit Dial Int [Internet]. 2003 [cited 2016 May 24];23(Suppl 2):S104-S108. Available from: Comparison of long-term survical (beyond 12 years) in patients on peritoneal dialysis and on hemodialysis

Tveit DP, Hshieh P, Cruess D, Agodoa LY, Welch PG, Abbott KC. Risk factors for pulmonary embolism in chronic dialysis patients. J Nephrol. 2002 May;15(3):241-7.

Uchida K, Shoda J, Sugahara S, Ikeda N, Kobayashi K, Kanno Y, et al. Comparison and survival of patients receiving hemodialysis and peritoneal dialysis in a single center. Adv Perit Dial. 2007;23:144-9.

Vacaroiu IA, Radulescu D, Ciocalteu A, Peride I, Ardeleanu S, Checherita IA. Functional status of chronic renal replacement therapy in elderly patients--comparison between hemodialysis and peritoneal dialysis. Rev Med Chir Soc Med Nat Iasi. 2012 Apr;116(2):375-82.

van Diepen AT, Hoekstra T, Rotmans JI, de Boer MG, le Cessie S, Suttorp MM, et al. The association between dialysis modality and the risk for dialysis technique and non-dialysis technique-related infections. Nephrol Dial Transplant [Internet]. 2014 Dec [cited 2016 Jun 16];29(12):2244-50. Available from: http://ndt.oxfordjournals.org/content/29/12/2244.full.pdf+html

Villar E, Remontet L, Labeeuw M, Ecochard R. Effect of age, gender, and diabetes on excess death in end-stage renal failure. J Am Soc Nephrol [Internet]. 2007 Jul [cited 2016 Jun 22];18(7):2125-34. Available from: http://jasn.asnjournals.org/content/18/7/2125.full.pdf+html

Vos PF, Zilch O, Jennekens-Schinkel A, Salden M, Nuyen J, Kooistra MM, et al. Effect of short daily home haemodialysis on quality of life, cognitive functioning and the electroencephalogram. Nephrol Dial Transplant [Internet]. 2006 Sep [cited 2016 May 16];21(9):2529-35. Available from: http://ndt.oxfordjournals.org/content/21/9/2529.full.pdf+html

Wagner M, Ansell D, Kent DM, Griffith JL, Naimark D, Wanner C, et al. Predicting mortality in incident dialysis patients: An analysis of the United Kingdom renal registry. Am J Kidney Dis [Internet]. 2011 [cited 2016 Jun 21];57(6):894-902. Available from: http://pubmedcentralcanada.ca/pmcc/articles/PMC3100445/pdf/nihms271845.pdf

Wang HH, Hung SY, Sung JM, Hung KY, Wang JD. Risk of stroke in long-term dialysis patients compared with the general population. Am J Kidney Dis. 2014 Apr;63(4):604-11.

Wang IK, Chang YC, Liang CC, Chuang FR, Chang CT, Lin HH, et al. Bacteremia in hemodialysis and peritoneal dialysis patients. Intern Med [Internet]. 2012 [cited 2016 Jun 16];51(9):1015-21. Available from: https://www.jstage.jst.go.jp/article/internalmedicine/51/9/51_9_1015/_pdf

Wang IK, Kung PT, Kuo WY, Tsai WC, Chang YC, Liang CC, et al. Impact of dialysis modality on the survival of end-stage renal disease patients with or without cardiovascular disease. J Nephrol. 2013 Mar;26(2):331-41.

Weinhandl ED, Foley RN, Gilbertson DT, Arneson TJ, Snyder JJ, Collins AJ. Propensity-matched mortality comparison of incident hemodialysis and peritoneal dialysis patients. J Am Soc Nephrol [Internet]. 2010 Mar [cited 2016 Jun 16];21(3):499-506. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2831857

Weinhandl ED, Liu J, Gilbertson DT, Arneson TJ, Collins AJ. Survival in daily home hemodialysis and matched thrice-weekly in-center hemodialysis patients. J Am Soc Nephrol [Internet]. 2012 May;23(5):895-904. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3338294

Weng CH, Hsu CW, Yu CC, Yen TH, Yang CW, Hung CC. Peritoneal dialysis and hemodialysis in systemic lupus erythematosus patients: comparison of clinical outcomes. Kidney Blood Press Res. 2009;32(6):451-6.

Williams VR, Quinn R, Callery S, Kiss A, Oliver MJ. The impact of treatment modality on infection-related hospitalization rates in perit oneal dialysis and hemodialysis patients. Perit Dial Int [Internet]. 2011 [cited 2016 May 24];31(4):440-9. Available from: http://www.pdiconnect.com/content/31/4/440.full.pdf+html

Wu B, Wang M, Gan L, Zhao H. Comparison of patient survival between hemodialysis and peritoneal dialysis in a single Chinese center. Int Urol Nephrol. 2014 Dec;46(12):2403-7.

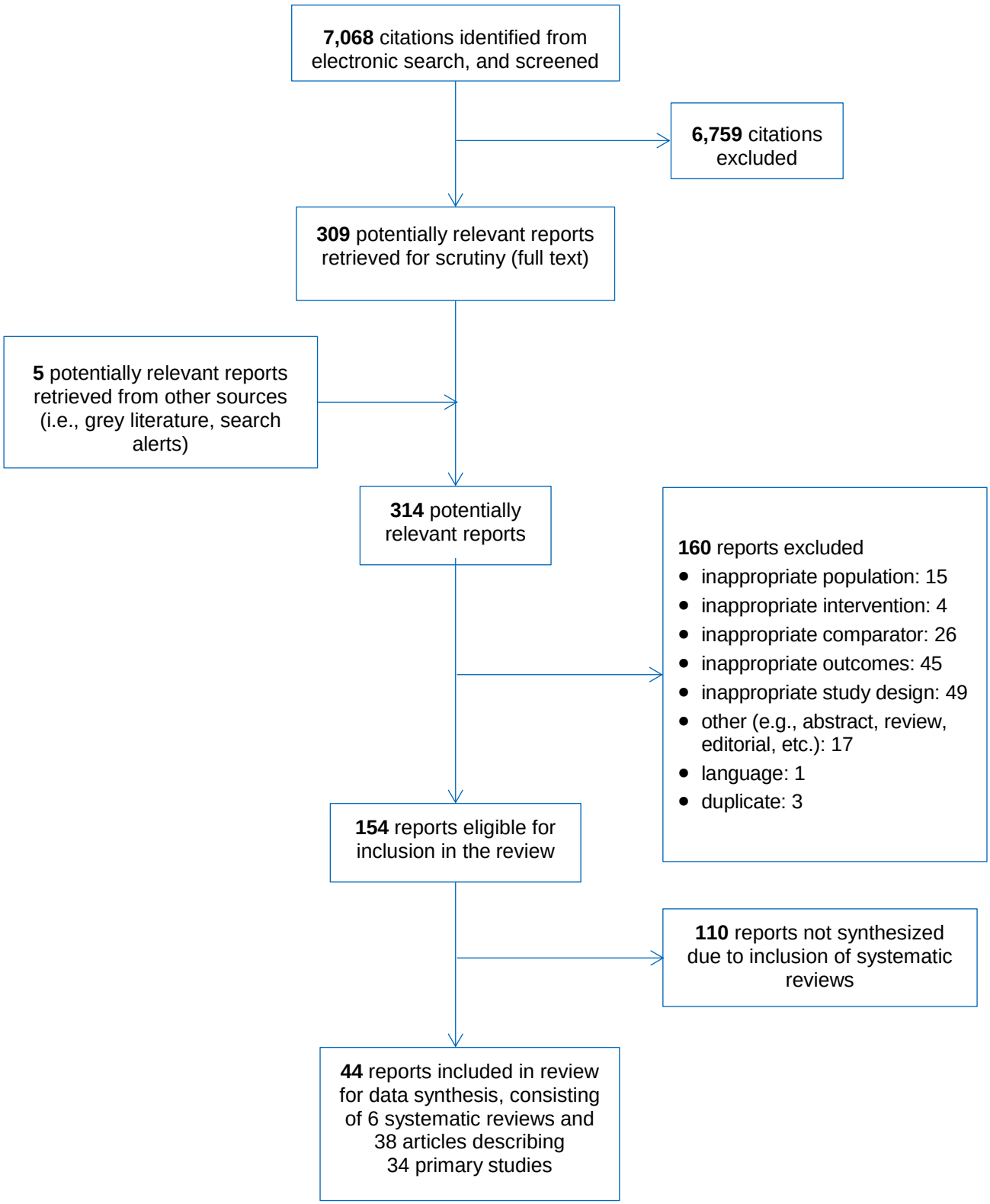
Wu MJ, Lo YC, Lan JL, Yu TM, Shu KH, Chen DY, et al. Outcome of lupus nephritis after entering into end-stage renal disease and comparison between different treatment modalities: a nationwide population-based cohort study in Taiwan. Transplant Proc. 2014;46(2):339-41.

Yang Q, Zhao S, Chen W, Mao H, Huang F, Zheng Z, et al. Influence of dialysis modality on renal transplant complications and outcomes. Clin Nephrol. 2009 Jul;72(1):62-8.

Yeates K, Zhu N, Vonesh E, Trpeski L, Blake P, Fenton S. Hemodialysis and peritoneal dialysis are associated with similar outcomes for end-stage renal disease treatment in Canada. Nephrol Dial Transplant [Internet]. 2012 Sep [cited 2016 May 5];27(9):3568-75. Available from: http://ndt.oxfordjournals.org/content/27/9/3568.full.pdf+html

Zhang L, Cao T, Li Z, Wen Q, Lin J, Zhang X, et al. Clinical outcomes of peritoneal dialysis patients transferred from hemodialysis: a matched case-control study. Perit Dial Int [Internet]. 2013 May [cited 2016 Jun 21];33(3):259-66. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3649894

Appendix 4: Study Selection Flow Diagram — Clinical Review



Appendix 5: Full-Text Screening Checklist — Clinical Review

Reviewer: _____ Date: _____

Ref ID: Author: Publication Year:			
Did the study include:	Yes (Include)	Unclear (Include)[a]	No (Exclude)
1. Adults with end-stage kidney disease	☐	☐	☐
2. At-home hemodialysis or peritoneal dialysis compared with in-centre hemodialysis AND/OR At-home hemodialysis compared with peritoneal dialysis AND/OR At-home hemodialysis compared with at-home hemodialysis AND/OR Self-care (including assisted by other than health care professionals) in-centre hemodialysis compared with in-centre dialysis (assistance by health care professionals)	☐	☐	☐
3. Any of the following as the study outcomes? • Patient quality of life, as reported by a standardized tool • Mortality (all-cause) • Hospitalization (all-cause) • Hospitalization (dialysis-related; e.g., revision of access, volume overload, uremic complications, hyperkalemia) • Adverse events (all-cause) • Clinical adverse events (during dialysis, following dialysis) • Infection (all-cause) • Infection (dialysis-related; e.g., access site infection, septicemia, peritonitis) • Cardiovascular adverse events • Transplants • Patient depression and anxiety • Patient satisfaction, as reported by a standardized tool • Caregiver quality of life, as reported by a standardized tool • Caregiver depression and/or anxiety • Adherence to dialysis prescription • Technique failure (permanent switch to another dialysis modality) • All-cause discontinuation of intervention, other than due to transplant. Includes technique failure and switching between self-care and assisted, home, and in-centre • Technical adverse events and equipment malfunctions	☐	☐	☐
4. Any of the following study designs: • Systematic review (with or without meta-analysis) • Health technology assessments incorporating systematic review • RCT • Non-randomized controlled study • Cohort study with a control group • Case-control study • Controlled before and after study (safety only) • Interrupted time series study (safety only)	☐	☐	☐

Decision for including the study in the review:	Yes☐	No☐
Reason(s) for exclusion:	• Inappropriate study population • No intervention of interest • No/inappropriate comparator • No relevant outcomes • Irrelevant study type • Not primary report of study • Study description only • Other:_____	

[a] Discuss with a second reviewer.
Note: If all items are answered “yes” or “unclear,” then the study is included.

CADTH

Appendix 6: Data Extraction Form — Clinical Review

For systematic reviews

Reviewer: _____ Date: _____

Study Characteristics	
Ref ID:	
Author(s):	
Publication title:	
Publication year:	
Country (where the study was conducted):	
Funding:	

Methodology	
Study design:	☐ SR ☐ MA ☐ HTA
Number of included studies:	
List of included studies:	
Total number of participants within studies included in the review:	
Study eligibility criteria:	
Type of included studies:	
Range of publication years of included studies:	
Databases searched:	
Search period:	
Quality assessment tool:	
Subgroup analyses / meta-regression:	

HTA = health technology assessment; MA = meta-analysis; SR = systematic review.

Comparison	
Intervention:	
Comparator:	
Range of therapy duration:	

Reported Outcomes	
Primary (including definition):	
Secondary (including definition):	
Length of follow-up:	

Results (To Be Completed for Each Comparison and Outcome)	
Comparison	
Intervention:	
Comparator:	
Outcome:	
Study (1st author)	
Number of included studies:	
Range of publication years of included studies:	
Study population	
Pairwise MA	
Treatment effect (95% CI)	
P value for effect	
I^2 statistics	
NMA	

Results (To Be Completed for Each Comparison and Outcome)	
Treatment effect (95% CI)	
P value for effect	
Subgroups	
Subgroup 1:	
Number of included studies	
Treatment effect (95% CI)	
P value for effect	
I^2 statistics	
Subgroup 2:	
Number of included studies	
Treatment effect (95% CI)	
P value for effect	
I^2 statistics	
(add subgroups, as needed)	
Meta-regression	
Variables	
Variable 1:	
Variable 2:	
(add variables as needed)	
Main conclusions:	

CI = confidence interval; MA = meta-analysis; NMA = network meta-analysis.

Did the SR report any data relevant to another research question (RQ)? □ Yes: RQ# _____ □ No

For individual studies

Reviewer: _____ Date: _____

Study Characteristics	
Ref ID:	
Author:	
Publication title	
Publication year	
Country (where the study was conducted)	
Study design	
Setting of study	
Intervention (including details of patient training)	
Comparator	
Allocation method	
Total sample size	
Study participant eligibility criteria	
Duration of follow-up	
Funding/Author conflicts of interest	

Complete additional copies of the following tables as required for subgroup results:

Patient and Caregiver Characteristics			
	Total	Intervention	Comparator
Sample size			
Age			
Sex			
Race/ethnicity (as reported)			
Type of hemodialysis access			
Comorbidities			
Frailty or functional status			
Residual renal function			

Patient and Caregiver Characteristics			
Setting of hemodialysis (e.g., patient's home, long-term care)			
Geographical location (e.g., urban, rural)			
Patient education			
Socioeconomic status			
Employment status			
Relationship to carer(s)			
Carer education			

Reported Outcomes	
Primary:	
Secondary:	

Results								
Outcome	Intervention			Comparator			Statistics	
Dichotomous Outcomes	N	No. of events	%	N	No. of events	%	RR (95% CI)	*P* Value
Mortality (all-cause)								
Hospitalization (all-cause)								
Adverse events								
Clinical adverse events								
Infection								
Infection (all-cause)								
Infection								
Cardiovascular adverse events								
Transplants								
Technique failure								
All-cause discontinuation of intervention								
Technical adverse events and equipment malfunctions								
Patient depression								
Patient anxiety								
Caregiver depression								
Caregiver anxiety								
Continuous Outcomes (Indicate Scale/Score)	**N**	**Pre-**	**Post-**	**N**	**Pre-**	**Post-**	**t**	***P* Value**
Patient quality of life.....								
Patient depression								
Patient anxiety.....								
Patient satisfaction.....								
Caregiver quality of life.....								
Caregiver depression.....								
Caregiver anxiety								

CI = confidence interval; N = number of patients; RR = relative risk.

Comments
Additional contextual information, e.g., family/caregiver support, multidisciplinary team, involvement, funding models

Did the SR report any data relevant to another research question (RQ)? ☐ Yes: RQ# _____ ☐ No

Appendix 7: Study and Patient Characteristics — Clinical Review

Characteristics of included systematic reviews

First Author, Publication Year Country Funding Sources	Review Methods Databases and Timeframes Searched QA Tool Used	Number of Study Types Included Publication Years of Primary Studies Included	Number of Patients Age, Sex, Comorbidities, of Patients Included; Subgroups of Interest	Intervention and Comparator	Start and End Years of Studies (Dates of Dialysis); Length of Follow-up	Outcomes Reported by SRs
Couchoud et al.,[3] 2015 France Funding source not reported	SR of RCTs and observational studies MEDLINE, EMBASE, CENTRAL databases searched until Feb 2014 QA using Newcastle-Ottawa scale	25 observational studies 1997 to 2014	1,179,153 patients (sample size range 181 to 398,940) Age, sex, general comorbidities NR Total number of diabetic patients = 721,783 (HD) and 106,790 (PD) Subgroups: diabetes	PD (CAPD and APD) versus HD (conventional and daily)	1987 to 2011 Follow-up 1 to 8 years	Mortality, risk of infectious complications
Han et al.,[39] 2015 Korea Government funding	MA of observational studies PubMED, Cochrane Library, Google Scholar searched from year 2000 onward QA not reported	15 observational studies 2002 to 2014	13,065 patients (sample size of elderly patients range 377 to 332,552) Mean age: 72.2 years (SD ± 5.53); 54.4% male Comorbidities reported Subgroups: elderly patients (≥ 65 years), diabetes mellitus, dialysis duration, dialysis start time	PD versus HD	1987 to 2011 Follow-up 1 to 10 years	Mortality
Ishani et al.,[38] 2015 US Government funding	SR of RCTs, CCTs, and observational studies MEDLINE and Cochrane Library searched from 1995 to December 2014 RCTs and CCTs assessed using modified Cochrane tool; observational studies assessed using criteria from AHRQ Methods Guide	3 SRs, 3 RCTs, 111 CCTs and observational studies 1995 to 2015 Only studies from North America, Europe, Australia, or New Zealand were included	Overall numbers NR for number of patients, age, sex or comorbidities (datum is presented individually for comparison types)	HHD versus ICHD; PD versus HHD; PD versus ICHD	1982 to 2011 Follow-up 0 days to 17 years	Mortality, all-cause hospitalization, hospitalization for CV causes, modality switching, QoL, adverse events (infection), technique survival, costs

First Author, Publication Year Country Funding Sources	Review Methods Databases and Timeframes Searched QA Tool Used	Number of Study Types Included Publication Years of Primary Studies Included	Number of Patients Age, Sex, Comorbidities, of Patients Included; Subgroups of Interest	Intervention and Comparator	Start and End Years of Studies (Dates of Dialysis); Length of Follow-up	Outcomes Reported by SRs
Palmer et al.,[40] 2014 New Zealand Funding through University of Otago (New Zealand); Diaverum Scientific Office, Sweden (private renal health care provider); and Consorzio Mario Negri Sud, Italy (non-profit research organization)	Cochrane SR Cochrane CENTRAL, MEDLINE OVID, EMBASE OVID, Clinical Trials Register and ClinicalTrials.gov searched to November 1, 2014 Risk of bias assessment tool	1 RCT (crossover) 2001	9 patients Mean age 48 years (range 23-63) 44% male Comorbidities not reported	HHD versus ICHD	Years of dialysis/study NR 2 treatment phases of 8 weeks each	QoL, echocardiographic measures (LVM index, LVEF, left atrial size, indices of diastolic function), blood pressure, anemia, calcium, and phosphorus metabolism
Pike et al.,[4] 2013 Norway Government funding	HTA (SR plus MA) The Cochrane Library; CDSR, DARE, Central, HTA, NHS EED Centre for Reviews and Dissemination (CRD); DARE, HTA, NHS EED Ovid MEDLINE; EMBASE (Ovid) searched from 1995 to 2013 QA using Grading of Recommendations, Assessment, Development and Evaluation (GRADE)	2 RCTs, 17 observational studies 1999 to 2012	Number of patients ranged from 28 to 11,238 Mean age ranged from 41 to 79 years Males ranged from 26 to 73% Comorbidities reported for each included study	Comparison of any of the following: ICHD (conventional and self-care) HD in satellite unit HHD; PD (CAPD and APD)	1994 to 2008 Follow-up 4 to 86 months	Mortality, QoL, complications requiring special measures (i.e., hospitalization, antibiotic treatment), economic evaluation
Vale et al.,[41] 2004 (current as of 2012) UK Government funding	Cochrane SR Cochrane CENTRAL MEDLINE EMBASE BIOSIS CINAHL CHEMABS HealthSTAR SIGLE; CRIB; UK NNR; CCTR; RSC (on BIDS); IBSS, NEED (NHS) searched from 1980 to 2004 QA using the criteria of the Cochrane Renal Group	1 RCT 2003	38 patients Mean age 59 years (SD ± 12) 58% male Comorbidities not reported	PD (CAPD) versus ICHD or HHD	Dates of dialysis not reported Follow-up 5 years	Survival, QoL

APD = automated peritoneal dialysis; CAPD = continuous ambulatory peritoneal dialysis; CCT = controlled clinical trial; HD = hemodialysis; HHD = home hemodialysis; HTA = health technology assessment; ICHD = in-centre hemodialysis; LVM = left ventricular mass; LVEF = left ventricular ejection fraction; MA = meta-analysis; PD = peritoneal dialysis; QA = quality assessment; QoL = quality of life; RCT = randomized controlled trial; SD = standard deviation; SR = systematic review.

Study characteristics of primary included studies

Author, Year Country Study Design	Stated Study Objective	Name of Trial/ Registry Years of Recruitment Length of Follow-up	Funding Source Author Conflicts	Dialysis Modalities Total no. of Patients (N) Incident or Prevalent Patients	Inclusion/ Exclusion Criteria	Primary / Secondary Outcomes of Interest	Analytic Model Model Covariates
Culleton et al.,[42] 2007 and Manns et al.,[43] 2009 Canada RCT	Comparison of frequent nocturnal HD versus conventional HD on changes in left ventricular mass and HRQoL over 6 months	Trial name NR 2004 to 2006 Follow-up to Dec. 2006	Funded by the Kidney Foundation of Canada Authors declare no conflicts of interest	Nocturnal HHD, Conventional HD N = 52 Prevalent patients	Inclusion: patients age ≥ 18 yr, receiving in-centre, self-care, or home conventional HD 3 times weekly, and interested in training for nocturnal HHD Exclusion: patients lacking the mental or physical capacity to train for nocturnal HHD	Primary: change in left ventricular mass Secondary: change in HRQoL	Intent-to-treat with last value carried forward approach; sensitivity analysis of using covariance (ANCOVA) Covariates: ANCOVA model: 6-month value was the dependent variable, and baseline value was the covariate
de Abreu et al.,[48] 2011 Brazil Prospective cohort	Comparison of the QoL in patients on HD or PD in Brazil	Trial name NR 2007 to 2009 12 months follow-up	Funded by Baxter Healthcare Corp One author employed by Baxter	PD, ICHD N = 350 Prevalent patients	Inclusion: patients at one of 6 dialysis centres, aged ≥ 18 yrs who had been on the same dialysis modality for at least 1 month Exclusion: hospitalized patients and those who planned to change modality within 6 months	Primary: HRQoL Secondary: NR	Multivariate regression to compare influence of dialysis modality on QoL for the 3 time periods and from baseline to 12 months Covariates: included demographics, comorbidities, lab values, time receiving dialysis, type of health insurance (public or private)
Frimat,[49] 2006 France Prospective cohort	Comparison of outcomes in patients contraindicated for kidney transplant, who were only on HD and those given PD as a first RRT	Epidémiologie de l'insuffisance renale chronique terminale en Lorraine (EPIREL) 1997 to 1999 13 to 24 months follow-up	Gov't funding Author conflicts of interest NR	PD, ICHD N = 387 (321 for QoL analysis) Incident patients	Inclusion: patients with ESRD, living in Lorraine France for ≥ 3 months, and began RRT between June 1997 and June 1999 Exclusion: patients with acute reversible renal failure or those returning to dialysis following kidney graft failure; age < 15 yrs	Primary: mortality Secondary: HRQoL, hospitalization	Multivariate analysis for analysis of variance and covariance Covariates: age, gender, comorbidity index, first dialysis session (planned versus unplanned)

Author, Year Country Study Design	Stated Study Objective	Name of Trial/ Registry Years of Recruitment Length of Follow-up	Funding Source Author Conflicts	Dialysis Modalities Total no. of Patients (N) Incident or Prevalent Patients	Inclusion/ Exclusion Criteria	Primary / Secondary Outcomes of Interest	Analytic Model Model Covariates
Habib et al.,[58] 2016 France Retrospective cohort	Comparison of survival of patients initially treated with PD or HD	Réseau épidémiologique et information en néphrologie (REIN) Registry 2004 to 2012 Follow-up to June 30, 2014	Funding source NR Authors declare no conflicts of interest	PD, ICHD N = 7,172 Incident patients	Inclusion: ESRD patients aged >18 yrs and starting dialysis therapy for the first time between Jan. 1, 2004 and Dec. 31, 2012 in the PACA region (France) Exclusion: patients who switched dialysis modality at least 2 times	Primary: survival/all-cause mortality Secondary: NR	Survival analysis using Kaplan–Meier technique and tested using the log-rank test; multivariate Cox regression; propensity score calculated based on logistic regression Covariates: age, activity level, hemoglobin, erythropoietin, diabetes, CVD, respiratory failure, cancer, number of comorbidities, placement on transplant waiting list, walking autonomy, admission to dialysis in the ED
Harris et al.,[50] 2002 UK Prospective cohort	Comparison of the effect of dialysis modality on outcomes in elderly patients on PD versus HD	North Thames Dialysis Study (NTDS) 1995 to 1996 12 months follow-up	Gov't funding Author conflicts of interest NR	PD, ICHD N = 174 Incident and prevalent patients	Inclusion: patients aged ≥ 70 yrs, with 90 days of uninterrupted chronic dialysis Exclusion: patients with terminal illness with life expectancy of < 6 months; diagnosis of psychosis; cognitive impairment	Primary: survival, hospitalization, QoL Secondary: NR	Cox proportional hazards models, Poisson regression models, multiple linear regression analyses Covariates: study cohort, time on dialysis, age, sex, social class (manual or non-manual occupation), and comorbidity
Jeloka et al.,[51] 2016 India Prospective cohort	Study of the survival and factors affecting survival of elderly dialysis patients	Name of trial NR 2006 to 2014 Follow-up to Mar. 31, 2014	No funding source was used Authors declare no conflicts of interest	PD, ICHD N = 42 Incident patients	Inclusion: incident patients with chronic kidney disease who initiated dialysis at ≥ 65 yrs and had completed > 89 days of dialysis Exclusion: patients with hepatitis B, C, or HIV; acute kidney disease; patients already on dialysis	Primary: all-cause mortality/survival Secondary: NR	Survival analysis with Kaplan–Meier and log- rank test Covariates: age, sex, diabetes, modality of dialysis, vintage of dialysis, all biochemical parameters, including albumin

Author, Year Country Study Design	Stated Study Objective	Name of Trial/ Registry Years of Recruitment Length of Follow-up	Funding Source Author Conflicts	Dialysis Modalities Total no. of Patients (N) Incident or Prevalent Patients	Inclusion/ Exclusion Criteria	Primary / Secondary Outcomes of Interest	Analytic Model Model Covariates
Kasza et al.,[59] 2016 Australia and New Zealand Retrospective cohort	Comparison of survival of patients on HHD with a permanent vascular access, ICHD with a permanent vascular access, ICHD with a central venous catheter, or PD	Australia and New Zealand Dialysis and Transplant Registry (ANZDATA) 2003 to 2011 Follow-up to Dec 31, 2011 median 2.25 yrs (IQR 1, 3.75)	Funded by Australian National Health and Medical Research Council Centre of Excellence Grant Authors have affiliations with Baxter Healthcare	HHD, PD, ICHD N = 20,191 Incident patients	Inclusion: adult incident patients starting dialysis within recruitment period, and undergoing ≥ 90 days of dialysis Exclusion: NR	Primary: mortality Secondary: NR	Marginal structural model, with dialysis modality as time-varying exposure (90-day periods) Covariates: age, serum creatinine, sex, smoker, late referral, race, year of first dialysis, primary renal disease, BMI, comorbidities (CAD, lung disease, diabetes type I, diabetes type II, PVD, cerebrovascular disease)
Kim et al.,[60] 2015 Korea Retrospective cohort	Determination of major CV event incidence and to compare between incident HD and PD patients	Korean Health and Insurance Review and Assessment Service (HIRA) database 2005 to 2008 Follow-up until Dec. 31, 2009 median follow-up 21.5 months (range 0 to 57 months)	University funding Authors declare no conflict of interest	PD, ICHD N = 30,279 Incident patients	Inclusion: All incident patients who started dialysis between Jan. 1, 2005 and Dec. 31, 2008 and who remained on therapy for at least 3 months, without an occurrence of MACCE Exclusion: age < 18 yrs	Primary: cardiovascular (cardiac and cerebrovascular) adverse events Secondary: all-cause mortality/survival, non-fatal AMI, TVR, PCI, CABG	Multivariate Poisson regression analysis, weighted Cox proportional hazards model (propensity scores based on logistic regression) Covariates: age, sex, comorbidities
Kim et al.,[52] 2015 Korea Prospective cohort	Investigation of the patient and technical survival rates and risk factors	Clinical Research Center for End-Stage Renal Disease (CRC for ESRD) 2008 to 2013 Follow-up to Mar. 2013	Funded by Korea Healthcare Technology R&D Project (gov't) Authors declare no conflicts of interest	PD, ICHD N = 410 (subgroup comparing PD vs. ICHD) Incident patients	Inclusion (subgroup): age ≥ 65 years initiating dialysis for ESRD Exclusion: missing creatinine levels at start of dialysis; recovery of kidney function	Primary: patient and technical survival Secondary: reasons for death and technical failure, hospitalization, incidence and microbiology of peritonitis, 1-year changes in QoL and BDI	Univariate analysis using Competing Risks Regression Covariates: age, hemoglobin, albumin, 24-hr urine volume, SGA, diabetes, and hospitalization

Author, Year Country Study Design	Stated Study Objective	Name of Trial/ Registry Years of Recruitment Length of Follow-up	Funding Source Author Conflicts	Dialysis Modalities Total no. of Patients (N) Incident or Prevalent Patients	Inclusion/ Exclusion Criteria	Primary / Secondary Outcomes of Interest	Analytic Model Model Covariates
Lee et al.,[61] 2015 Taiwan Retrospective cohort	Comparison of the risk of common GI diseases between cohorts undergoing HD or PD	Taiwan National Health Insurance Research Database (NHIRD) 2000 to 2009 Follow-up until 2010	Funded by hospital grants Authors declare no conflicts of interest	PD, ICHD N = 10,746 Incident patients	Inclusion: adult patients age ≥ 40 yrs with ESRD who started receiving PD or HD within a defined period (2000 to 2009) for ≥ 3 months Exclusion: patients who received both modalities but received HD 1 to 2 months longer than duration of PD or patients who received PD 1 to 2 months longer than the duration of HD; patients with a common GI disease or GI cancer history	Primary: total GI events, gastroesophageal reflux, peptic ulcer disease, mesenteric ischemia, intestinal obstruction or adhesions, appendicitis, lower GI diverticula or bleeding, liver cirrhosis, acute pancreatitis, abdominal hernia Secondary: NR	PS-matched multivariable-adjusted Competing Risk Regression (CRR) model Covariates: age, sex, diabetes mellitus, hyperlipidemia, hypertension, CHF, CAD, atrial fibrillation, cerebrovascular disease, asthma, COPD, diseases of the musculoskeletal system and connective tissue, chronic hepatitis (including hepatitis B, hepatitis C and alcoholic liver disease), depression, dementia, obesity, alcohol-related illness, and non-GI cancer
Lee et al.,[53] 2016 Korea Prospective cohort	Comparison of technique survival between dialysis modalities	Name of trial NR 2008 to 2011 PD mean follow-up 11.1 (SD ± 7.1) months; HD mean 10.9 (SD ± 7.4) months	Gov't funding Authors declare no conflicts of interest	PD, ICHD N = 1,042 Incident patients	Inclusion: incident patients undergoing dialysis therapy (including using dialysis for ≥ 90 days) Exclusion: concurrent HD and PD therapy; loss to follow-up	Primary: technique failure (change in dialysis modality that persisted for 60 days) Secondary: NR	Survival analysis using the Kaplan–Meier method, log-rank tests; multivariable Cox proportional hazards regression analysis Covariates: dialysis modality, sex, age, BMI, hemoglobin, albumin, RRF, SGA, chronic lung disease, cerebrovascular disease, diabetes, CHF, and tumour
Lin et al.,[62] 2015 Taiwan Retrospective cohort	Investigation of dementia risk in patients undergoing HD and PD	Taiwan Longitudinal Health Insurance Database (NHIRD) 1998 to 2007 Follow-up until Dec. 31, 2008	Funded by hospital grants Authors declare no competing financial interests	PD, ICHD N = 55,624 Incident patients	Inclusion: adult patients age > 40 yrs diagnosed with ESRD and who received HD and PD for more than 90 days between 1998 and Dec. 2007 Exclusion: previous renal transplant, diagnosed with dementia before dialysis	Primary: dementia Secondary: NR	Survival analysis using proportional hazards regression (cumulative incidence and competing risk methods) Covariates: each of the baseline characteristics, comorbidities, and medication use for propensity score; age and sex

Author, Year Country Study Design	Stated Study Objective	Name of Trial/ Registry Years of Recruitment Length of Follow-up	Funding Source Author Conflicts	Dialysis Modalities Total no. of Patients (N) Incident or Prevalent Patients	Inclusion/ Exclusion Criteria	Primary / Secondary Outcomes of Interest	Analytic Model Model Covariates
Lin et al.,[63] 2015 Taiwan Retrospective cohort	Comparison of different dialysis modalities on the incidence of peripheral artery occlusive disease (PAOD)	Taiwan National Health Insurance Research Database (NHIRD) 2000 to 2010 Follow-up to end of 2011; mean follow-up PD 2.92 yrs; HD 3.64 yrs	Funded by hospital, gov't, and foundation grants and funds Authors declare no conflicts of interest	PD, ICHD N = 26,927 Incident and prevalent patients	Inclusion: ESRD patients, age ≥ 20 yrs who underwent dialysis (HD or PD) for 3 months or longer Exclusion: patients who died within 90 days after first dialysis session, underwent transplantation, had a history of PAOD before the index date, or had incomplete information	Primary: peripheral artery occlusive disease Secondary: NR	Survival analysis using Kaplan–Meier method and Cox proportional hazards model Covariates: year of dialysis initiation, age, sex, and comorbidities of CAD, diabetes, stroke, hyperlipidemia, atrial fibrillation, hypertension, CHF
Lockridge et al.,[54] 2012 US Prospective cohort	Comparison of patient and technique survival in patients on daily HHD (long nocturnal and short daily)	Name of trial NR 1996 to 2009 Follow-up to 12 yrs	Funding source NR Author conflicts NR	Nocturnal HHD, short-daily HHD N = 191 Patient type NR	Inclusion: Patients with ESRD who had been on daily HHD for at least 3 months Exclusion: transplantation, abandonment of home training, death	Primary: mortality Secondary: technique failure	Cox proportional hazards model. Univariate Cox for 9 patient and 6 dialysis factors; backwards, stepwise Cox for independent predictors of patient survival Covariates: long night, education < high school, gender, age, race (black), comorbidity (yes), diagnosis, secondary renal disease, years on ESRD, start daily HHD before 2003 "Early era," fistula/graft, dialysis/wk, dialysis duration, weekly hours, Kt/V, stdKt/V. Final for survival: weekly standard Kt/V, high school graduation, use of graft/fistula. Final for technique survival: weekly standard Kt/V, start of daily HHD post 2003

Author, Year Country Study Design	Stated Study Objective	Name of Trial/ Registry Years of Recruitment Length of Follow-up	Funding Source Author Conflicts	Dialysis Modalities Total no. of Patients (N) Incident or Prevalent Patients	Inclusion/ Exclusion Criteria	Primary / Secondary Outcomes of Interest	Analytic Model Model Covariates
Manns et al.,[55] 2003 Canada Prospective cohort	Comparison of HRQoL in patients receiving HD or PD	Name of trial NR 1999 to 1999 12 months follow-up	Gov't funding Various authors work for university or the Institute of Health Economics (Alberta)	PD (CAPD and cyclic PD), HD (ICHD, satellite, home or self-care; 71.5% ICHD) N = 192 Prevalent patients (> 6 months)	Inclusion: patients on HD or PD for > 6 months Exclusion: dementia, inability to speak English, unwilling or unable to complete HRQoL questionnaires	Primary: HRQoL Secondary: NR	Multiple linear regression Covariates: NR
Marshall et al.,[19] 2011 Australia and New Zealand Retrospective cohort	Comparison of survival in patients using conventional HHD and frequent/ extended HHD	Australia and New Zealand Dialysis and Transplant Registry (ANSDATA) 1996 to 2007 Follow-up to Dec. 31 2007	Funded by Maruria and Phyllis Paykel Trust Several authors have affiliations with industry	Frequent/ extended HHD (including nocturnal and short-daily), conventional HHD N = 3,190 (for frequent/ extended HHD and conventional HHD comparators) Incident patients	Inclusion: all patients aged ≥ 18 yrs at dialysis inception, started RRT in Australia and NZ since Mar. 31, 1996 Exclusion: NR	Primary: mortality Secondary: NR	Marginal structural modelling to adjust for time-varying medical comorbidity. Censored at time of kidney transplant Covariates: age, sex, ethnicity, primary kidney disease, estimated GFR at dialysis inception, late referral for nephrology pre-dialysis care (< 3 months before dialysis inception), diabetes mellitus (none, type 1, and type 2), BMI, comorbid conditions (CAD, PVD, cerebrovascular disease, and chronic lung disease), smoking, country/state at dialysis inception. Year of treatment was included in all models to account for any secular variation. Adjusted for angioaccess and hemodialyzer flux in a supplementary analysis restricted to HD patients without PD exposure

Author, Year Country Study Design	Stated Study Objective	Name of Trial/ Registry Years of Recruitment Length of Follow-up	Funding Source Author Conflicts	Dialysis Modalities Total no. of Patients (N) Incident or Prevalent Patients	Inclusion/ Exclusion Criteria	Primary / Secondary Outcomes of Interest	Analytic Model Model Covariates
Marshall et al.,[64] 2016 Australia and New Zealand Retrospective cohort	To determine if intensive HD reduces mortality risk compared with conventional facility HD	Australia and New Zealand Dialysis and Transplant Registry (ANZDATA) 1996 to 2012 Follow-up to Dec. 31, 2012	Foundation and trust funding Authors have affiliations with industry	Conventional ICHD; conventional HHD; quasi-intensive HHD; intensive HHD; PD N = 40,850 Incident patients	Inclusion: patients with ESRD initiating dialysis therapy, ≥ 18 yrs Exclusion: patients with missing data	Primary: all-cause mortality/survival Secondary: NR	Survival analysis using marginal structural model (exposure-outcome model for survival) Covariates: age, sex, ethnicity, primary kidney disease, estimated GFR at dialysis therapy initiation, late referral for nephrology pre-dialysis care (3 months before dialysis therapy initiation), diabetes mellitus (none, type 1, and type 2), BMI, medical comorbid conditions (CAD, PVD, cerebrovascular disease, and chronic lung disease), current smoking, country/state at dialysis therapy initiation
Moldovan et al.,[56] 2016 Romania Prospective cohort	Analyze the relationship between mineral and bone disorders and their components impact on all-cause mortality and CV mortality and morbidity	Name of trial NR Years of recruitment NR 40 months follow-up	Funding source NR Author conflicts of interest NR	ICHD, PD (CAPD) N = 92 Prevalent patients	Inclusion: dialysis duration ≥ 6 months, age > 18 yrs Exclusion: neoplasm, severe infections or other terminal diseases, parathyroidectomy, previous renal transplant or previous bone disease	Primary: all-cause mortality/survival Secondary: CV adverse events	Cox proportional hazard model. Survival analysis performed with log-rank test, survival curves represented with Kaplan–Meier curve Covariates: age, gender, HD vintage, presence of diabetes mellitus, VC score, presence of ROD, Ca in dialysis solution, oral Ca salts, vitamin D treatment, various lab serum levels, spKt/V baseline renal disease, initial CdV disease

Author, Year Country Study Design	Stated Study Objective	Name of Trial/ Registry Years of Recruitment Length of Follow-up	Funding Source Author Conflicts	Dialysis Modalities Total no. of Patients (N) Incident or Prevalent Patients	Inclusion/ Exclusion Criteria	Primary / Secondary Outcomes of Interest	Analytic Model Model Covariates
Nadeau-Fredette et al.,[65] 2015 Australia and New Zealand Retrospective cohort	Evaluation of patient and technique survival treated with an integrated home dialysis model compared with those treated with PD or HHD	Australia and New Zealand Dialysis and Transplant Registry (ANZDATA) 2000 to 2012 Length of follow-up NR	Funded by Baxter Healthcare Clinical Evidence Council (CEC) research grant Authors report support and grants from industry including Baxter	HHD following 90 days of PD; HHD; PD N = 11,395 Incident patients after 90 days of RRT	Inclusion: patients treated with PD or HHD on Day 90 after renal replacement therapy initiation between Jan. 1, 2000 and Dec. 31, 2012 Exclusion: age < 18 yrs, and < 90 days of RRT	Primary: composite of patient and home dialysis technique survival Secondary: patient survival on home dialysis treatment	Multinomial logistic regression including all covariates with final multivariable multinomial logistic regression model for propensity-score matching Covariates: age, race, diabetes mellitus, BMI and primary kidney disease
Nadeau-Fredette et al.,[66] 2015 Australia and New Zealand Retrospective cohort	Comparison of survival of patients on incident HHD and incident PD	Australia and New Zealand Dialysis and Transplant Registry (ANZDATA) 2000 to 2012 Length of follow-up NR	Funded by Baxter Healthcare Clinical Evidence Council (CEC) research grant Authors report support and grants from industry including Baxter	HHD, PD N = 11,416 Incident patients after 90 days of RRT	Inclusion: patients treated with PD or HHD on day 90 after renal replacement therapy initiation between Jan. 1 2000 and Dec. 31, 2012 Exclusion: age < 18 yrs, and < 90 days of RRT	Primary: overall survival (patients followed until death, regardless of whether dialysis modality changed) Secondary: on-treatment survival (death occurring during the initial dialysis modality and up to 90 days after a switch), patient and technique survival (followed until first occurrence of technique failure or death; technique failure being ≥ 90 days of facility dialysis or the other home modality to allow use of temporary HD — any event occurring < 90 days after a switch from the initial home modality considered to have occurred during the initial modality), death-censored technique survival (only technique failure considered a failure event data censored at time of death)	Multivariable Cox proportional hazards regression model (main model). Results were validated using (1) propensity score Cox model with PS quintiles stratification, and (2) PS-matching Cox model Covariates: age, sex, race, diabetes, primary kidney disease, IHD, PVD, late referral

Author, Year Country Study Design	Stated Study Objective	Name of Trial/ Registry Years of Recruitment Length of Follow-up	Funding Source Author Conflicts	Dialysis Modalities Total no. of Patients (N) Incident or Prevalent Patients	Inclusion/ Exclusion Criteria	Primary / Secondary Outcomes of Interest	Analytic Model Model Covariates
Nesrallah et al.,[67] 2016 Canada (utilizing US data) Retrospective cohort	To compare survival between daily HHD and PD	United States Renal Data System (USRDS) Recruitment: 2004 to 2011 Follow-up for a maximum of 5 yrs after cohort entry, or to Dec. 31, 2012 (last date of available records) HHD group: mean follow-up 1.9 (SD ± 1.3) yrs PD group: mean follow-up 2.0 ± 1.4 yrs Matched group (n = 5,336): 1.9 ± 1.4 yrs	Funded by Baxter HealthcareExtramural Grant Program Authors declare no competing interests	Daily HHD, PD N = 5,336 Incident patients	Inclusion: all consecutive adult patients (age ≥ 18 yrs) who initiated daily home HD through the large dialysis provider's home dialysis facilities between Jan. 2004 and Oct. 2011 Exclusion: patients in long-term care facilities	Primary: all-cause mortality Secondary: NR	Logistic regression to calculate the probability of all included patients receiving daily HHD, conditional on variables that are known to be associated with either dialysis modality choice or survival on dialysis, or both; used a "greedy" matching algorithm to match daily HD and PD patients by propensity score in a 1:1 ratio Covariates: duration of ESRD before the index date, yr of initiation of RRT, age, weight, diabetes, CHF, vascular access type
Oliver et al.,[68] 2016 Canada Retrospective cohort	Comparison of rate of hospital days between assisted PD and ICHD	Dialysis Measure-ment, Analysis, and Reporting (DMAR) system 2004 to 2013 Minimum 6 months follow-up	Funded by gov't, Change Foundation of Ontario, Physician Services Incorp-orated Foundation 2 authors have an indirect affiliation with Baxter Healthcare	PD, ICHD N = 1,075 Incident patients	Inclusion: Incident ESRD patients on chronic dialysis Exclusion: inability to be assessed for PD, not eligible for PD and HD	Primary: hospital days/person-yr of follow-up Secondary: hospital admissions/person-yr and cause-specific rates of hospitalization, reasons for stopping dialysis (death or transplantation), and rate of home care nursing visits	Multivariable logistic regression Covariates: demographics, pre-dialysis care, comorbidities, pre-dialysis laboratory values, PD program, and year of PD start

Author, Year Country Study Design	Stated Study Objective	Name of Trial/ Registry Years of Recruitment Length of Follow-up	Funding Source Author Conflicts	Dialysis Modalities Total no. of Patients (N) Incident or Prevalent Patients	Inclusion/ Exclusion Criteria	Primary / Secondary Outcomes of Interest	Analytic Model Model Covariates
Rocco et al.,[44] 2015 Rocco et al.,[45] 2011 Unruh et al.,[46] 2013 Unruh et al.,[47] 2016 Canada and US RCT with prospective cohort extension study	Comparison of frequent nocturnal HHD six times per week with conventional three times per week HD	Frequent Hemodialysis Network (FHN) Nocturnal Trial 2006 to 2009 Follow-up to May 2010, with extension to Jul. 2011	Funded by National Institute of Health, National Institutes Diabetes, Digestive and Kidney Diseases (NIDDK), Center for Medicare and Medical Services (CMS) Several authors have affiliations with industry	Conventional HHD (3 times/wk; < 5 hr/session), nocturnal HHD (six times/wk; ≥ 6 hr/session) N = 87 (extension study N = 83 at one year and N = 70 at 2 years) Prevalent patients	Inclusion: Patients age ≥ 18 yrs with ESRD, who achieved mean eKt/V of ≥ 1.0 for last 2 baseline HD sessions Exclusion: current requirement for HD more than 3 times/wk; GFR > 10 mL/1.73m^2, < 3 months since kidney transplant failure, life expectancy < 6 months	Primary: all-cause mortality/survival Secondary: hospitalization, self-reported depression, transplant, adverse events, technical adverse events	Log-rank test, Cox proportional hazards regression Covariates: diabetes, age and baseline GFR (for time to death, first non-access hospitalization/death, and first access intervention)
Shen et al.,[69] 2016 Taiwan Retrospective cohort	Evaluation of the incidence and risk factors related to atrial fibrillation among Taiwanese HD and PD patients	Longitudinal Health Insurance Database (LHID) 2002 to 2003 (active treatment) 2002 to 2011 (controls) Follow-up until Dec. 31, 2011 mean 8 to 10 yrs.	Gov't and hospital funding Authors report no conflicts of interest	PD, ICHD N = 15,947 Type of patient NR	Inclusion: ESRD patients on dialysis Exclusion: patients < 18 yrs or those > 85 yrs, history of malignancy (ICD-9-CM 140–208) before the index date, patients with incomplete information on age and gender, and patients who did not receive a dialysis modality	Primary: atrial fibrillation Secondary: NR	Survival analysis using Kaplan–Meier method and log-rank test; Cox proportional hazards model Covariates: age, gender, geographic area, and comorbidities, including hypertension, diabetes mellitus, hyperlipidemia, CAD, hyperthyroidism, heart failure, valvular heart disease, LVH, venous thromboembolic disease, or COPD

Author, Year Country Study Design	Stated Study Objective	Name of Trial/ Registry Years of Recruitment Length of Follow-up	Funding Source Author Conflicts	Dialysis Modalities Total no. of Patients (N) Incident or Prevalent Patients	Inclusion/ Exclusion Criteria	Primary / Secondary Outcomes of Interest	Analytic Model Model Covariates
Suri et al.,[70] 2015 Canada (utilizing US data) Retrospective cohort	Comparison of dialysis-related hospitalization risk associated with daily HHD and PD; and daily HHD compared with ICHD	United States Renal Data System (USRDS) 2004 to 2009 Followed up to maximum 7.9 yrs HHD vs. PD mean 1.6 yrs HHD vs. ICHD mean 1.9 yrs	Funded by Baxter Extramural Grant Program Authors declare no competing interests	Daily HHD, PD, ICHD (conventional) N = 7,073 Prevalent patients (80% of patients > 1 year on dialysis)	Inclusion: All consecutive adult patients (age ≥ 18 yrs) who initiated daily HHD through the large dialysis provider's HHD facilities between Jan. 2004 and Dec. 2009 Exclusion: patients in long-term care facilities or assisted living situations; BMI > 50 or < 16; albumin < 1.0 g/dL; hemoglobin < 5 g/dL; > 2 prior transplants	Primary: hospitalization Secondary: modality failure (switch to ICHD)	Survival analysis using the Andersen-Gill model Covariates: duration of ESRD before the index date, yr of initiation of RRT, age
Wang et al.,[71] 2015 Taiwan Retrospective cohort	Comparison of risk of subdural hematoma and subsequent mortality in HD and PD patients with ESRD	National Health Insurance Administration Research Database 1998 to 2010 Follow-up until Dec. 31, 2011	Gov't and foundation funding Author conflicts of interest NR	PD, ICHD N = 20,272 (matched cohort) Incident patients	Inclusion: patients newly diagnosed with ESRD between 1998 and 2010 and undergoing dialysis for ≥ 3 months Exclusion: history of subdural hematoma before the index date; age < 20 yrs; patients with incomplete age or sex information, and patients who died before day 90	Primary: subdural hematoma and mortality due to subdural hematoma Secondary: NR	Cox proportional hazards regression analysis was used to estimate hazard ratios and 95% CIs of developing SDH in both cohorts Covariates: age, sex, comorbidity (CAD, CHF, stroke, hyperlipidemia, atrial fibrillation, hypertension, diabetes, dementia), selected medications (warfarin, clopidogrel, aspirin)
Wang et al.,[72] 2016 Taiwan Retrospective cohort	Evaluation of the risks of sudden sensorineural hearing loss (SSHL) and ESRD	National Health Insurance Research Database (NHIRD) 2000 to 2010 Follow-up to Dec. 31 2011	Funded by grants from the hospitals, gov't, and foundation Authors declare no conflict of financial interest	PD, ICHD N = 12,750 Incident patients	Inclusion: adult patients (age > 20 yrs) newly diagnosed with ESRD undergoing dialysis for ≥ 3 months Exclusion: patients with Alport's syndrome or hearing loss, or previous renal transplant	Primary: sudden hearing loss Secondary: NR (mortality and modality switching reported)	Cox proportional hazards regression Covariates: age, sex, year of dialysis initiation, all comorbidity, and competing risk of death

Author, Year Country Study Design	Stated Study Objective	Name of Trial/ Registry Years of Recruitment Length of Follow-up	Funding Source Author Conflicts	Dialysis Modalities Total no. of Patients (N) Incident or Prevalent Patients	Inclusion/ Exclusion Criteria	Primary / Secondary Outcomes of Interest	Analytic Model Model Covariates
Wang et al.,[73] 2016 Taiwan Retrospective cohort	Evaluation of the incidence and risk of hydrocephalus in ESRD patients	National Health Insurance Research Database (NHIRD) 2000 to 2010 Follow-up until Dec. 31, 2011	Funded by gov't and hospitals Authors declare no conflicts of interest	PD, ICHD N = 29,684 (matched cohort) Incident patients	Inclusion: patients newly diagnosed with ESRD between 2000 and 2010 and undergoing dialysis for ≥ 3 months Exclusion: patients who died before day 90, history of hydrocephalus, transplantation before index date, age < 20 yrs, or incomplete age or sex information	Primary: hydrocephalus Secondary: NR	Cox proportional hazards regression Covariates: age, sex, comorbidity (CAD, CHF, stroke, hyperlipidemia, atrial fibrillation, hypertension, diabetes, dementia), selected medications (warfarin, clopidogrel, aspirin)
Wang et al.,[74] 2016 Taiwan Retrospective cohort	Comparison of the differences in the pulmonary embolism risk between different dialysis modalities and to evaluate the 30-day fatality of pulmonary embolism	National Health Insurance Research Database (NHIRD) 1998 to 2010 Follow-up until end of 2011; PD mean 4.19 (SD ± 2.98) yrs; HD mean 4.23 (SD ± 3.26) yrs	Funded by gov't and hospitals Authors declare no conflicts of interest	PD, ICHD N = 14,680 Incident patients	Inclusion: newly diagnosed ESRD undergoing dialysis for at least 90 days Exclusion: patients with medical history of PE or renal transplant before index date; age < 20 yrs	Primary: pulmonary embolism Secondary: survival/all-cause mortality (30-day post PE)	Cox proportional hazards models Covariates: age, gender, comorbidities, warfarin use year of dialysis initiation

Author, Year Country Study Design	Stated Study Objective	Name of Trial/ Registry Years of Recruitment Length of Follow-up	Funding Source Author Conflicts	Dialysis Modalities Total no. of Patients (N) Incident or Prevalent Patients	Inclusion/ Exclusion Criteria	Primary / Secondary Outcomes of Interest	Analytic Model Model Covariates
Weinhandl et al.,[75] 2016 US Retrospective cohort	Comparison of risks for all-cause mortality, all-cause admissions, and technique failure in daily HHD and matched PD patients	NxStage Medical registry and USRDS Years of recruitment unclear, but patients started dialysis Oct. 2006 to Dec. 2010 Mean follow-up for HHD 1.79 yrs; PD 1.65 yrs	Funded by NxStage Medical Inc. 2 authors have been associated with industry	HHD, PD N = 8,402 Incident patients	Inclusion: patients in registry of NxStage System One who were also linked to the USRDS database, prescribed 5 or 6 dialysis sessions/wk, carried Medicare during 3 months preceding daily HHD or who initiated daily HHD within 6 months of ESRD onset (Jan. 1, 2007 to Dec. 31, 2010); matched to PD patients in USRDS database (Oct. 1, 2006 to Sept. 30, 2010) Exclusion: NR	Primary: mortality, hospitalization, and technique failure Secondary: NR	Logistic regression model using a greedy matching algorithm; propensity-score matching of incident HHD with incident PD patients Covariates: age, race, sex, primary cause of ESRD, ESRD duration, Medicare enrolment, comorbid conditions, BMI, transplant waitlist, lab results, affiliation of dialysis provider, epoetin alfa exposure, darbepoetin alfa exposure, IV iron exposure, and IV vitamin D sterol exposure
Wolfgram et al.,[76] 2015 US Retrospective cohort	Testing the hypothesis that the incidence of dementia would be higher in incident ESRD patients treated with HD than those treated with PD	United States Renal Data System (USRDS) 2006 to 2008 Follow-up until Dec. 31, 2009, mean 1.5 yrs, max 3.75 yrs	Gov't funding Authors declare no financial conflicts of interest	PD, ICHD N = 121,623 (matched cohort 23,551) Incident patients	Inclusion: patients initiating dialysis (≥ 90 days) during the target period with at least 2 yr of Medicare eligibility, who did not have pre-existing dementia or conditions that might progress to dementia (TBI, ICH, brain tumour) Exclusion: patients with code for dementia in 90 days post dialysis, to exclude those only diagnosed because of increased attention around dialysis initiation	Primary: incident dementia Secondary: NR	Cox proportional hazards model with 3 sets of covariates. Stratified Cox model by decile of propensity score and marginal Cox model on propensity-matched data Covariates: age, gender, race, and primary cause of renal failure, CHF, atherosclerotic heart disease, other cardiac disease, cerebrovascular disease, VA, TIA, PVD, hypertension, amputation, diabetes , COPD, tobacco use, malignant neoplasm, cancer, toxic nephropathy, alcohol dependence, drug dependence, inability to ambulate or transfer, needs assistance with daily activities, institutionalized, assisted living, nursing home, other Institution, non-renal congenital abnormality

Author, Year Country Study Design	Stated Study Objective	Name of Trial/ Registry Years of Recruitment Length of Follow-up	Funding Source Author Conflicts	Dialysis Modalities Total no. of Patients (N) Incident or Prevalent Patients	Inclusion/ Exclusion Criteria	Primary / Secondary Outcomes of Interest	Analytic Model Model Covariates
Wu et al.,[57] 2004 US Prospective cohort	Comparison of self-reported HRQoL and overall health status for HD and PD patients at the initiation of dialysis therapy and after 1 yr	Choices for Healthy Outcomes in Caring for ESRD (CHOICE) 1995 to 1998 12 month follow-up	Funded by gov't agencies 1 author is supported by 1 of the gov't agencies	PD, ICHD N = 928 (585 completed 12-month questionnaire) Incident patients	Inclusion: age ≥ 18 yrs, initiating dialysis Exclusion: HHD patients	Primary: HRQoL Secondary: NR	Intention-to-treat; difference in modalities compared using t-tests (unadjusted) or Wald test (adjusted) Covariates: age, gender, race, education, albumin, creatinine, hematocrit, and Index of Co-existent Disease (ICED) score
Yang et al.,[77] 2015 Singapore Retrospective cohort	Comparison of the survival outcomes of patients with ESRD who started dialysis with HD and PD	National University Hospital (NUH) Registry 2005 to 2010 Length of follow-up: max 5 yrs (median 3.2 yrs), censored until Aug. 31, 2013	Funding source NR Authors report no support or funding	PD, ICHD N = 871 Incident patients	Inclusion: adult patients (age ≥ 18 yrs) newly diagnosed with ESRD who began either HD or PD and survived the first 90 days of dialysis Exclusion: NR	Primary: all-cause mortality/survival Secondary: NR	Propensity-score marched logistic regression; survival analysis using the flexible Royston-Parmar parametric model (RP model) Covariates: Unclear
Yang et al.,[78] 2015 Taiwan Retrospective cohort	Explore the effects of dialysis modality on outcomes in patients with PCKD	National Health Insurance Database (NHIRD) 1999 to 2010 Follow-up to Dec. 31, 2010	Public funding Authors report no financial conflicts	HD (not specified);PD (received PD 2 to 4 months after initiation of dialysis) N = 1,417 (propensity-score matched N = 366) Type of patient NR (all patients on dialysis > 3 months)	Inclusion: random sample from database of adults with PCKD (age ≥ 20 yrs) who initiated maintenance dialysis for > 3 months during 1999 to 2010 Exclusion: patients missing data for sex or birth date; age < 20 yrs on dialysis start date	Primary: mortality Secondary: hospitalization for any cause, subarachnoid hemorrhage, abdominal herniation, length of stay, ICU stay, in-hospital mortality, infection-related hospitalization	Cox regression model; propensity-score matching; analyzed as ITT (regardless of whether modality was switched) and censored at modality switch Covariates: age, sex, socioeconomic status, diabetes, heart failure, CAD, COPD, CVD, cancer, hypertension, arrhythmia, vascular heart disease, PVD, liver disease, gout, hyperlipidemia

AMI = acute myocardial infarction; BDI = Beck Depression Inventory; BMI = body mass index; CABG = coronary artery bypass graft; CAD = coronary artery disease; CHF = congestive heart failure; COPD = chronic obstructive pulmonary disease; CV = cardiovascular; CVD = cardiovascular disease; eKt/V = dialysis adequacy measurement; GFR = glomerular filtration rate; GI = gastrointestinal; gov't = government; HD = hemodialysis; HHD = home hemodialysis; HRQoL = health-related quality of life; ICHD = in-centre HD; ICU = intensive care unit; IHD = ischemic heart disease; MACCE = major adverse cardiac and cerebrovascular events; max = maximum; N = number; PAOD = peripheral artery occlusive disease; NR = not reported; PCI = percutaneous coronary intervention; PCKD = polycystic kidney disease; PD = peritoneal dialysis; PE = pulmonary embolism; PS = propensity score; PVD = peripheral vascular disease; QoL = quality of life; RCT = randomized controlled trial; REIN = Réseau épidémiologique et information en néphrologie ; ROD = renal osteodystrophy; RRT = renal replacement therapy; SGA = subjective global assessment; TIA = transient ischemic attack; TVR = target vessel revascularization; VC = vascular or other soft tissue calcification; yrs = years.

Patient characteristics of included primary studies

Author, Year	Study Arms (Setting)	Number of Patients	Age, Mean (± SD)	Male, no. (%)	Frequency and No. of Hours of Dialysis	Vascular Access	Comorbidities, No. (%)	Duration of Dialysis at Start of Study Residual Renal Function (RRF)
Culleton et al.,[42] 2007 Manns et al.,[43] 2009	Frequent nocturnal HHD	26	55.1 (12.4)	18 (69%)	5 to 6 sessions/wk; minimum 6 h/night	AF fistula: 15 (58%); tunnelled dialysis catheter: 7 (27%); AV graft: 4 (15%)	Cerebrovascular disease 5 (19%); IHD 10 (38%); CHF 6 (23%); PVD 4 (15%); diabetes 10 (38%)	Duration at start of study: mean 5.5 yr RRF NR
	Conventional HD	25	53.1 (13.4)	14 (56%)	3 sessions/wk	AV fistula: 14 (56%); tunnelled dialysis catheter: 6 (24%); AV graft: 5 (20%)	Cerebrovascular disease 3 (12%); IHD 10 (40%); CHF 5 (20%); PVD 4 (16%); diabetes 11 (44%)	Duration at start of study: mean 4.8 yr RRF NR
de Abreu et al.,[48] 2011	PD	161	59.6 (13.8)	48.4%	NR	NR	CHD 83 (51.6%); cardiac arrhythmias 28 (17.4%); hypertension 147 (91.9%); CHF 28 (17.4%); PVD 18 (11.2%); stroke 19 (11.8%); cancer 5 (3.1%); diabetes 110 (68.3%)	Duration at start of study: mean 3.28 (SD ± 1.78) yr RRF NR
	ICHD	189	55.6 (14.8)	50.3%	NR	NR	CHD 106 (56.1%); cardiac arrhythmias 21 (11.6%); hypertension 159 (84.4%); CHF 28 (15.3%); PVD 20 (10.6%); stroke 14 (7.4%); cancer 5 (2.7%); diabetes 109 (57.7%)	Duration at start of study: mean 3.95 (SD ± 2.18) yr RRF NR
Frimat et al.,[49] 2006	PD	184	70.8 (11.4)	58 (56.3%)	NR	NR	CHD 45 (43.7%); CHF 33 (32.0%); cerebrovascular disease 23 (22.3%); PVD 31 (30.1%); diabetes 38 (36.9%)	Duration NR (incident pts) RRF NR
	ICHD	284	67.6 (11.3)	170 (59.9%)	At 6 months: 13.6/wk ± 3.1 hr At 12 months: 13.9/wk ± 3.8 hours	NR	CHD 101 (35.6%); CHF 106 (37.3%); cerebrovascular disease 45 (15.9%); PVD 110 (38.7%); diabetes 111 (39.1%)	Duration NR (incident pts) RRF NR
Habib et al.,[58] 2016	PD	448	67.9 (17.4)	272 (60.7%)	NR	NR	CVD 211 (50.2%); CHF 103 (24.6%); hypertension 335 (80.1%); cancer 18 (4.3%); diabetes mellitus 137 (32.2%)	Duration NR (incident patients) RRF NR
	ICHD	6,724	69.9 (4.5)	4,334	NR	NR	CVD 3,385 (54.8%); CHF 1,348 (22.1%); hypertension 4,772	Duration NR (incident patients)

Author, Year	Study Arms (Setting)	Number of Patients	Age, Mean (± SD)	Male, no. (%)	Frequency and No. of Hours of Dialysis	Vascular Access	Comorbidities, No. (%)	Duration of Dialysis at Start of Study Residual Renal Function (RRF)
				(64.5%)			(78%); cancer 602 (9.8%); diabetes mellitus 2,395 (38.4%)	RRF NR
Harris et al.,[50] 2002	PD	78 (36 incident)	76.8 (4.0) range 70-91	55 (70%)	NR (majority of pts received CAPD)	NR	Reported as conditions (presence of diabetes, IHD, PVD, cerebrovascular disease, COPD, or cancer) None: 19 (24%); 1 condition: 29 (37%); 2 or more conditions: 30 (39%)	Duration NR RRF NR
	ICHD	96 (42 incident)	77.0 (4.4) range 70-93	60 (62%)	NR	NR	None: 20 (21%); 1 condition: 32 (33%); 2 or more conditions: 44 (46%)	Duration NR RRF NR
Jeloka et al.,[51] 2016	PD	19	70.1 (3)	84%	3 times/day	swan neck double cuff Tenckhoff catheter: 100%	NR	Duration NR (incident patients) RRF NR
	ICHD	23	73.2 (7)	65%	3 sessions/wk	AV fistula: 87%; Permcath: 13%	NR	Duration NR (incident patients) RRF NR
Kasza et al.,[59] 2016	HHD	357	50.1 (11.2)	276 (77.3%)	NR	AV fistula /AV graft	CAD 64 (17.9%); cerebrovascular disease 13 (3.6%); PVD 36 (10.1%); lung disease 25 (7.0%); type 1 diabetes 10 (2.8%); type 2 diabetes 75 (21.0%)	Duration NR (incident patients) RRF NR
	PD	6,665	60·2 (14.8)	3,853 (57.8%)	NR	NR	CAD 2,469 (37.0%); cerebrovascular disease 961 (14.4%); PVD 1,562 (23.4%); lung disease 1,040 (15.6%); type 1 diabetes 292 (4.4%); type 2 diabetes 2,673 (40.1%)	Duration NR (incident patients) RRF NR
	ICHD	5,729	62·3 (14.1)	3,701 (64.6%)	NR	AV fistula /AV graft	CAD 2,392 (41.8%); cerebrovascular disease 835 (14.6%); PVD 1,441 (25.2%); lung disease 919 (16.0%); type 1 diabetes 150 (2.6%); type 2 diabetes 2,514 (43.9%)	Duration NR (incident patients) RRF NR
Kim et al.,[60] 2015	PD	7,387	53.7 (13.7)	4,120 (55.8%)	NR	NR	PVD 382 (5.2%); COPD 1,141 (15.4%); CVA 616 (8.3%); CHF 1,150 (15.6%); MI 270 (3.7%); peptic ulcer disease 995 (13.5%); liver disease 744 (10.1%); cancer 304 (4.1%)	Duration ≥ 90 days RRF NR
	ICHD	22,892	57.2 (14.0)	13,533 (59.1%)	NR	NR	PVD 1,344 (5.9%); COPD 3,705 (16.2%); CVA 2,473 (10.8%); CHF 3,165 (13.8%); MI 594 (2.6%); peptic ulcer disease 3,401 (14.9%); liver disease 2,582 (11.3%); cancer 1,565 (6.8%)	Duration ≥ 90 days RRF NR

Author, Year	Study Arms (Setting)	Number of Patients	Age, Mean (± SD)	Male, no. (%)	Frequency and No. of Hours of Dialysis	Vascular Access	Comorbidities, No. (%)	Duration of Dialysis at Start of Study Residual Renal Function (RRF)
Kim et al.,[52] 2015	PD	95	70.3 (4.4)	63 (66%)	NR	NR	CVD 40 (42%); hypertension 20 (21%); CHF 24 (25%); diabetes 51 (54%)	Duration NR (incident patients) RRF NR
	ICHD	315	72.2 (5.4)	191 (61%)	NR	NR	CVD 127 (40%); hypertension 65 (21%); CHF 37 (12%); diabetes 170 (55%)	Duration NR (incident patients) RRF NR
Lee et al.,[61] 2015	PD	1,791	NR (> 40)	862 (48.1%)	NR	NR	CAD 351 (19.6%); CHF 104 (5.8%); hypertension 1,505 (84.0%); hyperlipidemia 555 (31.0%); depression 36 (2.0%); non-GI cancer 96 (5.4%); diabetes mellitus 618 (34.5%)	Duration ≥ 90 days RRF NR
	ICHD	8,955	NR (> 40)	4,673 (52.2%)	NR	NR	CAD 2,820 (31.5%); CHF 1,165 (13.0%); hypertension 7,770 (86.8%); hyperlipidemia 3,104 (34.7%); depression 214 (2.4%); non-GI cancer 693 (7.7%); diabetes mellitus 5,038 (56.3%)	Duration ≥ 90 days RRF NR
Lee et al.,[53] 2016	PD	311	53.8 (13.4)	186 (60.0)	NR	NR	Connective tissue disease 31 (10.1%); CHF 40 (13.1%); peptic ulcer disease 21 (6.9%); cerebrovascular disease 30 (9.8%); PVD 20 (6.6%); COPD 16 (5.3%); diabetes 159 (51.5%); tumour 8 (2.6%)	Duration NR RRF: eGFR (mL/min/1.73m^2): mean 4.29 (SD ± 3.78)
	ICHD	731	60.0 (14.1)	439 (60.0)	NR	NR	Connective tissue disease 69 (9%); CHF 101 (14.4%); peptic ulcer disease 55 (7.9%); cerebrovascular disease 88 (12.6%); PVD 69 (9.8%); COPD 85 (12.1%); diabetes 419 (59%); tumour 60 (8.6%)	Duration NR RRF: eGFR (mL/min/1.73m^2): mean 3.91 SD ± 3.80)
Lin et al.,[62] 2015	PD	3,292	NR (> 40)	1,466 (44.5%)	NR	NR	PAD 17 (0.5%); cerebrovascular disease 315 (9.6%); CHF 482 (14.6%); IHD 679 (20.6%); COPD 192 (5.8%); hypertension 2,121 (64.4%); hyperlipidemia 583 (17.7%); depression 9 (0.3%); diabetes mellitus 1,363 (41.4%)	Duration ≥ 90 days RRF NR
	ICHD	52,332	NR (> 40)	24,976 (47.7%)	NR	NR	PAD 611 (1.2%); cerebrovascular disease 7,289 (13.9%); CHF 9,421 (18.0%); IHD 10,745 (20.5%); COPD 4,949 (9.5%); hypertension 30,478 (58.2%); hyperlipidemia 6,993 (13.4%); depression 194 (0.4%); diabetes mellitus 24,963 (47.7%)	Duration ≥ 90 days RRF NR
Lin et al.,[63] 2015	PD	9,190	NR	4,223 (46.0%)	NR	NR	CAD 2,690 (29.3%); CHF 1,583 (17.2%); hypertension 8,217 (89.4%); hyperlipidemia 4,050 (44.1%); stroke 867 (9.43%); diabetes mellitus 3,149 (34.3%)	Duration ≥ 3 months RRF NR
	ICHD	9,190	NR	4,237 (46.1%)	NR	NR	CAD 2,721 (29.6%); CHF 1,613 (17.6%); hypertension 8,266 (90.0%); hyperlipidemia 3,986 (43.4%); stroke 878 (9.6%); diabetes mellitus 3,107 (33.8%)	Duration ≥ 3 months RRF NR

Author, Year	Study Arms (Setting)	Number of Patients	Age, Mean (± SD)	Male, no. (%)	Frequency and No. of Hours of Dialysis	Vascular Access	Comorbidities, No. (%)	Duration of Dialysis at Start of Study Residual Renal Function (RRF)
Lockridge et al.,[54] 2012	Nocturnal HHD	81	57 (15)	49 (60%)	5.7 sessions /wk (SD ± 0.5); 6.9 h/session (SD ± 0.73) (range 5–8)	fistula 28%; graft 5%; catheter 68%	Diabetes 22%	Duration at start of study 4.4 yr (SD ± 4.9) RRF NR
	Short-daily HHD	110	53 (14)	70 (64%)	5.5 sessions /wk (SD ± 0.5); 2.7 h/session (SD ± 0.67) (range 1.5–4.5)	fistula 58% graft 27% catheter 15%	Diabetes 23%	Duration at start of study 4.9 yr (SD ± 5.0) RRF NR
Manns et al.,[55] 2003	PD	41	56.1 (95% CI 48.8 to 63.4)	20 (48.7%)	NR	NR	Diabetes 15 (36.6%)	Duration at start of study: median 23 months (IQR 10 to 42) RRF NR
	ICHD	151	62.2 (95% CI 59.2 to 65.3)	87 (57.6%)	3 sessions/wk for ≥ 4 h	NR	Diabetes 36 (23.8%)	Duration at start of study: median 22 months (IQR 9 to 44) RRF NR
Marshall et al.,[19] 2011	Frequent/ extended HHD	865	Median 50.5 (IQR 40.9 to 58.8)	676 (78.2%)	Any of 3 sessions/wk (≥ 4 h); 3 sessions/wk (≥ 6 h); 5 sessions/wk (≥ 3 NRh); > 5 sessions/wk (≥ 2 h)	NR	PVD 144 (16.6%); cerebrovascular disease 99 (11.4%); lung disease 68 (7.9%); CAD 242 (28%); type 1 diabetes 25 (2.9%); type 2 diabetes 190 (22%)	Duration NR RRF: eGFR median 4.83 (IQR 3.52 to 6.61)
	Conventional HHD	2,325	Median 50.8 (IQR 40.8 to 59.4)	1,649 (70.9%)	Any regime not fulfilling criteria for frequent /extended dialysis	NR	PVD 319 (13.7%); cerebrovascular disease 247 (10.6%); lung disease 150 (6.4%); CAD 545 (23.4%); type 1 diabetes 87 (3.7%); type 2 diabetes 484 (20.8%)	Duration NR RRF: eGFR median 4.85 (IQR 3.21 to 6.95)
Marshall et al.,[64] 2016	Conventional HHD	3,626	51.4 (18.3)	2,559 (71%)	≤ 3 sessions/ wk; ≤ 6 h /session	NR	PVD 563 (16%); cerebrovascular disease 272 (8%); lung disease 414 (11%); CAD 951 (26%); type 1 diabetes 123 (3%); type 2 diabetes 922 (25%)	Duration NR RRF: eGFR, median 5.2 (IQR 3.9)
	Quasi-intensive HHD	1,763	51.5 (18.1)	1.300 (74%)	Longer and/or more frequent than conventional, but < 5 sessions/wk	NR	PVD 281 (16%); cerebrovascular disease 120 (7%); lung disease 203 (12%); CAD 494 (28%); type 1 diabetes 54 (3%); type 2 diabetes 433 (25%)	Duration NR RRF: eGFR, median 5.4 (IQR 3.7)
	Intensive HHD	375	49.8 (15.7)	291 (78%)	≥ 5 sessions/wk; any h /session	NR	PVD 82 (22%); cerebrovascular disease 31 (8%); lung disease 56 (15%); CAD 116 (31%); type 1 diabetes 11 (3%); type 2 diabetes 120 (32%)	Duration NR RRF: eGFR, median 5.3 (IQR 3.5)
	PD	17,022	61.8 (21.1)	9,522 (56%)	NR	NR	PVD 4,542 (27%); cerebrovascular disease 2,658 (16%); lung	Duration NR

Author, Year	Study Arms (Setting)	Number of Patients	Age, Mean (± SD)	Male, no. (%)	Frequency and No. of Hours of Dialysis	Vascular Access	Comorbidities, No. (%)	Duration of Dialysis at Start of Study Residual Renal Function (RRF)
							disease 2,678 (16%); CAD 6,773 (40%); type 1 diabetes 818 (5%); type 2 diabetes 6,453 (38%)	RRF: eGFR, median 6.4 (IQR 4.7)
	Conventional ICHD	32,823	62.4 (22.1)	19,843 (60%)	≤ 3 sessions/ wk; ≤ 6 h/session	NR	PVD 8,984 (27%); cerebrovascular disease 5,256 (16%); lung disease 5,774 (18%); CAD 13,904 (42%); type 1 diabetes 1,094 (3%); type 2 diabetes 13,215 (40%)	Duration NR RRF: eGFR, median 6.1(IQR 4.5)
Moldovan et al.,[56] 2016	PD (CAPD)	11	56.82 (7.80)	8 (73%)	NR	NR	Diabetes 2	Duration at start of study mean 40.09 (SD ± 20.90) months RRF NR
	ICHD	81	56.68 (12.04)	46 (57%)	3 sessions/wk; 4 h/session	NR	CVD 38; diabetes 10	Duration at start of study mean 50.89 (SD ± 48.43) months RRF NR
Nadeau-Fredette et al.,[65] 2015; Data presented for propensity-matched cohort	HHD following 90 days PD	84	Median 47 (IQR 41 to 57)	67 (80%)	NR	NR	Pulmonary disease 10 (12%); coronary disease 8 (10%); PVD 5 (6%); cerebrovascular disease 4 (5%); diabetes 16 (20%)	Duration at start of study 90 days RRF: eGFR median 7.5 (IQR 6.1, 9.5)
	HHD	168	Median 47.5 (IQR 42 to 55)	116 (69%)	NR	NR	Pulmonary disease 14 (8%); coronary disease 33 (20%); PVD 16 (10%); cerebrovascular disease 6 (4%); diabetes 33 (20%)	Duration at start of study 90 days RRF: eGFR median 7.2 (IQR 5.8, 9.4)
	PD	168	Median 47 (IQR 37 to 60)	115 (68%)	NR	NR	Pulmonary disease 17 (10%); coronary disease 28 (17%); PVD 15 (9%); cerebrovascular disease 7 (4%); diabetes 32 (19%)	Duration at start of study 90 days RRF: eGFR median 7.0 (IQR 6.7, 9.7)
Nadeau-Fredette et al.,[66] 2015	HHD	706	Median 50 (IQR 42 to 58)	531 (75%)	NR	NR	Chronic lung disease 54 (8%); coronary disease 122 (17%); PVD 61 (9%); cerebrovascular disease 32 (5%); diabetes 159 (23%)	Duration at start of study 90 days RRF: eGFR median 7.5 (IQR 5.8, 9.4)
	PD (CAPD or automated)	10,710	Median 62 (IQR 50 to 71)	6,082 (57%)	NR	NR	Chronic lung disease 1,606 (15%); coronary disease 4,060 (38%); PVD 2,585 (24%); cerebrovascular disease 1,594 (15%); diabetes 4,648 (43%)	Duration at start of study 90 days RRF: eGFR median 7.5 (IQR 5.6, 9.9)
Nesrallah et al.,[67] 2016; Data presented for propensity-matched cohort	HHD	2,668	51.3 (14.3)	1,750 (65.6%)	Overall: 5–7 sessions/wk; 1.5–3.0 h/ session	fistula or graft: 550; catheter: 1,320; unknown: 798	COPD 4.3%; PVD 7.2%; cerebrovascular disease 4%; CHF 16.2%; hypertension 84%; cancer 6%; diabetes 28.8%	Duration NR (incident patients) RRF NR
	PD	2,668	51.4 (14.1)	1,750 (65.6%)	CAPD or automatic; 7 days/wk	fistula or graft: 550;	COPD 4.8%; PVD 9.1%; cerebrovascular disease 4.7%; CHF 16.2%; hypertension 85.6%; cancer 4.3%; diabetes 28.8%	Duration NR (incident patients) RRF NR

Author, Year	Study Arms (Setting)	Number of Patients	Age, Mean (± SD)	Male, no. (%)	Frequency and No. of Hours of Dialysis	Vascular Access	Comorbidities, No. (%)	Duration of Dialysis at Start of Study Residual Renal Function (RRF)
						catheter: 1,320; unknown: 798		
Oliver et al.,[68] 2016	PD	203	68.9 (13.2)	56%	NR	NR	CAD 34%; cerebrovascular disease 17%; CHF 23%; other cardiac disease 24%; PVD 13%; cancer 14%; diabetes mellitus 52%	Duration NR (incident patients) RRF: eGFR (mL/min/1.73m^2): mean 9.0 (SD ± 4.6)
	ICHD	198 (after weighting by propensity score)	68.8 (6.6)	59%	NR	NR	CAD 33%; cerebrovascular disease 18%; CHF 21%; other cardiac disease 23%; PVD 14%; cancer 15%; diabetes mellitus 50%	Duration NR (incident patients) RRF: eGFR (mL/min/1.73m^2): mean 8.8 (SD ± 2.3)
Rocco et al.,[44] 2015; Rocco et al.,[45] 2011 Unruh et al.,[46] 2013; Unruh et al.,[47] 2016	Nocturnal HHD	45	51.7 (14.4)	29 (64%)	Mean 5.06 (SD ± 0.80) sessions/wk; Session time mean 379 (SD ± 62) min; Total time mean 30.8 (SD ± 9.1) h/wk	fistula 49%; synthetic graft 7%; catheter 44%	PVD 8 (18%); chronic pulmonary disease 2 (4%); stroke/CVA 1 (2%); heart failure 5 (11%); MI 5 (11%); hypertension 41 (91%); diabetes 19 (42%)	Duration NR RRF (urea clearance in mL/min): Anuric = 29%; > 0–1 =16%; > 1–3 = 36%; > 3 +20%
	Conventional HHD	42	54.0 (12.9)	28 (67%)	Mean 2.91 (SD ± 0.21) sessions/wk; Session time mean 256 (SD ± 65) min; Total time mean 12.6 (SD ± 3.9) h/wk	fistula 41%; synthetic graft 10%; catheter 50%	PVD 7 (17%); chronic pulmonary disease 2 (5%); stroke/CVA 1 (2%); heart failure 7 (17%); MI 4 (10%); hypertension 39 (93%); diabetes 18 (43%)	Duration NR RRF (urea clearance in mL/min): Anuric = 26%; > 0–1 = 21%; > 1–3 = 33%; > 3 = 19%
Shen et al.,[69] 2016	PD	1,093	53.7 (15.0)	429 (39.2%)	NR	NR	COPD 117 (10.7%); IHD 217 (19.9%); heart failure 187 (17.1%); hypertension 722 (66.1%); hyperlipidemia 239 (21.9%); diabetes mellitus 359 (32.9%)	Duration NR RRF NR
	ICHD	14,854	61.3 (13.3)	7,201 (48.5%)	NR	NR	COPD 2,493 (16.8%); IHD 3,925 (26.4%); heart failure 4,884 (32%); hypertension 10,952 (73.7%); hyperlipidemia 3,896 (26.2%); diabetes mellitus 7,485 (50.4%)	Duration NR RRF NR

Author, Year	Study Arms (Setting)	Number of Patients	Age, Mean (± SD)	Male, no. (%)	Frequency and No. of Hours of Dialysis	Vascular Access	Comorbidities, No. (%)	Duration of Dialysis at Start of Study Residual Renal Function (RRF)
Suri et al.,[70] 2015 Patients were propensity matched	HHD (vs. PD)	1,116	50.5 (15.8)	751 (67.3%)	Mean treatment time 2.7 h (SD ± 0.6) during month 1; 2.9 h (SD ± 0.6) by 24 months	AV fistula 10.9% AV graft 2.1% catheter 33.8% unknown 53.2%	COPD 5.1%; PVD 7.8%; cerebrovascular disease 2.6%; CHF 16.5%; hypertension 82%; cancer 3.3%; IHD 6.3%; diabetes 24.1%	80% of patients > 1 year on dialysis RRF NR
	PD	2,784	50.9 (15.6)	1,862 (66.9%)	68% CAPD; 32% used a cycler	NA	COPD 5.4%; PVD 8.4%; cerebrovascular disease 2.1%; CHF 16.1%; hypertension 82.2%; cancer 2.5%; IHD 7.4%; diabetes 24.9%	80% of patients > 1 year on dialysis RRF NR
	HHD (vs. ICHD)	1,187	50.3 (15.9)	802 (67.6%)	Mean treatment time 2.7 h (SD ± 0.6) during month 1; 2.9 h (SD ± 0.6) by 24 months	AV fistula 10.6%; AV graft 2.0% catheter 34.9% unknown 52.5%	COPD 5.3%; PVD 8.3%; cerebrovascular disease 4.8%; CHF 18.1%; hypertension 82.1%; cancer 5.8%; IHD 5.5%; diabetes 22.9%	80% of patients > 1 year on dialysis RRF NR
	ICHD	3,173	50.8 (15.7)	2,145 (67.6%)	3 sessions/wk	AV fistula 9.4% AV graft 2.1% catheter 33.4% unknown 55.0%	COPD 5.3%; PVD 9.5%; cerebrovascular disease 5.5%; CHF 18.3%; hypertension 81.6%; cancer 3.6%; IHD 5.8%; diabetes 23.5%	80% of patients > 1 year on dialysis RRF NR
Wang et al.,[71] 2015	PD	10,136	53.3 (14.9)	4,628 (45.7%)	NR	NR	CAD 2,297 (22.7%); CHF 1,756 (17.3%); atrial fibrillation 216 (2.1%); hypertension 8,998 (88.8%); hyperlipidemia 4.388 (43.3%); stroke 921 (9.1%); dementia 121 (1.2%); diabetes 3,627 (35.8%)	Duration NR RRF NR
	ICHD	10,136	53.5 (14.6)	4,661 (46%)	NR	NR	CAD 2,368 (23.4%); CHF 1,793 (17.7%); atrial fibrillation 201 (2%); hypertension 9.056 (89.3%); hyperlipidemia 4.371 (43.1%); stroke 950 (9.4%); dementia 125 (1.2%); diabetes 3,587 (35.4%)	Duration NR RRF NR
Wang et al.,[72] 2016	PD	6,375	53.1 (14.9)	2,954 (46.3%)	NR	NR	CAD 1,879 (29.5%); hypertension 5,700 (89.4%); stroke 618 (9.7%) ; hyperlipidemia 2,866 (45.0%) ; diabetes 2,445 (38.4%)	Duration NR RRF NR
	ICHD	6,375	52.9 (15.1)	3,025	NR	NR	CAD 1,976 (31.0%); hypertension 5,976 (89.0%); stroke 614	Duration NR

Author, Year	Study Arms (Setting)	Number of Patients	Age, Mean (± SD)	Male, no. (%)	Frequency and No. of Hours of Dialysis	Vascular Access	Comorbidities, No. (%)	Duration of Dialysis at Start of Study Residual Renal Function (RRF)
				(47.5%)			(9.6%); hyperlipidemia 2,862 (44.9%); diabetes 2,479 (38.9%)	RRF NR
Wang et al.,[73] 2016	PD	10,014	53.7 (15.0)	4,638 (46.3%)	NR	NR	CAD 3,081 (30.8%); CHF 1,809 (18.1%); atrial fibrillation 174 (1.7%); hypertension 8.985 (89.7%); hyperlipidemia 4,556 (45.5%); stroke 1,013 (10.1%); dementia 138 (1.4%); diabetes 3,637 (36.3%)	Duration NR RRF NR
	ICHD	10,014	53.8 (14.9)	4,669 (46.6%)	NR	NR	CAD 3,083 (30.8%); CHF 1,793 (17.9%); atrial fibrillation 170 (1.7%); hypertension 8,989 (89.8%); hyperlipidemia 4,561 (45.6%); stroke 1,000 (10%); dementia 128 (1.3%); diabetes 3,657 (36.5%)	Duration NR RRF NR
Wang et al.,[74] 2016	PD	7,340	53.4 (15.1)	3,374 (46%)	NR	NR	CAD 1,672 (22.8%); stroke 700 (9.5%); hyperlipidemia 3,234 (44.1%); atrial fibrillation 88 (1.2%); hypertension 6,512 (88.7%); CHF 1,273 (17.3%); cancer 266 (3.6%); diabetes 2,832 (38.6%); systemic lupus erythematosus 184 (2.5%)	Duration NR RRF NR
	ICHD	7,340	53.3 (15.2)	3,416 (46.5%)	NR	NR	CAD 1,620 (22.1%); stroke 683 (9.3%); hyperlipidemia 3,199 (43.6%); atrial fibrillation 92 (1.2%); hypertension 6,493 (88.5%); CHF 1,280 (17.4%); cancer 277 (3.8%); diabetes 2,817 (38.4%); systemic lupus erythematosus 182 (2.5%)	Duration NR RRF NR
Weinhandl et al.,[75] 2016 Propensity-matched data	HHD	4,201	53.8 (14.9)	2,815 (67%)	NR	NR	Chronic pulmonary disease 13.1%; PVD 21.2%; cerebrovascular disease 8%; CHF 31.1%; hypertension 43.2%; cancer 10%; IHD 27.5%; cardiac disease 27.4%; pulmonary heart disease 2.5%; diabetes 47.7%	Duration of dialysis NR RRF NR
	PD	4,201	54.6 (15.0)	2,668 (63.5%)	NR	NR	Chronic pulmonary disease 13.5%; PVD 22.7%; cerebrovascular disease 9.1%; CHF 31.3%; hypertension 45.6%; cancer 8.7%; IHD 28.9%; cardiac disease 27.6%; pulmonary heart disease 2.2%; diabetes 48.9%	Duration NR RRF NR
Wolfgram et al.,[76] 2015	PD	8,083	62.4 (15.9)	4,444 (55%)	NR	NR	CAD 1,620 (20%); CHF 1,839 (22.8%); hypertension 6,933 (85.8%); cerebrovascular disease 581 (7.2%); PVD 1,005 (12.4%); smoker 552 (6.8%); cancer 484 (6%); diabetes mellitus 3,956 (48.9%) *frailty status data available	Duration NR RRF NR
	ICHD	15,468	64.1 (14.4)	8,591 (55.5%)	NR	NR	CAD 3,168 (20.5%); CHF 3,546 (22.9%); hypertension 13,346 (86.3%); cerebrovascular disease 1,130 (7.3%); PVD 1,953 (12.6%); smoker 1,016 (6.6%); cancer 930 (6%); diabetes mellitus 7,728 (50%)	Duration NR RRF NR

Author, Year	Study Arms (Setting)	Number of Patients	Age, Mean (± SD)	Male, no. (%)	Frequency and No. of Hours of Dialysis	Vascular Access	Comorbidities, No. (%)	Duration of Dialysis at Start of Study Residual Renal Function (RRF)
Wu et al.,[57] 2004 *reporting baseline data of total cohort, as this study was ITT. There is also data for 1-yr cohort	PD	230	54	125 (54%)	NR *geographical location data also available (i.e., urban or rural)	NR	ICED 1–2: 111 (48%) 2: 60 (26%) 3: 59 (26%)	Duration NR RRF NR
	ICHD	698	59	366 (52%)	NR	NR	ICED 1–2: 217 (31%) 2: 270 (39%) 3: 210 (30%)	Duration NR RRF NR
Yang et al.,[77] 2015	PD	230	64.31 (12.3)	98 (42.6%)	NR	NR	Hypertension 219 (95.2%); CVD 132 (57.4%); hyperlipidemia 58 (25.2%); diabetes 172 (74.8%)	Duration of dialysis: more than 90 days RRF: Mean eGFR 8.63 (SD ± 5.63)
	ICHD	641	58.21 (12.1)	358 (55.8%)	NR	NR	Hypertension 587(91.6%); CVD 288 (44.9%); hyperlipidemia 145 (22.6%); diabetes 426 (66.5%)	Duration of dialysis: more than 90 days RRF: Mean eGFR 7.25 (SD ± 4.24)
Yang et al.,[78] 2015	ICHD	244	54.0 (13.3)	130 (53.3)	NR	NR	Diabetes mellitus 26 (10.7); Hypertension 172 (70.5); CAD 39 (16.0); cerebrovascular disease 6 (2.5); heart failure 27 (11.1); COPD 9 (3.7); comorbidity index: mean 2.88 (SD ± 1.32)	Duration of dialysis: more than 3 months RRF NR
	PD	122	54.0 (14.7)	62 (50.8)	NR	NR	Diabetes mellitus 15 (12.3); Hypertension 86 (70.5); CAD 18 (14.8); cerebrovascular disease 4 (3.3); heart failure 12 (9.8); COPD 4 (3.3); comorbidity index: mean 2.80 (SD ± 1.15)	Duration of dialysis: more than 3 months RRF NR

AF = atrial fibrillation; AV = arteriovenous; CAD = coronary artery disease; CAPD = continuous ambulatory peritoneal dialysis; CHD = coronary heart disease; CHF = congestive heart failure; COPD = chronic obstructive pulmonary disease; CVA = cerebrovascular accident; CVD = cardiovascular disease; eGFR = estimated glomerular filtration rate (mL/min/1.73m²); GI = gastrointestinal; h = hours; HD = hemodialysis; HHD = home hemodialysis; ICHD = in-centre HD; ICED = Index of Co-existent Disease; ICHD = in-centre hemodialysis; IHD = ischemic heart disease; IQR = interquartile range; MI = myocardial infarction; n = number; NA = not applicable; NR = not reported; PAD = peripheral artery disease; PD = peritoneal dialysis; PVD = peripheral vascular disease; pt = patient; SD = standard deviation; wk = week.

Appendix 8: Detailed Outcome Data — Clinical Review

In-centre hemodialysis versus peritoneal dialysis

Short Form-36 (SF-36) quality of life scores

Domain	Dialysis Modality	Manns et al.,[55] 2003 (ICHD N = 151 PD N = 41)			Frimat et al.,[49] 2006 (ICHD N = 284 PD N = 103)			Harris et al.,[50] 2002 (ICHD N = 96 PD = 78)				Wu et al.,[57] 2004 (ICHD N = 698 PD = 203)			
		Baseline: mean (± SE)	6 mo: mean (± SE)	12 mo: mean (± SE)	Baseline: mean	6 mo: mean	12 mo: mean	Baseline: mean	6 mo: mean	12 mo: mean	Calculated mean differences (95% CI) for PD-ICHD[a]	Baseline: mean	6 mo: mean	12 mo: mean	Adjusted ORs (95% CI) for PD vs. ICHD at 12 mo[b]
MCS	**ICHD**							49.9	53.1	52.6	Baseline: 2.9 (–0.4,6.2); 6 mo: –1.5 (–4.1 to1.1); 12 mo: –0.9 (–4.5 to 2.7)	46.8		48.2	0.95 (0.62 to 1.45)
	PD							52.5	54.6	54.6		48		49.4	
PCS	**ICHD**							32.7	30.1	31.6	Baseline: 1.2 (–2.0 to 4.3) 6 mo: 2.9 (–0.04 to 5.9) 12 mo: –0.5 (–4.1 to 1.7)	32.5		33.2	0.79 (0.52 to 1.20)
	PD							34.7	35.5	32		33.5		32.5	
PF	**ICHD**	48.0 (2.7)	47.3 (2.9)	47.6 (3.0)	40	42.9	43.3					45.3		45.7	0.72 (0.45 to 1.15)
	PD	47.5 (6.1)	45 (6.0)	43.8 (5.9)	42	48.5	35.1					49.6		45.1	
RP	**ICHD**	25.9 (3.4)	33.2 (3.8)	31.6 (3.7)	12.2	24.3	21.4					23.7		28.5	0.84 (0.54 to 1.31)
	PD	34.4 (9.5)	25 (7.4)	27.2 (7.4)	13.9	36.7	35.1					25.3		26.5	
BP	**ICHD**	62.6 (2.7)	57.9 (2.9)	57.5 (2.7)	43	49.7	46.1					56		57.2	1.12 (0.74 to 1.71)
	PD	66.0 (6.1)	64.7 (5.9)	66.3 (5.6)	44.5	59.2	55.2					62.5		62.6	
GH	**ICHD**	43.0 (2.0)	42 (2.1)	41.8 (2.0)	38.1	40.5	44.1					41.5		44.3	0.65 (0.41 to 1.04)
	PD	43.3 (4.1)	43.3 (4.1)	40.4 (4.0)	39.6	46.8	44.9					42.2		41.2	
V	**ICHD**	43.3 (2.2)	43.9 (2.2)	42.4 (2.1)	30.1	35.4	35.3					42.2		44.3	0.90 (0.59 to 1.38)
	PD	41.7 (3.6)	41.3 (4.1)	41 (3.7)	30.8	42.1	37.7					40.7		39.9	
RE	**ICHD**	56.5 (4.2)	58.6 (4.1)	56.3 (4.3)	55.7	62.4	60.5					60.3		64.2	0.88 (0.56 to 1.38)
	PD	63.9 (8.7)	51.4 (10.0)	44.4 (9.3)	53.4	63	62.9					62.9		64.1	

Domain	Dialysis Modality	Manns et al.,[55] 2003 (ICHD N = 151 PD N = 41)			Frimat et al.,[49] 2006 (ICHD N = 284 PD N = 103)			Harris et al.,[50] 2002 (ICHD N = 96 PD = 78)				Wu et al.,[57] 2004 (ICHD N = 698 PD = 203)			
SF (Social functioning)	ICHD	60.6 (2.4)	59.9 (2.8)	58 (2.9)	18.9	26.3	27.4					52.3		57.4	0.88 (0.58 to 1.36)
	PD	68.2 (5.3)	60.9 (5.2)	65.1 (4.0)	17.3	44.6	48.3					60.9		63.1	
MH	ICHD	72.6 (1.7)	69.3 (2.0)	69.4 (1.9)	47.7	55.7	52.1					69.1		69.7	1.19 (0.76 to 1.89)
	PD	70.5 (4.0)	69.7 (5.0)	71.7 (3.5)	47.3	58	58.3					71.8		73.1	

CI = confidence intervals; ICHD = in-centre hemodialysis; mo = months; OR = odds ratio; PD = peritoneal dialysis; SE = standard error; vs. = versus.
Note: Data are presented as it was reported in the published studies (some studies did not report SDs or SEs, and only presented means). Empty cells indicate data not reported in the published studies.
[a] Harris et al.'s mean differences adjusted for study cohort, time on dialysis, age, sex, social class, and comorbidity.
[b] Wu et al.'s ORs adjusted for baseline domain score, age, gender, race, education, albumin, creatinine, and hematocrit.

SF-36 domains

MCS = mental health component score

- V = vitality (energy/fatigue)
- SF = social function (social functioning)
- RE = role, emotional (limitation in role functioning due to mental health)
- ME = mental health (psychological well-being).

PCS = physical health component score

- PF = physical function (limitations in performing physical activities)
- RP = role physical (limitations in role functioning due to physical health)
- BP = bodily pain (somatic pain)
- GH = general health (general perceptions about health).

In-centre hemodialysis versus peritoneal dialysis

Short Form-36 (SF-36) quality of life scores presented as same, better or worse

Domain	Dialysis Modality	de Abreu et al.,[48] 2011[a] (ICHD N = 249 PD = 228)			Wu et al.,[57] 2004[b] (ICHD N = 698 PD = 203)		
		Change in domain score from baseline to 12 months					
		Same (%)	Better (%)	Worse (%)	Same (%)	Better (%)	Worse (%)
MCS (mental component score)	**ICHD**	54.5	22.8	22.8	48	25	27
	PD	47.8	26.1	26.1	49	27	24
PCS (physical component score)	**ICHD**	40.2	24.3	35.5	42	27	31
	PD	36	23.6	40.4	43	25	32
PF (physical function —limitations in performing physical activities)	**ICHD**				51	22	27
	PD				54	18	28
RP (role physical —limitations in role functioning due to physical health)	**ICHD**				58	21	21
	PD				56	21	23
BP (bodily pain — somatic pain)	**ICHD**				46	25	28
	PD				47	27	26
GH (general health - general perceptions about health)	**ICHD**				59	20	21
	PD				63	16	21
V (vitality — energy/fatigue)	**ICHD**				49	24	27
	PD				46	25	29
RE role emotional —limitation in role functioning due to mental health)	**ICHD**				59	21	20
	PD				57	21	22
SF (social functioning)	**ICHD**				41	28	30
	PD				43	27	30
MH (mental health —psychological well-being)	**ICHD**				57	19	24
	PD				57	22	21

ICHD = in-centre hemodialysis; PD = peritoneal dialysis.
Note: Empty cells indicate data not reported in the published studies.
[a] Clinically significant changes in quality of life for the individual domains were defined as a difference of ± 5 points. Clinically significant changes for the PCS and MCS are defined as ± 5.7 points and ± 6.3 points, respectively.
[b] Defined significant 1-yr increases and decreases in dialysis-specific and SF-36 domains as changes in domain scores exceeding two standard errors of measurement (SEM).

In-centre hemodialysis versus peritoneal dialysis

Kidney disease quality of life (KDQoL) scores

Domain	Dialysis Modality	Manns et al.,[55] 2003 (ICHD N = 151 PD N = 41)			Frimat et al.,[49] 2006 (ICHD N = 284 PD N = 103)			Harris et al.,[50] 2002 (ICHD N = 96 PD = 78)			
		Baseline Mean (± SE)	6-Month Mean (± SE)	12-Month Mean (± SE)	Baseline Mean	6 month mean	12-Month Mean	Baseline: Mean	6-Month Mean	12-Month Mean	Calculated Mean Differences (95% CI) for PD-ICHD
SP	ICHD	72.8 (1.6)	73.1 (1.5)	73.1 (1.5)	65.7	68.8	66.9	81.6	79.7	80	*Baseline:* 3.5 (0.3 to 6.6); *6 months*: 2.4 (–0.5 to 5.3); *12 months*: –1.2 (–4.1 to 1.7)
	PD	73.7 (3.1)	73.6 (3.3)	73.5 (3.2)	68	74.8	75	85.4	85.2	82	
EK	ICHD	59.0 (2.0)	60.4 (2.2)	59.4 (2.0)	61	57.2	55.9				
	PD	68.5 (4.3)	67.7 (3.3)	66.7 (2.9)	58.5	66.3	64				
BK	ICHD	36.9 (2.3)	38.3 (2.5)	40.3 (2.4)	42.5	39.5	38.8				
	PD	48.7 (5.4)	52.6 (5.5)	51.8 (5.2)	40.2	53.9	51				
WS	ICHD	31.0 (3.3)	26.2 (3.1)	29.2 (3.3)	14.5	9.5	11				
	PD	35.4 (8.2)	33.3 (8.3)	29.2 (7.9)	17	21.3	17.3				
CF	ICHD	79.2 (1.6)	78.1 (1.7)	78.3 (1.7)	63.5	66.5	65.8				
	PD	76.7 (4.2)	77.8 (4.0)	81.1 (3.2)	63.4	71.7	71.7				
QS	ICHD	77.2 (1.8)	77.4 (1.5)	77.7 (1.5)	79.1	77.3	78.4				
	PD	71.9 (3.2)	75.6 (3.6)	75.6 (2.9)	77.4	79.8	80.2				
SF (Sexual function)	ICHD	77.5 (7.9)	75.6 (8.5)	76.3 (9.2)	59.3	51.5	49.1				
	PD	70.7(12.5)	71.2(13.1)	70.9(12.1)	53.8	56.5	70.8				
SL	ICHD	58.4 (1.9)	57.5 (1.9)	55.9 (1.9)	53.1	55.4	54.3				
	PD	56.6 (3.3)	49.4 (2.7)	53.7 (2.7)	53.8	58.6	60.3				
SS	ICHD	75.3 (2.3)	72.6 (2.5)	72.6 (2.4)	70.5	66.4	67.1				
	PD	77.1 (5.2)	69.4 (5.5)	72.2 (5.0)	66.2	69.8	66.7				
DE	ICHD	79.3 (2.2)	84.6 (1.7)	81.6 (2.0)							
	PD	89.6 (2.8)	82.8 (3.7)	87 (3.1)							
PS	ICHD	75.9 (2.2)	76.5 (1.9)	77.2 (1.9)							
	PD	83.3 (2.7)	79.8 (3.2)	77.1 (3.7)							

CI = confidence intervals; ICHD = in-centre hemodialysis; PD = peritoneal dialysis; SE = standard error; vs. = versus.
Note: Harris et al.'s mean differences adjusted for study cohort, time on dialysis, age, sex, social class, and comorbidity.
Note: Data are presented as it was reported in the published studies (some studies did not report SDs or SEs, and only presented means). Empty cells indicate data not reported in the published studies.

KDQoL domains

SP = symptoms/problems; EK = effects of kidney disease; BK = burden of kidney disease; WS = work status; CF = cognitive function; QS = quality of social function; SF = sexual function; SL = sleep; SS = social support; DE = dialysis staff encouragement; PS = patient satisfaction.

In-centre hemodialysis versus peritoneal dialysis

Kidney disease quality of life (kdqol) scores presented as same, better, or worse

Domain	Dialysis Modality	de Abreu et al.,[48] 2011 (ICHD N = 249; PD = 228) Change in Domain Score From Baseline to 12 Months		
		Same (%)	Better (%)	Worse (%)
SP (symptoms/problems)	**ICHD**	30.9	31.4	37.8
	PD	29.8	30.4	39.8
EK (effects of kidney disease)	**ICHD**	29.3	27.1	43.6
	PD	26.1	23.6	50.3
BK (burden of kidney disease)	**ICHD**	20.2	27.7	52.1
	PD	26.9	23.1	50
WS (work status)	**ICHD**	61.4	18	20.6
	PD	58.1	16.3	25.6
CF (cognitive function)	**ICHD**	14.9	30.9	54.3
	PD	24.2	36.7	39.1
QS (quality of social function)	**ICHD**	18.8	33.3	47.9
	PD	16.3	33.1	50.6
SF (sexual function)	**ICHD**	53.5	6.9	39.7
	PD	56.3	0	43.8
SL (sleep)	**ICHD**	15	39.6	45.5
	PD	20.5	28.6	50.9
SS (social support)	**ICHD**	56.6	24.3	19.1
	PD	65.6	13.8	20.6
DE (dialysis staff encouragement)	**ICHD**	59.6	21.3	19.2
	PD	73.9	13	13
PS (patient satisfaction)	**ICHD**	43.9	27.5	28.6
	PD	45.3	22.4	32.3

ICHD = in-centre hemodialysis; PD = peritoneal dialysis.

In-centre hemodialysis versus peritoneal dialysis

EuroQol (EQ-5D) quality of life scores

Domain	Dialysis Modality	Manns et al.,[55] 2003 (ICHD N = 151; PD N = 41) Domain Scores		
		Baseline Mean (± SE)	6-Months Mean (± SE)	12-Months Mean (± SE)
Visual analogue scale (VAS) (0 to 100)	ICHD	61.9 (1.8)	59.3 (1.8)	59.5 (1.9)
	PD	63.3 (3.6)	64.3 (3.3)	65.5 (3.0)
Index score (IND) (0 to 1)	ICHD	0.65 (0.027)	0.62 (0.031)	0.62 (0.30)
	PD	0.68 (0.063)	0.68 (0.070)	0.67 (0.046)

ICHD = in-centre hemodialysis; PD = peritoneal dialysis; SE = standard error.

In-centre hemodialysis versus peritoneal dialysis

CHOICE Health Experience Questionnaire (CHEQ) quality of life scores

Domain	Dialysis Modality	Wu et al.,[57] 2004 (ICHD N = 698; PD = 203)				
		Domain Scores		Change In Domain Score From Baseline to 12 Months		
		Baseline Mean	12 Months Mean	Same (%)	Better (%)	Worse (%)
SP (symptoms/problems)	ICHD	77.3	76.3	56	19	25
	PD	79.3	78.1	59	18	23
CF (cognitive function)	ICHD	76.2	74.3	56	17	27
	PD	77.5	75.8	56	19	25
SL (sleep)	ICHD	56.6	58.4	57	20	23
	PD	62.5	56.9	56	17	27
SX (sex)	ICHD	68.4	66.8	50	20	30
	PD	62.5	58	50	20	30
BI (body image)	ICHD	78.9	82.4	64	17	19
	PD	79.8	79.7	69	13	18
QoL (quality of life)	ICHD	52.5	52.6	57	19	24
	PD	56.6	53.1	58	17	25
FR (freedom)	ICHD	57.9	58.5	59	19	22
	PD	60.1	61.7	59	21	20
TR (travel)	ICHD	58.1	54.3	58	17	25
	PD	66.6	63	60	17	23
RC (recreation)	ICHD	58.9	58.8	60	18	22
	PD	64.9	61.4	65	14	21
FN (finance)	ICHD	53.1	52.7	61	17	23
	PD	58.3	64.5	63	19	18
WK (work)	ICHD	62	61	58	18	24
	PD	63.9	67.8	58	23	19
DT (diet)	ICHD	58.7	57.2	58	17	25
	PD	72.3	72.9	62	17	21
TM (time)	ICHD	57.3	55	63	16	21
	PD	58.7	59.8	67	17	16
AC (access)	ICHD	66.6	72.3	53	24	23
	PD	74.9	80.7	58	23	19

ICHD = in-centre hemodialysis; PD = peritoneal dialysis.

In-centre hemodialysis versus home hemodialysis

Short Form-36 (SF-36) Quality of Life Scores

Domain	Dialysis Modality	Culleton et al.,[42] 2007 and Manns et al.,[43] 2009 (ICHD N = 25, NHHD N = 26)	
		Domain scores	
		Baseline: Mean (95% CI)	Difference of Nocturnal HHD-ICHD at 6 Months: Mean (95% CI)
MCS (mental component score)	ICHD	42.1 (37.2 to 47.0)	0.71 (–5.85 to 7.26)
	NHHD	50 (45.4 to 54.5)	
PCS (physical component score)	ICHD	32.7 (29.0 to 36.5)	1.24 (–3.59 to 6.07)
	NHHD	31.7 (26.1 to 37.4)	
PF (physical function - limitations in performing physical activities)	ICHD	53.3 (43.7 to 62.9)	1.35 (–9.98 to 12.67)
	NHHD	49.6 (36.7 to 62.6)	
RP (role physical - limitations in role functioning due to physical health)	ICHD	21 (6.8 to 35.2)	–3.88 (–24.15 to 16.38)
	NHHD	29.8 (13.4 to 46.2)	
BP (bodily pain - somatic pain)	ICHD	48.8 (37.7 to 59.9)	–1.03 (–14.77 to 12.72)
	NHHD	59.9 (47.4 to 72.3)	
GH (general health - general perceptions about health)	ICHD	32 (23.3 to 40.7)	12.82 (2.88 to 22.77)
	NHHD	34.8 (24.8 to 44.8)	
V (vitality – energy/fatigue)	ICHD	36.0 (27.9 to 44.1)	2.82 (–8.67 to 14.30)
	NHHD	40.6 (30.2 to 51.0)	
RE (role emotional – limitation in role functioning due to mental health)	ICHD	41.3 (23.9 to 58.8)	–10.46 (–35.43 to 14.50)
	NHHD	75.6 (60.6 to 90.7)	
SF (social functioning)	ICHD	54.5 (44.5 to 64.5)	2.92 (–9.52 to 15.37)
	NHHD	63.5 (50.6 to 76.3)	
MH (mental health – psychological well-being)	ICHD	63.4 (54.6 to 72.1)	4.78 (–6.24 to 15.81)
	NHHD	71.4 (62.7 to 80.1)	

CI = confidence intervals; HHD = home hemodialysis; ICHD = in-centre hemodialysis; NHHD = nocturnal home hemodialysis.

In-centre hemodialysis versus home hemodialysis

Kidney Disease quality of life (KDQoL) scores

Domain	Dialysis Modality	Culleton et al.,[42] 2007 and Manns et al.,[43] 2009 (ICHD N = 25, NHHD N = 26) Domain Scores	
		Baseline: Mean (95% CI)	Difference of Nocturnal HHD-ICHD at 6 Months:Mean (95% CI)
SP (symptoms/problems)	ICHD	65.4 (57.5 to 73.4)	–1.04 (–8.31 to 6.23)
	NHHD	73.8 (67.6 to 79.9)	
EK (effects of kidney disease)	ICHD	42 (32.9 to 51.1)	2.58 (–4.54 to 9.71)
	NHHD	54.6 (45.9 to 63.2)	

Domain	Dialysis Modality	Culleton et al.,[42] 2007 and Manns et al.,[43] 2009 (ICHD N = 25, NHHD N = 26) Domain Scores	
BK (burden of kidney disease)	ICHD	25.4 (17.1 to 33.7)	10.70 (2.42 to 18.99)
	NHHD	35.3 (23.1 to 47.6)	
SL (sleep)	ICHD	46.3 (36.5 to 56.1)	–3.50 (–12.66 to 5.66)
	NHHD	58.8 (53.2 to 64.5)	

CI = confidence intervals; HHD = home hemodialysis; ICHD = in-centre hemodialysis; NHHD = nocturnal home hemodialysis.

Frequent nocturnal hemodialysis versus conventional home hemodialysis

RAND-36 quality of life scores, Beck Depression Inventory (BDI), and medical outcomes Study Sleep Problems Index (SPI II)

Domain	Dialysis Modality	Unruh et al.,[46] 2013 and Unruh et al.,[47] 2016 (CHHD = 42, NHHD = 45)			
		Domain Scores		Calculated Data	
		Baseline Mean (± SD)	12 Months Mean (± SD)	Change From Baseline Mean (± SE)[a]	Treatment Comparison FNHHD vs. CHHD (95% CI)[a]
(RAND-36) Mental health composite	NHHD	45.6 ± 10.5	48.2 ± 11.7	+3.0 ± 1.6	3.7 (−0.5 to 8.3)
	CHHD	45.9 ± 12.6	45.6 ± 12.2	−0.7 ± 1.6	
(RAND-36) Emotional well-being	NHHD	75.7 ± 18.1	78.4 ± 18.0	+3.3 ± 2.7	5.3 (−1.8 to 12.5)
	CHHD	77.1 ± 21.7	75.6 ± 21.4	−2.0 ± 2.7	
(RAND-36) Role limitation due to emotional problems	NHHD	87.4 ± 24.9	89.7 (26.7)	+6.6 (5.4)	4.9(−8.2 to 18.2)
	CHHD	77.0 (39.3)	82.9 (33.2)	+1.7 (5.5)	
(RAND-36) Energy/fatigue	NHHD	48.6 (22.9)	51.4 (25.0)	+3.1 (3.3)	3.0 (−5.9 to 11.9)
	CHHD	48.4 (19.5)	49.6 (22.6)	+0.1 (3.3)	
(RAND-36) Social functioning	NHHD	73.1 (25.3)	80.4 (26.1)	+7.5 (3.9)	7.2 (−3.1 to 17.5)
	CHHD	75.6 (25.6)	76.0 (26.2)	+0.3 (3.9)	
SPI II (Sleep Problems Index)	NHHD	33.8 (17.4)	29.8 (17.7)	−3.3 (2.8)	−4.5 (−12.2 to 3.2)
	CHHD	32.0 (18.4)	33.0 (23.1)	+1.2 (2.8)	
Hours of sleep	NHHD	6.51 (1.43)	6.80 (1.71)	+ 0.27 (0.19)	0.43 (−0.09 to 0.96)
	CHHD	6.37 (1.45)	6.24 (1.55)	−0.16 (0.19)	
BDI (Beck Depression Inventory)	NHHD	11.2 (8.1)	9.7 (8.6)	−2.0 (1.2)	−1.6 (−4.9 to 1.7)
	CHHD	12.2 (9.2)	11.1 (10.2)	−0.4 (1.2)	
CG (cognitive subscale of BDI)	NHHD	6.2 (6.1)	5.3 (5.9)	−1.1 (0.9)	−1.6 (−4.1 to 0.8)
	CHHD	6.5 (6.9)	6.6 (7.8)	+ 0.6 (0.9)	

CHHD = conventional home hemodialysis; NHHD = nocturnal home hemodialysis; SD = standard deviation; SE = standard error.
[a] Adjusted for clinical centre and baseline score.

Question 1

Study First Author Publication Date Country Study Design	Study Years Length of Follow-up Sample Size (N)	Modality Description	QoL (Study Authors' Summary)	Mortality / Survival	Hospital-ization	Technique Failure	Adverse Events
HHD Versus ICHD							
Randomized Controlled Trials							
Culleton et al.,[42] 2007 Manns et al.,[43] 2009 Canada RCT	2004 to 2006 Follow-up to Dec. 2006 (Culleton) May 2007 (Mann) N = 52	*HHD*: Nocturnal, 5–6 sessions/ wk; minimum 6h/night *ICHD*: 3 sessions/wk	Index scores from baseline to 6 months: Nocturnal HHD did not improve the change compared with ICHD. Similar findings for EQ-5D visual analogue score; no statistically significant difference in change. HHD resulted in clinically and statistically significant 10-point change from randomization to 6-month values compared with ICHD. Statistically significant improvement in the domains "effects of kidney disease" and "burden of kidney disease" compared with ICHD				
Cohort Studies							
Kasza et al.,[59] 2016 Australia and New Zealand Retrospective cohort	2003 to 2011 Follow-up to Dec. 31, 2011 median 2.25 yrs (IQR 1 to 3.75) N = 20,191	*HHD (with permanent AV access)* *ICHD (with permanent AV access)*		Mortality *HHD vs. ICHD, HR (95% CI):* 1 yr: 0.63 (0.40 to 1.0); 2 yr: 0.63 (0.44 to 0.90); 3 yr: 0.53 (0.44 to 0.75); 5 yr: 0.66 (0.50 to 0.87); 8 yr: 0.86 (0.36 to 2.14)			
Marshall et al.,[64] 2016 Australia and New Zealand Retrospective cohort	1996 to 2012 Follow-up to Dec. 31, 2012 N = 40,850	*Conventional HHD:* < 3 sessions/wk; < 6 h/session *Quasi-intensive HHD*: Longer and/or more frequent than conventional, but < 5 sessions/wk *Intensive HHD*: > 5 sessions/wk, any hours per session *Conventional ICHD*: ≤ 3		Mortality reported as HR (95% CI) using Conventional ICHD as reference (1) *Conventional HHD*: 0.68 (0.42 to 1.10) *Quasi-intensive HHD:* 0.56 (0.44 to 0.73) *Intensive HHD:* 0.59 (0.32 to 1.10)			

Study First Author Publication Date Country Study Design	Study Years Length of Follow-up Sample Size (N)	Modality Description	QoL (Study Authors' Summary)	Mortality / Survival	Hospital-ization	Technique Failure	Adverse Events
		sessions/wk, ≤ 6 h/session					
Suri et al.,[70] 2015 Canada (using US data) Retrospective cohort	2004 to 2009 Mean follow-up 1.9 (SD ± 1.4) years N = 4,360	*HHD:* > 5 sessions/wk; 1.5–4.5 h/day *ICHD*: Conventional (details NR)			*HHD (n = 1,187)* Hospitalizations= 1,503; Rate: 5.2 days /patient-year *ICHD (n = 3,173)* Hospitalizations = 7, 562; Rate: 7.0 days /patient-year	*HHD (Switch back to ICHD):* 172 (15%)	*HHD (n = 1,187)* Infection (all-cause): 730 Cardiovascular events: 555 Bleeding: 89 *ICHD (n = 3,173)* Infection (all-cause): 2,905 Cardiovascular events: 3,717 Bleeding: 317
PD Versus ICHD							
Cohort Studies							
de Abreu et al.,[48] 2011 Brazil Prospective cohort	2007 to 2009 12 months follow-up N = 350	*PD:* details NR *ICHD:* details NR	After 6 months, burden of kidney disease, encouragement/ support from staff, and patient satisfaction with care were significantly in favour of PD. At 12 months encouragement/ support from staff and patient satisfaction with care were also significantly in favour of PD. However, more HD patients had significant improvements in HRQoL from baseline to 12 months compared with PD patients.					
Frimat et al.,[49] 2006 France Prospective cohort	1997 to 1999 12 months follow-up N = 321 for QoL	*PD:* self-care at home or nurse-assisted at home *ICHD:* mixed cohort of ≥ 3 sessions/wk and ≤ 2 sessions/wk	PD was associated with a better QoL than HD at 6 and 12 months after the start of RRT, particularly in the domains of role limitation due to emotional function, burden of kidney disease, and role limitation due to physical function				

Study First Author Publication Date Country Study Design	Study Years Length of Follow-up Sample Size (N)	Modality Description	QoL (Study Authors' Summary)	Mortality / Survival	Hospital-ization	Technique Failure	Adverse Events
Habib et al.,[58] 2016 France Retrospective cohort	2004 to 2012 Follow-up until June 30, 2014 N = 7,172	*PD:* details NR *ICHD:* details NR		Deaths *PD (n = 448)*: 192 (42.9%) *ICHD (n = 6,724): 3,347 (49.8%)* RR (95% CI): 0.601 (0.41 to 0.86); PD = 1 (reference) *subgroup data also available			
Harris et al.,[50] 2002 UK Prospective cohort	1995 to 1996 12 months follow-up N = 174	*PD:* majority CAPD but some with automated PD *ICHD:* details NR	QoL are similar in elderly people on PD and HD, at 6 and 12 months.				
Jeloka et al.,[51] 2016 India Prospective cohort	2006 to 2014 Follow-up to Mar. 2014 N = 42	*PD:* 3 sessions/day *ICHD:* 3 sessions/wk		Survival *PD (n = 19)* 1 yr: 77.4% 2 yr: 54.2% 3 yr: 13.9% *ICHD (n = 23)* 1 yr: 81.3% 2 yr: 73.9% 3 yr: 35.9%			
Kasza et al.,[59] 2016 Australia and New Zealand Retrospective cohort	2003 to 2011 Follow-up to Dec. 31 2011; median 2.25 yr (IQR 1, 3.75)	*PD:* details NR *HHD* with AVF/AVG access: details NR		Mortality *PD vs. ICHD,* *HR (95% CI):* 1 yr:1.49 (1.31 to 1.68) 2 yr: 1.7 (1.53 to 1.93) 3 yr: 1.65 (1.49 to 1.83) 4 yr: 1.75 (1.56 to 2.01) 5 yr: 2.29 (1.52 to 3.53)			
Kim et al.,[60] 2015 Korea Retrospective cohort	2005–2008 Follow-up to Dec. 31, 2009 N = 30,279	*PD:* details NR *ICHD:* details NR		All-cause mortality, RR (95% CI), with ICHD as reference (1.0) *PD:* 1.23 (1.16 to 1.31) *there is also data provided for mortality/pt-yr. and crude incident rate			Reported as RR (95% CI), with ICHD as reference (1) *PD* Major cardiac and CV AEs: 1.09 (1.03 to 1.15) Non-fatal acute MI: 1.29 (1.13 to 1.48) Non-fatal stroke (ischemic and hemorrhagic): 1.01 (0.92 to 1.09) PCI: 1.19 (1.03 to 1.38)

Study First Author Publication Date Country Study Design	Study Years Length of Follow-up Sample Size (N)	Modality Description	QoL (Study Authors' Summary)	Mortality / Survival	Hospital-ization	Technique Failure	Adverse Events
							CABG: 09.5 (0.59 to 1.52) *there are also events/pt-yr available for all AEs and crude incident rate
Kim et al.,[52] 2015 South Korea Prospective cohort	2008–2013 Follow-up 1 yr for QoL outcomes; other details NR N = 410	*PD:* assisted or CAPD *ICHD:* 1 to 5 sessions/wk	Overall QoL outcomes (12-month changes from baseline) were similar between elderly PD and HD patients. Twelve-month changes from baseline in the BDI scale were significantly improved in the effects and burden domains, for elderly PD patients	*PD (n = 95)* All-cause mortality: 22 (23.2%); Death from CV cause: 7 (7.4%); Death from infectious cause: 6 (6.3%); Death from other causes: 9 (9.5%) *ICHD (n = 315)* All-cause mortality: 39 (12.4%); Death from CV cause: 13 (4.1%); Death from infectious cause: 8 (2.6%); Death from other causes: 18 (5.7%)			
Lee et al.,[61] 2015 Taiwan Retrospective cohort	2000 to 2009 Follow-up to 2010 N = 10,746	*PD*: details NR *ICHD:* details NR					Reported as HR (95% CI), with ICHD as reference (1.0) *PD* Total GI events: 1.00 (0.91 to 1.10) GERD: 2.25 (1.65 to 3.06) Peptic ulcer disease: 0.78 (0.70 to 0.88) Mesenteric ischemia: 0.47 (0.17 to 1.32) Intestinal obstruction or adhesions: 1.52 (1.10 to 2.09) Appendicitis: 0.31 (0.11 to 0.85) Lower GI diverticula and bleeding: 0.78 (0.64 to 0.96) Liver cirrhosis: 0.74 (0.50 to

Study First Author Publication Date Country Study Design	Study Years Length of Follow-up Sample Size (N)	Modality Description	QoL (Study Authors' Summary)	Mortality / Survival	Hospital-ization	Technique Failure	Adverse Events
							1.09) Acute pancreatitis: 0.81 (0.52 to 1.27) Abdominal hernia: 4.13 (3.20 to 5.34) *there is also data available on # of events for each AE
Lee et al.,[53] 2016 Korea Prospective cohort	2008 to 2011 Mean follow-up: *PD* 11.1 (SD ± 7.1) months *ICHD* 10.9 (SD ± 7.4) months N = 1,042	*PD*: details NR *ICHD*: details NR				Reported as HR (95% CI) with HD as reference (1.00) *PD* 10.78 (1.87, 62.00) *data available for subgroups of male, age, and some comorbidities	
Lin et al.,[62] 2015 Taiwan Retrospective cohort	1998 to 2007 Follow-up to Dec. 31, 2008; Mean PD follow-up 3.79 (SD ± 3.06) yrs; Mean ICHD follow-up 4.07 (SD ± 3.1) yrs N = 55,624	*PD:* details NR *ICHD:* details NR					*PD (n = 3,292)* Dementia: 181 cases *ICHD (n = 52,332)* Dementia: 3,775 cases *PD reference (1)* *ICHD HR (95% CI):* 1.086 (0.940 to 1.255) *data also given for many subgroups

Study First Author Publication Date Country Study Design	Study Years Length of Follow-up Sample Size (N)	Modality Description	QoL (Study Authors' Summary)	Mortality / Survival	Hospital-ization	Technique Failure	Adverse Events
Lin et al.,[63] 2015 Taiwan Retrospective cohort	2000 to 2010 Follow-up to end of 2011; Mean PD follow-up 2.92 yrs; Mean ICHD follow-up 3.64 yrs N = 26,927	*PD:* details NR *ICHD:* details NR					*PD (n = 9,190)* Peripheral artery disease: 331 cases *ICHD (n = 9,190)* Peripheral artery disease: 717 cases *PD reference (1)* *ICHD HR (95% CI):* 1.92 (1.62 to 2.28) *data also given for many subgroups
Manns et al.,[55] 2003 Canada Prospective cohort	July 1999 to Nov. 1999 12-months follow-up N = 192 at baseline; 79 complete 12-month HRQoL question-naire		EQ-5D VAS and index scores were not significantly different for patients treated with HHD or self-care HD compared with satellite HD and ICHD, at 6 and 12 months				
Marshall et al.,[64] 2016 Australia and New Zealand Retrospective cohort	1996 to 2012 Follow-up to Dec. 31, 2012 N = 40,850	*PD*: details NR *Conventional ICHD*: ≤ 3 sessions/wk, ≤ 6 h/session *Quasi-intensive ICHD*: Longer and/or more frequent than conventional, but < 5 sessions/wk *Intensive ICHD*: > 5 sessions/wk, any hours per session		Reported as HR (95% CI) with Conventional ICHD as reference (1) *PD:* 1.07 (1.03 to 1.12)			

Study First Author Publication Date Country Study Design	Study Years Length of Follow-up Sample Size (N)	Modality Description	QoL (Study Authors' Summary)	Mortality / Survival	Hospital-ization	Technique Failure	Adverse Events
Moldovan et al.,[56] 2016 Romania Prospective cohort	Study years NR 40 months follow-up N = 92	*PD*: CAPD with 4 changes/day *ICHD*: conventional HD; 3 sessions/wk, 4h/session		*PD (n = 11)* Deaths = 3 (27.3%); Survival (months) = mean 30.3 (SD ± 8.6) *ICHD (n = 81)* Deaths = 25 (30.9%); Survival (months) = mean 28.3 (SD ± 10.3)			*PD (n = 11)* Causes of death: 2 CDV; 1 unknown *ICHD (n = 81)* Causes of death: 11 CDV; 4 sepsis; remaining patients: cirrhosis, digestive bleeding, internal hemorrhage, cancers, or unknown
Oliver et al.,[68] 2016 Canada Retrospective cohort	2004 to 2013 Minimum 6 months follow-up; Mean assisted PD follow-up 849 days (SD ± 545); Mean ICHD follow-up 878 days (SD ± 278) N = 1,075	*Assisted PD:* assisted by family or home care (usually registered nurses) *ICHD*: details NR			*Assisted PD (n = 203)* Hospital days, mean (SD): 26.5 (± 42.3); Rate: 11.1 (95% CI, 9.4 to 13.0) Hospital visits, mean (SD): 1.9 (± 1.8); Rate: 0.80 (95% CI, 0.72 to 0.88) *ICHD (n = 198)* Hospital days, mean (SD): 25.1 (± 26.6); Rate: 12.9 (95% CI, 10.3 to 16.1) Hospital visits, mean (SD): 1.7 (± 0.8); Rate: 0.71 (95% CI, 0.61 to 0.86)	*Assisted PD (n = 203):* 51 (25%) *ICHD:* 179 (21%)	
Shen et al.,[69] 2016 Taiwan Retrospective cohort	2002 to 2003 Follow-up from index data until onset of AF or Dec. 31, 2011 Mean: 8 to 10 yrs N = 15,947	*PD:* details NR *ICHD:* details NR					Atrial fibrillation *PD (n = 1,093)* No. of events: 64 Incident rate: 6.42 Incident rate ratio (95% CI), 1.78 (1.30 to 2.44) Adjusted HR (95% CI), 1.32 (1.00 to 1.83) *ICHD (n = 14,854)*

Study First Author Publication Date Country Study Design	Study Years Length of Follow-up Sample Size (N)	Modality Description	QoL (Study Authors' Summary)	Mortality / Survival	Hospital-ization	Technique Failure	Adverse Events
							No. of events: 1,318 Incident rate: 9.91 Incident rate ratio (95% CI), 2.07 (1.93 to 2.23) Adjusted HR (95% CI), 1.46 (1.32 to 1.61) *subgroup data available
Wang et al.,[74] 2016 Taiwan Retrospective cohort	1998 to 2010 Follow-up from the index date to the date when PE diagnosis or until the end of 2011; *PD*: mean 4.19 (SD ± 2.98) yr; *HD*: mean 4.23 (SD ± 3.26) yr N = 14,680	*PD:* details NR *ICHD:* details NR		30-day all-cause mortality for patients who developed PE *PD (n = 7,340)*: 1 (7.14%) *ICHD (n=7,340):* 67 (16.8%) All-cause mortality vs. non-ERSD presented as control HR (95% CI) *PD:* 1.04 (0.12 to 9.05) *ICHD:* 2.60 (1.34, 5.03)			Pulmonary embolism presented as HR (95% CI) HD vs. PD: 2.30 (1.23 to 4.29)

Study First Author Publication Date Country Study Design	Study Years Length of Follow-up Sample Size (N)	Modality Description	QoL (Study Authors' Summary)	Mortality / Survival	Hospital-ization	Technique Failure	Adverse Events
Wang et al.,[71] 2015 Taiwan Retrospective cohort	1998 to 2010 Follow-up to Dec. 31, 2011 N = 20,272	*PD (at ≥ 90 days post initiation)*: details NR *ICHD (at ≥ 90 days post initiation):* details NR		Death per SDH *PD (n SDH = 95)*: 24 Rate: 25.3% *ICHD (n SDH = 158)*: 46 Rate:29.1%			SDH incidence rate presented as median (IQR) *PD (follow-up 44,133 person-years):* 21.5 (20.2 to 22.9) *ICHD (follow-up 47,442 person-years):* 34.7 (31.4 to 35.4) Adjusted HR of SDH: *ICHD* = 1.62 (95% CI, 1.17 to 2.33); *PD* reference (1) *Overall SDH presented here. More data available for traumatic and non-traumatic subgroups
Wang et al.,[72] 2016 Taiwan Retrospective cohort	2000 to 2010 Follow-up to Dec. 31, 2011 N = 12,750	*PD:* details NR *ICHD*: details NR		Mortality *PD:* (reference) = 1 *ICHD*: HR 1.64 (95% CI, 1.19 to 2.27)		*PD*: 35.80% *ICHD*: 1.30% *also broken down by subgroup (age, sex, comorbidity – do we need detail?)	Sensorineural hearing loss *PD*: 71 cases (rate 2.96) *ICHD*: 49 cases (rate 1.70)
Wang et al.,[73] 2016 Taiwan Retrospective cohort	2000 to 2010 Follow-up to Dec. 21, 2011; Mean 4.13 (SD ± 3.0) yr N = 29,684	*PD (at ≥ 90 days post initiation)*: details NR *ICHD (at ≥ 90 days post initiation):* details NR					Hydrocephalus *PD (n = 37,244 patient-years)*: 41 cases (rate 11) *ICHD (n = 45,362 patient-years):* 47 cases (rate 10.4) Adjusted HR *ICHD:* 0.72 (95% CI, 0.42 to 1.23) *PD* reference (1)
Wolfgram et al.,[76] 2015 US Retrospective cohort	2006 to 2008 Follow-up to Dec. 31, 2009; mean 1.5 yrs; maximum 3.75 yrs N = 121,623 (23,551 matched cohort)	*PD (at ≥ 90 days post initiation)*: details NR *ICHD (at ≥ 90 days post initiation):* details NR		Mortality *PD (n = 8,663, unadjusted)* 1 yr: 1,256 2 yr: 2,702 3 yr: 4,167 *ICHD (n = 112,960, unadjusted)* 1 yr: 30,047		*PD (n = 8,663):* 2,313 (26.7%) *ICHD (n = 112,960):* 2,824 (2.5%)	Dementia; presented as HR (95% CI) *PD:* reference (1) *ICHD: 0.74 (0.64 to 0.86)* *Data presented are matched PS. There are other models and stratified PS

Study First Author Publication Date Country Study Design	Study Years Length of Follow-up Sample Size (N)	Modality Description	QoL (Study Authors' Summary)	Mortality / Survival	Hospital-ization	Technique Failure	Adverse Events
				2 yr: 52,300 3 yr: 72,068			
Wu et al.,[57] 2004 US Prospective cohort	1995 to 1998 Follow-up 12 months N = 928 (585 complete 12-month questionnaire)		HD and PD patients were similar in change in overall health status and the 2 modalities were associated with similar HRQoL outcomes at 1 yr. Both showed improvements in most aspects of general functioning and psychologic well-being. Results were not consistent for ESRD-specific HRQoL, with some domains better for PD patients (finances) and others better for HD patients (sleep and overall quality of life).				
Yang,[77] 2015 Singapore Retrospective cohort	2005 to 2010 Length of follow-up: maximum of 5 years (median 3.2 years), censored until August 31, 2013 N = 871	*PD*: details NR *ICHD*: details NR		Mortality *PD*: HR 2.08 (95% CI, 1.67 to 2.59) *ICHD*: (reference) = 1 *Subgroups (PD vs. ICHD)*: Age > 65 yrs: HR 1.85 (95% CI, 1.50 to 2.27); Diabetes: HR 1.54 (95% CI, 1.20 to 1.99); CVD: HR 2.06 (95% CI, 1.65 to 2.56)			

Study First Author Publication Date Country Study Design	Study Years Length of Follow-up Sample Size (N)	Modality Description	QoL (Study Authors' Summary)	Mortality / Survival	Hospital-ization	Technique Failure	Adverse Events
Yang et al.,[78] 2015 Taiwan Retrospective cohort	1999 to 2010 Follow-up to Dec. 31, 2010 N = 366	*PD (received 2 to 4 months after initiation of dialysis)*: details NR *ICHD:* details NR		*PD (n = 122)* Death: 22 (18.0%); Death during hospitalization: 13 *ICHD (n = 244)* Death: 62 (25.4%); Death during hospitalization: 33	*PD (n = 122)* Hospitalizations: 22 Hospitalization rate: median 0.7 (IQR 0.2 to 1.6) Hospitalizations for infection: 71 Hospitalizations for abdominal infection: 11 *ICHD (n = 244)* Hospitalizations: 165 Hospitalization rate: median 0.6 (IQR 0.2 to 1.4); Hospitalizations for infection: 109 Hospitalizations for abdominal infection: 21	Reported as modality switch *PD (n = 122):* 31 (25.4%) *ICHD (n = 244*): 3 (1.2%)	

AVF = arteriovenous fistula; AVG = arteriovenous graft; BDI = Beck Depression Inventory; CABG = coronary artery bypass graft; CAPD = continuous ambulatory peritoneal dialysis; CV = cerebrovascular; CVD = cardiovascular disease; GERD = gastroesophageal reflux; HR = hazard ratio; HRQoL = health-related quality of life; IQR = interquartile range; MI = myocardial infarction; PCI = percutaneous coronary intervention ; PE = pulmonary embolism; pt = patient; QoL = quality of life; RR = relative risk; RRT = renal replacement therapy; SD = standard deviation; SDH = subdural hematoma; wk = week; yr = year.

Question 2

Study First Author, Publication Date Country Study Design	Study Years; Length of Follow-Up Sample Size (N)	Modality Description	QoL (Study Authors' Summary)	Mortality/Survival	Hospitalization	Technique Failure	Adverse Events
Cohort Studies							
Nadeau-Fredette et al.,[65] 2015 Australia and New Zealand Retrospective cohort	2000 to 2012 Follow-up to Dec. 31, 2012 N = 11,395 (matched cohort = 420)	*PD only:* PD on day 90 after RRT initiation without direct transfer to HHD after PD completion *PD + HHD:* PD on Day 90 after RRT initiation with direct transfer to HHD after PD completion *HHD only:* HHD on Day 90 after RRT initiation without direct transfer to PD after HHD completion		All-cause mortality *PD only (n = 168):* 31 *PD + HHD (n = 84):* 7 *HHD only (n = 168):* 13		*PD only (n = 168):* 60 *PD + HHD (n = 84):* 8 *HHD only (n = 168):* 21	
Nadeau-Fredette et al.,[66] 2015 Australia and New Zealand Retrospective cohort	2000 to 2012 Length of follow-up NR N = 11,416	*PD*: CAPD or continuous PD *HHD:* conventional, long, frequent, long/frequent		All-cause mortality *PD (n = 10,710):* 4,970 *HHD (n = 706):* 86; adjusted HR: 0.47 (95% CI, 0.38 to 0.59)		Death-censored technique failure *HHD:* adjusted HR 0.34 (95% CI 0.28 to 0.41)	
Nesrallah et al.,[67] 2016 Canada (using US data) Retrospective cohort	2004 to2011 Follow-up in matched group mean 1.9 (SD ± 1.4) yr N = 5,336	*PD:* CAPD or continuous cycler (automated), 7 sessions/wk *HHD:* 5–7 sessions/wk for 1.5–3.0 h/session (> 90% used low dialysate flows < 300 mL/min)		All-cause mortality *PD (n = 2,668):* 868; deaths/100 pt-yr: 16.71 *HHD (n = 2,668):* 625; deaths/100 pt-yr: 12.56 HR (95% CI), 0.75 (0.68 to 0.82)			

Study First Author, Publication Date Country Study Design	Study Years; Length of Follow-Up Sample Size (N)	Modality Description	QoL (Study Authors' Summary)	Mortality/Survival	Hospitalization	Technique Failure	Adverse Events
Suri et al.,[70] 2015 Canada (using US data only) Retrospective cohort	2004 to 2009 Mean follow-up 1.6 (SD ± 1.3) yr N = 3,900	*PD:* details NR *HHD:* > 5 sessions/wk; 1.5–4.5 h/ session			*PD (n=2,784)* Hospitalizations: 6,689; Days in hosp: 9.2 days/patient-year *HHD (n = 1,116)* Hospitalizations: 1,414; Days in hosp: 5.2 days/patient-year HR (95% CI), 0.73 (0.67 to 0.79)	Switch back to ICHD *PD (n = 2,784)*: 1,233 (44%), HR (95% CI), 3.40 (2.9 to 4.0) *HHD (n = 1,116)*: 172 (15%)	*PD (n=2,784)*: All-cause infection: 2,898; CV events: 2,897; Bleeding: 288 *HHD (n = 1,116):* All-cause infection: 681, HR (95% CI), 0.81 (0.73 to 0.90); CV events: 524, HR (95% CI), 0.66 (0.58 to 0.74); Bleeding: 87, HR (95% CI), 0.89 (0.67 to 1.17)
Weinhandl et al.,[75] 2016 US Retrospective cohort	Study years unclear; dates dialysis started 2006 to 2010 Follow-up *PD:* mean 1.65 yr *HHD:* mean 1.79 yr N = 8,402	*PD:* details NR *HHD:* 5–6 sessions/wk		Reported as absolute rate *PD (n =4,201)* All-cause mortality: 15.1 Infection-related mortality: 2.1 *HHD (n = 4,201)* All-cause mortality: 12.1, HR (95% CI), 0.80 (0.73 to 0.87) Infection-related mortality: 1.5, HR	Reported as absolute rate *PD (n = 4,201)* Hospitalizations: 199.0; Days in hosp: 1,266.9/patient-year *HHD (n = 4,201)* Hospitalizations: 173.7, HR (95% CI), 0.92 (0.89 to 0.95); Days in hosp: 1,027.2/patient-yr, HR (95% CI), 0.81 (0.75 to 0.87)	Switch back to ICHD *PD (n = 4,201)* at 6 months: 17.3%, • at 1 yr: 27.1%, • at 2 yr: 37.0%, • at 3 yr: 44.1% *HHD (n = 4,201)* • at 6 months: 9.2%, • at 1 yr: 18.0%, • at 2 yr: 27.5%, • at 3 yr: 32.1%, HR (95% CI), 0.63 (0.58 to 0.68)	

CI = confidence intervals; CV = cardiovascular; HHD = home hemodialysis; HR = hazard ratio; N = number; NR = not reported; PD = peritoneal dialysis; pt = patient; RRT = renal replacement therapy; yr = year.

Question 3

Study First Author Publication Date Country Study Design	Study Years Length of Follow-up Sample Size (N)	Modality Description	QoL (Study Authors' Summary)	Mortality / Survival	Hospitalization	Technique Failure	Adverse Events
Randomized Controlled Trials							
Rocco et al.,[44] 2011 Rocco et al.,[45] 2015 Unruh et al.,[46] 2013 Unruh et al.,[47] 2016 US and Canada RCT with prospective cohort extension study	2006 to 2010 Follow-up: 14 months; extended an additional 12 and 24 months for mortality outcomes N = 87; 12-month extension N = 83; 24-month extension N = 70	*Conventional HHD:* 3 sessions/ wk; < 5 hr/session *Nocturnal HHD:* 6 sessions/wk; ≥ 6 h/session	There were no statistically significant differences between conventional HHD and nocturnal HHD.	All-cause mortality *Conventional HHD (n = 42)* Deaths: 5 (11.9%) *Nocturnal HHD (n = 45)* Deaths: 14 (31.1%); HR 3.88 (95% CI, 1.27 to 11.79) *age, sex, and race subgroup data available	*Conventional HHD (n = 42)* All hospitalizations: 30 events (16 pt) Cardiovascular causes: 4 events (3 pt) Infection causes: 7 events (5 pt) Access causes: 4 events (3 pt) *Nocturnal HHD (n = 45)* All hospitalizations: 43 events (19 pt), HR 1.42 (95% CI, 0.69 to 2.90) Cardiovascular causes: 6 events (5 pt), HR 1.60 (0.49 to 5.22); Infection causes: 14 events (8 pt), HR 2.04 (0.80 to 5.17) Access causes: 8 events (5 pt), HR 2.15 (0.67 to 6.89)		*Conventional HHD (n = 42)* Hypotensive episodes: 136 events (28 pt); Hypokalemia (potassium < 3.5 mEq/l): 16 episodes (9 pt); Hypophosphatemia (phosphorus < 2.17 mg/dL): 5 episodes (3 pt); All vascular access interventions failures: 13 episodes (10 pt) *Nocturnal HHD (n = 45)* Hypotensive episodes: 71 events (25 pt); Hypokalemia (potassium < 3.5 mEq/l): 62 episodes (13 pt); Hypophosphatemia (phosphorus < 2.17 mg/dL): 11 episodes (10 pt); All vascular access interventions failures: 17 episodes (13 pt)
Cohort Studies							
Lockridge et al.,[54] 2012 US Prospective cohort	1996 to 2009 Follow-up until Sept. 2009 N = 191	*Nocturnal HHD*: mean 5.7 (SD ± 0.5) (range 5 to 7) sessions/wk; 6.9 (0.73) (range 5 to 8) h/session *Short-daily HHD:* mean 5.5 (SD ± 0.5) (range 5 to 7) sessions/wk; 2.7 (0.67) (range 1.5 to 4.5) h/session		*Nocturnal HHD (n = 81):* 13 deaths; Mortality/ 1,000 patient-years = 45; SMR: 0.28 (CI, 0.15 to 0.37) *Short-daily HHD (n=110):* 14; Mortality/ 1,000 patient years = 84; SMR: 0.52 (CI, 0.42 to 0.60)		Defined as return to ICHD *Nocturnal HHD (n = 81)*: 9 (11%) *Short-daily HHD (n = 110)*: 22 (20%)	

Study First Author Publication Date Country Study Design	Study Years Length of Follow-up Sample Size (N)	Modality Description	QoL (Study Authors' Summary)	Mortality / Survival	Hospitalization	Technique Failure	Adverse Events
Marshall et al.,[19] 2011 Australia and New Zealand Retrospective cohort	1996 to 2007 Follow-up until Dec. 31, 2007	*Frequent/ extended HHD*: included both nocturnal and short-daily regimens. > 3 sessions/wk, ≥ 4 h/session; or 3 sessions/wk, ≥ 6 h/session; or 5 sessions/wk ≥ 3 h/session; or > 5 sessions/wk, > 2 h/session; *Conventional HHD:* all regimens not fulfilling criteria for frequent/ extended HHD		All-cause mortality *Frequent/ extended HHD (n = 865)* Deaths: 75 Adjusted HR vs. ICHD: 0.53 (95% CI, 0.41 to 0.68); Adjusted HR with 6 month lag: 0.59 (0.46 to 0.77) **Indirect comparison *Conventional HHD (n = 2,325)* Deaths: 226 Adjusted HR vs. ICHD: 0.51 (0.44, 0.59) Adjusted HR with 6 month lag: 0.58 (0.50 to 0.66) **Indirect comparison Mortality (all-cause infection) *Frequent/ extended HHD (n = 865)* Deaths: 6 *Conventional HHD (n = 2,325)* Deaths: 13 Mortality (cardiovascular events) *Frequent/ extended HHD (n = 865)* Deaths: 55 *Conventional HHD (n = 2,325)* Deaths: 146			

CI = confidence interval; h = hours; HHD = home hemodialysis; HR = hazard ratio; ICHD = in-centre hemodialysis; N = number; pt = patient; SD = standard deviation; SMR = standard mortality ratio; wk = week; yr = year.

Appendix 9: Critical Appraisal — Clinical Review

Strengths and limitations of systematic reviews using the ROBIS tool

Strengths	Limitations
Couchoud et al., 2015[3]	
Domain 1: Study eligibility criteria • Eligibility criteria were unambiguous and appropriate for the review question • The restrictions placed in eligibility criteria regarding study characteristics and sources of information were appropriate *Domain 2: Identification and selection of studies* • The search included an adequate range of electronic sources for published and unpublished reports • Appropriate restrictions were placed on the search dates, publication format, and language • Adequate effort was made to minimize errors in the selection of studies (i.e., article screening and selection by at least two independent reviewers) *Domain 3: Data collection and study appraisal* • Adequate effort was made to minimize error in data collection (e.g., data extraction by two independent reviewers or by one reviewer and detailed checking by a second reviewer) • The methodological quality (or risk of bias) of included studies was formally assessed using appropriate criteria *Domain 4: Synthesis and findings* • Synthesis included all studies known to have collected data relevant to the question being addressed (i.e., no mismatch between the number of included studies and numbers of synthesized studies) • Narrative approach to synthesis was appropriate given the nature and similarity in the research questions, study designs, and outcomes across included studies • Biases in the included primary studies were adequately addressed in the synthesis	*Domain 1: Study eligibility criteria* • Unclear if eligibility criteria were determined a priori owing to no mention of review protocol or pre-defined objectives *Domain 2: Identification and selection of studies* • No major concerns were identified *Domain 3: Data collection and study appraisal* • Unclear whether methodological quality assessment was performed by two independent reviewers *Domain 4: Synthesis and findings* • No major concerns were identified
Han et al., 2015[39]	
Domain 1: Study eligibility criteria • The review authors adhered to pre-defined objectives and eligibility criteria • Eligibility criteria were unambiguous and appropriate for the review question *Domain 2: Identification and selection of studies* • The search included an adequate range of electronic sources for published and unpublished reports • Appropriate restrictions were placed on the search dates, publication format, and language • Adequate effort was made to minimize errors in the selection of studies (i.e., article screening and selection by at least two independent reviewers) *Domain 3: Data collection and study appraisal* • All relevant study results were collected for use in the synthesis	*Domain 1: Study eligibility criteria* • Appropriateness of restrictions placed in eligibility criteria regarding study characteristics and sources of information is uncertain *Domain 2: Identification and selection of studies* • No major concerns were identified *Domain 3: Data collection and study appraisal* • Unclear if data extraction was performed by two independent reviewers or by a single reviewer with verification by a second reviewer • The methodological quality (or risk of bias) of included studies was not assessed *Domain 4: Synthesis and findings* • Unclear whether a quantitative approach to synthesis (meta-analysis) was appropriate given the nature and similarity in the research questions,

Strengths	Limitations
Domain 4: Synthesis and findings • Synthesis included all studies known to have collected data relevant to the question being addressed (i.e., no mismatch between the number of included studies and numbers of synthesized studies) • Between-study variation (heterogeneity) was explored through subgroup analyses	study designs, and outcomes across included studies • Between-studies variation (heterogeneity) was high and it was unclear if the choice of subgroups was defined a priori (i.e., no justification was provided for variables chosen for subgroup analyses) • The robustness of findings using funnel plots or sensitivity analyses was not addressed • Biases in the included primary studies were not adequately addressed in the synthesis
Ishani et al., 2015[38]	
Domain 1: Study eligibility criteria • The review authors adhered to pre-defined objectives and eligibility criteria • Eligibility criteria were unambiguous and appropriate for the review question • The restrictions placed in eligibility criteria regarding study characteristics were appropriate *Domain 2: Identification and selection of studies* • Appropriate restrictions were placed on the search dates, publication format, and language *Domain 3: Data collection and study appraisal* • The methodological quality (or risk of bias) of included studies was formally assessed using appropriate criteria *Domain 4: Synthesis and findings* • Synthesis included all studies known to have collected data relevant to the question being addressed (i.e., no mismatch between the number of included studies and numbers of synthesized studies) • Narrative approach to synthesis was appropriate given the nature and similarity in the research questions, study designs, and outcomes across included studies • Biases in the included primary studies were adequately addressed in the synthesis	*Domain 1: Study eligibility criteria* • Authors did not specify any restrictions placed in eligibility criteria regarding sources of information (i.e., publication status, language) *Domain 2: Identification and selection of studies* • The search included a limited range of electronic sources for published and unpublished reports (i.e., MEDLINE and Cochrane register) • Unclear whether article screening and selection was performed by at least two independent reviewers *Domain 3: Data collection and study appraisal* • Unclear if data extraction was performed by two independent reviewers or by a single reviewer with verification by a second reviewer • Unclear whether methodological quality assessment was performed by two independent reviewers *Domain 4: Synthesis and findings* • No major concerns were identified
Palmer et al., 2014[40]	
Domain 1: Study eligibility criteria • Eligibility criteria were unambiguous and appropriate for the review question • The restrictions placed in eligibility criteria regarding sources of information were appropriate *Domain 2: Identification and selection of studies* • The search included an adequate range of electronic sources for published and unpublished reports • Appropriate restrictions were placed on the search dates, publication format, and language • Adequate effort was made to minimize errors in the selection of studies (i.e., article screening and selection by at least two independent reviewers) *Domain 3: Data collection and study appraisal* • Adequate effort was made to minimize error in data collection (e.g., data extraction by two independent reviewers or by one reviewer and detailed checking by a	*Domain 1: Study eligibility criteria* • Unclear if eligibility criteria were determined a priori owing to no mention of review protocol or pre-defined objectives • Review authors only considered RCTs and quasi-RCTs, but no rationale provided for this restriction *Domain 2: Identification and selection of studies* • No major concerns were identified *Domain 3: Data collection and study appraisal* • No major concerns were identified *Domain 4: Synthesis and findings* • No major concerns were identified

Strengths	Limitations
second reviewer) • The methodological quality (or risk of bias) of included studies was formally assessed using appropriate criteria, with sufficient effort made to minimize error in the assessment *Domain 4: Synthesis and findings* • Synthesis included all studies (RCTs) known to have collected data relevant to the question being addressed • Narrative approach to synthesis was appropriate given the inclusion of one relevant study • Biases in the included primary study were adequately addressed in the synthesis	
Vale et al., 2004 (current as of 2012)[41]	
Domain 1: Study eligibility criteria • Eligibility criteria were unambiguous and appropriate for the review question • The restrictions placed in eligibility criteria regarding sources of information were appropriate *Domain 2: Identification and selection of studies* • The search included an adequate range of electronic sources for published and unpublished reports • Appropriate restrictions were placed on the search dates, publication format, and language • Adequate effort was made to minimize errors in the selection of studies (i.e., article screening and selection by at least two independent reviewers) *Domain 3: Data collection and study appraisal* • The methodological quality (or risk of bias) of included studies was formally assessed using appropriate criteria, with sufficient effort made to minimize error in the assessment *Domain 4: Synthesis and findings* • Synthesis included all studies (RCTs) known to have collected data relevant to the question being addressed • Narrative approach to synthesis was appropriate given the inclusion of one relevant study • Biases in the included primary study were adequately addressed in the synthesis	*Domain 1: Study eligibility criteria* • Unclear if eligibility criteria were determined a priori owing to no mention of review protocol or pre-defined objectives • Review authors only considered RCTs and quasi-RCTs, but no rationale provided for this restriction *Domain 2: Identification and selection of studies* • No major concerns were identified *Domain 3: Data collection and study appraisal* • No mention of data verification following data extraction by a single reviewer *Domain 4: Synthesis and findings* • No major concerns were identified

Strengths	Limitations
Pike et al., 2013[4]	
Domain 1: Study eligibility criteria • Eligibility criteria were unambiguous and appropriate for the review question • The restrictions placed in eligibility criteria regarding study characteristics and sources of information were appropriate *Domain 2: Identification and selection of studies* • The search included an adequate range of electronic sources for published and unpublished reports • Appropriate restrictions were placed on the search dates, publication format, and language • Adequate effort was made to minimize errors in the selection of studies (i.e., article screening and selection by at least two independent reviewers) *Domain 3: Data collection and study appraisal* • Adequate effort was made to minimize error in data collection (e.g., data extraction by two independent reviewers or by one reviewer and detailed checking by a second reviewer) • The methodological quality (or risk of bias) of included studies was formally assessed using appropriate criteria, with sufficient effort made to minimize error in the assessment *Domain 4: Synthesis and findings* • Synthesis included all studies known to have collected data relevant to the question being addressed (i.e., no mismatch between the number of included studies and numbers of synthesized studies)	*Domain 1: Study eligibility criteria* • Unclear if eligibility criteria were determined a priori owing to no mention of review protocol or pre-defined objectives *Domain 2: Identification and selection of studies* • No major concerns were identified *Domain 3: Data collection and study appraisal* • No major concerns were identified *Domain 4: Synthesis and findings* • Unclear whether a quantitative approach to synthesis (meta-analysis) was appropriate given the nature and similarity in the research questions, study designs, and outcomes across included studies • No justification was provided for the statistical pooling of included studies • Between-studies variation (heterogeneity) was high and insufficiently addressed in the synthesis (i.e., choice of subgroups in assessment of heterogeneity not justified, inclusion of low-quality studies not addressed)

Strengths and limitations of randomized controlled trials using the SIGN 50 checklist

Strengths	Limitations
Cullerton et al., 2007;[42] Manns et al., 2009[43]	
• Study addressed an appropriate and clearly focused question • Assignment of study participants to treatment groups was randomized • An adequate concealment method was used • Assessors were blinded to treatment allocation • Treatment and control groups were similar at the start of the trial • All relevant outcomes were measured in a standard, valid and reliable way • Percentage of participants recruited into each study group who dropped out before study completion was small • All participants were analyzed in the groups to which they were randomly allocated	• Sample size may not be sufficient to detect clinically meaningful differences between groups • The design was unable to keep study participants and physicians blind about treatment allocation • Unclear whether the only difference between groups was the treatment under investigation • Uncertain whether results are comparable for all sites which recruited participants

Strengths	Limitations
Rocco, 2011,[44] 2015;[45] Unruh, 2013,[46] 2016[47]	
• Study addressed an appropriate and clearly focused question • Assignment of study participants to treatment groups was randomized • An adequate concealment method was used • Assessors were blinded to treatment allocation • Treatment and control groups were similar at the start of the trial • All relevant outcomes were measured in a standard, valid and reliable way • Percentage of participants recruited into each study arm who dropped out before study completion was small • All participants were analyzed in the groups to which they were randomly allocated	• Sample size may not be sufficient to detect clinically meaningful differences between groups • The design was unable to keep study participants and physicians blind about treatment allocation • Unclear whether the only difference between groups was the treatment under investigation • Uncertain whether results are comparable for all sites which recruited participants

Strengths and limitations of non-randomized studies using the SIGN 50 checklist

Strengths	Limitations
de Abreu et al., 2011[48]	
• Study addressed an appropriate and clearly focused question • The method of assessment of dialysis modality was reliable • Main study outcomes were clearly defined • Method of outcome assessment (SF-12, KDQoL-SF) is valid and reliable • Measurement of outcome (HRQoL) was not likely to have been influenced by knowledge of the dialysis modality received • Main potential clinical confounders (age, sex, comorbid conditions, length of time on dialysis) were identified and controlled for in the design and analysis	• Sample size may not be sufficient to detect clinically meaningful differences between groups • Assessment of outcome was not made blind to exposure status • Patient characteristics not well balanced at baseline (i.e., PD patients were older, and had more comorbidities) • Possibility of residual confounding cannot be ruled out • Study may be of limited generalizability to the Canadian setting • Socioeconomic and system-level confounders were not adjusted for in the analysis
Frimat et al., 2006[49]	
• Study addressed an appropriate and clearly focused question • The method of assessment of dialysis modality was reliable • Main study outcomes were clearly defined • Measurement of outcomes (mortality, hospitalization, HRQoL) was not likely to have been influenced by knowledge of the dialysis modality received • Method of outcome assessment (KDQoL-SF) is valid and reliable • Main potential clinical confounders (age, sex, comorbid conditions) were identified and controlled for in the design and analysis	• Sample size may not be sufficient to detect clinically meaningful differences between groups • Percentage of participants who dropped out of each group before study completion was high (PD = 39.8%; HD = 33.8%) • No comparison was made between full participants and those lost to follow-up, by dialysis modality • Assessment of outcome was not made blind to exposure status • Description of adjustment covariates unclear • Socioeconomic and system-level confounders were not adjusted for in the analysis • Possibility of residual confounding cannot be ruled out

Strengths	Limitations
Habib et al., 2016[58]	
• Study addressed an appropriate and clearly focused question • The method of assessment of dialysis modality was reliable • Main study outcomes were clearly defined • Measurement of study outcome (all-cause mortality) was not likely to have been influenced by knowledge of the dialysis modality received • Main potential clinical confounders (age, sex, comorbid conditions) were identified and controlled for in the design and analysis	• Study was retrospective • Lack of reporting and comparison of matched cohort patient characteristics with non-matched cohort • Competing risks present (kidney transplantation), but not taken into account in the analysis • Socioeconomic and system-level confounders were not adjusted for in the analysis • Possibility of residual confounding cannot be ruled out
Harris et al., 2002[50]	
• Study addressed an appropriate and clearly focused question • The method of assessment of dialysis modality was reliable • Main study outcomes were clearly defined • Measurement of outcomes (i.e., survival, hospitalization, quality of life) was not likely to have been influenced by knowledge of the dialysis modality received • Method of outcome assessment (quality of life) is valid and reliable • Main potential clinical confounders (age, sex, comorbid conditions/number of comorbidities, length of time on dialysis) were identified and controlled for in the design and analysis	• Sample size may not be sufficient to detect clinically meaningful differences between groups • Number of participants who dropped out from each group before study completion was not reported • Assessment of outcomes was not made blind to exposure status • Possibility of residual confounding cannot be ruled out • Socioeconomic and system-level confounders were not adjusted for in the analysis
Jeloka et al., 2016[51]	
• Study addressed an appropriate and clearly focused question • The method of assessment of dialysis modality was reliable • Main study outcomes were clearly defined • Measurement of study outcome (all-cause mortality) was not likely to have been influenced by knowledge of the dialysis modality received	• Sample size may not be sufficient to detect clinically meaningful differences between groups • Number of participants who dropped out from each group before study completion was not reported • Incomplete adjustment for the main potential confounders in the analysis (did not adjust for multiple comorbid conditions in the main model, only diabetes) • Study may be of limited generalizability to the Canadian setting • Socioeconomic and system-level confounders were not adjusted for in the analysis • Possibility of residual confounding cannot be ruled out • Competing risks present (kidney transplantation), but not taken into account in the analysis
Kasza et al., 2016[59]	
• Study addressed an appropriate and clearly focused question • The method of assessment of dialysis modality was reliable • Main study outcomes were clearly defined • Measurement of study outcome (all-cause mortality) was not likely to have been influenced by knowledge of the dialysis modality received • Main potential clinical confounders (age, sex, comorbid conditions/number of comorbidities) were identified and controlled for in the design and analysis	• Study was retrospective • Possibility of residual confounding cannot be ruled out, despite explicit modelling of the potential impact of unmeasured confounding on the results • Socioeconomic and system-level confounders were not adjusted for in the analysis • Competing risks present (kidney transplantation), but not taken into account in the analysis

Strengths	Limitations
Kim et al., 2015[60]	
• Study addressed an appropriate and clearly focused question • The method of assessment of dialysis modality was reliable • Main study outcomes were clearly defined • Measurement of study outcomes (cardiac and cerebrovascular adverse events, all-cause mortality, etc.) was not likely to have been influenced by knowledge of the dialysis modality received • Main potential clinical confounders (age, sex, comorbid conditions) were identified and controlled for in the design and analysis	• Study was retrospective • Study may be of limited generalizability to the Canadian setting (i.e., pattern of developing cardiac and cerebrovascular events may be different between Korean and Western patients initiating dialysis) • Socioeconomic and system-level confounders were not adjusted for in the analysis • Possibility of residual confounding cannot be ruled out • Competing risks present (kidney transplantation), but not taken into account in the analysis
Kim et al., 2015[52]	
• Study addressed an appropriate and clearly focused question • The method of assessment of dialysis modality was reliable • Main study outcomes were clearly defined • Measurement of outcomes (i.e., patient and technique survival, HRQoL) was not likely to have been influenced by knowledge of the dialysis modality received • Method of outcome assessment (KDQoL-36) is valid and reliable • Potential for competing risks (transplant , modality switch) recognized and competing risk regression used in the analysis	• Sample size may not be sufficient to detect clinically meaningful differences between groups • Number of participants who dropped out from each group before study completion was not reported • Incomplete adjustment for the main potential confounders in the analysis (did not adjust for sex or more than one comorbid condition) • Study may be of limited generalizability to the Canadian setting • Assessment of outcome was not made blind to exposure status • Socioeconomic and system-level confounders were not adjusted for in the analysis • Possibility of residual confounding cannot be ruled out
Lee et al., 2016[53]	
• Study addressed an appropriate and clearly focused question • The method of assessment of dialysis modality was reliable • Main study outcomes were clearly defined • Percentage of participants who dropped out before study completion was small (2.6% overall) • Main potential clinical confounders (age, sex, comorbid conditions/number of comorbidities) were identified and controlled for in the design and analysis	• Comparison between full participants and those lost to follow-up (by dialysis modality) was not made • Knowledge of the dialysis modality received at baseline may have influenced the assessment of outcome (i.e., PD associated with higher risk of technique failure than HD) • Assessment of outcome was not made blind to exposure status • Socioeconomic and system-level confounders were not adjusted for in the analysis • Possibility of residual confounding cannot be ruled out • Competing risks present (death, kidney transplantation), but not taken into account in the analysis

Strengths	Limitations
Lee et al., 2015[61]	
• Study addressed an appropriate and clearly focused question • The method of assessment of dialysis modality was reliable • Main study outcomes were clearly defined • Measurement of outcomes (i.e., gastrointestinal events) was not likely to have been influenced by knowledge of the dialysis modality received • Main potential clinical confounders (age, sex, comorbid conditions/number of comorbidities) were identified and controlled for in the design and analysis • Potential for competing risks (death) recognized and competing risk models used to adjust for risk of death in the analysis	• Study was retrospective • Study may be of limited generalizability to the Canadian setting • Socioeconomic and system-level confounders were not adjusted for in the analysis • Possibility of residual confounding cannot be ruled out
Lin et al., 2015[62]	
• Study addressed an appropriate and clearly focused question • The method of assessment of dialysis modality was reliable • Main study outcomes were clearly defined • Measurement of study outcome (i.e., dementia) was not likely to have been influenced by knowledge of the dialysis modality received • Main potential clinical confounders (age, sex, comorbid conditions/number of comorbidities) were identified and controlled for in the design and analysis • Potential for competing risks (death) recognized and cumulative risk competing risk (CICR) method used to adjust for risk of death in the analysis	• Study was retrospective • Study may be of limited generalizability to the Canadian setting • Socioeconomic and system-level confounders were not adjusted for in the analysis • Possibility of residual confounding cannot be ruled out
Lin et al., 2015[63]	
• Study addressed an appropriate and clearly focused question • The method of assessment of dialysis modality was reliable • Main study outcomes were clearly defined • Measurement of outcomes (i.e., peripheral artery occlusive disease) was not likely to have been influenced by knowledge of the dialysis modality received • Main potential clinical confounders (age, sex, comorbid conditions/number of comorbidities) were identified and controlled for in the design and analysis	• Study was retrospective • Study may be of limited generalizability to the Canadian setting • Length of time on dialysis was not adjusted for prevalent patients in the analysis (only year of dialysis initiation) • Socioeconomic and system-level confounders were not adjusted for in the analysis • Possibility of residual confounding cannot be ruled out • Competing risks present (death, kidney transplantation), but not taken into account in the analysis
Lockridge et al., 2012[54]	
• Study addressed an appropriate and clearly focused question • The method of assessment of dialysis modality was reliable • Main study outcomes were clearly defined • Percentage of participants who dropped out before study completion was small (4.1% overall) • Measurement of outcomes (i.e., mortality, technique failure) was not likely to have been influenced by knowledge of the dialysis modality received • Main potential clinical confounders (age, sex, comorbid	• Sample size may not be sufficient to detect clinically meaningful differences between groups • Assessment of outcome was not made blind to exposure status • Socioeconomic and system-level confounders were not adjusted for in the analysis • Possibility of residual confounding cannot be ruled out • Competing risks present (death, kidney transplantation), but not taken into account in the analysis

Strengths	Limitations
conditions/number of comorbidities, length of time on dialysis) were identified and controlled for in the design and analysis	
Manns et al., 2003[55]	
• Study addressed an appropriate and clearly focused question • The method of assessment of dialysis modality was reliable • Main study outcomes were clearly defined • Measurement of outcomes (i.e., HRQoL) was not likely to have been influenced by knowledge of the dialysis modality received • Method of outcome assessment (KDQoL-SF, SF-36, EQ-5D) is valid and reliable	• Assessment of outcome was not made blind to exposure status • Unclear whether adjustment for the main potential confounders was performed in the design and analysis • Large number of participants (59% of baseline sample) did not complete 12-month HRQoL assessment (16% and 28% did not return the 6-month and 12-month questionnaires, respectively) • No comparison was made between full participants and those lost to follow-up, by dialysis modality • Socioeconomic and system-level confounders were not adjusted for in the analysis • Possibility of residual confounding cannot be ruled out.
Marshall et al., 2016[64]	
• Study addressed an appropriate and clearly focused question • The method of assessment of dialysis modality was reliable • Main study outcomes were clearly defined • Measurement of outcomes (i.e., all-cause mortality) was not likely to have been influenced by knowledge of the dialysis modality received • Main potential clinical confounders (age, sex, comorbid conditions/number of comorbidities) were identified and controlled for in the design and analysis	• Study was retrospective • Socioeconomic and system-level confounders were not adjusted for in the analysis • Possibility of residual confounding cannot be ruled out
Moldovan et al., 2016[56]	
• Study addressed an appropriate and clearly focused question • The method of assessment of dialysis modality was reliable • Main study outcomes were clearly defined • Measurement of outcomes (i.e., all-cause mortality, cardiovascular adverse events) not likely to have been influenced by knowledge of the dialysis modality received	• Sample size may not be sufficient to detect clinically meaningful differences between groups • Assessment of outcome was not made blind to exposure status • Incomplete adjustment for the main potential clinical confounders in the analysis (did not adjust for more than one comorbid condition in the main model) • Socioeconomic and system-level confounders were not adjusted for in the analysis • Study may be of limited generalizability to the Canadian setting • Possibility of residual confounding cannot be ruled out • Competing risks present (kidney transplantation), but not taken into account in the analysis

Strengths	Limitations
Nadeau-Fredette et al., 2015[65]	
• Study addressed an appropriate and clearly focused question • The method of assessment of dialysis modality was reliable • Main study outcomes were clearly defined • Measurement of outcomes (i.e., composite of patient and dialysis technique survival, patient survival) was not likely to have been influenced by knowledge of the dialysis modality received • Main potential clinical confounders (age, sex, comorbid conditions) were identified and controlled for in the design and analysis • Competing risk regression performed as sensitivity analysis with transplantation as competing outcome	• Study was retrospective • Socioeconomic and system-level confounders were not adjusted for in the analysis • Possibility of residual confounding cannot be ruled out, even after matching procedures
Nadeau-Fredette et al., 2015[66]	
• Study addressed an appropriate and clearly focused question • The method of assessment of dialysis modality was reliable • Main study outcomes were clearly defined • Measurement of outcomes (i.e., overall survival, on-treatment survival, patient and technique survival,) was not likely to have been influenced by knowledge of the dialysis modality received • Main potential clinical confounders (age, sex, comorbid conditions) were identified and controlled for in the design and analysis • Competing risk regression performed as sensitivity analysis with transplantation as competing outcome	• Study was retrospective • Socioeconomic and system-level confounders were not adjusted for in the analysis • Possibility of residual confounding cannot be ruled out
Nesrallah et al., 2016[67]	
• Study addressed an appropriate and clearly focused question • The method of assessment of dialysis modality was reliable • Main study outcomes were clearly defined • Measurement of outcomes (i.e., all-cause mortality) not likely to have been influenced by knowledge of the dialysis modality received • Main potential clinical confounders (age, sex, comorbid conditions, vascular access type) were identified and controlled for in the design and analysis	• Study was retrospective • Socioeconomic and system-level confounders were not adjusted for in the analysis • Possibility of residual confounding cannot be ruled out
Oliver et al., 2016[68]	
• Study addressed an appropriate and clearly focused question • The method of assessment of dialysis modality was reliable • Main study outcomes were clearly defined • Measurement of outcomes (hospital days, hospital admissions, and cause-specific rate of hospitalization per person-year of follow-up) was not likely to have been influenced by knowledge of the dialysis modality received • Main potential clinical confounders (age, sex, comorbid conditions) were identified and controlled for in the design and analysis	• Study was retrospective • Enrolment was not balanced between recruitments sites • Family assisted and home care assisted PD were grouped together to increase the sample size; however, uncertain whether differences between the two types of assisted PD may have had an impact on the findings • Findings may not extend to self-care PD patients • Socioeconomic and system-level confounders were not adjusted for in the analysis • Possibility of residual confounding cannot be ruled out

Strengths	Limitations
Quinn et al., 2011[192]	
• Study addressed an appropriate and clearly focused question • The method of assessment of dialysis modality was reliable • Main study outcomes were clearly defined • Measurement of outcomes (i.e., all-cause mortality) was not likely to have been influenced by knowledge of the dialysis modality received • Main potential clinical confounders (age, sex, comorbid conditions/number of comorbidities) were identified and controlled for in the design and analysis	• Study was retrospective • Socioeconomic and system-level confounders were not adjusted for in the analysis • Possibility of residual confounding cannot be ruled out • Competing risks present (kidney transplantation), but were not taken into account in the analysis
Shen et al., 2016[69]	
• Study addressed an appropriate and clearly focused question • The method of assessment of dialysis modality was reliable • Main study outcomes were clearly defined • Measurement of outcomes (i.e., atrial fibrillation) was not likely to have been influenced by knowledge of the dialysis modality received • Main potential clinical confounders (age, sex, comorbid conditions) were identified and controlled for in the design and analysis	• Study was retrospective • Study may be of limited generalizability to the Canadian setting • Socioeconomic and system-level confounders were not adjusted for in the analysis • Possibility of residual confounding cannot be ruled out • Competing risks present (death, kidney transplantation), but were not taken into account in the analysis
Suri et al., 2015[70]	
• Study addressed an appropriate and clearly focused question • The method of assessment of dialysis modality was reliable • Main study outcomes were clearly defined • Measurement of hospitalization outcome was not likely to have been influenced by knowledge of the dialysis modality received	• Study was retrospective • Knowledge of the dialysis modality received at baseline may have influenced the assessment of technique failure outcome • Incomplete adjustment for the main potential clinical confounders in the analysis (did not adjust for sex or comorbid conditions in the main model) • Socioeconomic and system-level confounders were not adjusted for in the analysis • Possibility of residual confounding cannot be ruled out
Wang et al., 2016[72]	
• Study addressed an appropriate and clearly focused question • The method of assessment of dialysis modality was reliable • Main study outcomes were clearly defined • Measurement of study outcome (sudden sensorineural hearing loss) was not likely to have been influenced by knowledge of the dialysis modality received • Main potential clinical confounders (age, sex, comorbid conditions/number of comorbidities) were identified and controlled for in the design and analysis	• Study was retrospective • Study may be of limited generalizability to the Canadian setting • Socioeconomic and system-level confounders were not adjusted for in the analysis • Possibility of residual confounding cannot be ruled out • Multivariate Cox model adjusted for competing risk of death, but competing risk regression does not appear to have been carried out

Strengths	Limitations
Wang et al., 2016[73]	
• Study addressed an appropriate and clearly focused question • The method of assessment of dialysis modality was reliable • Main study outcomes were clearly defined • Measurement of study outcome (hydrocephalus) was not likely to have been influenced by knowledge of the dialysis modality received • Main potential clinical confounders (age, sex, comorbid conditions) were identified and controlled for in the design and analysis	• Study was retrospective • Study may be of limited generalizability to the Canadian setting • Socioeconomic and system-level confounders were not adjusted for in the analysis • Possibility of residual confounding cannot be ruled out • Competing risks present (death, kidney transplantation), but were not taken into account in the analysis
Wang et al., 2016[74]	
• Study addressed an appropriate and clearly focused question • The method of assessment of dialysis modality was reliable • Main study outcomes were clearly defined • Measurement of outcomes (i.e., pulmonary embolism, all-cause mortality) was not likely to have been influenced by knowledge of the dialysis modality received • Main potential clinical confounders (age, sex, comorbid conditions) were identified and controlled for in the design and analysis • Potential for competing risks (death) recognized and competing risk models used to adjust for risk of death in the analysis	• Study was retrospective • Study may be of limited generalizability to the Canadian setting • Socioeconomic and system-level confounders were not adjusted for in the analysis • Possibility of residual confounding cannot be ruled out
Wang et al., 2015[71]	
• Study addressed an appropriate and clearly focused question • The method of assessment of dialysis modality was reliable • Main study outcomes were clearly defined • Measurement of outcomes (i.e., subdural hematoma, mortality due to subdural hematoma) was not likely to have been influenced by knowledge of the dialysis modality received • Main potential clinical confounders (age, sex, comorbid conditions) were identified and controlled for in the design and analysis	• Study was retrospective • Study may be of limited generalizability to the Canadian setting • Socioeconomic and system-level confounders were not adjusted for in the analysis • Possibility of residual confounding cannot be ruled out • Competing risks present (death, kidney transplantation), but were not taken into account in the analysis
Weinhandl et al., 2016[75]	
• Study addressed an appropriate and clearly focused question • The method of assessment of dialysis modality was reliable • Main study outcomes were clearly defined • Measurement of outcomes (i.e., mortality, hospitalization, technique failure) was not likely to have been influenced by knowledge of the dialysis modality received • Main potential clinical confounders (age, sex, comorbid conditions) were identified and controlled for in the design and analysis	• Study was retrospective • Socioeconomic and system-level confounders were not adjusted for in the analysis • Possibility of residual confounding cannot be ruled out

Strengths	Limitations
Wolfgram et al., 2015[76]	
• Study addressed an appropriate and clearly focused question • The method of assessment of dialysis modality was reliable • Main study outcomes were clearly defined • Measurement of study outcome (incident dementia) was not likely to have been influenced by knowledge of the dialysis modality received • Main potential clinical confounders (age, sex, comorbid conditions) were identified and controlled for in the design and analysis • Potential for competing risks (kidney transplantation, end of Medicare as primary insurance, or death) was recognized and competing risk regression used in the analysis	• Study was retrospective • Socioeconomic and system-level confounders were not adjusted for in the analysis • Possibility of residual confounding cannot be ruled out
Wu et al., 2004[57]	
• Study addressed an appropriate and clearly focused question • The method of assessment of dialysis modality was reliable • Main study outcomes were clearly defined • Method of outcome assessment (CHEQ, SF-36) is valid and reliable • Measurement of study outcome (HRQoL) was not likely to have been influenced by knowledge of the dialysis modality received	• Assessment of outcome was not made blind to exposure status • HRQoL was not measured before patients initiated dialysis • Large number of participants (56% of baseline sample) did not complete the 12-month HRQoL assessment • No comparison was made between full participants and those lost to follow-up, by dialysis modality • Incomplete adjustment for the main potential clinical confounders in the analysis (did not adjust for comorbid conditions) • Socioeconomic and system-level confounders were not adjusted for in the analysis • Possibility of residual confounding cannot be ruled out
Yang et al., 2015[77]	
• Study addressed an appropriate and clearly focused question • The method of assessment of dialysis modality was reliable • Main study outcomes were clearly defined • Measurement of outcomes (i.e., all-cause mortality) was not likely to have been influenced by knowledge of the dialysis modality received	• Study was retrospective • Study may be of limited generalizability to the Canadian setting • Unclear whether the main potential clinical confounders (age, sex, comorbid conditions) were identified and controlled for in the design and analysis • Possibility of residual confounding cannot be ruled out
Yang et al., 2015[78]	
• Study addressed appropriate and clearly focused question • The method of assessment of exposure was reliable • Main study outcomes were clearly defined • Measurement of outcomes (i.e., mortality, hospitalization, other adverse events) was not likely to have been influenced by knowledge of the dialysis modality received • Main potential clinical confounders (age, sex, comorbid conditions) were identified and controlled for in the design and analysis	• Study was retrospective • Study may be of limited generalizability to the Canadian setting • Possibility of residual confounding cannot be ruled out

Strengths	Limitations
Yeates et al., 2012[79]	
• Study addressed an appropriate and clearly focused question • The method of assessment of dialysis modality was reliable • Main study outcomes were clearly defined • Measurement of outcomes (i.e., survival) was not likely to have been influenced by knowledge of the dialysis modality received • Main potential clinical confounders (age, sex, comorbid conditions) were identified and controlled for in the design and analysis	• Study was retrospective • Socioeconomic and system-level confounders were not adjusted for in the analysis • Possibility of residual confounding cannot be ruled out

Appendix 10: Validity of Outcomes for Health-Related Quality of Life Instruments — Clinical Review

EuroQoL 5-Dimensions (EQ-5D) Questionnaire

The EuroQol 5-Dimensions Questionnaire (EQ-5D) is a generic quality of life instrument that may be applied to a wide range of health conditions and treatments.[193] The first of two parts of the EQ-5D is a descriptive system that classifies respondents (aged ≥ 12 years) into one of 243 distinct health states. The descriptive system consists of the following five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. For the 3L version of the EQ-5D, each dimension has three possible levels (1, 2, or 3) representing "no problems," "some problems," and "extreme problems," respectively. Respondents are asked to choose the level that reflects their health state for each of the five dimensions. A scoring function can be used to assign a value (EQ-5D index score) to self-reported health states from a set of population-based preference weights.[193] The second part is a 20 cm visual analogue scale (EQ-VAS) that has end points labelled 0 and 100, with respective anchors of "worst imaginable health state" and "best imaginable health state." Respondents are asked to rate their health by drawing a line from an anchor box to the point on the EQ-VAS that best represents their health on that day. Hence, the EQ-5D produces three types of data for each respondent:

- A profile indicating the extent of problems on each of the five dimensions represented by a five-digit descriptor, such as 11121, 33211, etc.
- A population preference-weighted health index score based on the descriptive system.
- A self-reported assessment of health status based on the EQ-VAS.

The EQ-5D index score is generated by applying a multi-attribute utility function to the descriptive system. Different utility functions are available that reflect the preferences of specific populations (e.g., US or UK). The lowest possible overall score (corresponding to severe problems on all five attributes) varies depending on the utility function that is applied to the descriptive system (e.g., –0.59 for the UK algorithm and –0.109 for the US algorithm). Scores less than 0 represent health states that are valued by society as being worse than dead, while scores of 0 and 1.00 are assigned to the health states "dead" and "perfect health," respectively.[193]

A minimal clinically important difference (MCID) for the EQ-5D index score in patients with ESKD undergoing renal replacement therapy (RRT) was not identified; however, in other conditions, it typically ranges from 0.033 to 0.074.[194,195] A Canadian study on quality of life in patients undergoing nocturnal HD considered a minimum incremental change of 0.03 as clinically important.[43]

Medical outcomes study Short Form-36 health survey (SF-36)

The Short Form (36) Health Survey (SF-36) is a 36-item, general health status instrument that has been used extensively in clinical trials in many disease areas.[196] The SF-36 consists of eight health domains — physical functioning (PF), role physical (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role emotional (RE), and mental health (MH).[197] For each of the eight categories, a subscale score can be calculated. The SF-36 also provides two component summaries, the physical component score (PCS) and the mental component summary (MCS), derived from aggregating the eight domains according to a scoring algorithm. The PCS and MCS scores range from 0 to 100, with higher scores indicating better health status. The summary scales are scored using norm-based methods, with regression weights and constants derived from the general US population. Both the PCS and MCS scales are transformed to have a mean of 50 and a standard deviation (SD) of 10 in the general US population. Therefore, all scores above/below 50 are considered above/below average for the general US population.

A study of 172 patients receiving HD, PD, and kidney transplant showed that the SF-36 allowed adequate comparison between patients receiving RRT and the general population.[198] The instrument was able to discriminate between the three RRT therapies and controls, so the authors concluded that the SF-36 showed good evidence for validity in these groups. The MCID for either the PCS or MCS of the SF-36 among the general population is typically between 2.5 and 5 points;[199-201] however, no MCID for ESKD patients on RRT was identified.

36-Item Short Form Survey from the RAND Medical Outcomes Study (RAND-36)

The 36-item Short Form Survey from the RAND Medical Outcomes Study (RAND-36) is a QoL questionnaire that is available to the public for use, and contains a set of generic QoL measures that rely upon patient self-reporting.[202] It is a variant of the original SF-36 questionnaire and only differs in terms of the scoring algorithm. The RAND-36 is composed of eight domains: physical functioning (10 items), role physical (4 items), pain index (2 items), general health (5 items), energy/fatigue (4 items), social functioning (2 items), role emotional (3 items), and emotional well-being (5 items), for a total of 35 items. In addition, the survey contains a 36th item, a health transition item that is

used to rate the patient's present health compared with their health the previous year.[202] For each of the eight categories, a subscale score can be calculated. Scores range from 0 to 100 with higher scores indicating better health status. Scoring the RAND-36 is a two-step process. First, pre-coded numeric values are re-coded per the scoring key using a pre-defined table. In addition, each item is scored on a 0 to 100 range so that the lowest and highest possible scores are 0 and 100, respectively.[202] In step two, items in the same domains are averaged together to create the eight domain scores. Items that are left blank (missing data) are not taken into account when calculating the scale scores. Therefore, scale scores represent the average for all items in the scale that the respondent answered.[202]

The RAND-36 was validated as a general health survey in its initial development; however, no additional literature assessing the reliability and validity of its psychometric properties or MCID in a population with ESKD on dialysis was identified.

Kidney Disease Quality of Life (KDQoL) instrument

The KDQoL is a self-report instrument, designed for people with kidney disease who are on dialysis. It includes the SF-36 health survey as a generic core, and 19 additional multi-item kidney disease–targeted scales, plus an overall health rating item.[203] The additional scales include symptom/problems, effects of kidney disease, burden of kidney disease, work status, cognitive function, quality of social interaction, sexual function, sleep, social support, dialysis staff encouragement, and patient satisfaction. Scale scores are linearly transformed into scales from 0 to 100. Higher values indicate better HRQoL.[203]

The KDQoL instrument was validated during its initial development, in a study of 165 patients with kidney disease in nine outpatient dialysis clinics in the US.[203] Internal consistency reliability estimates were considered acceptable (exceeding Cronbach's alpha 0.70) for all kidney disease–targeted measures except for quality of social interaction (0.68).[203] These results were further validated in a subsequent study of 375 ESKD patients in 32 centres in the Netherlands, at the beginning of their chronic dialysis treatment.[204] The Dutch study concluded that the psychometric properties of the instrument were good (with Cronbach's alpha greater than 0.70, except for quality of social interaction, which was below recommended values, at 0.39), and the instrument was able to detect clinical changes over time.[204] It is unclear if these findings are generalizable to the Canadian population. An MCID for the KDQoL score was not identified.

Beck Depression Inventory

The Beck Depression Inventory (BDI) is a 21-item questionnaire that is used as a screening tool for measuring severity of depression.[205] Respondents rate the presence of cognitive, affective, performance, and depression during the preceding week, using a four-point scale of 0 to 3.[206] Total scores for the instrument range from 0 to 63, with higher scores indicating more severe symptoms. A score of ≥ 11 has been validated for indication of depression in the general population;[205] however, it is considered difficult to define appropriate cut-off scores in patients with chronic physical ill health.[206]

A study of 57 patients with ESKD, undergoing HD in the UK was performed to validate the scale in this demographic. The results of the study indicated that a score of ≥ 11 was not a valid cut-off score for patients undergoing HD, and it was suggested that a cut-off of ≥ 15 maximized Youden's index of validity, and the BDI tool might be considered useful for screening out depression in these patients at the higher threshold.[206] This was based on a comparison of the BDI score with a blinded psychiatric assessment, with a full psychiatric history and mental state examination. Another study of 62 patients in the US who had been receiving HD or PD for a minimum of 90 days, recommended a cut-off of 16 for screening out depression in this group of patients.[207] This conclusion was based on a comparison of the BDI score with the mood module of the Structured Clinical Interview for *DSM*-IV (SCID-IV), which was considered to be the gold-standard measure for this study, and was administered by a mental health professional who was blinded to the BDI results. It is unclear if these findings are generalizable to the Canadian population. An MCID for the BDI score in patients with ESKD and on dialysis was not identified.

CHOICE Health Experience Questionnaire

The CHOICE Health Experience Questionnaire (CHEQ) instrument was designed for the Choices for Healthy Outcomes In Caring for ESRD (CHOICE) study. The study's aim was to evaluate the effectiveness of different dialysis prescriptions, and the CHEQ tool was developed to measure patient HRQoL, with domains specific to a population undergoing dialysis.[208] The CHEQ tool is a 21-domain, 83-item self-reporting questionnaire. The tool incorporates the general health questionnaire (SF-36) and ESKD-specific questions. The ESKD-specific domains are role physical, mental health, general health, freedom, travel restriction, cognitive function, financial function, restriction of diet and fluids, recreation, work, body image, symptoms, sex, sleep, access, and quality of life. Scoring of the tool is measured from 0 to 100.[209]

During development, the questionnaire was tested for reliability and validity on 928 patients in the US (694 undergoing HD, and 234 undergoing PD). Internal consistency reliability was generally acceptable.[208] A study on 110 Thai ESKD patients (23 undergoing PD and 87 undergoing HD) confirmed the reliability and validity of the original CHEQ version, with all domains higher than 0.7 (Cronbach's alpha) except the social function (0.66) and quality of life (0.57).[209] It is unclear if these findings are generalizable to the Canadian population. An MCID for the CHEQ score was not identified.

Medical Outcomes Study Sleep Problems Index

The Sleep Problems Index (SPI II) was developed with the Medical Outcomes Study, involving two pilot studies of adults in a US academic medical clinic and a rural health clinic setting.[210] The index consists of 12 items assessing: initiation of sleep (2 items), sleep maintenance (2 items), respiratory problems (2 items), quantity of sleep (1 item), perceived adequacy of sleep (2 items), and somnolence (3 items).[210] The quantity of sleep is scored specifically as the number of hours of sleep, and the question on how long it took to fall asleep during the past four weeks is answered with one of five choices, ranging from 0 to 15 minutes, to more than 60 minutes. The other scales provide respondents with six choices of answer, ranging from "all of the time" to "none of the time," and these are transformed linearly to a range from 0 to 100.[210]

The study judged the variability of score distribution to be fairly normal, and with good reliability (ranging from 0.75 to 0.86 [Cronbach's alpha]).[210] Correlations between the SPI II and 18 other health measures that included pain, energy/fatigue, physical functioning, cognitive functioning, anxiety, and depression/behavioural-emotional control, were reviewed.[210] Snoring showed the least correlation, and the sleep problem indices (awaken short of breath or with a headache, and getting the amount of sleep needed) showed the strongest correlations. Many of the sleep measures had low correlation to the other health measures, and the authors conclude that this suggests the SPI II could be useful as a complement to generic health measures.[210] It is unclear if these findings are generalizable to the Canadian population. No MCID was identified for this instrument.

Appendix 11: List of Studies Excluded and the Reasons for Exclusion — Clinical Review

Reason for exclusion: Population (n=15)

Ahmad M, Robert R, Bargman JM, Oreopoulos D. Advantages of peritoneal dialysis in comparison to hemodialysis, in cardiac allograft recipients with end stage renal disease. Int Urol Nephrol. 2008;40(4):1083-7.

Arogundade FA, Ishola DA, Jr., Sanusi AA, Akinsola A. An analysis of the effectiveness and benefits of peritoneal dialysis and haemodialysis using Nigerian made PD fluids. Afr J Med Med Sci. 2005 Sep;34(3):227-33.

Beladi Mousavi SS, Hayati F, Valavi E, Rekabi F, Mousavi MB. Comparison of survival in patients with end-stage renal disease receiving hemodialysis versus peritoneal dialysis. Saudi J Kidney Dis Transpl [Internet]. 2015 Mar [cited 2016 Jun 16];26(2):392-7. Available from: http://www.sjkdt.org/temp/SaudiJKidneyDisTranspl262392-407476_111907.pdf

Chou CY, Wang SM, Liang CC, Chang CT, Liu JH, Wang IK, et al. Peritoneal dialysis is associated with a better survival in cirrhotic patients with chronic kidney disease. Medicine (Baltimore). 2016 Jan;95(4):e2465.

De Vecchi A, Finazzi S, Padalino R, Santagostino T, Bottaro E, Roma E, et al. Sleep disorders in peritoneal and haemodialysis patients as assessed by a self-administered questionnaire. Int J Artif Organs. 2000 Apr;23(4):237-42.

Fernández-Cean J, Alvarez A, Burguez S, Baldovinos G, Larre-Borges P, Cha M. Infective endocarditis in chronic haemodialysis: two treatment strategies. Nephrol Dial Transplant [Internet]. 2002 Dec [cited 2016 Jun 22];17(12):2226-30. Available from: http://ndt.oxfordjournals.org/content/17/12/2226.full.pdf+html

Fu J, Huang J, Lei M, Luo Z, Zhong X, Huang Y, et al. Prevalence and impact on stroke in patients receiving maintenance hemodialysis versus peritoneal dialysis: a prospective observational study. PLoS ONE. 2015 [cited 2016 Jun 21];10(10):e0140887. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4617449

Hsieh CY, Chen CH, Wu AB, Tseng CC. Comparative outcomes between hemo- and peritoneal dialysis patients with acute intracerebral hemorrhage. Am J Nephrol. 2010;32(1):31-7.

Iseki K, Tozawa M, Takishita S. Determinants of prescribed dialysis dose and survival in a cohort of chronic hemodialysis patients. Clinical and Experimental Nephrology. 2003;7(3):231-7.

Kumar VA, Ananthakrishnan S, Rasgon SA, Yan E, Burchette R, Dewar K. Comparing cardiac surgery in peritoneal dialysis and hemodialysis patients: perioperative outcomes and two-year survival. Perit Dial Int [Internet]. 2012 Mar [cited 2016 Jun 21];32(2):137-41. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3525404

Soleymanian T, Raman S, Shannaq FN, Richardson R, Jassal SV, Bargman J, et al. Survival and morbidity of HIV patients on hemodialysis and peritoneal dialysis: one center's experience and review of the literature. Int Urol Nephrol. 2006;38(2):331-8.

Szeto CC, Kwan BC, Chow KM, Pang WF, Kwong VW, Leung CB, et al. Outcome of hemodialysis patients who had failed peritoneal dialysis. Nephron. 2010;116(4):c300-c306.

Thomson BK, Huang SH, Chan C, Urquhart B, Skanes A, Lindsay RM. Nocturnal home hemodialysis associates with improvement of electrocardiographic features linked to sudden cardiac death. ASAIO J. 2014 Jan;60(1):99-105.

Wang IK, Liang WM, Lin CL, Liu YL, Chang CT, Yen TH, et al. Impact of dialysis modality on the survival of patients with end-stage renal disease and prior stroke. Int Urol Nephrol. 2016 Jan;48(1):139-47.

Zimbudzi E, Samlero R. How do hospitalization patterns of home hemodialysis patients compare with a reasonably well dialysis patient cohort? Int J Nephrol Renovascular Dis. 2014 [cited 2016 May 16];7:203-7:-7. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4051731/pdf/ijnrd-7-203.pdf

Reason for exclusion: Intervention (n=4)

Achinger SG, Ikizler TA, Bian A, Shintani A, Ayus JC. Long-term effects of daily hemodialysis on vascular access outcomes: A prospective controlled study. Hemodial Int [Internet]. 2013 [cited 2016 May 24];17(2):208-15. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4108201/pdf/nihms413668.pdf

Badve SV, Paul SK, Klein K, Clayton PA, Hawley CM, Brown FG, et al. The association between body mass index and mortality in incident dialysis patients. PLoS ONE [Internet]. 2014 [cited 2016 Jun 21];9(12):e114897. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4267775

Koc Y, Unsal A, Basturk T, Sakaci T, hbap-Dal E, Sinangil-Arar A, et al. Is there impact of mortality prior hemodialysis therapy in peritoneal dialysis patients? Nefrologia [Internet]. 2012 May 14 [cited 2016 May 20];32(3):335-42. Available from: http://www.revistanefrologia.com/es-linkresolver-X0211699512001277

Laurin LP, Harrak H, Elftouh N, Ouimet D, Vallee M, Lafrance JP. Outcomes of Infection-Related Hospitalization according to Dialysis Modality. Clin J Am Soc Nephrol [Internet]. 2015 May 7 [cited 2016 Jun 21];10(5):817-24. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4422244

Reason for exclusion: Comparator (n=26)

Benabed A, Bechade C, Ficheux M, Verger C, Lobbedez T. Effect of assistance on peritonitis risk in diabetic patients treated by peritoneal dialysis: report from the French language Peritoneal Dialysis Registry. Nephrol Dial Transplant. 2016 Feb 29.

Brown L, Gardner G, Bonner A. A comparison of treatment options for management of end stage kidney disease in elderly patients: A systematic review. JBI Database of Systematic Reviews and Implementation Reports. 2014;12(7):374-404.

Brunelli SM, Wilson SM, Ficociello LH, Mullon C, Diaz-Buxo JA. A comparison of clinical parameters and outcomes over 1 year in home hemodialysis patients using 2008K@home or NxStage system one. ASAIO J. 2016;62(2):182-9.

Chen JY, Wan EY, Choi EP, Wong CK, Chan AK, Chan KH, et al. Clinical and patient-reported outcomes of Chinese patients undergoing haemodialysis in hospital or in the community: A 1-year longitudinal study. Nephrology (Carlton). 2015 Nov 30.

Cheng CH, Shu KH, Chuang YW, Huang ST, Chou MC, Chang HR. Clinical outcome of elderly peritoneal dialysis patients with assisted care in a single medical centre: a 25 year experience. Nephrology. 2013 Jun;18(6):468-73.

Cnossen TT, Kooman JP, Krepel HP, Konings CJ, Uszko-Lencer NH, Leunissen KM, et al. Prospective study on clinical effects of renal replacement therapy in treatment-resistant congestive heart failure. Nephrol Dial Transplant [Internet]. 2012 Jul [cited 2016 Jun 16];27(7):2794-9. Available from: http://ndt.oxfordjournals.org/content/27/7/2794.full.pdf+html

Dalrymple LS, Johansen KL, Chertow GM, Cheng SC, Grimes B, Gold EB, et al. Infection-related hospitalizations in older patients with ESRD. Am J Kidney Dis [Internet]. 2010 Sep [cited 2016 Jun 16];56(3):522-30. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2926212

Finkelstein FO, Schiller B, Daoui R, Gehr TW, Kraus MA, Lea J, et al. At-home short daily hemodialysis improves the long-term health-related quality of life. Kidney Int. 2012 Sep;82(5):561-9.

Hall YN, Larive B, Painter P, Kaysen GA, Lindsay RM, Nissenson AR, et al. Effects of six versus three times per week hemodialysis on physical performance, health, and functioning: Frequent Hemodialysis Network (FHN) randomized trials. Clin J Am Soc Nephrol [Internet]. 2012 May [cited 2016 May 16];7(5):782-94. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3338281

Hsieh CY, Fang JT, Yang CW, Lai PC, Hu SA, Chen YM, et al. The impact of type of assistance on characteristics of peritonitis in elderly peritoneal dialysis patients. Int Urol Nephrol. 2010 Dec;42(4):1117-24.

Jaar BG, Plantinga LC, Crews DC, Fink NE, Hebah N, Coresh J, et al. Timing, causes, predictors and prognosis of switching from peritoneal dialysis to hemodialysis: a prospective study. BMC Nephrol [Internet]. 2009 [cited 2016 Jun 21];10:3. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2649113

Jayanti A, Nikam M, Ebah L, Dutton G, Morris J, Mitra S. Technique survival in home haemodialysis: a composite success rate and its risk predictors in a prospective longitudinal cohort from a tertiary renal network programme. Nephrol Dial Transplant [Internet]. 2013 Oct [cited 2016 May 20];28(10):2612-20. Available from: http://ndt.oxfordjournals.org/content/28/10/2612.full.pdf+html

Johansen KL, Zhang R, Huang Y, Chen SC, Blagg CR, Goldfarb-Rumyantzev AS, et al. Survival and hospitalization among patients using nocturnal and short daily compared to conventional hemodialysis: a USRDS study. Kidney Int [Internet]. 2009 Nov [cited 2016 May 16];76(9):984-90. Available from: http://ac.els-cdn.com/S0085253815541008/1-s2.0-S0085253815541008-main.pdf?_tid=9f4a62b8-1b9d-11e6-b4ae-00000aacb360&acdnat=1463427627_a1d2e3662fb02241128bacce7d68be6d

Lafrance JP, Rahme E, Iqbal S, Elftouh N, Laurin LP, Vallee M. Trends in infection-related hospital admissions and impact of length of time on dialysis among patients on long-term dialysis: a retrospective cohort study. CMAJ Open [Internet]. 2014 Apr [cited 2016 Jun 21];2(2):E109-E114. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4084745

Lindsay RM, Leitch R, Heidenheim AP, Kortas C, London Daily/Nocturnal Hemodialysis Study. The London Daily/Nocturnal Hemodialysis Study--study design, morbidity, and mortality results. Am J Kidney Dis. 2003 Jul;42(1 Suppl):5-12.

Lobbedez T, Verger C, Ryckelynck JP, Fabre E, Evans D. Is assisted peritoneal dialysis associated with technique survival when competing events are considered? Clin J Am Soc Nephrol [Internet]. 2012 Apr [cited 2016 May 16];7(4):612-8. Available from: http://cjasn.asnjournals.org/content/7/4/612.full.pdf+html

Luik AJ, Sande FM, Weideman P, Cheriex E, Kooman JP, Leunissen KML. The influence of increasing dialysis treatment time and reducing dry weight on blood pressure control in hemodialysis patients: A prospective study. Am J Nephrol. 2001;21(6):471-8.

Martins Castro MC, Luders C, Elias RM, Abensur H, Romao Junior JE. High-efficiency short daily haemodialysis - Morbidity and mortality rate in a long-term study. Nephrology Dialysis Transplantation [Internet]. 2006 [cited 2016 May 17];21(8):2232-8. Available from: http://ndt.oxfordjournals.org/content/21/8/2232.full.pdf+html

Nadeau-Fredette AC, Bargman JM, Chan CT. Clinical outcome of home hemodialysis in patients with previous peritoneal dialysis exposure: evaluation of the integrated home dialysis model. Perit Dial Int. 2015 May;35(3):316-23.

O'Hare AM, Tawney K, Bacchetti P, Johansen KL. Decreased survival among sedentary patients undergoing dialysis: results from the dialysis morbidity and mortality study wave 2. Am J Kidney Dis. 2003 Feb;41(2):447-54.

Raithatha A, McKane W, Kendray D, Evans C. Catheter access for hemodialysis defines higher mortality in late-presenting dialysis patients. Ren Fail. 2010;32(10):1183-8.

Rayment G, Chow J. The efficacy of short daily dialysis - A single-centre experience. J RENAL CARE. 2010;36(3):118-25.

Roderick P, Byrne C, Casula A, Steenkamp R, Ansell D, Burden R, et al. Survival of patients from South Asian and Black populations starting renal replacement therapy in England and Wales. Nephrol Dial Transplant [Internet]. 2009 Dec [cited 2016 Jun 21];24(12):3774-82. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2781153

Suzuki H, Hoshi H, Inoue T, Kikuta T, Tsuda M, Takenaka T. Early start of combination therapy with hemodialysis and peritoneal dialysis prolongs survival and reduces cardiovascular events in male patients. Adv Perit Dial. 2012;28:68-73.

Weinreich T, De los RT, Gauly A, Passlick-Deetjen J. Effects of an increase in time vs. frequency on cardiovascular parameters in chronic hemodialysis patients. Clin Nephrol. 2006;66(6):433-9.

Zimmermann PR, Camey SA, de Jesus Mari J. A cohort study to assess the impact of depression on patients with kidney disease. Int J Psychiatry Med. 2006;36(4):457-68.

Reason for exclusion: Outcome (n=45)

Agar JW, Knight RJ, Simmonds RE, Boddington JM, Waldron CM, Somerville CA. Nocturnal haemodialysis: an Australian cost comparison with conventional satellite haemodialysis. Nephrology. 2005 Dec;10(6):557-70.

Bugeja AL, Chan CT. Improvement in lipid profile by nocturnal hemodialysis in patients with end-stage renal disease. ASAIO J. 2004 Jul;50(4):328-31.

Chan CT, Greene T, Chertow GM, Kliger AS, Stokes JB, Beck GJ, et al. Effects of frequent hemodialysis on ventricular volumes and left ventricular remodeling. Clin J Am Soc Nephrol [Internet]. 2013 Dec [cited 2016 May 16];8(12):2106-16. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3848394

Cheung CY, Chan GC, Chan SK, Ng F, Lam MF, Wong SS, et al. Cancer Incidence and Mortality in Chronic Dialysis Population: A Multicenter Cohort Study. Am J Nephrol [Internet]. 2016 [cited 2016 Jun 21];43(3):153-9. Available from: http://www.karger.com/Article/Pdf/445362

Cina DP, Dacouris N, Kashani M, Unana B, Cook R, Fung J, et al. Use of home hemodialysis after peritoneal dialysis technique failure. Perit Dial Int [Internet]. 2013 Jan [cited 2016 May 20];33(1):96-9. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3598259

Courivaud C, Ladrière M, Toupance O, Caillard S, Hurault de Ligny B, Ryckelynck JP, et al. Impact of pre-transplant dialysis modality on post-transplant diabetes mellitus after kidney transplantation. Clin Transplant. 2011 Sep;25(5):794-9.

Dasgupta I, Burden R. Blood pressure control before and after starting dialysis. Nephron. 2005;99(3):c86-c91.

Daugirdas JT, Chertow GM, Larive B, Pierratos A, Greene T, Ayus JC, et al. Effects of frequent hemodialysis on measures of CKD mineral and bone disorder. J Am Soc Nephrol [Internet]. 2012 [cited 2016 May 17];23(4):727-38. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3312501/?report=printable

Fagugli RM, Pasini P, Pasticci F, Ciao G, Cicconi B, Buoncristiani U. Effects of short daily hemodialysis and extended standard hemodialysis on blood pressure and cardiac hypertrophy: A comparative study. J Nephrol. 2006;19(1):77-83.

Foote C, Ninomiya T, Gallagher M, Perkovic V, Cass A, McDonald SP, et al. Survival of elderly dialysis patients is predicted by both patient and practice characteristics. Nephrol Dial Transplant [Internet]. 2012 Sep [cited 2016 May 20];27(9):3581-7. Available from: http://ndt.oxfordjournals.org/content/27/9/3581.full.pdf+html

Hiramatsu T, Furuta S, Kakuta H. Impact of dialysis modality on ultrasonographic cardiovascular parameters in elderly patients. Adv Perit Dial. 2007;23:94-7.

Hiramatsu T, Furuta S, Kakuta H. Longitudinal changes in parameters of cardiovascular function in patients treated for 8 years with hemodialysis or peritoneal dialysis. Adv Perit Dial. 2007;23:62-5.

Ipema KJ, van der Schans CP, Vonk N, de Vries JM, Westerhuis R, Duym E, et al. A difference between day and night: protein intake improves after the transition from conventional to frequent nocturnal home hemodialysis. J Ren Nutr. 2012 May;22(3):365-72.

Jayanti A, Foden P, Morris J, Brenchley P, Mitra S. Time to recovery from haemodialysis - location, intensity and beyond. Nephrology (Carlton). 2015 Dec 4.

Jefferies HJ, Virk B, Schiller B, Moran J, McIntyre CW. Frequent hemodialysis schedules are associated with reduced levels of dialysis-induced cardiac injury (myocardial stunning). Clin J Am Soc Nephrol [Internet]. 2011 Jun [cited 2016 May 16];6(6):1326-32. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3109928/?report=printable

Jiménez C, Manrique A, Morales JM, Andres A, Ortuño T, Abradelo M, et al. Influence of dialysis modality on complications and patient and graft survival after pancreas-kidney transplantation. Transplant Proc. 2008 Nov;40(9):2999-3000.

Kaysen GA, Greene T, Larive B, Mehta RL, Lindsay RM, Depner TA, et al. The effect of frequent hemodialysis on nutrition and body composition: frequent Hemodialysis Network Trial. Kidney Int [Internet]. 2012 Jul [cited 2016 May 20];82(1):90-9. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3328304

Kim SC, Chang HJ, Kim MG, Jo SK, Cho WY, Kim HK. Relationship between pulmonary hypertension, peripheral vascular calcification, and major cardiovascular events in dialysis patients. Kidney Res Clin Pract [Internet]. 2015 Mar [cited 2016 Jun 21];34(1):28-34. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4570633

Kojima E, Hoshi H, Watanabe Y, Takenaka T, Suzuki H. Daily hemodialysis improves uremia-associated clinical parameters in the short term. Contrib Nephrol. 2012;177:169-77.

Korevaar JC, Feith GW, Dekker FW, van Manen JG, Boeschoten EW, Bossuyt PM, et al. Effect of starting with hemodialysis compared with peritoneal dialysis in patients new on dialysis treatment: a randomized controlled trial. Kidney Int [Internet]. 2003 Dec [cited 2016 May 20];64(6):2222-8. Available from: http://ac.els-cdn.com/S0085253815495924/1-s2.0-S0085253815495924-main.pdf?_tid=dfe9a788-1ebe-11e6-8dce-00000aab0f02&acdnat=1463771763_65bdfe7fba46f305fcd0effbcbd49f5a

Kotanko P, Garg AX, Depner T, Pierratos A, Chan CT, Levin NW, et al. Effects of frequent hemodialysis on blood pressure: Results from the randomized frequent hemodialysis network trials. Hemodial Int. 2015 Jul;19(3):386-401.

Kurella Tamura M, Unruh ML, Nissenson AR, Larive B, Eggers PW, Gassman J, et al. Effect of more frequent hemodialysis on cognitive function in the frequent hemodialysis network trials. Am J Kidney Dis [Internet]. 2013 Feb [cited 2016 May 16];61(2):228-37. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3546160/pdf/nihms413888.pdf

Kuttykrishnan S, Kalantar-Zadeh K, Arah OA, Cheung AK, Brunelli S, Heagerty PJ, et al. Predictors of treatment with dialysis modalities in observational studies for comparative effectiveness research. Nephrol Dial Transplant. 2015 Jul;30(7):1208-17.

Liu JH, Chen JY, Lin SY, Lin HH, Ting IW, Liang CC, et al. Comparing Survival between peritoneal dialysis and hemodialysis patients with subclinical peripheral artery disease: a 6-year follow-up. Int J Med Sci [Internet]. 2013 [cited 2016 Jun 16];10(4):434-40. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3590604

Lorenzen JM, Thum T, Eisenbach GM, Haller H, Kielstein JT. Conversion from conventional in-centre thrice-weekly haemodialysis to short daily home haemodialysis ameliorates uremia-associated clinical parameters. Int Urol Nephrol. 2012 Jun;44(3):883-90.

McFarlane PA, Bayoumi AM, Pierratos A, Redelmeier DA. The quality of life and cost utility of home nocturnal and conventional in-center hemodialysis. Kidney Int [Internet]. 2003 [cited 2016 May 24];64(3):1004-11. Available from: http://ac.els-cdn.com/S0085253815494219/1-s2.0-S0085253815494219-main.pdf?_tid=4dad8e0a-21b3-11e6-bb1c-00000aab0f27&acdnat=1464096646_a082a5c33c061552ee0868004094ca61

McGregor DO, Buttimore AL, Lynn KL, Nicholls MG, Jardine DL. A Comparative Study of Blood Pressure Control with Short In-Center versus Long Home Hemodialysis. Blood Purif. 2001;19(3):293-300.

Murashima M, Kumar D, Doyle AM, Glickman JD. Comparison of intradialytic blood pressure variability between conventional thrice-weekly hemodialysis and short daily hemodialysis. Hemodial Int. 2010 Jul;14(3):270-7.

Opatrny K, Jr., Reischig T, Vienken J, Eiselt J, Vit L, Opatrna S, et al. Does treatment modality have an impact on anemia in patients with chronic renal failure? Effect of low- and high-flux biocompatible dialysis. Artif Organs. 2002;26(2):181-8.

Orhan FO, Ozer A, Sayarlioglu H, Dogan E, Altunoren O, Akman O, et al. Temperament and character profiles of end stage renal disease patients undergoing hemodialysis and peritoneal dialysis. Klinik Psikofarmakoloji Bulteni [Internet]. 2011 [cited 2016 May 24];21(3):201-9. Available from: http://www.scopemed.org/fulltextpdf.php?mno=5793

Oygar DD, Zekican G. Pulmonary hypertension in dialysis patients. Ren Fail. 2012;34(7):840-4.

Paneni F, Gregori M, Ciavarella GM, Sciarretta S, De BL, Marino L, et al. Right ventricular dysfunction in patients with end-stage renal disease. Am J Nephrol. 2010;32(5):432-8.

Pauly RP, Asad RA, Hanley JA, Pierratos A, Zaltzman J, Chery A, et al. Long-term clinical outcomes of nocturnal hemodialysis patients compared with conventional hemodialysis patients post-renal transplantation. Clin Transplant. 2009 Jan;23(1):47-55.

Poon CK, Tang HL, Wong JH, Law WP, Lam CM, Yim KF, et al. Effect of alternate night nocturnal home hemodialysis on anemia control in patients with end-stage renal disease. Hemodial Int. 2015 Apr;19(2):235-41.

Rocco MV, Larive B, Eggers PW, Beck GJ, Chertow GM, Levin NW, et al. Baseline characteristics of participants in the Frequent Hemodialysis Network (FHN) daily and nocturnal trials. Am J Kidney Dis [Internet]. 2011 Jan [cited 2016 May 16];57(1):90-100. Available from:

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3058226/pdf/nihms241933.pdf

Schwartz DI, Pierratos A, Richardson RM, Fenton SS, Chan CT. Impact of nocturnal home hemodialysis on anemia management in patients with end-stage renal disease. Clin Nephrol. 2005 Mar;63(3):202-8.

Suri RS, Larive B, Hall Y, Kimmel PL, Kliger AS, Levin N, et al. Effects of frequent hemodialysis on perceived caregiver burden in the Frequent Hemodialysis Network trials. Clin J Am Soc Nephrol [Internet]. 2014 May [cited 2016 May 16];9(5):936-42. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4011443

Suri RS, Garg AX, Chertow GM, Levin NW, Rocco MV, Greene T, et al. Frequent Hemodialysis Network (FHN) randomized trials: study design. Kidney Int [Internet]. 2007 Feb [cited 2016 May 5];71(4):349-59. Available from: http://www.sciencedirect.com/science/article/pii/S0085253815523624

Susantitaphong P, Koulouridis I, Balk EM, Madias NE, Jaber BL. Effect of frequent or extended hemodialysis on cardiovascular parameters: a meta-analysis. Am J Kidney Dis [Internet]. 2012 May [cited 2016 May 16];59(5):689-99. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3395217

Tian JP, Wang T, Wang H, Cheng LT, Tian XK, Lindholm B, et al. The prevalence of left ventricular hypertrophy in Chinese hemodialysis patients is higher than that in peritoneal dialysis patients. Ren Fail. 2008;30(4):391-400.

Unal A, Kocyigit I, Sipahioglu MH, Tokgoz B, Oymak O, Utas C. Comparison and causes of transfer from one dialysis modality to another. Int Urol Nephrol. 2011 Jun;43(2):513-8.

Wald R, Yan AT, Perl J, Jiang D, Donnelly MS, Leong-Poi H, et al. Regression of left ventricular mass following conversion from conventional hemodialysis to thrice weekly in-centre nocturnal hemodialysis. BMC Nephrol [Internet]. 2012 [cited 2016 May 24];13:3. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3297503

Wang IK, Lin HJ, Wan L, Lin CL, Yen TH, Sung FC. Risk of age-related macular degeneration in end-stage renal disease patients receiving long-term dialysis. Retina. 2016 Mar 10.

Yang JY, Lee TC, Montez-Rath ME, Chertow GM, Winkelmayer WC. Risk factors of short-term mortality after acute nonvariceal upper gastrointestinal bleeding in patients on dialysis: a population-based study. BMC Nephrol [Internet]. 2013 [cited 2016 Jun 16];14:97. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3639820

Yao YH, Fu CH, Ho SJ, Tsai SH, Ng YY, Chuang CL, et al. Peritoneal dialysis as compared with hemodialysis is associated with higher overhydration but non-inferior blood pressure control and heart function. Blood Purif. 2012;34(1):40-7.

Reason for exclusion: Study type (n=49)

Abdel-Kader K, Myaskovsky L, Karpov I, Shah J, Hess R, Dew MA, et al. Individual quality of life in chronic kidney disease: influence of age and dialysis modality. Clin J Am Soc Nephrol [Internet]. 2009 Apr [cited 2016 May 20];4(4):711-8. Available from: http://cjasn.asnjournals.org/content/4/4/711.full.pdf+html

Abedini M, Sadeghi M, Naini AE, Atapour A, Golshahi J. Pulmonary hypertension among patients on dialysis and kidney transplant recipients. Ren Fail. 2013;35(4):560-5.

Aghakhani N, Nia HS, Zadeh SS, Toupchi V, Toupchi S, Rahbar N. Quality of life during hemodialysis and study dialysis treatment in patients referred to teaching hospitals in Urmia-Iran in 2007. Caspian Journal of Internal Medicine [Internet]. 2011 [cited 2016 May 24];2(1):183-8. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3766931/pdf/cjim-2-183.pdf

Al Wakeel J, Al Harbi A, Bayoumi M, Al-Suwaida K, Al Ghonaim M, Mishkiry A. Quality of life in hemodialysis and peritoneal dialysis patients in Saudi Arabia. Ann Saudi Med. 2012 Nov;32(6):570-4.

Al-Jahdali H. A comparison of sleep disturbances and sleep apnea in patients on hemodialysis and chronic peritoneal dialysis. Saudi J Kidney Dis Transpl [Internet]. 2011 Sep [cited 2016 Jun 16];22(5):922-30. Available from: http://www.sjkdt.org/temp/SaudiJKidneyDisTranspl225922-4362206_120702.pdf

Atapour A, Eshaghian A, Taheri D, Dolatkhah S. Hemodialysis versus peritoneal dialysis, which is cost-effective? Saudi J Kidney Dis Transpl [Internet]. 2015 Sep [cited 2016 Jun 16];26(5):962-5. Available from: http://www.sjkdt.org/temp/SaudiJKidneyDisTranspl265962-4089093_112130.pdf

Avramovic M, Stefanovic V. Health-related quality of life in different stages of renal failure. Artif Organs. 2012 Jul;36(7):581-9.

Barata NE. Dyadic relationship and quality of life patients with chronic kidney disease. J Bras Nefrol [Internet]. 2015 Jul [cited 2016 May 20];37(3):315-22. Available from: http://www.scielo.br/pdf/jbn/v37n3/0101-2800-jbn-37-03-0315.pdf

Baykan H, Yargic I. Depression, anxiety disorders, quality of life and stress coping strategies in hemodialysis and continuous ambulatory peritoneal dialysis patients. Klinik Psikofarmakoloji Bulteni [Internet]. 2012 [cited 2016 May 24];22(2):167-76. Available from: http://www.scopemed.org/fulltextpdf.php?mno=14208

Boateng EA, East L. The impact of dialysis modality on quality of life: a systematic review. J Ren Care. 2011 Dec;37(4):190-200.

Brown EA, Johansson L, Farrington K, Gallagher H, Sensky T, Gordon F, et al. Broadening Options for Long-term Dialysis in the Elderly (BOLDE): Differences in quality of life on peritoneal dialysis compared to haemodialysis for older patients. Nephrology Dialysis Transplantation [Internet]. 2010 [cited 2016 May 24];25(11):3755-63. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2957589/pdf/gfq212.pdf

Cameron JI, Whiteside C, Katz J, Devins GM. Differences in quality of life across renal replacement therapies: a meta-analytic comparison. Am J Kidney Dis. 2000 Apr;35(4):629-37.

Czyzewski L, Sanko-Resmer J, Wyzgal J, Kurowski A. Assessment of health-related quality of life of patients after kidney transplantation in comparison with hemodialysis and peritoneal dialysis. Ann Transplant. 2014;19:576-85.

Etemadi J, Zolfaghari H, Firoozi R, Ardalan MR, Toufan M, Shoja MM, et al. Unexplained pulmonary hypertension in peritoneal dialysis and hemodialysis patients. Rev Port Pneumol [Internet]. 2012 Jan [cited 2016 Jun 22];18(1):10-4. Available from: http://www.elsevier.pt/en/revistas/revista-portuguesa-pneumologia-320/pdf/S0873215911001000/S300/

Fong E, Bargman JM, Chan CT. Cross-sectional comparison of quality of life and illness intrusiveness in patients who are treated with nocturnal home hemodialysis versus peritoneal dialysis. Clin J Am Soc Nephrol [Internet]. 2007 Nov [cited 2016 May 16];2(6):1195-200. Available from: http://cjasn.asnjournals.org/content/2/6/1195.full.pdf+html

Gataa R, Ajmi TN, Haouala F, Mtiraoui A. [Quality of life patterns of dialysed patients in the region of Kairouan]. Tunis Med. 2008 Jan;86(1):68-74. French.

Ginieri-Coccossis M, Theofilou P, Synodinou C, Tomaras V, Soldatos C. 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 [Internet]. 2008 [cited 2016 May 20];9. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2611965

Goncalves FA, Dalosso IF, Borba JM, Bucaneve J, Valerio NM, Okamoto CT, et al. Quality of life in chronic renal patients on hemodialysis or peritoneal dialysis: a comparative study in a referral service of Curitiba - PR. J Bras Nefrol [Internet]. 2015 Oct [cited 2016 May 20];37(4):467-74. Available from: http://www.scielo.br/pdf/jbn/v37n4/en_0101-2800-jbn-37-04-0467.pdf

Griva K, Davenport A, Harrison M, Newman S. An evaluation of illness, treatment perceptions, and depression in hospital- vs. home-based dialysis modalities. J Psychosom Res. 2010 Oct;69(4):363-70.

Homaie RE, Mostafavi H, Delavari S, Mostafavi S. Health-related Quality of Life in Patients on Hemodialysis and Peritoneal Dialysis: a Meta-Analysis of Iranian Studies. Iran J Kidney Dis. 2015 Sep;9(5):386-93.

Iyasere OU, Brown EA, Johansson L, Huson L, Smee J, Maxwell AP, et al. Quality of life and physical function in older patients on dialysis: a comparison of assisted peritoneal dialysis with hemodialysis. Clin J Am Soc Nephrol [Internet]. 2016 Mar 7 [cited 2016 May 20];11(3):423-30. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4785682

Jassal SV, Devins GM, Chan CT, Bozanovic R, Rourke S. Improvements in cognition in patients converting from thrice weekly hemodialysis to nocturnal hemodialysis: a longitudinal pilot study. Kidney Int [Internet]. 2006 Sep [cited 2016 May 16];70(5):956-62. Available from: http://ac.els-cdn.com/S0085253815520413/1-s2.0-S0085253815520413-main.pdf?_tid=5cbafe8e-1b9e-11e6-8456-00000aab0f6c&acdnat=1463427945_6fef8c30b32b90a6bc7bb79b8f6d91f2

Kutner NG, Zhang R, Brogan D. Race, gender, and incident dialysis patients' reported health status and quality of life. J Am Soc Nephrol [Internet]. 2005 May [cited 2016 May 24];16(5):1440-8. Available from: http://jasn.asnjournals.org/content/16/5/1440.full.pdf+html

Laudanski K, Nowak Z, Niemczyk S. Age-related differences in the quality of life in end-stage renal disease in patients enrolled in hemodialysis or continuous peritoneal dialysis. Med Sci Monit [Internet]. 2013 [cited 2016 May 24];19:378-85. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3665666

Lausevic M, Nesic V, Stojanovic M, Stefanovic V. Health-related quality of life in patients on peritoneal dialysis in Serbia: Comparison with hemodialysis. Artif Organs. 2007;31(12):901-10.

Lee CC, Wu CJ, Chou LH, Shen SM, Chiang SF, Jen PC, et al. Peripheral artery disease in peritoneal dialysis and hemodialysis patients: single-center retrospective study in Taiwan. BMC Nephrology [Internet]. 2012 [cited 2016 Jun 21];13(1). Available from: Peripheral artery disease in peritoneal dialysis and hemodialysis patients: Single-center retrospective study in Taiwan

Liem YS, Bosch JL, Hunink MG. Preference-based quality of life of patients on renal replacement therapy: a systematic review and meta-analysis. Value Health. 2008 Jul;11(4):733-41.

Lin CT, Liu XN, Xu HL, Sui HY. Menstrual disturbances in premenopausal women with end-stage renal disease: a cross-sectional study. Med Princ Pract [Internet]. 2016 [cited 2016 Jun 21];25(3):260-5. Available from: http://www.karger.com/Article/Pdf/445362

Lindqvist R, Carlsson M, Sjoden PO. Coping strategies and health-related quality of life among spouses of continuous ambulatory peritoneal dialysis, haemodialysis, and transplant patients. J Adv Nurs. 2000 Jun;31(6):1398-408.

Losso RL, Minhoto GR, Riella MC. Sleep disorders in patients with end-stage renal disease undergoing dialysis: comparison between hemodialysis, continuous ambulatory peritoneal dialysis and automated peritoneal dialysis. Int Urol Nephrol. 2015 Feb;47(2):369-75.

Mowatt G, Vale L, Perez J, Wyness L, Fraser C, MacLeod A, et al. Systematic review of the effectiveness and cost-effectiveness, and economic evaluation, of home versus hospital or satellite unit haemodialysis for people with end-stage renal failure. Health Technol Assess. 2003;7(2):1-174.

Murray AM, Seliger S, Lakshminarayan K, Herzog CA, Solid CA. Incidence of stroke before and after dialysis initiation in older patients. J Am Soc Nephrol [Internet]. 2013 Jun [cited 2016 Jun 21];24(7):1166-73. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3699827

Niu SF, Li IC. Quality of life of patients having renal replacement therapy. J Adv Nurs. 2005 Jul;51(1):15-21.

Nowak Z, Wankowicz Z, Laudanski K. Denial defense mechanism in dialyzed patients. Med Sci Monit [Internet]. 2015 [cited 2016 May 24];21:1798-805. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4482183/pdf/medscimonit-21-1798.pdf

Oyekcin DG, Gulpek D, Sahin EM, Mete L. Depression, anxiety, body image, sexual functioning, and dyadic adjustment associated with dialysis type in chronic renal failure. Int J Psychiatry Med. 2012;43(3):227-41.

Pajek J, Hutchison AJ, Bhutani S, Brenchley PE, Hurst H, Perme MP, et al. Outcomes of peritoneal dialysis patients and switching to hemodialysis: a competing risks analysis. Perit Dial Int [Internet]. 2014 May [cited 2016 Jun 21];34(3):289-98. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4033329

Rad EH, Mostafavi H, Delavari S, Mostafavi S. Health-related quality of life in patients on hemodialysis and peritoneal dialysis a meta-analysis of Iranian studies. Iranian Journal of Kidney Diseases. 2015;9(5):386-93.

Sennfalt K, Magnusson M, Carlsson P. Comparison of hemodialysis and peritoneal dialysis--a cost-utility analysis. Perit Dial Int [Internet]. 2002 Jan [cited 2016 Jun 16];22(1):39-47. Available from: http://www.pdiconnect.com/content/22/1/39.long

Sinclair PM. Home haemodialysis: a literature review. Renal Society of Australasia Journal [Internet]. 2009 Jun 12 [cited 2016 May 17];5(1):9-15. Available from: http://www.renalsociety.org/public/6/files/documents/RSAJ/2009.03/sinclair.pdf

Soyupek F, Demir M, Suslu FE, Baykal B, Sezer MT, Yesildag A. The upper extremity musculoskeletal complications in dialysis patients: comparison between hemodialysis and peritoneal dialysis. J Back Musculoskeletal Rehabil. 2013;26(3):267-71.

Suri RS, Nesrallah GE, Mainra R, Garg AX, Lindsay RM, Greene T, et al. Daily hemodialysis: a systematic review. Clin J Am Soc Nephrol [Internet]. 2006 Jan [cited 2016 Jan 16];1(1):33-42. Available from: http://cjasn.asnjournals.org/content/1/1/33.full.pdf+html

Tilki HE, Akpolat T, Tunali G, Kara A, Onar MK. Effects of haemodialysis and continuous ambulatory peritoneal dialysis on P300 cognitive potentials in uraemic patients. Ups J Med Sci. 2004;109(1):43-8.

Ting GO, Kjellstrand C, Freitas T, Carrie BJ, Zarghamee S. Long-term study of high-comorbidity ESRD patients converted from conventional to short daily hemodialysis. Am J Kidney Dis. 2003 Nov;42(5):1020-35.

Van Eps CL, Jones M, Ng T, Johnson DW, Campbell SB, Isbel NM, et al. The impact of extended-hours home hemodialysis and buttonhole cannulation technique on hospitalization rates for septic events related to dialysis access. Hemodial Int. 2010 Oct;14(4):451-63.

Van Eps CL, Jeffries JK, Johnson DW, Campbell SB, Isbel NM, Mudge DW, et al. Quality of life and alternate nightly nocturnal home hemodialysis. Hemodial Int. 2010 Jan;14(1):29-38.

Walsh M, Manns BJ, Klarenbach S, Quinn R, Tonelli M, Culleton BF. The effects of nocturnal hemodialysis compared to conventional hemodialysis on change in left ventricular mass: rationale and study design of a randomized controlled pilot study. BMC Nephrol [Internet]. 2006 [cited 2016 May 16];7:2. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1458958

Wright LS. CNE. Quality of Life and Self-Efficacy in Three Dialysis Modalities: Incenter Hemodialysis, Home Hemodialysis, and Home Peritoneal Dialysis. Nephrol Nurs J. 2015;42(5):463-77.

Wright LS, Wilson L. Quality of life and self-efficacy in three dialysis modalities: incenter hemodialysis, home hemodialysis, and home peritoneal dialysis. Nephrol Nurs J. 2015 Sep;42(5):463-76.

Zimmermann PR, Poli de Figueiredo CE, Fonseca NA. Depression, anxiety and adjustment in renal replacement therapy: a quality of life assessment. Clin Nephrol. 2001 Nov;56(5):387-90.

Reason for exclusion: Duplicate (n=3)

Lindsay RM, Leitch R, Heidenheim AP, Kortas C, London Daily/Nocturnal Hemodialysis Study. The London Daily/Nocturnal Hemodialysis Study--study design, morbidity, and mortality results. Am J Kidney Dis. 2003 Jul;42(1 Suppl):5-12.

Nadeau-Fredette AC, Hawley CM, Pascoe EM, Chan CT, Clayton PA, Polkinghorne KR, et al. An incident cohort study comparing survival on home hemodialysis and peritoneal dialysis (Australia and New Zealand Dialysis and Transplantation Registry). Clin J Am Soc Nephrol. 2015 Aug 7;10(8):1397-407.

Al Wakeel J, Al Harbi A, Bayoumi M, Al-Suwaida K, Al Ghonaim M, Mishkiry A. Quality of life in hemodialysis and peritoneal dialysis patients in Saudi Arabia. Ann Saudi Med. 2012 Nov;32(6):570-4.

Reason for exclusion: Language (n=1)

Otero González A, Iglesias Forneiro A, Camba Caride MJ, Perez Melón C, Borrajo Prol MP, Novoa Fernández E, et al. Survival for haemodialysis vs. peritoneal dialysis and technique transference. Experience in Ourense, Spain, from 1976 to 2012. Nefrologia. 2015 Nov;35(6):562-6.

Reason for exclusion: Other (e.g., abstract, editorial) (n=15)

Culleton BF, Walsh M, Klarenbach SW, Mortis G, Scott-Douglas N, Quinn RR, et al. Nocturnal hemodialysis lowers blood pressure and reduces left ventricular mass: results of a randomized controlled trial. Journal of the American Society of Nephrology : JASN. 2007;18(Abstracts):67A-8A.

Doss S, Moran J. Quality of Life (SF-36) results for NxStage in-center and NxStage home daily therapies. Nephrol Nurs J. 2006 Jun 9;33(2):137.

Kawada T. Risk of major cardiovascular events in patients with hemodialysis or peritoneal dialysis with special reference to stroke. Int J Cardiol. 2016 Jan 1;202:941.

Kawada T. Risk of Peptic Ulcer Bleeding in Patients with Chronic Kidney Disease and End-Stage Renal Disease Receiving Peritoneal or Hemodialysis. Dig Dis Sci. 2014;59(12):3131-2.

Lindsay RM, Daily/Nocturnal Dialysis Study Group. The London, Ontario, Daily/Nocturnal Hemodialysis Study. Semin Dial. 2004 Mar;17(2):85-91.

Lindsay RM, Blagg CR. The London daily/nocturnal hemodialysis study: a review. Nephrol News Issues. 2003 Nov;17(12):55-8.

Mukherjee D. [Commentary on] Comparing the risk for death with peritoneal dialysis and hemodialysis in a national cohort of patients with chronic kidney disease [New York, New York]. ACC Curr J Rev. 2005 Nov;14(11):7.

Nesrallah GE. Increased frequency of hemodialysis reduced adverse clinical outcomes. Ann Intern Med [Internet]. 2011;154(8):JC4-JC6.

Panday VB, Tong ZP, Ng PL, Lee EJ, Lau T, Teo BW, et al. Dialysis modality and 2-year outcomes in patients with ischemic cardiomyopathy and end-stage renal disease. Int J Cardiol. 2014 Oct 20;176(3):1097-9.

Quinn RR, Hux JE, Oliver MJ, Austin PC, Tonelli M, Laupacis A. Selection bias explains apparent differential mortality between dialysis modalities. J Am Soc Nephrol [Internet]. 2011 Aug;22(8):1534-42. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3148708

Quinn RR, Austin PC, Oliver MJ. Comparative studies of dialysis therapies should reflect real world decision-making. J Nephrol. 2008 Mar;21(2):139-45.

Ray K. Dialysis: Daily hemodialysis improves depressive symptoms and postdialysis fatigue. Nature Reviews Nephrology. 2010;6(11):631.

Shetty H, Gokal R. Peritoneal dialysis as the first-choice treatment. Contrib Nephrol. 2003;(140):218-25.

Walsh M, Manns B, Tonelli M, Quinn R, Culleton B. Description of a randomized controlled trial on the effects of nocturnal hemodialysis on left ventricular hypertrophy compared to conventional hemodialysis. Journal of the American Society of Nephrology : JASN. 2005;16:734A-5A.

Wheeler DC, Caplin B. New observational data demonstrate that mortality is lower in patients receiving more frequent dialysis. J Am Soc Nephrol [Internet]. 2012 [cited 2016 May 17];23(5):770-3. Available from: http://jasn.asnjournals.org/content/23/5/770.full.pdf+html

Appendix 12: Modelling Mortality — Economic Review

Mortality data were obtained from Canadian Institute for Health Information **(**CIHI) quick stats: "CORR Pre-formatted ESKD Tables and Figures: 2005 to 2014 Data."[87]

The five-year mortality rate was calculated using the five-year survival rate, and weighted by the proportion of patients with diabetes (2014) and the proportion of patients younger than 65 and those older than 65 (2013) from the 2015 CORR report.[87]

Mortality beyond year five was adjusted by the Canadian Life Table (Statistics Canada. Table 053-0003 — Elements of the life table, Canada, provinces and territories, annual [number] both sexes).[88] Since the average age in the reference case was 55 to 60, mortality for age 60 and older from the Life Table was added to the ESRD mortality rate. Mortality rates stayed the same after age 95. For prevalent patients, an average of two- to five-year mortality rate was used and weighted by the proportion of patients with diabetes (2014) and the proportion of patients who were younger than 65 and those older than 65 (2013) from the 2015 CORR report.[87]

Similarly, the mortality rate for transplant patients were calculated from the five-year survival from the 2015 CORR annual report[87] (starting year 2008), weighted by the proportion of deceased and living donors.

For subsequent years, the first-year mortality rate (0.0629) was reduced by a relative risk (RR) of 0.32 which is also similar to the mortality rate at three-year and five-year from the CORR five-year.[87]

Appendix 13: Clinical Inputs on Relative Efficacy and Safety Estimates, Applied in Scenario Analyses

Table 39: Relative Efficacy and Safety

Variable Description	Reference Case	Point Estimate Scenario Analysis	Lower 95% CrL	Upper 95% CrL	Probability Distribution	References
Hazard Ratio for Death						
PD vs. ICHD	1.0	2.08	0.88	2.59	Triangular	Marshall et al., 2016 [64] Yang et al., 2015 [77]
SD HHD vs. ICHD	1.0	0.59	0.32	1.10	Triangular	Marshall et al., 2016 [64]
NHHD vs. ICHD	1.0	0.56	0.44	0.73	Triangular	Marshall et al., 2016 [64]
CvHHD vs. ICHD	1.0	0.53	0.42	1.10	Triangular	Marshall et al., 2016 [64] Kasza et al., 2016[59]
SD ICHD vs. ICHD	1.0	1.30	0.92	1.84	Triangular	Marshall et al., 2016 [64]
Nocturnal ICHD vs. ICHD	1.0	0.77	0.57	1.03	Triangular	Marshall et al., 2016 [64]
Hazard Ratio for All-Cause Hospitalization						
DHHD[a] vs. PD	1.0	0.73	0.67	0.79	Triangular	Suri et al., 2015 [70]
SD HHD vs. ICHD	1.0	–	–	–	Use DHHD	Assumption
NHHD vs. CvHHD	1.0	1.42	0.69	2.90	Triangular	Rocco et al., 2015 [45]
DHHD vs. ICHD	1.0	0.92	0.85	1.00	Triangular	Suri et al., 2015 [70]
SD ICHD vs. ICHD	1.0	–	–	–	No data	
Nocturnal ICHD vs. ICHD	1.0	–	–	–	No data	
Hazard Ratio for Cardiovascular-Related Hospitalization						
DHHD vs. PD	1.0	0.66	0.58	0.74	Triangular	Suri et al., 2015 [70]
SD HHD vs. ICHD	1.0	–	–	–	Use DHHD	Assumption
NHHD vs. CvHHD	1.0	1.60	0.49	5.22	Triangular	Rocco et al., 2015 [45]
DHHD vs. ICHD	1.0	0.68	0.61	0.88	Triangular	Suri et al., 2015 [70]
SD ICHD vs. ICHD	1.0	–	–	–	No data	
Nocturnal ICHD vs. ICHD	1.0	–	–	–	No data	

Variable Description	Reference Case	Point Estimate Scenario Analysis	Lower 95% CrL	Upper 95% CrL	Probability Distribution	References
Hazard ratio for infection-related hospitalization						
DHHD vs. PD	1.0	0.81	0.73	0.90	Triangular	Suri et al., 2015 [70]
SDHHD vs. ICHD	1.0	–	–	–	Use DHHD	Assumption
NHHD vs. CvHHD	1.0	2.04	0.80	5.17	Triangular	Rocco et al., 2015 [45]
DHHD vs. ICHD	1.0	1.32	1.04	1.40	Triangular	Suri et al., 2015 [70]
SDICHD vs. ICHD	1.0	–	–	–	No data	
Nocturnal ICHD vs. ICHD	1.0	–	–	–	No data	

Cv = conventional; HHD = home hemodialysis; DHHD = daily home hemodialysis; ICHD = in-centre hemodialysis; NHHD = nocturnal home hemodialysis; PD = peritoneal dialysis; RCT = randomized controlled trial; SDHHD = short-daily home hemodialysis; SDICHD = short-daily in-centre hemodialysis.
Note: Assumed 1.0 in reference case if no RCT data exist, use estimates from observational studies to inform PSA.
[a] DHHD (daily home hemodialysis) is defined as nocturnal home hemodialysis (NHHD) or short-dialy home hemodialysis (SDHHD)
Source: Clinical Review.

Table 40: Relative Efficacy and Safety of PD Versus ICHD (Scenario Analysis Values from Yeates et Al.[79] and Marshall et Al.[64])

Variable Description	Reference Case	Point Estimate Scenario Analysis	Lower 95% CrL	Upper 95% CrL
Yeates et al.[79]				
Overall	1.0	0.99	0.92	1.06
12 months	1.0	0.70	0.61	0.83
24 months	1.0	0.89	0.80	0.98
36 months	1.0	0.99	0.92	1.08
60 months	1.0	1.03	0.95	1.22
Marshall[64]				
Overall	1.0	1.07	1.03	1.12
12 months	1.0	0.72	0.66	0.79
24 months	1.0	0.88	0.83	0.94
36 months	1.0	0.96	0.91	1.01

PD = peritoneal dialysis; ICHD = in-centre hemodialysis.

Table 41: RR of Hospitalization, Different Parameter Values Assessed in Scenario Analysis

Variable Description	Source	Point Estimate	Lower 95% CrL	Upper 95% CrL
Hazard ratio for all-cause hospitalization				
DHHD[a] vs. **PD**	Suri et al.[70]	0.73	0.67	0.79
	Weinhandl et al.[75]	0.92	0.89	0.95
NHHD vs. **HHD (Cv)**	Rocco et al.[44]	1.42	0.69	2.90
DHHD vs. ICHD	Suri et al.[70]	0.92	0.85	1.00
	Ishani et al.[38]	1.03	0.99	1.08
Hazard ratio for CV-related hospitalization				
DHHD[a] vs. **PD**	Suri et al.[70]	0.66	0.58	0.74
NHHD vs. **HHD (Cv)**	Rocco et al.[44]	1.60	0.49	5.22
DHHD vs. ICHD	Suri et al.[70]	0.68	0.61	0.77
	Ishani et al.[38]	0.83	0.78	0.88
Hazard ratio for infection-related hospitalization				
DHHD[a] vs. **PD**	Suri et al.[70]	0.81	0.73	0.90
NHHD vs. **HHD (Cv)**	Rocco et al.[44]	2.04	0.80	5.17
DHHD vs. ICHD	Suri et al.[70]	1.15	1.04	1.29
	Ishani et al.[38]	1.32	1.24	1.40

CvHHD = home conventional hemodialysis; DHHD = daily home hemodialysis; ICHD (Cv) = in-centre conventional hemodialysis; NHHD = nocturnal home hemodialysis; PD = peritoneal dialysis; RR = relative risk; SDHHD = short-daily home hemodialysis.
[a] Reversed RR in model; DHHD includes short-daily and nocturnal HHD.

Appendix 14: Subcategories of Costs by Study (2015 CAN $) — Economic Review

Source	Methods	Notes	CAPD or APD Home	CAPD or APD Home Assisted	HD (In centre/ Satellite) Short Daily	HD (In centre/ Satellite) Nocturnal	HD (In centre/ Satellite) Conventional (anchor	HD (Home) Short-Daily Self	HD (Home) Nocturnal Self	HD (Home) Conventional Self
ON reimburse-ment[91]	2016-2017 Chronic Kidney Disease Amalgamated Funding Guide	Based on dialysis bundling amounts; no breakdown.	36,801 NA	57,368 NA	83,467 NA	83,467 NA	50,076 NA	36,661 NA	36,661 NA	23,825 (–26,251, 0.48)
Kroeker et al. 2003[81]	Operating cost study, 18-month in London, ON	Includes Treatment supplies, consults, ER, lab tests, machine, water, RN, other labour, biomedical engineering, non-treatment supplies; excludes hospitalizations, pharmaceuticals, physician fees.					59,613 Treatment supplies 13,007 ER 2,576 Labs 78 Consults 2,576 Machine 2,616 Water 933 RN 24,045 Other Labour 10,142 Biomedical Engineering 2,404 Non-treatment supplies 1,283	55,232 Treatment supplies 26,424 ER 1,756 Labs 17 Consults 1,757 Machine 7,909 Water 4,623 RN 3,938 Other Labour 2,366 Biomedical Engineering 5,544 Non-treatment supplies 1,283	57,274 Treatment supplies 25,882 ER 3,052 Labs 303 Consults 3,052 Machine 8,334 Water 5,253 RN 3,362 Other Labour 2,366 Biomedical Engineering 5,544 Non-treatment supplies 1,283	

Source	Methods	Notes	CAPD or APD Home	CAPD or APD Home Assisted	HD (In centre/ Satellite) Short Daily	HD (In centre/ Satellite) Nocturnal	HD (In centre/ Satellite) Conventional (anchor	HD (Home) Short-Daily Self	HD (Home) Nocturnal Self	HD (Home) Conventional Self
Komenda et al., 2012[83]	Costing model_on published analyses	Includes machine costs, pump, consumables and peripheral costs, total allied health care costs, medical equipment, dialysis-related lab costs, costs of in-centre runs, facility costs; excludes renal medication, dialysis water and electricity costs, patient evaluation/ recruitment and training costs, home preparation, travel costs to and from dialysis, and hospitalization costs.					35,086 Machine 1,599 Pump 0 Consumables 6,167 Total allied health 13,793 Medical equipment 437 Lab costs 1,071 Costs of in-centre runs 0 Facility cost 11,891	34,055 Machine 8,058 Pump 588 Consumables 17,923 Total allied health 1,682 Medical equipment 2,619 Lab costs 1,173 Costs of in-centre runs 1,871 Facility cost 0	34,055 Machine 8,058 Pump 588 Consumables 17,923 Total allied health 1,682 Medical equipment 2,619 Lab costs 1,173 Costs of in-centre runs 1,871 Facility cost 0	25,577 Machine 8,058 Pump 588 Consumables 9,006 Total allied health 1,682 Medical equipment 2,619 Lab costs 1,565 Costs of in-centre runs 1,871 Facility cost 0
Klarenbach et al., 2014[29]	CEA with RCT micro-costing data in Alberta	Includes nursing, water, dialysis supplies, and machine, overhead.					75,019 RN 44,143 water 2,987 dialysis supplies 11,256 dialysis machine 1,321 overhead 14,927 OP 385		60,016 RN 9,216 water 15,743 dialysis supplies 18,760 dialysis machine 2,970 overhead 12,648 OP 678	49,262 RN 9,216 water 15,743 dialysis supplies 11,256 dialysis machine 2,970 overhead 9,691 OP 385
Wong et al., 2014[14]	Micro-costing in Northern Alberta	Includes materials, staff and utilities; excludes HD machine maintenance, patient-borne costs, and physician billing.				25,576 NA	Reference[a] NA			

Source	Methods	Notes	CAPD or APD Home	CAPD or APD Home Assisted	HD (In centre/ Satellite) Short Daily	HD (In centre/ Satellite) Nocturnal	HD (In centre/ Satellite) Conventional (anchor	HD (Home) Short-Daily Self	HD (Home) Nocturnal Self	HD (Home) Conventional Self
Chui et al., 2013[6]	Micro-costing in Alberta that characterized the economic effect of initial dialysis modality choice, subsequent early modality switching, and the impact of PD technique failure	Includes dialysis costs, inpatient costs, medication costs and physician fees; cannot exclude as subcategories were not reported.	36,874 NA				96,553 NA			
McFarlane et al., 2002[85]	A prospective one-year descriptive costing study in Toronto	Includes staff, direct HD materials, overhead and support, admits/procedures, depreciation; excludes drug, physician fees, lab tests/imaging.					57,407 Staff 29,269 HD materials 8,725 Overhead 16,446 Depreciation 1,156 Lab tests 1,810		52,524 Staff 14,507 Materials 22,012 Overhead 5,544 Depreciation 8,147 Lab tests 2,314	
Lee et al., 2002[84]	A prospective one-year descriptive costing study of 166 patients in Alberta	Only includes outpatient dialysis costs in this table	32,015 RN 3,055 Supplies 20,987 Machines 0 Water 0 Overhead 4,808 OP 866 Labs 2,299				56,819 RN 26,854 Supplies 9,721 Machines 2,217 Water 716 Overhead 11,845 OP 931 Labs 4,533			33,666 RN 5,403 Supplies 9,721 Machines 3,371 Water 5,611 Overhead 4,826 OP 874 Labs 3,860

Source	Methods	Notes	CAPD or APD Home	CAPD or APD Home Assisted	HD (In centre/ Satellite) Short Daily	HD (In centre/ Satellite) Nocturnal	HD (In centre/ Satellite) Conventional (anchor	HD (Home) Short-Daily Self	HD (Home) Nocturnal Self	HD (Home) Conventional Self
Laplante et al., 2013[13] (Non-Canadian)	CEA with costing data taken from the Dutch official tariffs	No details on what cost categories were included.		122,531 NA			87,882 NA			
Couillerot-Peyrondet et al., 2016[96] (Non-Canadian)	1-year retrospective study using two French national administrative databases	Includes RRT, nurse fees, lab expenditure, medical devices and health auxiliary; excludes other hospitalization, transport, pharmaceutical expenditure, personal autonomy allowances, doctor fees and other.	55,208 Dialysis related 50,139 RN 2,415 Labs 1,806 Medical devices 914 Health auxiliary 135	86,404 Dialysis related 42,148 RN 39,877 Labs 1,816 Medical devices 1,890 Health auxiliary 674			92,326 Dialysis related[a] 84,725 RN 2,969 Labs 2,906 Medical devices 1,453 Health auxiliary 274			60,996 Dialysis related 57,628 RN 505 Labs 2,084 Medical devices 695 Health auxiliary 84

APD = automated peritoneal dialysis; CAPD = continuous ambulatory peritoneal dialysis; CEA = cost-effectiveness analysis; ER = emergency room; HD = hemodialysis; NA = not applicable; RN = registered nurse; RCT = randomized controlled trial; RRT = renal replacement therapy.

[a] Costs related to dialysis procedure or hospitalization related to renal graft rejection or follow-up.

Appendix 15: Additional Costs Inputs in the Economic Review

Additional cost parameters used in the model are described in Table 42.

Table 42: Cost Parameters Used in the Model (2015 C$)

Variable Description	Original Estimate	Base Estimate In Model	Probability Distribution	Reference
Annual Dialysis[a] PD PD (assisted) SDHHD NHHD Cv HHD SD ICHD Nocturnal ICHD Cv ICHD	 36,801[b] 57,368[b] 36,661 36,661 23,825 83,467 83,467 50,076	Same as original	—	ON reimbursement[91] (2015 C$)
Initial Training PD PD (assisted) SDHHD NHHD Cv HHD SD ICHD Nocturnal ICHD Cv ICHD	 2,374[b] 2,374[b] 11,400 11,400 11,400 NA NA NA	Same as original	—	ON reimbursement[91] (2015 C$)
Initial Installation PD PD (assisted) SDHHD NHHD Cv HHD SD ICHD Nocturnal ICHD Cv ICHD	 NA NA 3,000 3,000 3,000 NA NA NA	Same as original	—	ON reimbursement[91] (2015 C$)
Retraining PD[b] PD (assisted) SDHHD NHHD Cv HHD SD ICHD Nocturnal ICHD Cv ICHD	 284.05/day NA 542.84/day 542.84/day 542.84/day NA NA NA	Same as original	—	ON reimbursement[91] (2015 C$)
Annual Medications PD PD (assisted) SDHHD NHHD CvHHD SD ICHD Nocturnal ICHD Cv ICHD	 4,941 + 4,890	10,227[c] 10,227 10,227 10,227 10,227 10,227 10,227 10,227	Gamma	Klarenbach et al., 2014[29] (2012 C$)
Annual Access HD only	6,818 (2,443 to 7,520)	8,632 (3,093-9,520)	Gamma	Manns et al., 2005[97] (2002 C$)

Variable Description	Original Estimate	Base Estimate In Model	Probability Distribution	Reference
Technique Failure (one-time) PD only	7,972 (1,793 to 14,151)	8,663 (1,948 to 15,378)	Gamma	Chui et al., 2013[6] (2012 C$)
Hospitalization (per admission)[d] All-cause (CMG 480) Cardiovascular-related (CMG 202/175) Infection-related (CMG 654)	7,960 x 1.8085 4,272/10,214 11,752	14,556 7,324 11,884	Gamma	CIHI et al.,[211] (2014 C$)
Annual Physician Claims For all modalities		6,614	—	ON reimbursement[91]
Transplant First year Subsequent years	25,603 + 72,980 24,857	107,130 27,012	Gamma	Barnieh et al., 2014[212] (2010 C$)

CIHI = Canadian Institute for Health Information Cv = conventional; HHD = home hemodialysis; ICHD = in-centre hemodialysis; NA = not applicable; NHHD = nocturnal home hemodialysis; PD = peritoneal dialysis; SDHHD = short-daily home hemodialysis; SDICHD = short-daily, in-centre hemodialysis.
Note: All costs not in 2015 C$ were Inflated using all-items CPI.
[a] Assumed including OP and labs costs.
[b] Weighted average of CCPD and CAPD based on Ontario renal network data.
[c] Assumed same as ICHD for non-NHHD.
[d] Weighted average of age groups 18 to 59, 60 to 79, and 80 years and older; all-cause admission adjusted by comorbidity level 2.

In particular, cost per hospitalization related to adverse events was estimated through the CIHI cost estimator (https://www.cihi.ca/en/spending-and-health-workforce/spending/patient-cost-estimator).[211] Year 2014 costs for age groups 18 to 59, 60 to 79, and 80 and older in Canada were used. The costs were then inflated to 2015 costs.

For infection, CMG 654 was used.

Table 43: Hospitalization cost associated with an infection (based on CMG grouper 654)

CMG	Description	Age Groups	Estimate Costs	Average Cost	2015$
654	Other/unspecified sepsis	18 to 59	12,820	11,752	11,884
		60 to 79	12,196		
		80 and older	10,241		

For cardiovascular events, CMG 202 and CMG 175 were used to capture both the lower and higher end of events. A weighted average of $7,324 was used in the model.

Table 44: Hospitalization cost associated with a cardiovascular event (based on CMG grouper 202 and 175)

CMG	Description	Age Groups	Estimate Costs	Average Cost	2015$
202	Arrhythmia without coronary angiogram	18 to 59	3,657	4,272	4,320
		60 to 79	4,258		
		80 and older	4,902		

CMG	Description	Age Groups	Estimate Costs	Average Cost	2015$
175	Percutaneous coronary intervention with MI/shock/arrest/heart failure	18 to 59	9,717	10,214	10,328
		60 to 79	10,124		
		80 and older	10,801		

For general hospital admission, CMG 480 for Kidney Disease was used. Since ESKD patients are generally sicker, the cost was adjusted by the comorbidity level factor 2 (1.80847),[213] resulting in a cost of $14,556.

Table 45: Hospitalization cost associated with kidney disease

CMG	Description	Age Groups	Estimate Costs	2015$	Adjusted Comorbidity (2015$)
480	Kidney disease	18 to 59	7,960	8,049	14,556
		60 to 79	7,960		
		80 and older	7,960		

Validation

Annual cost of adverse events used in the model are:

- IP general = 0.741 X $14,556 = $10,535
- IP cardiovascular = 0.295 X $7,324 = $2,100
- IP infection = 0.181 X $11,884 = $2,148
- IP access = $8,632
- Total = $23,731

Micro-costing data from Alberta NHHD vs. ICHD RCT (unpublished) shows an annual hospitalization cost of $27,066 (C$ 2015).

Appendix 16: Sensitivity Analyses — Varying Discount Rates, Time Horizon, and Older Age (All Modalities)

Sensitivity Analysis	Strategy	ICUR (Versus ICHD [Cv])	Incremental Cost
Reference case	**ICHD (Cv)**		
	HHD (Cv)	**dominant**	**–75,139**
	PD	**dominant**	**–36,292**
	SDHHD	**dominant**	**–19,117**
	NHHD	**dominant**	**–19,117**
	Assisted PD	**dominated**	**33,351**
	SDICHD	**dominated**	**199,122**
	Nocturnal ICHD	**dominated**	**199,122**
Discount Rate			
0% discount rate	ICHD (Cv)		
	HHD (Cv)	dominant	–88,929
	PD	dominant	–39,285
	SDHHD	dominant	–23,783
	NHHD	dominant	–15,266
	Assisted PD	dominated	37,058
	SDICHD	dominated	269,526
	Nocturnal ICHD	dominated	284,306
1.5% discount rate	ICHD (Cv)		
	HHD (Cv)	dominant	–84,121
	PD	dominant	–38,284
	SDHHD	dominant	–22,156
	NHHD	dominant	–14,157
	Assisted PD	dominated	35,817
	SDICHD	dominated	241,565
	Nocturnal ICHD	dominated	254,595
3% discount rate	ICHD (Cv)		
	HHD (Cv)	dominant	–79,937
	PD	dominant	–37,377
	SDHHD	dominant	–20,741
	NHHD	dominant	–13,193
	Assisted PD	dominated	34,694
	SDICHD	dominated	220,455
	Nocturnal ICHD	dominated	232,163
Time Horizon			
5-year time horizon	ICHD (Cv)		
	HHD (Cv)	dominant	–47,245
	PD	dominant	–28,948
	SDHHD	dominant	–9,210
	NHHD	dominant	–5,107
	Assisted PD	dominated	26,824
	SDICHD	dominated	105,640
	Nocturnal ICHD	dominated	110,162
10-year time horizon	ICHD (Cv)		
	HHD (Cv)	dominant	–69,652
	PD	dominant	–35,569
	SDHHD	dominant	–17,167
	NHHD	dominant	–10,712
	Assisted PD	dominated	32,710
	SDICHD	dominated	165,076
	Nocturnal ICHD	dominated	173,318

Sensitivity Analysis	Strategy	ICUR (Versus ICHD [Cv])	Incremental Cost
20-year time horizon	ICHD (Cv)		
	HHD (Cv)	dominant	–74,780
	PD	dominant	–36,277
	SDHHD	dominant	–18,989
	NHHD	dominant	–11,996
	Assisted PD	dominated	33,338
	SDICHD	dominated	191,330
	Nocturnal ICHD	dominated	201,216
40-year time horizon	ICHD (Cv)		
	HHD (Cv)	dominant	–75,138
	PD	dominant	–36,292
	SDHHD	dominant	–19,117
	NHHD	dominant	–12,086
	Assisted PD	dominated	33,351
	SDICHD	dominated	198,443
	Nocturnal ICHD	dominated	208,773
Older Age			
Average age 65	ICHD (Cv)		
	HHD (Cv)	dominant	–75,055
	PD	dominant	–36,289
	SDHHD	dominant	–19,094
	NHHD	dominant	–19,094
	Assisted PD	dominated	33,334
	SDICHD	dominated	198,060
	Nocturnal ICHD	dominated	198,060

Cv = conventional; ICUR = incremental cost-utility ratio; HHD = home hemodialysis; ICHD = in-centre hemodialysis; PD = peritoneal dialysis; SDHHD = short-daily home hemodialysis; SDICHD = short-daily in-centre hemodialysis.

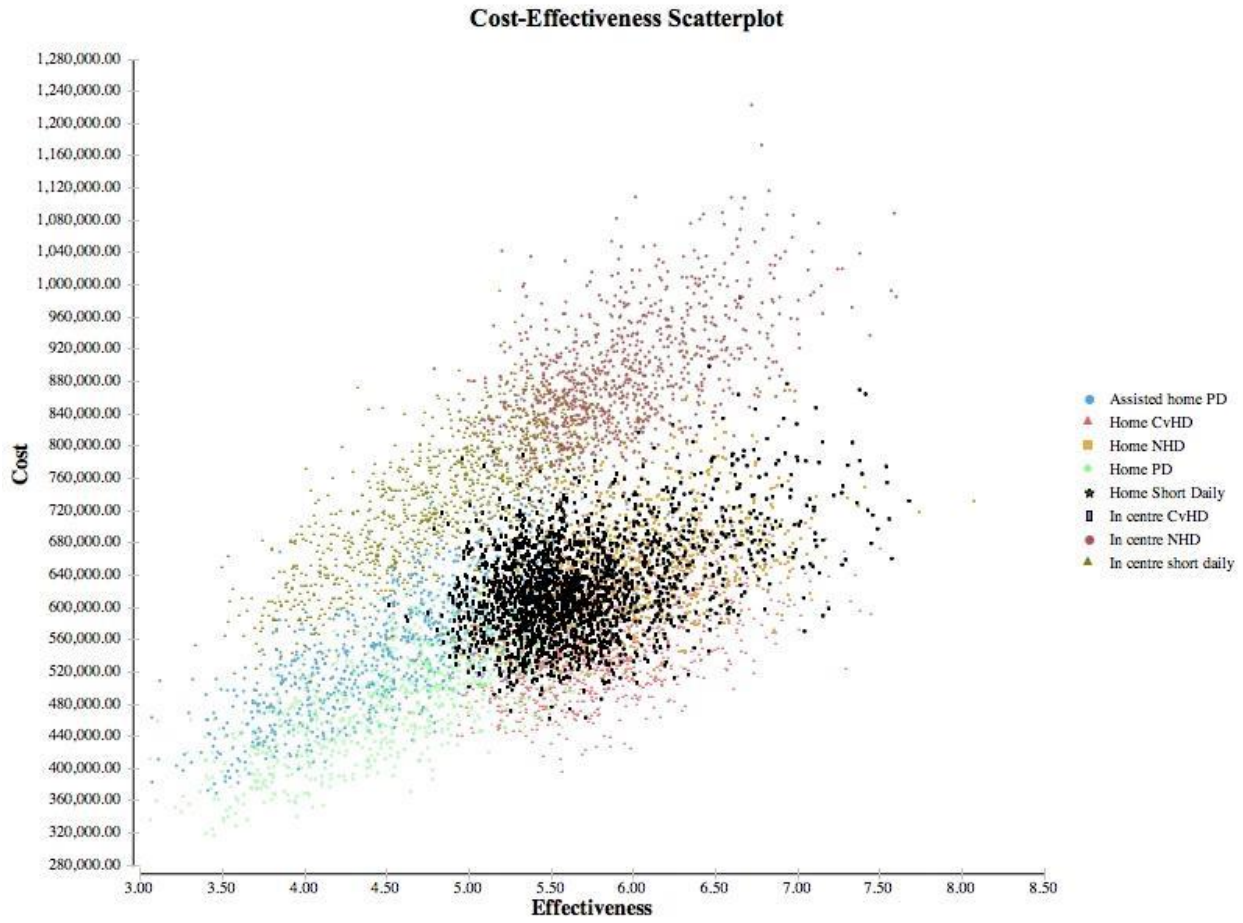
Appendix 17: Scenario Analyses — Prevalent Patients (all modalities)

Strategy	Cost ($)	Incremental Cost ($)	QALYs	Incremental QALYs	ICUR ($/QALY)
Prevalent Cases					
ICHD (Cv)	**698,020**	**0**	**6.03**	**0**	**–**
HHD (Cv)	616,699	–81,320	6.03	0	(Dominant)
PD	661,044	–36,976	6.03	0	(Dominant)
SDHHD	677,166	–20,853	6.03	0	(Dominant)
NHHD	677,166	–20,853	6.03	0	(Dominant)
PD (assisted)	735,224	37,204	6.03	0	(Dominated)
SDICHD	915,404	217,384	6.03	0	(Dominated)
Nocturnal ICHD	915,404	217,384	6.03	0	(Dominated)
Average Age 65					
ICHD (Cv)	**691,129**	**0**	**5.65**	**0**	**–**
HHD (Cv)	610,065	–81,065	5.65	0	(Dominant)
PD	654,172	–36,957	5.65	0	(Dominant)
SDHHD	670,348	–20,782	5.65	0	(Dominant)
NHHD	670,348	–20,782	5.65	0	(Dominant)
PD (assisted)	728,230	37,101	5.65	0	(Dominated)
SDICHD	906,773	215,643	5.65	0	(Dominated)
Nocturnal ICHD	906,773	215,643	5.65	0	(Dominated)

Cv = conventional; HHD = home hemodialysis; ICHD = in-centre hemodialysis; NHHD = nocturnal home hemodialysis; PD = peritoneal dialysis; SDICHD = short-daily in-centre hemodialysis; SDHHD = short-daily home hemodialysis.

APPENDIX 18: Reference Case Results, All Dialysis Modalities

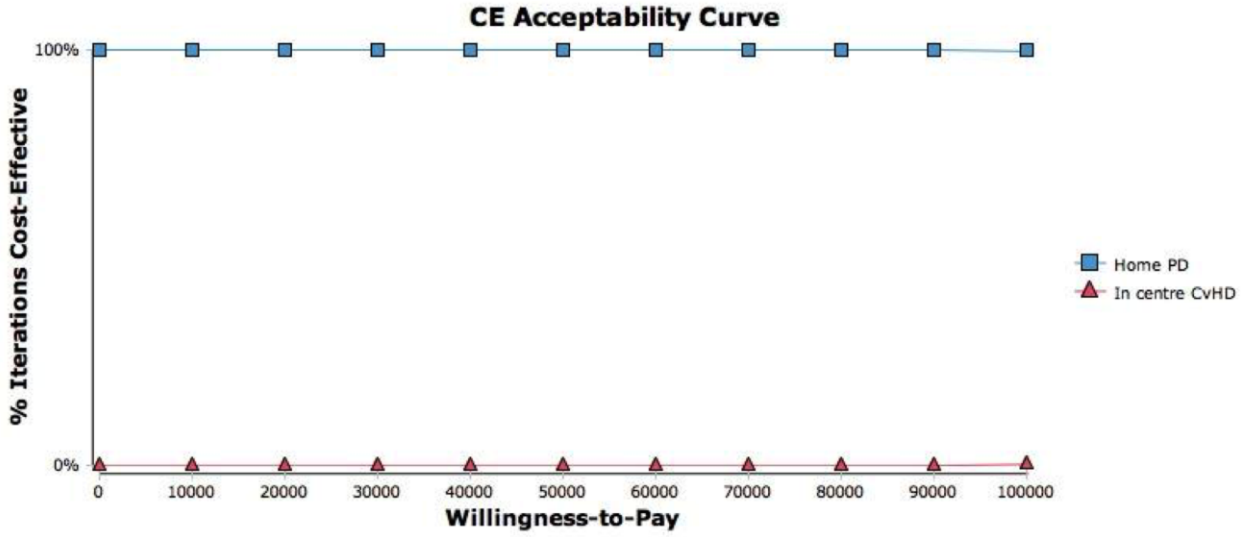
Figure 5: Scatter Plots With Triangular Distributions (Centred HR = 1)



CvHD = conventional hemodialysis; HR = hazard ratio; NHD = nocturnal hemodialysis; PD = peritoneal dialysis. CvHD = conventional hemodialysis; HR = hazard ratio; NHD = nocturnal hemodialysis; PD = peritoneal dialysis.

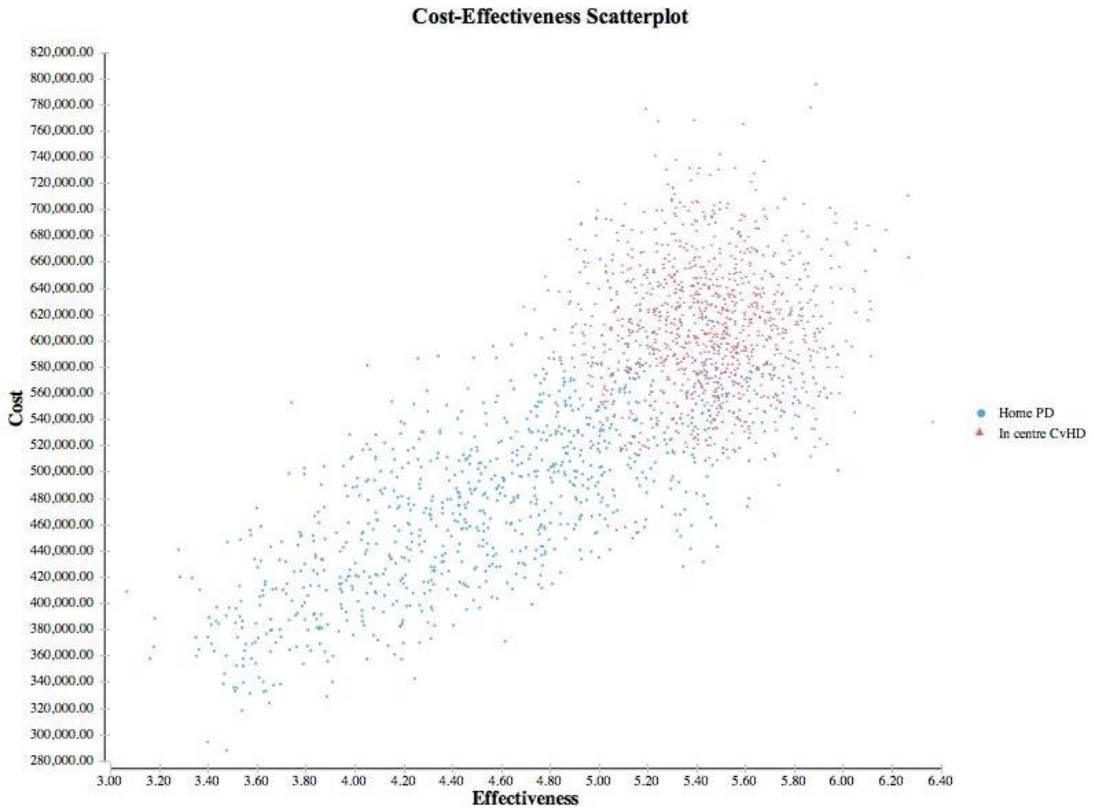
APPENDIX 19: Findings From Sensitivity Analyses, PD Versus Conventional ICHD

Figure 6: Cost-Effectiveness Acceptability Curve, PD Versus ICHD (Conventional)



CE = cost-effectiveness; CvHD = conventional hemodialysis; PD = peritoneal dialysis.

Figure 7: Scatterplots of 5,000 Probabilistic Simulations, PD Versus ICHD (Conventional)



CvHD = conventional hemodialysis; ICHD = in-centre hemodialysis; PD = peritoneal dialysis.

Table 46: PD Versus Conventional ICHD — Deterministic Sensitivity Analysis

Strategy	Cost ($)	Incremental Cost ($)	QALYs	Incremental QALYs	ICUR ($/QALY)
RR Death (PD Relative to ICHD; Reference Case: RR = 1 All Years)					
Marshall et al.[64] mean estimate: Year 1 = 0.72; Year 2 = 0.88; Year 3 =0.96; Year 4 onward = 1					
ICHD (Cv)	637,101	0	5.45	0	—
PD	651,251	4,150	5.84	0.39	10,728
Marshall et al.[64] lower CI: Year 1 = 0.66; Year 2 = 0.83; Year 3 = 0.91; Year 4 onward = 1					
ICHD (Cv)	637,101	0	5.45	0	—
PD	651,448	14,347	5.94	0.48	29,624
Marshall et al.[64] upper CI: Year 1 = 0.79; Year 2 = 0.94; Year 3 = 1.01; Year 4 onward = 1					
ICHD (Cv)	637,101	0	5.45	0	—
PD	629,612	–7,488	5.73	0.28	Dominant
Yeates et al.[79] mean estimate: Year 1 = 0.70; Year 2 = 0.89; Year 3 = 0.99; Year 5 on = 1.03[a]					
ICHD (Cv)	637,101	0	5.45	0	—
PD	642,465	5,364	5.85	0.40	13,453
Yeates et al.[79] lower CI: Year 1 = 0.61; Year 2 = 0.80; Year 3 = 0.92; Year 5 onward = 0.95					
ICHD (Cv)	637,101	0	5.45	0	—
PD	660,668	23,567	6.03	0.57	41,195
Yeates et al.[79] upper CI: Year 1 = 0.83; Year 2 = 0.98; Year 3 = 1.08; Year 5 onward = 1.22					
ICHD (Cv)	637,101	0	5.45	0	—
PD	616,641	–20,460	5.61	0.15	Dominant
Yang et al. [102] mean estimate: 2.08					
PD	427,799	0	3.80	0	—
ICHD (Cv)	637,101	209,301	5.45	1.65	126,755
Yang et al.[102] lower CI, 1.67					
PD	485,520	0	5.45	0	—
ICHD (Cv)	637,101	151,581	4.35	1.10	137,860
Yang et al.[102] upper CI, 2.59					
PD	366,393	0	3.22	0	—
ICHD (Cv)	637,101	270,707	5.45	2.24	120,905
Prevalent and starting age (reference case: incident patients, average age 55)					
Prevalent patients, average age 55					
ICHD (Cv)	698,020	0	6.03	0	(Dominated)
PD	661,044	–36,976	6.03	0	—
Prevalent patients, average age 65					
ICHD (Cv)	691,129	0	5.65	0	(Dominated)
PD	654,172	–36,957	5.65	0	—
Incident patients, average age 65					
ICHD (Cv)	632,578	0	5.13	0	(Dominated)
PD	596,289	–36,289	5.13	0	—
Scenario of RR of death and population					
Prevalent patients starting dialysis at age 55, RR death from Marshall et al.[64]					
ICHD (Cv)	698,020	0	6.03	0	(Dominated)
PD	687,738	–10,282	6.29	0.26	—
Prevalent patients starting dialysis at age 55, RR death from Yeates et al.[79]					
ICHD (Cv)	698,020	0	6.03	0	(Dominated)
PD	687,890	–10,130	6.29	0.26	—
Prevalent patients starting dialysis at age 65, RR death from Marshall et al.[64]					
ICHD (Cv)	691,129	0	5.65	0	(Dominated)
PD	680,753	–10,376	5.89	0.24	—

Strategy	Cost ($)	Incremental Cost ($)	QALYs	Incremental QALYs	ICUR ($/QALY)
Prevalent patients starting dialysis at age 65, RR death from Yeates et al.[79]					
ICHD (Cv)	691,129	0	5.65	0	(Dominated)
PD	680,912	–10,217	5.89	0.24	—
Incident patients starting dialysis at age 65, RR death from Marshall et al.[64]					
ICHD (Cv)	632,578	0	5.13	0	—
PD	636,355	3,776	5.49	0.36	10,406
Incident Patients Starting Dialysis at Age 65, RR Death From Yeates et al.[79]					
ICHD (Cv)	632,578	0	5.13	0	—
PD	637,563	4,984	5.50	0.37	13,330
Incident patients starting dialysis at age 65, RR death from Marshall et al.[64] age subgroups					
PD	568,115	0	4.87	0	—
ICHD (Cv)	632,578	64,464	5.13	0.26	252,794
QoL (Klarenbach et al., 2014)[29]					
ICHD (Cv) (0.657 then 0.61)	637,101	0	5.45	0	(Dominated)
PD[b] (0.696 then 0.71)	600,808	36,292	5.61	0.209	—

CI = confidence interval; Cv = conventional; ICHD = in-centre hemodialysis; ICUR = incremental cost-utility ratio; PD = peritoneal dialysis; QALY = quality-adjusted life-year; QoL = quality of life; RR = relative risk.
[a] The last end point reported was at 60 months. Linear interpolation conducted to determine the year 4 estimates.
[b] By assumption.

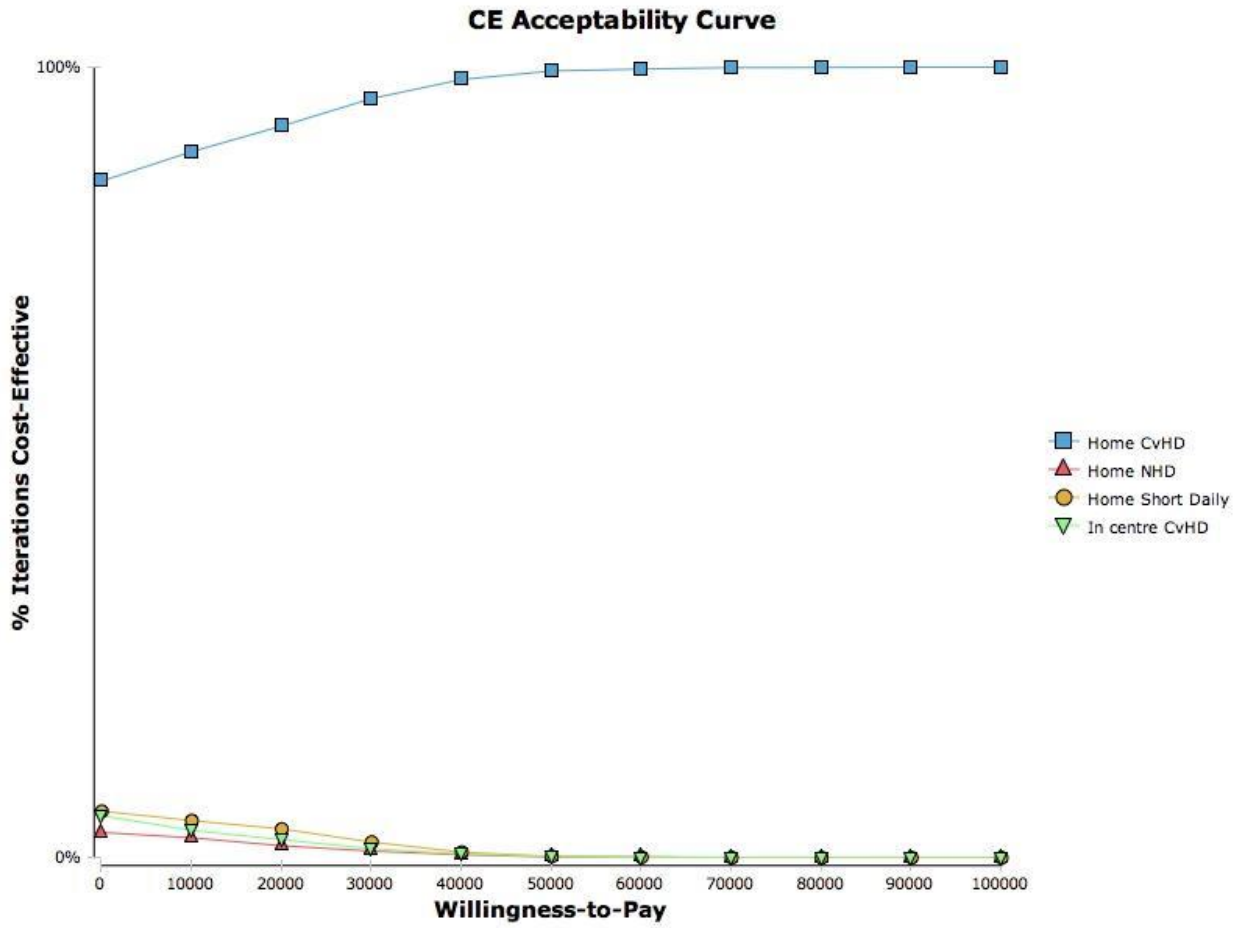
Table 47: PD Versus Conventional ICHD — Additional Deterministic Sensitivity Analysis

Sensitivity Analysis	Strategy	ICUR	Incremental Cost
Reference case	PD ICHD (Cv)	Dominated	36,292
PD Technique Failure Rate			
PD failure rate = 0 (base case 0.178)	PD ICHD	Dominated	122,600
PD failure rate –50% (0.089, base case 0.178)	PD ICHD	Dominated	66,752
PD failure rate +50% (0.267, base case 0.178)	PD ICHD	Dominated	17,065
Cost			
Access cost lower CI (3,093, base case 8,632)	PD ICHD	Dominated	19,866
Access cost upper CI (9,520, base case 8,632)	PD ICHD	Dominated	38,928
No access cost (0, base case 8,632)	PD ICHD	Dominated	10,694
PD failure cost lower CI (1,948, base case 8,663)	PD ICHD	Dominated	39,185
PD failure cost upper CI (15,378, base case 8,663)	PD ICHD	Dominated	33,400
No PD failure cost (0, base case 8,663)	PD ICHD	Dominated	40,024
Retraining Days			
Increase retraining days by 50% (0.46, base case 0.31)	PD ICHD	Dominated	36,187
Increase retraining days by 100% (0.62, base case 0.31)	PD ICHD	Dominated	36,081
Decrease retraining days by 50% (0.155, base case 0.31)	PD ICHD	Dominated	36,398

CI = confidence interval; Cv = conventional; ICHD = in-centre hemodialysis; ICUR = incremental cost-utility ratio; PD = peritoneal dialysis.

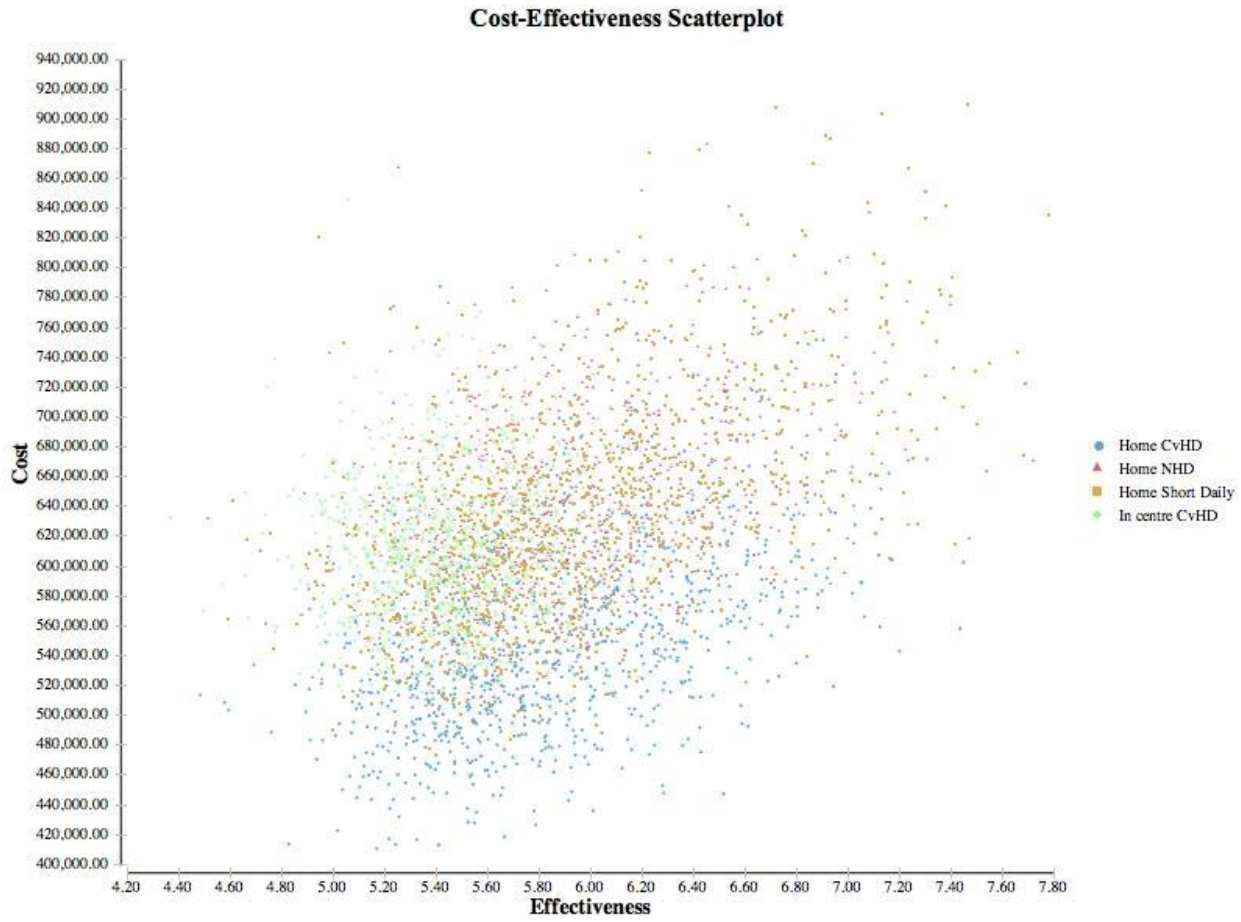
Appendix 20: Findings From Sensitivity Analyses — Home HD Versus Cv ICHD

Figure 8: Cost-Effectiveness Acceptability Curve, Acceptability Curve HHD Versus Cv ICHD



CE = cost-effectiveness; Cv = conventional; HD = hemodialysis; ICHD = in-centre hemodialysis.

Figure 9: Scatterplots of 5,000 Probabilistic Simulations — HHD Versus Cv ICHD



Cv = conventional; HHD = home hemodialysis; ICHD = in-centre hemodialysis.

Table 48: HHD Versus Conventional ICHD — Deterministic Sensitivity Analysis of Additional Parameters

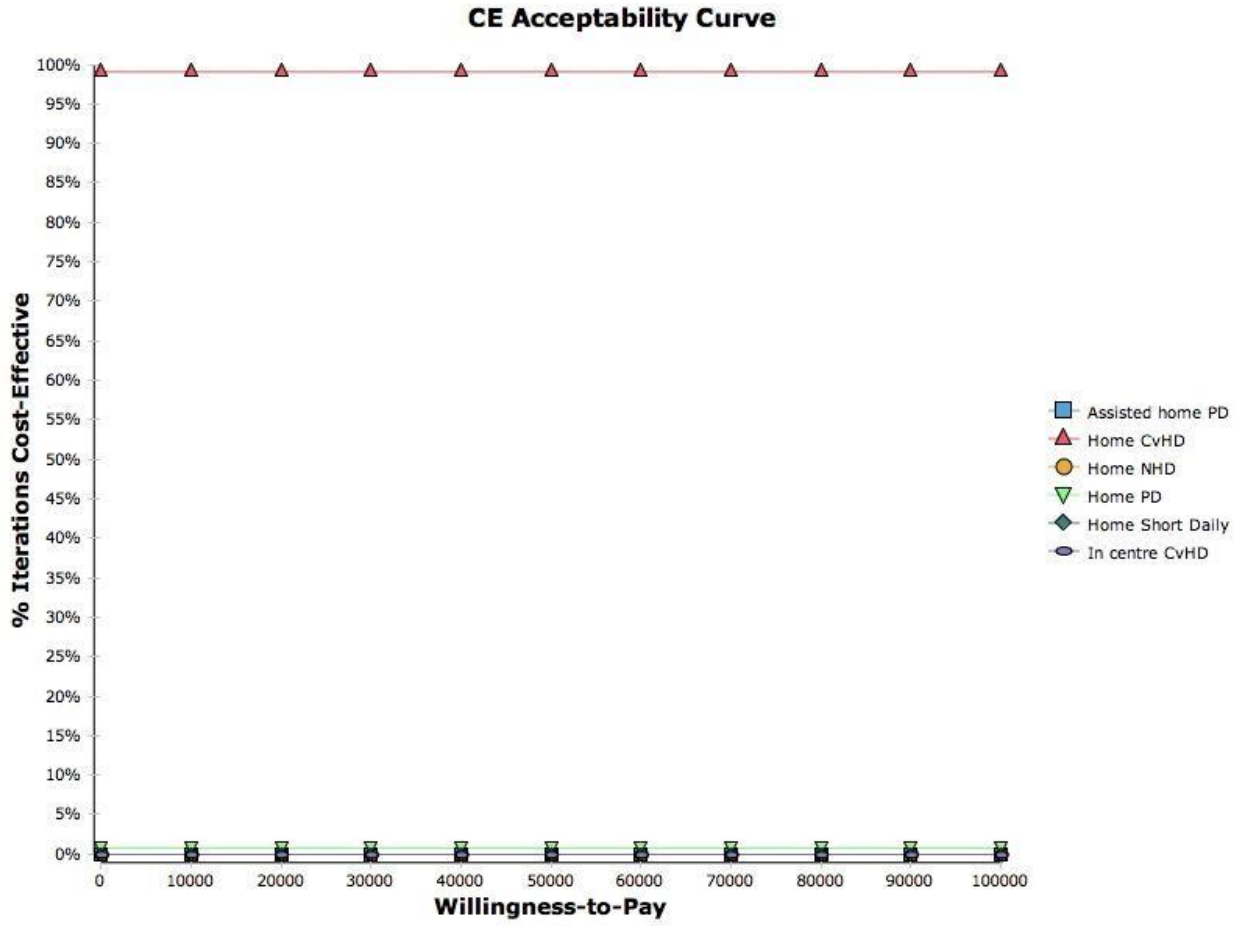
Sensitivity Analysis	Strategy	ICUR	Incremental Cost
Reference Case	**ICHD (Cv)** **HHD (Cv)** **SDHHD** **NHHD**	 **Dominant** **Dominant** **Dominant**	 **–75,139** **–19,117** **–19,117**
NHHD meds costs –50%	ICHD (Cv) HHD (Cv) NHHD SDHHD	 Dominant Dominant Dominant	 –75,139 –36,321 –19,117
NHHD meds costs +50%	ICHD (Cv) HHD (Cv) SDHHD NHHD	 Dominant Dominant Dominant	 –75,139 –19,117 –1,914
Add HHD failure cost (assume same as PD failure cost)	ICHD (Cv) HHD (Cv) SDHHD NHHD	 Dominant Dominant Dominant	 –72,964 –16,942 –16,942

Sensitivity Analysis	Strategy	ICUR	Incremental Cost
Technique Failure Rate			
Dropout rate = 0 (base case 0.077)	ICHD (Cv) HHD (Cv) SDHHD NHHD	 Dominant Dominant Dominant	 –126,725 –53,255 –53,255
Dropout rate –50% (0.039, base case 0.077)	ICHD (Cv) HHD (Cv) SDHHD NHHD	 Dominant Dominant Dominant	 –96,980 –33,573 –33,573
Dropout rate +50% (0.12, base case 0.077)	ICHD (Cv) HHD (Cv) SDHHD NHHD	 Dominant Dominant Dominant	 –58,417 –8,045 –8,045
Retraining Days			
Increase retraining days by 50% (5.34 days; base case 3.56 days)	ICHD (Cv) HHD (Cv) SDHHD NHHD	 Dominant Dominant Dominant	 –71,888 –15,866 –15,866
Increase retraining days by 100% (7.12 days)	ICHD (Cv) HHD (Cv) SDHHD NHHD	 Dominant Dominant Dominant	 –68,637 –12,615 –12,615
Decrease retraining days by 50% (1.78 days)	ICHD (Cv) HHD (Cv) SDHHD NHHD	 Dominant Dominant Dominant	 –78,390 –22,368 –22,368
Mixed HHD (50% DHHD and 50% ICHD) With Utility Cost (Assumed Paid by Health Care Payer)			
Base case	ICHD (Cv) Mixed HHD	Dominant	–47,128
Electricity cost by Klarenbach[29] (492 HNHHD)	ICHD (Cv) Mixed HHD	Dominant	–46,882
Water cost by Kroeker et al.[81] (4,623 HSDHD, 5,253 HNHHD)	ICHD (Cv) Mixed HHD	Dominant	–44,659
Water and electricity by Komenda et al.[83] (4,020 DHHD, 2,412 HICHD)	ICHD (Cv) Mixed HHD	Dominant	–43,912
Water and electricity by Nickel et al.[99] (639 HSDHD, 998 HNHHD, 427 HICHD)	ICHD (Cv) Mixed HHD	Dominant	–46,505
QoL from Klarenbach et al. 2014[29]			
	ICHD (Cv) NHHD	Dominant	–19,117

Cv = conventional; HHD = home hemodialysis; DHHD = daily home hemodialysis; ICHD = in-centre hemodialysis; NHHD = nocturnal home hemodialysis; SDHHD = short-daily home hemodialysis.
Note: DHHD stands for daily HHD, which includes SDHHD or NHHD.

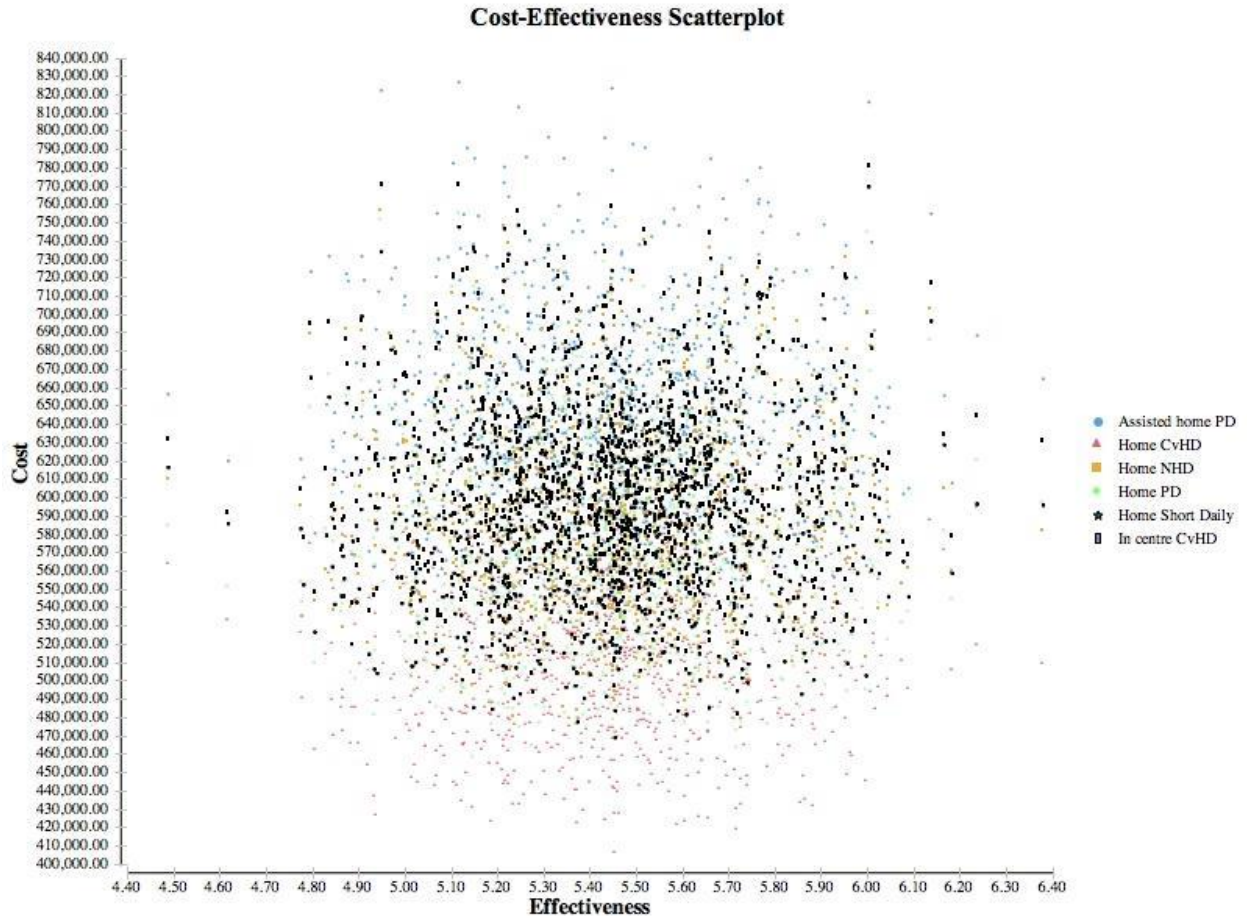
Appendix 21: Findings from Sensitivity Analyses — HHD Versus PD

Figure 10: Cost-Effectiveness Acceptability Curve, HD (HHD or PD) Versus Cv ICHD



CE = cost-effectiveness; Cv = conventional; HD = hemodialysis; HHD = home hemodialysis; ICHD = in-centre hemodialysis; PD = peritoneal dialysis.

Figure 11: Scatterplots of 5,000 Probabilistic Simulations — HHD Versus Cv ICHD



Cv = conventional; HHD = home hemodialysis; ICHD = in-centre hemodialysis.

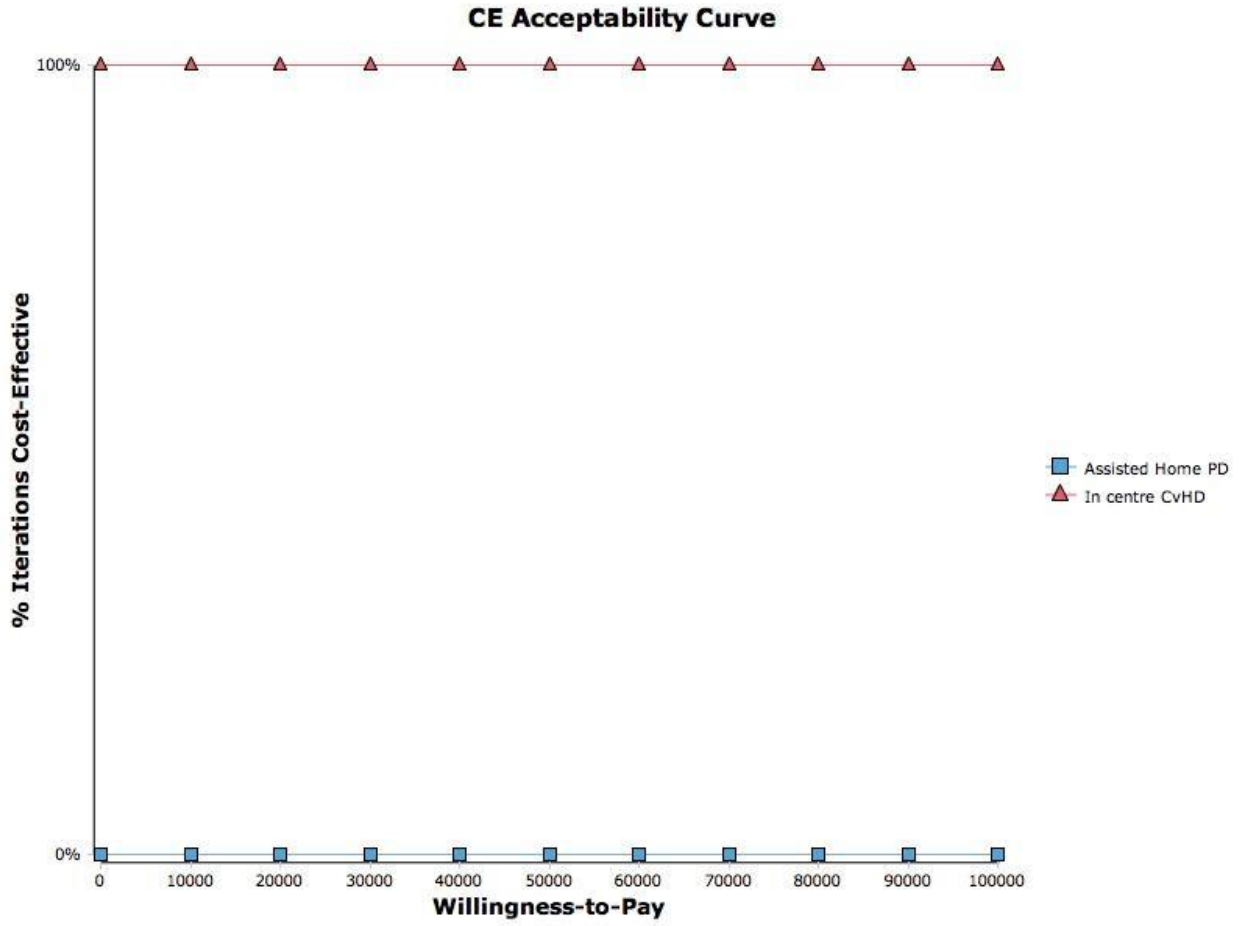
Table 49: HHD Versus PD — Deterministic Sensitivity Analyses (Varying RR of Technique Failure)

Sensitivity Analysis	Strategy	ICUR	Incremental Cost
RR Technique Failure (Reference Case, 0.178 PD, 0.077 HHD), With Technique Failure Cost for PD Only			
RR technique failure Nadeau-Fredette[104] point estimates (0.34 HHD vs. PD)	PD HHD (Cv) SDHHD NHHD	 Dominant Dominated Dominated	 –47,486 11,456 11,456
RR technique failure Suri et al.[70] point estimates (0.29 HHD vs. PD)	PD DHHD[a]	 Dominated	 8,091
RR technique failure Weinhandl et al.[75] point estimates 1 yr 27.5% vs. 37% 3 yr + 32.1% vs. 44.1%	PD DHHD[a]	 Dominant	 –21,157

DHHD = daily home hemodialysis; HHD (Cv) = home conventional hemodialysis; NHHD = nocturnal home hemodialysis; PD = peritoneal dialysis; SDHHD = short-daily home hemodialysis.
[a] The clinical studies included only frequent (daily) home HD prescriptions, as such they are presented in aggregate (the reference case for DHHD is the same as for SDHHD and NHHD [dominated by PD, additional cost of $17,175]).

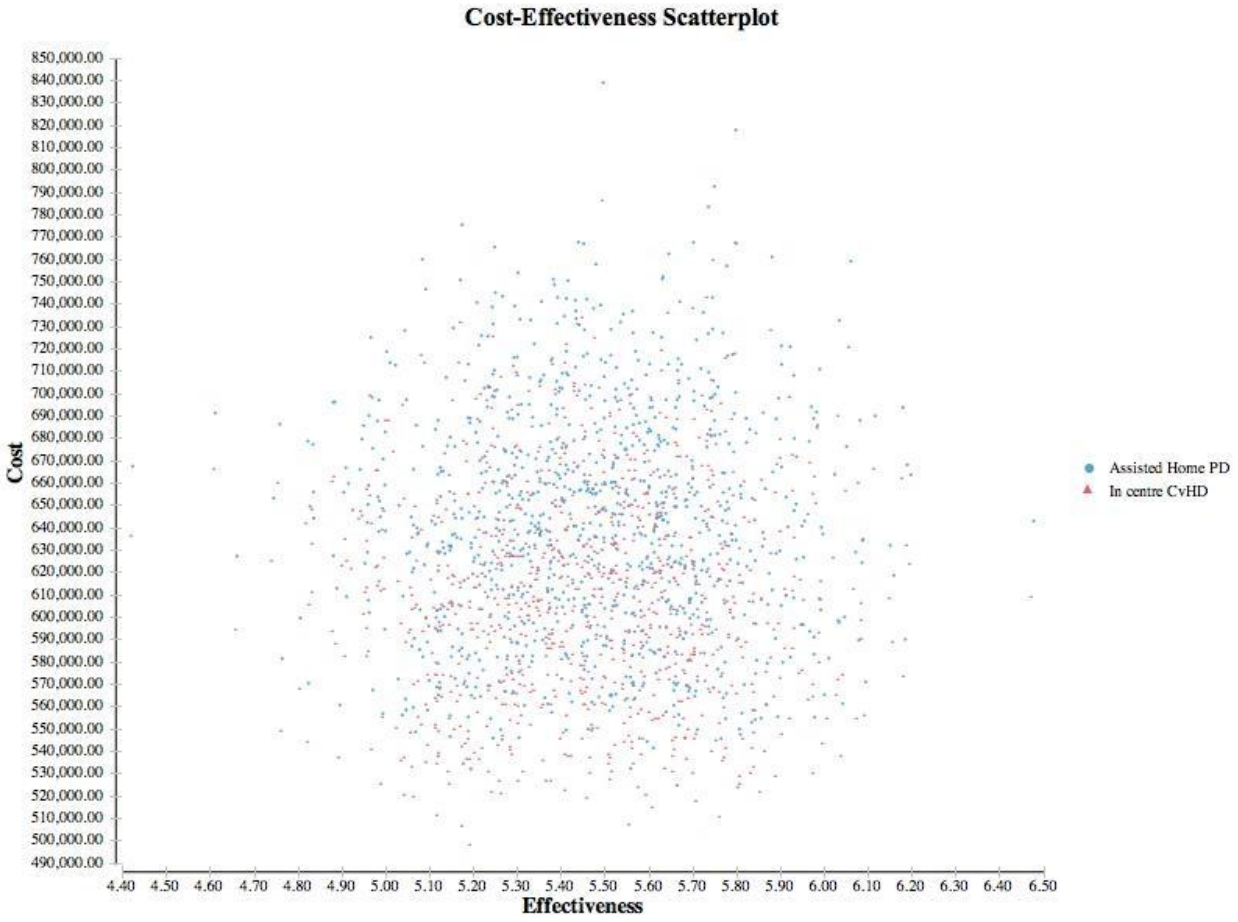
APPENDIX 22: Findings from Additional Sensitivity Analyses

Figure 12: Cost-Effectiveness Acceptability Curve, Assisted PD Versus Cv ICHD



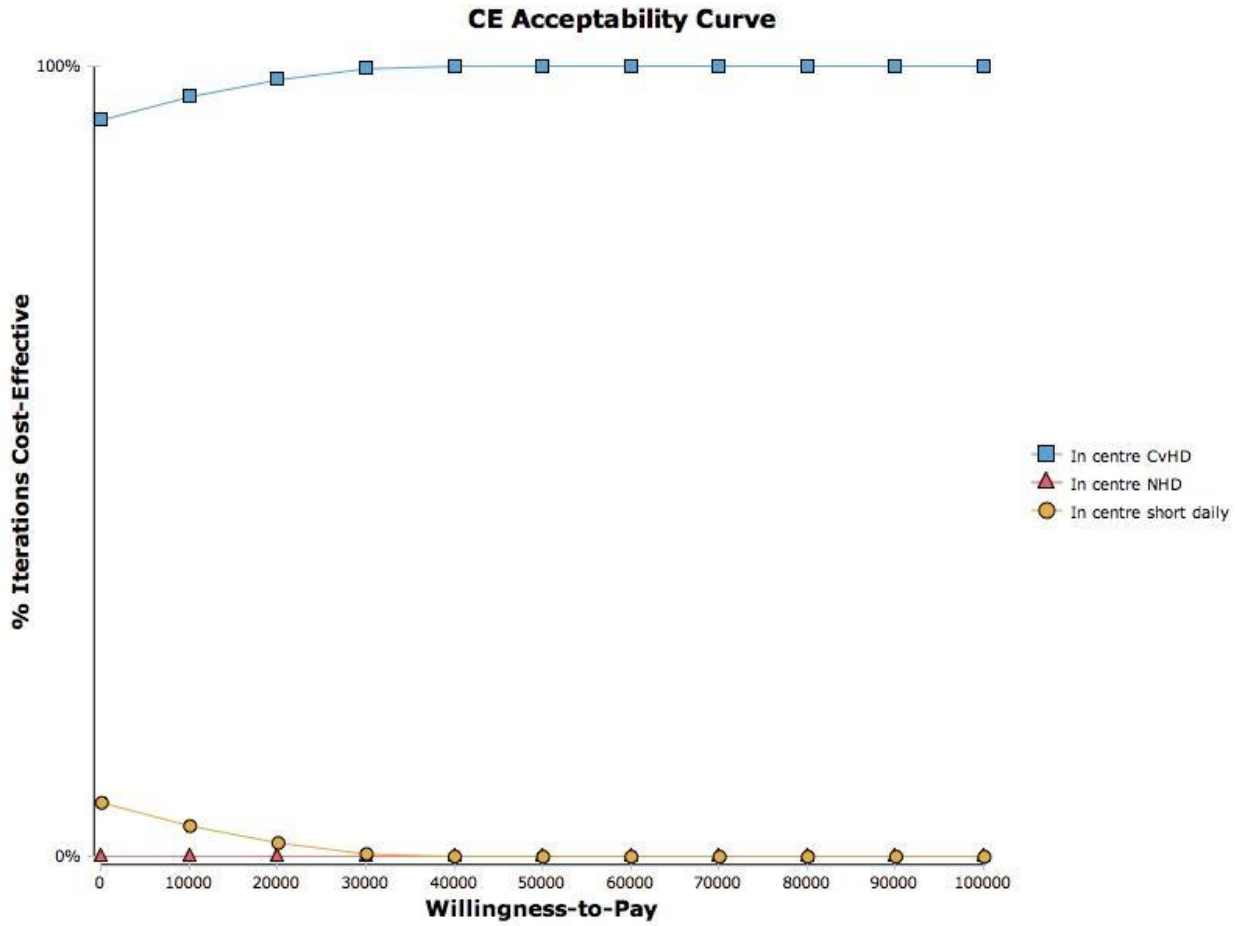
Cv = conventional; CE = cost-effectiveness; ICHD = in-centre hemodialysis; PD = peritoneal dialysis.

Figure 13: Scatterplots of 5,000 Probabilistic Simulations — Assisted PD Versus Cv ICHD



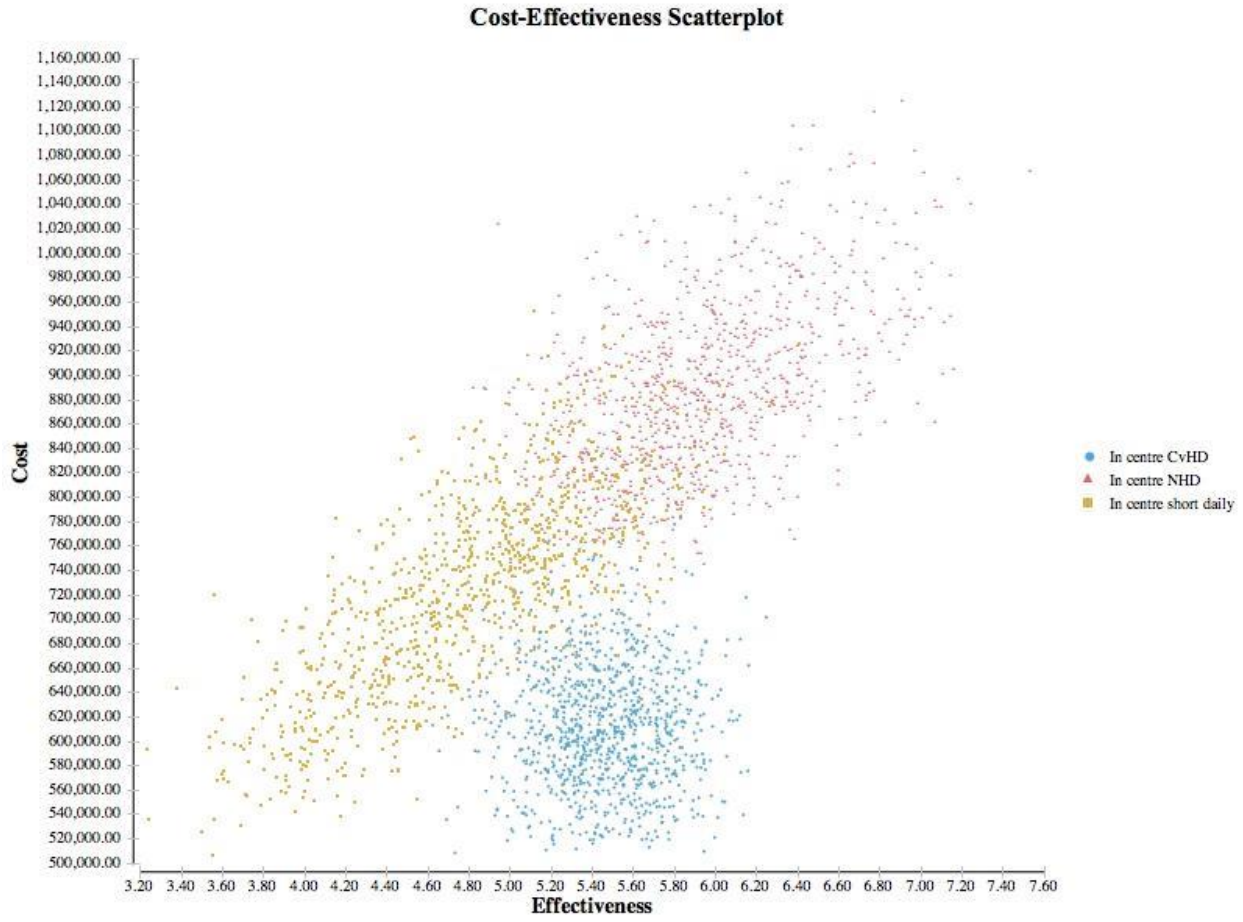
Cv = conventional; ICHD = in-centre hemodialysis; PD = peritoneal dialysis.

Figure 14: Cost-Effectiveness Acceptability Curve — Different ICHD Modalities



CE = cost-effectiveness; CvHD = conventional hemodialysis; ICHD = in-centre hemodialysis; NHD = nocturnal hemodialysis.

Figure 15: Scatterplots of 5,000 Probabilistic Simulations — Different ICHD Modalities

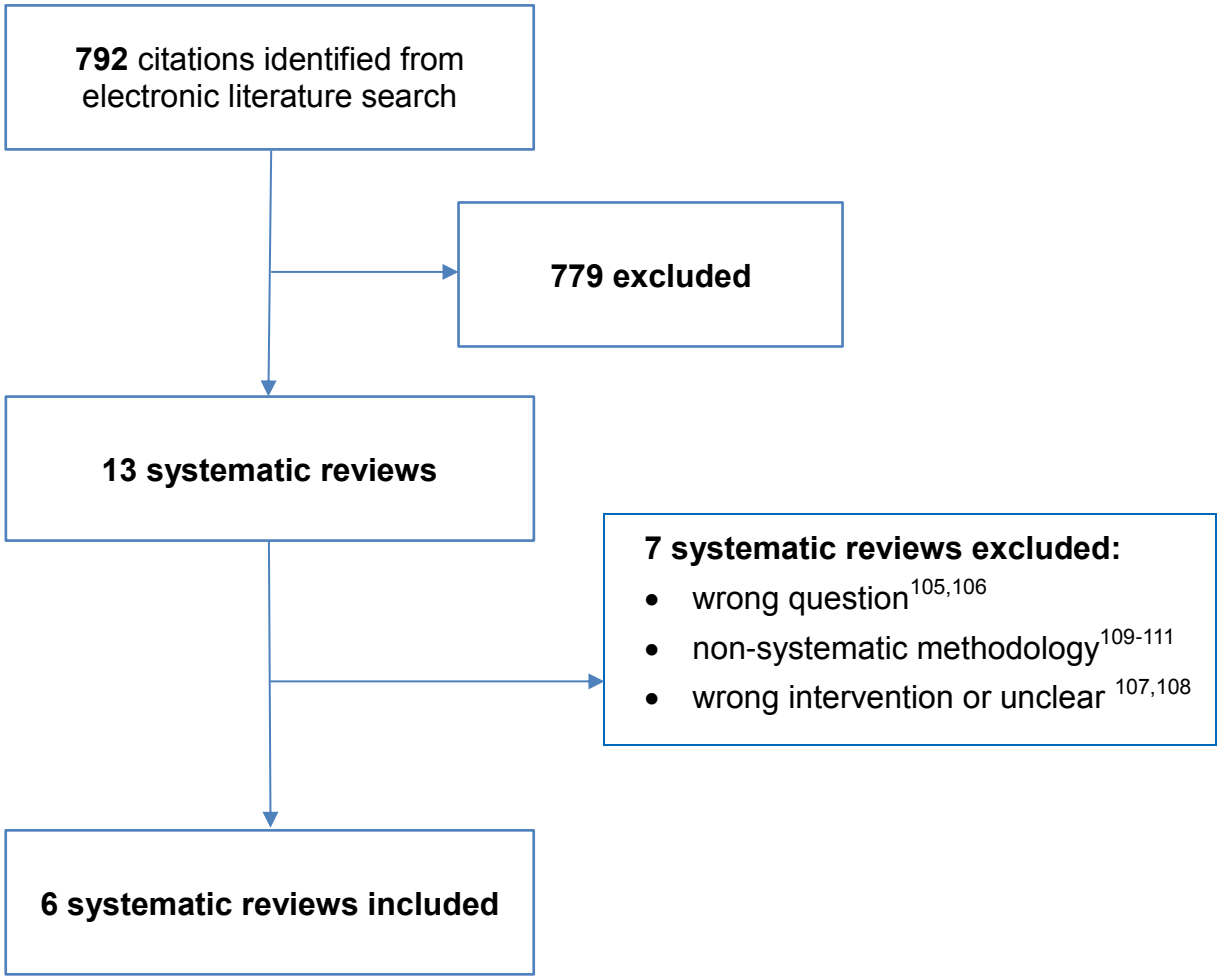


CvHD = conventional hemodialysis; ICHD = in-centre hemodialysis; NHD = nocturnal hemodialysis.

Appendix 23: Quality Assessment Instrument — Patient Preferences Review

JBI Checklist	
1. Is the review question clearly and explicitly stated?	□ Yes □ No □ Unclear □ Not applicable
2. Were the inclusion criteria appropriate for the review question?	□ Yes □ No □ Unclear □ Not applicable
3. Was the search strategy appropriate?	□ Yes □ No □ Unclear □ Not applicable
4. Were the sources of studies adequate?	□ Yes □ No □ Unclear □ Not applicable
5. Were the criteria for appraising studies appropriate?	□ Yes □ No □ Unclear □ Not applicable
6. Was critical appraisal conducted by two or more reviewers independently?	□ Yes □ No □ Unclear □ Not applicable
7. Were there methods to minimize errors in data extraction?	□ Yes □ No □ Unclear □ Not applicable
8. Were the methods used to combine studies appropriate?	□ Yes □ No □ Unclear □ Not applicable
9. Was the likelihood of publication bias assessed?	□ Yes □ No □ Unclear □ Not applicable
10. Were recommendations for policy and/or practice supported by the reported data?	□ Yes □ No □ Unclear □ Not applicable
11. Were the specific directives for new research appropriate?	□ Yes □ No □ Unclear □ Not applicable

Appendix 24: Study Selection Flow Diagram — Patient Preferences Review



Appendix 25: List of Included Studies — Patient Preferences Review

Harwood L, Clark AM. Understanding pre-dialysis modality decision-making: A meta-synthesis of qualitative studies. Int J Nurs Stud. 2013;50(1):109-20.

Burns T, Fernandez R, Stephens M. The experiences of adults who are on dialysis and waiting for a renal transplant from a deceased donor: a systematic review. JBI Database System Rev Implement Rep. 2015;13(2):169-211.

Tong A, Cheung KL, Nair SS, Kurella Tamura M, Craig JC, Winkelmayer WC. Thematic synthesis of qualitative studies on patient and caregiver perspectives on end-of-life care in CKD. Am J Kidney Dis. 2014 Jun;63(6):913-27.

Morton RL, Tong A, Howard K, Snelling P, Webster AC. The views of patients and carers in treatment decision making for chronic kidney disease: systematic review and thematic synthesis of qualitative studies. BMJ [Internet]. 2010 [cited 2016 May 26];340:c112. Available from: http://www.bmj.com/content/bmj/340/bmj.c112.full.pdf

Walker RC, Hanson CS, Palmer SC, Howard K, Morton RL, Marshall MR, et al. Patient and caregiver perspectives on home hemodialysis: a systematic review. Am J Kidney Dis. 2015 Mar;65(3):451-63.

Bayhakki, Hatthakit U. Lived experiences of patients on hemodialysis: a meta-synthesis. Nephrol Nurs J. 2012 Jul;39(4):295-304.

Appendix 26: List of Excluded Studies — Patient Preferences Review

Reason for exclusion: Wrong question (n=2)

Murtagh FEM, Addington-Hall J, Higginson IJ. The prevalence of symptoms in end-stage renal disease: a systematic review. Adv Chronic Kidney Dis. 2007;14(1):82-99.

Noble H, Meyer J, Bridges J, Kelly D, Johnson B. Patient experience of dialysis refusal or withdrawal--a review of the literature. J Ren Care. 2008 Jun;34(2):94-100.

Reason for exclusion: Non-systematic methodology (n=3)

Moustakas J, Bennett PN, Nicholson J, Tranter S. The needs of older people with advanced chronic kidney disease choosing supportive care: a review. Renal Society of Australasia Journal [Internet]. 2012 Jul [cited 2016 May 27];8(2):70-5. Available from: http://www.renalsociety.org/public/6/files/documents/RSAJ/2012.07/moustakas.pdf

Sinclair PM. Home haemodialysis: a literature review. Renal Society of Australasia Journal [Internet]. 2009 Jun 12 [cited 2016 May 17];5(1):9-15. Available from: http://www.renalsociety.org/public/6/files/documents/RSAJ/2009.03/sinclair.pdf

Wadd K, King L, Bennett P, Grant J. Being a parent on dialysis: a literature review. J Ren Care. 2011 Dec;37(4):208-15.

Reason for exclusion: Wrong intervention or unclear (n=2)

Hussain JA, Flemming K, Murtagh FE, Johnson MJ. Patient and health care professional decision-making to commence and withdraw from renal dialysis: a systematic review of qualitative research. Clin J Am Soc Nephrol. 2015 Jul 7;10(7):1201-15.

Tong A, Sainsbury P, Craig JC. Support interventions for caregivers of people with chronic kidney disease: A systematic review. Nephrology Dialysis Transplantation [Internet]. 2008 [cited 2016 May 27];23(12):3960-5. Available from: http://ndt.oxfordjournals.org/content/23/12/3960.full.pdf+html

Appendix 27: Characteristics of Included Studies — Patient Preferences Review

First Author, Publication Year,	Review Methods Databases and Timeframes Searched QA Tool Used	Countries of Included Studies	Study Types Included Number Publication Years of Primary Studies Included	Number of Patients Age, Sex, Comorbidities, of Patients Included Subgroups of Interest	Modalities	Outcomes
Morton, et al., 2010[116]	Thematic synthesis MEDLINE, PsycINFO, CINAHL, Embase, social work abstracts, and digital theses to week 3 October 2008) (COREQ) framework	US, Canada, Denmark, Australia, Hong Kong, and Taiwan	Qualitative studies 18 (including three unpublished theses) 1996-2008	375 patients + 87 informal caregivers or family members of the patients were also included. NR No	HD, PD home and ICHD, transplant and palliative care	Four major themes were identified as being central to treatment choices: confronting mortality (choosing life or death, being a burden, living in limbo), lack of choice (medical decisions, lack of information, and constraints on resources), gaining knowledge of options (peer influence, timing of information), and weighing alternatives (maintaining lifestyle, family influences, maintaining the status quo).
Tong et al., 2014[117]	Thematic synthesis MEDLINE, Embase, PsycINFO, CINAHL, and reference lists were searched to May 2013 (COREQ) framework	US, UK, Australia, Canada, Netherlands, Sweden, Thailand, Ireland	Qualitative studies 26 1988-2012	711 patients (non–dialysis dependent [n = 41], HD [n = 544], PD [n = 9]; unspecified dialysis modality [n = 31], conservative management [n = 86]) and 178 caregivers were included. NR No	HD, PD, conservative care	Invasive suffering, personal vulnerability, relational responsibility (being a burden, demonstrating loyalty, protecting others from grief), negotiating existential tensions, and preparedness (decisional clarity, informational power, spirituality, and hope).

First Author, Publication Year,	Review Methods Databases and Timeframes Searched QA Tool Used	Countries of Included Studies	Study Types Included Number Publication Years of Primary Studies Included	Number of Patients Age, Sex, Comorbidities, of Patients Included Subgroups of Interest	Modalities	Outcomes
Walker et al., 2015[118]	Thematic synthesis MEDLINE, EMBASE, PsycINFO, CINAHL, and reference lists were searched to October 2013 (COREQ) framework	Australia, New Zealand, Norway, Italy, UK, US, Italy, Canada, China, Sweden	Qualitative and mixed method studies 24 2003-2013	221 patients (HHD [n = 109], ICHD [n = 97], and predialysis [n= 15]) and 121 caregivers were eligible NR No	HD (home, nocturnal, in-centre, short term) + those considering HD	5 themes identified: vulnerability of dialyzing independently, fear of being alone, concern of family burden, opportunity to thrive, and appreciating medical responsiveness
Bayhakki and Hatthakit, 2012[119]	Meta-synthesis, meta-ethnographic approach ProQuest, CINAHL, Cochrane Library, and ScienceDirect from 2000 to 2010 5-part quality assessment[214]	NR	Qualitative studies 10 2001-2010	224 NR No	Not specified	Physical shackle in life, feeling mental and emotional distress, relying on HD, dealing with problems.

First Author, Publication Year,	Review Methods Databases and Timeframes Searched QA Tool Used	Countries of Included Studies	Study Types Included Number Publication Years of Primary Studies Included	Number of Patients Age, Sex, Comorbidities, of Patients Included Subgroups of Interest	Modalities	Outcomes
Harwood and Clark, 2016[120]	Meta-synthesis MEDLINE (1950–2009), Embase (1950–2009), CINAHL (1937–2009), Web of Science (1956–2009) and Scopus (1960–2009). The Joanna Briggs Library of Systematic Reviews, and the Cochrane database Tables of contents for "Hemodialysis International" were handsearched from the years 2003 to 2009. Critical Appraisal Skills Programme (CASP)	US, UK, Taiwan, Denmark, Australia, Canada, Netherlands	Qualitative studies 16 1996-2011	410 NR No	HD, PD home and ICHD	The illusion of choice — a matter of life and death, personal factors and the minimization of intrusiveness of dialysis, other factors perceived to affect intrusiveness, knowledge and social support; essential and context bound
Burns et al., 2015[121]	17	NR	Qualitative studies 12 1985-2013	151 NR No	HD in a hospital or a satellite unit or at home, or PD, and those who were waiting for a kidney transplant from a deceased donor	Mortality, physical health, restricted life, character, state of mind, hope, knowledge, life losses, stress and anxiety, uncertainty, relationships, and community

COREQ = Consolidated Criteria for Reporting Qualitative Research; HD = hemodialysis; ICHD = in-centre hemodialysis; NR = not reported; PD = peritoneal dialysis; QA = quality assessment.

Appendix 28: Quality Assessment of Included Studies — Patient Preferences Review

First Author Year of Publication	Major Strengths	Major Limitations
Morton et al., 2010[116]	• Research objectives and questions were clearly defined. • Appropriate literature sources and resources were used. • COREQ framework used for appraisal. • Critical appraisal done by two reviewers. • Methods to combine studies were appropriate. • Recommendations/conclusions were supported by the data presented. • Directions for future research suggestions for care improvements were given.	• Full search strategies or terms were not reported. • Data extraction method unclear. • Publication bias was not assessed.
Tong et al., 2014[117]	• Research objectives and questions were clearly defined. • Appropriate literature sources and resources were used. • COREQ framework used for appraisal. • Critical appraisal done by three reviewers. • Methods to combine studies were appropriate. • Recommendations/conclusions were supported by the data presented.	• Full search strategies or terms were not reported. • One reviewer extracted data; no verification reported. • Publication bias was not assessed.
Walker et al., 2015[118]	• Research objectives and questions were clearly defined. • Appropriate literature sources and resources were used. • Researchers used triangulation, and three authors verified codes and themes to increase reliability. • COREQ framework used for appraisal. • Critical appraisal done by two reviewers. • Methods to combine studies were appropriate. • Recommendations/conclusions were supported by the data presented. • Directions for future research suggestions for care improvements were given.	• Full search strategies or terms were not reported. • Data extraction method was unclear. • Publication bias was not assessed.
Bayhakki and Hatthakit, 2012[119]	• Research objectives and questions were clearly defined. • Methods to combine studies were appropriate. • Recommendations/conclusions were supported by the data presented. •	• Full search strategies or terms were not reported. • Grey literature sources were not well described. • Inclusion criteria were not well described. • Data extraction method was unclear. • Publication bias was not assessed.

First Author Year of Publication	Major Strengths	Major Limitations
Harwood and Clark, 2016[120]	• Research objectives and questions were clearly defined. • Full search strategies were reported. • Appropriate literature sources and resources were used. • CASP quality appraisal tool used. • Critical appraisal done by two reviewers. • To minimize errors, data extraction was performed by one author, verification by another. • Methods to combine studies were appropriate. • Recommendations/conclusions were supported by the data presented. • Directions for future research suggestions for health policy improvements were given.	• No major limitations. • Publication bias was not assessed.
Burns et al., 2015[121]	• Research objectives and questions were clearly defined. • Full search strategies were reported. • Appropriate literature sources and resources were used. • Justification for Joanna Briggs meta-synthesis methods was given. • Methods to combine studies were appropriate. • Recommendations/conclusions were supported by the data presented. • Implications for practice and research were presented.	• Data extraction method unclear. • Publication bias was not assessed.

COREQ = Consolidated Criteria for Reporting Qualitative Research.

Appendix 29: Implementation Surveys — Implementation Review

General Survey

Part I: ABOUT YOUR PRACTICE OR PROGRAM

Prior to starting the survey, a few questions about you and your practice or program.

In which province or territory do you practice/are located?

- ○ Alberta
- ○ British Columbia
- ○ Manitoba
- ○ New Brunswick
- ○ Newfoundland and Labrador
- ○ Northwest Territories
- ○ Nova Scotia
- ○ Nunavut
- ○ Ontario
- ○ Prince Edward Island
- ○ Quebec
- ○ Saskatchewan
- ○ Yukon

Please identify your main role:

- ○ Nurse
- ○ Other clinician (please specify) _____
- ○ Administrator (please specify) _____
- ○ Other (please specify) _____

Would you consider that your practice/program includes rural populations?

- ○ Yes
- ○ No

Would you consider that your practice/program includes remote populations?

- ○ Yes
- ○ No

Which of the following services are available within your practice or program?

- ☐ Centre HD
- ☐ Centre, self-care HD
- ☐ Satellite HD
- ☐ Home PD
- ☐ Home PD training
- ☐ Home PD-assisted
- ☐ Home HD

- ☐ Home HD training
- ☐ Home HD-assisted
- ☐ Renal Transplantation

Which of the following services require referral to a program outside of your practice or partnership?

- ☐ Centre HD
- ☐ Centre, self-care HD
- ☐ Satellite HD
- ☐ Home PD
- ☐ Home PD training
- ☐ Home PD-assisted
- ☐ Home HD
- ☐ Home HD training
- ☐ Home HD-assisted
- ☐ Renal Transplantation

Please enter the approximate number of patients who receive each of these modalities at your facility/through your program each year:

Centre HD (including satellite)	
Centre, Self-Care HD	
Home PD (all prescriptions)	
Home HD (all prescriptions)	

Part II: STRATEGIES FOR IMPLEMENTING HOME HEMODIALYSIS AND PERITONEAL PROGRAMS

Please briefly describe any strategy, policy, or intervention that you are aware of that has the goal to increase the uptake of home-based dialysis modalities, including home hemodialysis or home peritoneal dialysis. Please provide the name of the strategy or program, and if possible any supporting information such as the target population, description of the strategy, who was involved, and links to any related websites, reports, training materials, etc.

In relation to the strategy(ies) you described above, please describe any factors you believe helped to make this strategy successful. What worked well? What was needed in order to ensure successful implementation?

In relation to the strategy(ies) you described above, please describe any factors you believe hindered the success of the strategy. What did not work well? What were some of the barriers to implementation?

III. STRATEGIES FOR IMPLEMENTING IN-CENTRE SELF-CARE HEMODIALYSIS

Please briefly describe any strategy, policy, or intervention that you are aware of that has the goal to increase the uptake of in-centre self-care hemodialysis. Please provide the name of the strategy or

program, and if possible any supporting information such as the target population, description of the strategy, who was involved, and links to any related websites, reports, training materials, etc.

In relation to the strategy(ies) you described above, please describe any factors you believe helped to make this strategy successful. What worked well? What was needed in order to ensure successful implementation?

In relation to the strategy(ies) you described above, please describe any factors you believe hindered the success of the strategy. What did not work well? What were some of the barriers to implementation?

IV. DIALYSIS FOR PATIENTS FROM RURAL OR REMOTE AREAS

Please describe any strategy that you are aware of that had the goal to facilitate the implementation of home dialysis or in-centre self-care dialysis programs for patients in rural settings. For rural patients undergoing home dialysis or in-centre self-care dialysis, what specifically are they provided with to help them participate in these programs?

Please describe any strategy that you are aware of that had the goal to facilitate the implementation of home dialysis or in-centre self-care dialysis programs for patients in remote settings. For patients in remote settings who were undergoing home dialysis or in-centre self-care dialysis, what specifically are they provided with to help them participate in these programs?

V. PUBLIC FUNDING OF DIALYSIS PROGRAMS

In your province or territory, please indicate if public funding is available for the following and whether the funding comes through a specific program. If funding is available, please specify what is included:

Traditional in-centre hemodialysis

Transportation costs (urban, from patient living in a city to dialysis center) ○ Yes ○ No

Transportation costs (rural, from patients living in rural areas to dialysis center) ○ Yes ○ No

Transportation costs (remote, from patients living in remote areas to dialysis center) ○ Yes ○ No

What costs are typically paid out-of-pocket by the patient relating to their dialysis treatment:

Any additional details (e.g., name of program, maximum coverage, etc.):

Home hemodialysis or home peritoneal dialysis

Training, accommodations ○ Yes ○ No

Training, travel
- ○ Yes
- ○ No

Utilities, power
- ○ Yes
- ○ No

Utilities, water
- ○ Yes
- ○ No

Formal caregiving:
- ○ Yes
- ○ No

Reimbursement for informal caregiver support (family, friend):
- ○ Yes
- ○ No

Home renovations
- ○ Yes
- ○ No

What costs are typically paid out-of-pocket by the patient relating to their dialysis treatment:

Any additional details (e.g., name of program, maximum coverage, etc.):

In-centre self-care hemodialysis

Is this a publicly funded option in your region?
- ○ Yes
- ○ No

Transportation costs (urban)
- ○ Yes
- ○ No

Transportation costs (rural)
- ○ Yes
- ○ No

Transportation costs (remote)
- ○ Yes
- ○ No

Formal caregiving
- ○ Yes
- ○ No

Reimbursement for informal caregiver support (family, friend):
- ○ Yes
- ○ No

What costs are typically paid out-of-pocket by the patient relating to their dialysis treatment:

Any additional details (e.g., name of program, maximum coverage, etc.):

VI. GENERAL QUESTIONS

Do you have any other comments you would like to share regarding the implementation of home-based hemodialysis, home-based peritoneal dialysis, or in-centre self-care hemodialysis in Canadian jurisdictions?

If you are willing to be contacted by us in case we need to clarify any of your responses, please provide your name and contact information: (optional)

Nephrologist survey

PART I: ABOUT YOUR PRACTICE OR PROGRAM

Prior to starting the survey, a few questions about you and your practice or program.

In which province or territory do you practice?

- ○ Alberta
- ○ British Columbia
- ○ Manitoba
- ○ New Brunswick
- ○ Newfoundland and Labrador
- ○ Northwest Territories
- ○ Nova Scotia
- ○ Nunavut
- ○ Ontario
- ○ Prince Edward Island
- ○ Quebec
- ○ Saskatchewan
- ○ Yukon

Is your practice or program affiliated with a university?

- ○ Yes
- ○ No

How many years have you been practising nephrology?

Did you participate in a peritoneal dialysis rotation for 2 months or longer during your nephrology fellowship?

- ○ Yes
- ○ No

Did you participate in a home hemodialysis rotation for 2 months or longer during your nephrology fellowship?

- ○ Yes
- ○ No

Would you consider that your practice or program includes or serves a rural population?

- ○ Yes
- ○ No

Would you consider that your practice or program includes or serves a remote population?

- ○ Yes
- ○ No

Which of the following services are available within your practice or program? (select all that apply)

- ☐ Centre HD
- ☐ Centre, self-care HD
- ☐ Satellite HD
- ☐ Home PD
- ☐ Home PD training
- ☐ Home PD-assisted (e.g., home care)
- ☐ Home HD
- ☐ Home HD training
- ☐ Home HD-assisted (e.g., home care)
- ☐ Renal Transplantation
- ☐ SELECT ALL

Which of the following services require referral to a program outside of your practice or partnership? (select all that apply)

- ☐ Centre HD
- ☐ Centre, self-care HD
- ☐ Satellite HD
- ☐ Home PD
- ☐ Home PD training
- ☐ Home PD-assisted
- ☐ Home HD
- ☐ Home HD training
- ☐ Home HD-assisted
- ☐ Renal Transplantation
- ☐ SELECT ALL

Please enter the approximate number of patients who receive each of these modalities at your facility/through your program each year.

Centre HD (including satellite)	
Centre, Self-Care HD	
Home PD (all prescriptions)	
Home HD (all prescriptions)	

PART II – FACILITATORS for PD or HHD

Several facilitators to the promotion of optimal use of home-based dialysis modalities, including home HD or PD, (as well as for self-care in-centre HD) have been identified in the literature. We would like to know, based on your experience, whether you agree that these are facilitators within your program or practice. Additionally, we are interested in your feedback on decision support tools.

Funding for personnel and infrastructure

The following policies, practices or interventions might promote optimal use of HHD or PD. Please indicate the degree to which you would support each of them:

	Not at all supportive	Slightly supportive	Moderately supportive	Very supportive	Extremely supportive
Establishment of a local or regional long-term care facility with capacity for HD provision	○	○	○	○	○
Establishment of a local or regional long-term care facility with capacity for PD provision	○	○	○	○	○
Funding for a formal caregiver (nurse) to provide full-care HD or PD at home, assuming that it shown to be cost-neutral or cost-saving	○	○	○	○	○
Funding for nurse-assisted home hemodialysis, specifically to assist patients with cannulation (patient or informal caregiver would be responsible for other components of dialysis prescription)	○	○	○	○	○
Funding for electrical and water costs for HHD so that patients don't have to pay those	○	○	○	○	○

Which of these policies, practices, or interventions are available to you?

	Yes	No
LTC with HD provision	○	○
LTC with PD provision	○	○
Full-care HD or PD at home	○	○
Nurse-assisted home HD	○	○
Electrical and water costs for HHD	○	○

Other suggested personnel and infrastructure interventions? Please describe.

External support systems

The following policies, practices, or interventions might promote optimal use of HHD or PD. Please indicate the degree to which you would support each of them:

	Not at all supportive	Slightly supportive	Moderately supportive	Very supportive	Extremely supportive
A regional “centre of excellence” to which patients can be referred for modality education, dialysis training, and vascular or peritoneal access (while you remain most responsible physician during training and treatment)	○	○	○	○	○
24-hour regional on-call physician supported by local home HD expert, to assist with home dialysis prescription or other technical issues	○	○	○	○	○

Which of these policies, practices, or interventions are available to you?

	Yes	No
Regional “Centre of Excellence”	○	○
24-hour on-call physician support	○	○

Other suggested external support systems? Please describe.

Health systems policy

The following policies, practices, or interventions might promote optimal use of HHD or PD. Please indicate the degree to which you would support each of them:

	Not at all supportive	Slightly supportive	Moderately supportive	Very supportive	Extremely supportive
Policy of mandatory modality education in which all patients approaching dialysis are offered the opportunity to receive home HD or PD	○	○	○	○	○
Centre-specific target for independent dialysis rates (incident or prevalent) that is linked to quality improvement initiatives intended to identify and overcome local barriers	○	○	○	○	○
Regular external (e.g., provincial agency) panel review to provide your program with feedback on where to target interventions to improve your local PD and home HD adoption rates	○	○	○	○	○

Which of the above policies, practices, or interventions are available to you?

	Yes	No
Mandatory modality education	○	○
Dialysis rate targets linked to quality improvement initiatives	○	○
Regular external program review	○	○

Other suggested health systems policy? Please describe.

Nephrology training and continued health education

The following policies, practices, or interventions might promote optimal use of HHD or PD. Please indicate the degree to which you would support each of them:

	Not at all supportive	Slightly supportive	Moderately supportive	Very supportive	Extremely supportive
Hemodialysis certification program for physicians through the Canadian Society of Nephrology	○	○	○	○	○
Peritoneal dialysis certification program for physicians through the Canadian Society of Nephrology.	○	○	○	○	○

Which of these policies, practices, or interventions are available to you?

	Yes	No
HD certification program	○	○
PD certification program	○	○

Other suggested training? Please describe.

Decision support tools

The following tools might promote optimal use of HHD or PD. Please indicate the degree to which you would support each of them:

	Not at all supportive	Slightly supportive	Moderately supportive	Very supportive	Extremely supportive
An online clinical decision support tool to assist with patient selection for independent dialysis	○	○	○	○	○
A paper-based clinical decision support tool to assist with patient selection for independent dialysis	○	○	○	○	○
Patient education tools about the different dialysis modalities	○	○	○	○	○
General information about dialysis care and when it is appropriate	○	○	○	○	○

Other suggested tools?

Part III: REMOTE OR RURAL POPULATIONS

For any strategy intended to increase the uptake of home-based dialysis modalities, please enter your comments here as they may relate to RURAL populations:

For any strategy intended to increase the uptake of home-based dialysis modalities, please enter your comments here as they may relate to REMOTE populations:

Part IV: GENERAL COMMENTS

Additional comments?

If you are willing to be contacted by us in case we need to clarify any of your responses, please provide your name and contact information: (optional)