



# Comparative Effectiveness of Home-based Kidney Dialysis versus In-center or Other Outpatient Kidney Dialysis Locations – A Systematic Review

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## PREFACE

Quality Enhancement Research Initiative's (QUERI) Evidence-based Synthesis Program (ESP) was established to provide timely and accurate syntheses of targeted healthcare topics of particular importance to Veterans Affairs (VA) clinicians, managers and policymakers as they work to improve the health and healthcare of Veterans. The ESP disseminates these reports throughout the VA, and some evidence syntheses inform the clinical guidelines of large professional organizations.

QUERI provides funding for four ESP Centers and each Center has an active university affiliation. The ESP Centers generate evidence syntheses on important clinical practice topics, and these reports help:

- develop clinical policies informed by evidence;
- guide the implementation of effective services to improve patient outcomes and to support VA clinical practice guidelines and performance measures; and
- set the direction for future research to address gaps in clinical knowledge.

In 2009, the ESP Coordinating Center was created to expand the capacity of HSR&D Central Office and the four ESP sites by developing and maintaining program processes. In addition, the Center established a Steering Committee comprised of QUERI field-based investigators, VA Patient Care Services, Office of Quality and Performance, and Veterans Integrated Service Networks (VISN) Clinical Management Officers. The Steering Committee provides program oversight, guides strategic planning, coordinates dissemination activities, and develops collaborations with VA leadership to identify new ESP topics of importance to Veterans and the VA healthcare system.

Comments on this evidence report are welcome and can be sent to Nicole Floyd, ESP Coordinating Center Program Manager, at [Nicole.Floyd@va.gov](mailto:Nicole.Floyd@va.gov).

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## EXECUTIVE SUMMARY

### INTRODUCTION

Home-based dialysis (defined for this review as in-home hemodialysis [HHD] or peritoneal dialysis [PD] outside of a dialysis facility) may offer advantages over in-center hemodialysis (HD), including patient convenience, expanded capacity for VA to deliver fully integrated care to Veterans with end-stage renal disease (ESRD), a reduction in fee-basis costs associated with dialysis, and potentially improved patient quality of life and blood pressure control with greater survival and fewer hospitalizations. As the number of patients requiring renal replacement therapy (RRT) increases, there is need for a current review of the benefits and harms of home-based dialysis (HHD or PD) versus in-center HD, the benefits and harms of different home-based dialysis modalities, and the predictors of successful home-based dialysis to allow VA to better serve patient needs. We reviewed the evidence from studies of adults with chronic kidney disease requiring dialysis and comparing home-based and in-center HD. Due to between-country differences in health care systems, we focused our review on studies most relevant to the VA, *ie*, those from North America, Europe, or Australia/New Zealand.

We addressed the following key questions:

**Key Question 1.** What are the benefits and harms (*ie*, all-cause mortality, cardiovascular events, hospitalizations, depression, cognitive impairment, quality of life, conversion to a different type of dialysis, complications related to vascular access, complications of dialysis) of *in-home* compared to *in-center hemodialysis*?

**1a.** What are the benefits and harms (*ie*, all-cause mortality, cardiovascular events, hospitalizations, depression, cognitive impairment, quality of life, conversion to a different type of dialysis, complications related to vascular access, complications of dialysis) of the various modalities of in-home hemodialysis (*ie*, short daily, nocturnal) compared to conventional hemodialysis?

**Key Question 2.** What are the benefits and harms (*ie*, all-cause mortality, cardiovascular events, hospitalizations, depression, cognitive impairment, quality of life, conversion to a different type of dialysis, complications related to vascular access, complications of dialysis) of *peritoneal dialysis* compared to *in-home hemodialysis* or *in-center hemodialysis*?

**2a.** Do results differ depending on whether peritoneal dialysis was the initial therapy or the therapy used following failed in-center dialysis?

**Key Question 3.** What are the a) health care system, b) provider, and c) patient factors associated with selection of and technique survival for home-based dialysis (including peritoneal dialysis)?

**Key Question 4.** In the published literature, what are the costs of home hemodialysis or peritoneal dialysis compared to in-center hemodialysis?

## METHODS

### Data Sources and Searches

MEDLINE and the Cochrane Library were searched from 1995 to December 2014 for randomized controlled trials (RCTs), controlled clinical trials (CCTs), and observational studies. The search strategy included MeSH terms and keywords for hemodialysis and peritoneal dialysis.

We included studies of adults with chronic kidney disease receiving dialysis (in-center, in-home, or peritoneal) as outpatients. We excluded studies that did not report our outcomes of interest: all-cause mortality (primary outcome); health system, provider, or patient factors associated with selection of and technique survival for home-based dialysis; costs; cardiovascular events; hospitalizations; clinically diagnosed depression or cognitive impairment; clinically meaningful difference in quality of life scale scores; conversion to a different type of dialysis; quality of life scale scores; depressive symptoms; cognitive function; total and mental- and physical-health subscale scores; or harms.

### Study Selection

We included all RCTs or CCTs that met eligibility criteria. For Key Questions 1, 2, and 4, eligible studies provided comparison data for 2 or more dialysis modalities. For Key Questions 1 and 2, we required registry studies to enroll at least 1,000 patients and have a mean or median follow-up of at least one year if they reported outcomes of mortality, cardiovascular events, technique failure, or transplantation. For all other outcomes and for Key Question 3, a minimum enrollment of 100 and a mean or median follow-up of at least one year was required. Additionally, for Key Question 3, we included studies of dialysis modality selection only if they followed patients to determine the dialysis modality the patient received.

### Data Abstraction, Quality Assessment, and Strength of Evidence

From registry studies we extracted study characteristics, patient characteristics, data analysis technique, length of follow-up, and outcomes. If reported, we also extracted data on interactions between mortality and age, gender, race, body mass index (BMI), diabetes, cardiovascular disease, and duration of ESRD therapy.

For mortality outcomes, most of the registry studies presented more than one analysis approach (different statistical model, different adjustment factors, *etc*). We extracted the most-adjusted model. Many studies reported outcomes at multiple time points during the follow-up period. We focused on data at one year, 2 years, and at maximum follow-up time, if provided.

For included RCTs and CCTs, trained research methodologists rated the risk of bias of individual studies as low, moderate, or high risk. Risk of bias ratings were based the following criteria: allocation sequence generation, allocation concealment, blinding, incomplete outcome data, and selective outcome reporting – a modification of the Cochrane approach to determining risk of bias.

For observational studies, we assessed risk of bias based on selection bias, masking of the outcome assessment, use of intention-to-treat principles, attrition bias, and selective reporting of

prespecified outcomes. Studies were considered high risk of bias unless all 5 criteria were addressed. Studies addressing all 5 criteria were considered moderate or low risk of bias depending on the completeness of addressing the criteria.

We assessed strength of evidence based on study risk of bias as well as the consistency, directness, and precision of our main outcome (mortality) as reported in the registry studies for the comparisons of HHD to HD and PD to HD.

## Data Synthesis and Analysis

Due to differences in study methodology, data could not be pooled. For Key Questions 1 and 2, we summarized the results by outcome. For Key Question 3, we summarized findings for health care system, provider, and patient factors. For Key Question 4, we summarized costs of HHD versus in-center HD and PD versus in-center HD.

## RESULTS

### Results of Literature Search

We identified 130 articles (3 of which were systematic reviews) meeting inclusion criteria. For Key Questions 1 and 2, we included data from 32 registry studies, 3 RCTs, 3 CCTs, and 4 reports from 2 clinical cohort studies. Sixteen of the registry studies, 1 of the CCTs, and 1 of the clinical cohort studies were completed in the US. To further address hospitalization, quality of life, and cognitive, depression, and adverse event outcomes, we included 3 systematic reviews, 1 CCT, and 17 other articles reporting on observational studies (4 from the US). For Key Question 3, we included 29 articles reporting on 28 studies (8 from the US, 1 from the US and Canada, and 1 multinational, including North America) addressing factors associated with selection of a dialysis modality, 5 articles (none from the US) reporting factors associated with HHD technique survival, and 15 articles (8 from the US) reporting factors associated with PD technique survival. We identified 15 articles (2 from the US) that reported cost outcomes (Key Question 4) comparing either PD to HD or HHD to HD.

### Summary of Results for Key Questions

*Key Question 1. What are the benefits and harms (ie, all-cause mortality, cardiovascular events, hospitalizations, depression, cognitive impairment, quality of life, conversion to a different type of dialysis, complications related to vascular access, complications of dialysis) of in-home compared to in-center hemodialysis?*

Evidence regarding the comparative effectiveness of HHD versus in-center HD should be interpreted with caution because it is generally of high risk of bias and limited clinical applicability. Specifically, we found few randomized or controlled clinical trials, or prospective clinical cohort studies, comparing in HHD and in-center HD. Available clinical trials were small in size and had short follow-up durations. Most of the data on mortality is from registry studies. Results from these studies should be viewed cautiously due to likely residual confounding and selection bias. Of 7 registry studies reporting mortality, 5 suggest that HHD is associated with improved overall survival compared to in-center HD. One registry study found a benefit for individuals receiving in-center HD over HHD while another found no difference. Two small RCTs of short follow-up duration reported no difference in mortality between in-center versus in-home modalities. A multinational CCT with 415 patients and 1006 patient-years of follow-up

reported a mortality benefit for HHD compared to in-center HD while 2 smaller, shorter duration CCTs found no difference. Two registry studies reported no difference in cardiovascular mortality.

Strength of evidence for mortality was low, based on high risk of bias associated with the registry studies (Executive Summary Table).

Limited data are available for secondary outcomes. One registry study reported no difference in all-cause hospitalization but reduced hospitalization for cardiovascular causes in the HHD group. Results from 2 registry studies suggest that HHD patients may be more likely than in-center HD patients to switch dialysis modalities at some point during their treatment but no differences in rate of transplant or all-cause hospitalizations were observed. Results for quality of life and adverse events were mixed with some studies showing benefits of HHD and others showing no difference. No studies suggested HHD was associated with harms.

#### Executive Summary Table. Strength of Evidence for Mortality Outcome Based on Registry Studies

Outcome (studies reporting)	Results	Risk of Bias	Consistency	Directness	Precision	Strength of Evidence
Overall Mortality HHD vs HD (7 registry studies)	5 of 7 studies reported decreased overall mortality with HHD	high	consistent	direct	precise	low
Overall Mortality PD vs HD (22 registry studies)	4 studies reported decreased mortality with PD; 6 studies reported increased mortality with PD; 12 studies reported no difference in mortality	high	inconsistent	direct	imprecise	low

HHD = home hemodialysis; HD = in-center hemodialysis; PD = peritoneal dialysis

**Key Question 1a.** *What are the benefits and harms (ie, all-cause mortality, cardiovascular events, hospitalizations, depression, cognitive impairment, quality of life, conversion to a different type of dialysis, complications related to vascular access, complications of dialysis) of the various modalities of in-home hemodialysis (ie, short daily, nocturnal) compared to conventional hemodialysis?*

Based on evidence from generally low-quality studies we were unable to detect differences between various modalities of HHD compared to conventional HD. Of 6 studies reporting, 3 registry studies found reduced mortality with more frequent and longer HHD compared to conventional HD while 3 trials (2 RCTs and one CCT) found no difference in mortality between more frequent and/or extended HHD and conventional HD. Cardiovascular mortality, all-cause hospitalization, and catheter-related sepsis or catheter life (each reported in one or 2 studies) did not differ between the modalities.

*Key Question 2. What are the benefits and harms (ie, all-cause mortality, cardiovascular events, hospitalizations, depression, cognitive impairment, quality of life, conversion to a different type of dialysis, complications related to vascular access, complications of dialysis) of peritoneal dialysis compared to in-home hemodialysis or in-center hemodialysis?*

#### *Peritoneal versus In-center HD*

Evidence is inconsistent whether mortality differs between patients treated with PD compared to in-center HD. Twenty-seven registry studies, one RCT, and 2 clinical cohort studies provided evidence for the comparison of PD to in-center HD. Of 22 registry studies reporting mortality for the total sample, 12 (2 from the US, 3 from Canada, 1 from Australia/New Zealand, and 6 from Europe/UK) found no difference in mortality between PD and in-center HD. Four studies (2 from the US, one from Canada, and one from Europe/UK) found a mortality benefit for PD while 6 studies (3 from the US, 2 from Australia/New Zealand, and one from Europe/UK) found a mortality benefit for in-center HD. It is difficult to assess if results vary by time of publication due to differences in study populations, length of follow-up reported, and methods of data analysis, but publication dates suggest that a trend may exist. Studies showing increased mortality with PD compared to in-center HD were generally published before 2003 while studies showing no difference or reduced mortality with PD were generally published after 2003.

A small RCT from the Netherlands found no difference in mortality between PD and in-center HD. This study was terminated due to low enrollment. A prospective, clinical cohort study from the United States with 1,041 patients and a follow-up of up to 7 years found no difference in mortality. Data from a prospective cohort study from the Netherlands showed no difference in 2-year mortality.

Analyses of interactions between dialysis modality and age (10 studies), gender (4 studies), race (5 studies), BMI (5 studies), diabetes (12 studies), cardiovascular disease (6 studies), and duration of ESRD (3 studies) yielded mixed results.

Of 5 registry studies reporting cardiovascular disease risk, only one reported a significantly higher percentage of deaths due to cardiovascular disease in the PD group; the 4 others suggested no difference. Hospitalizations were significantly higher in the HD groups in 3 of 5 studies reporting hospitalizations. Mixed results were reported for quality of life outcomes including mental and physical health components, quality of life utilities, and life participation activities. Changes in treatment modality were generally more likely for patients receiving PD while rates kidney transplantation results were mixed. Few studies reported adverse events. Findings were based on evidence from studies of generally low quality.

#### *Peritoneal versus In-home HD*

There is limited evidence for the comparison of PD and HHD. In 2 registry studies, results were mixed with a study from the United States finding no difference in mortality and a study from the United Kingdom finding a mortality benefit for HHD. Other outcomes were not reported.

*Key Question 2a. Do results differ depending on whether peritoneal dialysis was the initial therapy or the therapy used following failed in-center dialysis?*

Two studies reported higher mortality among patients who initiated ESRD treatment with HD and then switched to PD compared to patients who initiated PD as their first modality. A third study reported no difference in mortality. Overall duration of ESRD was likely longer in the patients who initiated with HD.

*Key Question 3. What are the a) health care system, b) provider, and c) patient factors associated with selection of and technique survival for home-based dialysis (including peritoneal dialysis)?*

#### *Peritoneal Dialysis – Selection*

Twenty-two papers reporting data from 21 studies, including 8 from the US, provided information on factors associated with selection of PD.

- *Health Care System Factors:* One US cross-sectional study reported that provision of home-based dialysis (including PD) was more likely in larger dialysis facilities (defined as 62 patients or more) with more years of facility Medicare certification and facilities with a higher population of employed 18- to 54-year-old patients. Home-based dialysis was less likely at facilities in more rural areas, facilities offering evening care, and facilities with higher treatment capacity (based on number of patients, number of HD stations, and availability of a late shift).
- *Provider Factors:* Several studies found that provision of patient education about dialysis modalities and a determination of medical (including comorbid conditions and decreased strength, manual dexterity, vision, or hearing) and psychosocial suitability (including fear of self-cannulation, anxiety, decreased cognition, psychiatric conditions, or history of non-compliance) for PD were associated with greater selection of PD. No studies reported on provider factors such as provider age, training, knowledge about PD, etcetera.
- *Patient Factors:* Autonomy, ability to travel, and compatibility with employment were identified as positive features of PD. Conversely, lack of understanding, living alone, lack of space in the home, inability to perform PD in the place of residence, fear of social isolation, fear of inability to perform PD, and preference for medical supervision were patient barriers to selection of PD.

#### *In-Home Hemodialysis – Selection*

We identified 5 reports (2 from the US or US and Canada) of factors associated with selection of HHD.

- *Health Care System Factors:* As noted above, dialysis facility size, geographic location, and years of certification were all factors in provision of any home-based dialysis.
- *Provider Factors:* From a provider perspective, patients with medical contraindications, psychosocial contraindications, unsuitable living conditions (including HHD not permitted, overcrowding, dampness/mold growth), lack of support in the home, and



unplanned start or shorter pre-dialysis care by a nephrologist were less likely to be suitable for HHD. Providers with greater numbers of HHD patients reported having a dedicated education team.

- *Patient Factors:* Patient-reported barriers to and advantages of HHD were similar to those noted above for PD.

#### *Peritoneal Dialysis – Technique Survival*

Fifteen studies (8 from the US), with sample sizes ranging from 118 to 41,197, evaluated factors associated with technique failure (the inverse of technique survival – a switch from PD to in-center HD). Data were mostly obtained from large registry studies.

- *Health Care System Factors:* Patients from larger clinics had lower technique failure.
- *Provider Factors:* No studies reported on provider factors associated with PD technique survival.
- *Patient Factors:* African-American or indigenous race, increased BMI or obesity, elevated systolic blood pressure, use of HD before switching to PD, and peritoneal dialysis catheter problems were associated with higher rates of technique failure but each factor was reported in 4 or fewer of the 14 included studies. Mixed results were found for presence of diabetes, age, gender, distance from clinic/nephrologist, and need for assisted PD.

#### *In-Home HD – Technique Survival*

Five studies (4 from Canada and one from the UK) reported factors associated with HHD technique failure.

- *Health Care System Factors:* No studies reported on health care system factors associated with HHD technique survival.
- *Provider Factors:* No studies reported on provider factors associated with HHD technique survival.
- *Patient Factors:* Interference with home life, lack of carer support, caregiver anxiety, inability to perform cannulation, medical issues (including diabetes and access problems), and increased age were associated with increased technique failure in 4 studies; one identified no significant predictors of technique failure. Another study reported no difference in a composite outcome of time to all-cause hospitalization, technique failure, or death in patients categorized as dependent on or independent of assistance with nocturnal HHD.

*Key Question 4. In the published literature, what are the costs of home hemodialysis or peritoneal dialysis compared to in-center hemodialysis?*

We identified 15 studies (2 from the US) reporting cost outcomes. Cost analyses have typically reported lower costs for HHD and PD compared to in-center HD. However, the cost categories (eg, direct costs, indirect costs) considered in the analyses and factors that can influence costs (eg, failure rates, patient age, and comorbidity) vary across studies. Both US studies reported lower expenditures for PD compared to HD as an initial dialysis modality. In one study, with 50 matched pairs, the difference in costs was largely related to increased hospitalizations and emergency department visits among the HD patients. The other study found that switching from PD to HD within one year of starting PD resulted in no economic benefit of the initial start on PD while switching after more than one year on PD maintained the economic benefit of the initial start on PD.

## DISCUSSION

### Key Findings and Strength of Evidence

- We found few randomized or controlled clinical trials, or prospective clinical cohort studies, comparing home-based and in-center kidney dialysis. Available clinical trials were small in size and had short follow-up durations.
- Most of the data on mortality is from registry studies. Results from these studies should be interpreted with caution due to likely residual confounding and selection bias.
- Home hemodialysis (HHD) versus in-center HD:
  - We found low strength of evidence (findings from registry studies) that HHD is associated with improved overall survival compared to in-center HD. There were few studies of variations of HHD (including longer duration or more frequent sessions).
  - There is evidence from generally low-quality studies to suggest no difference in cardiovascular mortality, no difference or improved quality of life with HHD, no difference in access survival, no difference in transplantation rate, and no difference in all-cause hospitalization rate. In 2 studies reporting, a higher percentage of HHD patients switched dialysis modalities over follow-up periods of up to 4 years.
- Peritoneal dialysis (PD) versus in-center HD:
  - We found low strength of evidence (findings from registry studies) that there is no difference in overall mortality between PD to in-center HD. However, most studies reporting outcomes over time noted an early survival advantage for PD patients with no difference after 2 to 3 years of treatment.
  - There were inconsistent findings for quality of life outcomes with studies reporting no differences or higher scores on some elements of quality of life in PD or in-center HD patients. With limited reporting, results were mixed for cardiovascular outcomes, adverse events, transplantation, and hospitalization. Over follow-up periods of 2 to 7 years, higher percentages of PD patients switched dialysis modalities.

- Only 2 studies compared HHD and PD with mixed results for mortality. Other outcomes were not reported.
- Factors associated with increased selection of home-based dialysis:
  - Facility factors: larger facility, more years of Medicare certification, providing care for more employed patients or patients in the 18 to 54 year age range, earlier initiation of pre-dialysis care, increased patient/family education ;
  - Patient factors: well-informed about choices, patient preference (more autonomy, more flexible schedule, and less travel to dialysis), family/caregiver support;
  - Provider factors: team approach (physician, nurse, social worker) to determining patient eligibility (medical and psychosocial).
- Factors associated with decreased selection of home-based dialysis:
  - Facility factors: location in more rural area, location in high-density zip code area, availability of an evening shift, higher percentage of black patients;
  - Patient factors: lack of knowledge, living alone, lack of space in the home, inability to perform PD in the place of residence, fear of social isolation, fear of inability to perform PD, and preference for medical supervision.
- Factors associated with technique failure:
  - Facility factors: lower technique failure if receiving care from larger dialysis facilities;
  - Patient factors: higher technique failure if lack of caregiver support, caregiver anxiety, medical issues (including diabetes or psychosocial problems), treatment interferes with home life, African-American race (vs white), HD before PD;
  - Provider factors: none identified.
- Costs are lower with HHD and PD compared to in-center HD but costs considered in the analyses and factors that can influence costs (failure rates, patient comorbidity) varied across studies.

This evidence report summarizes literature on the comparative effectiveness and harms of home-based versus in-center dialysis. Home-based dialysis is a potentially effective option of considerable interest to Veterans and could permit VA to expand internal dialysis capacity. However, it is not well known if this is feasible within the Veteran population, due to in part to a greater prevalence of patients of older age and a greater number of comorbidities in the VA system. None of the included studies were conducted at VA medical centers.

Data on clinical outcomes come predominately from large registry studies, not randomized controlled trials. While authors attempted to control for confounding, significant residual confounding from both measured and unmeasured variables likely exists. Patients who undergo

home dialysis are generally different than those who undergo in-center dialysis. In the United States patients undergoing home dialysis are generally younger and healthier than those treated with in-center hemodialysis. Also, patients without insurance and those without pre-dialysis care who present emergently requiring dialysis are much more likely to be initiated on in-center hemodialysis. These differences in patient characteristics can be inferred by the greater rate of transplantation among patients undergoing peritoneal dialysis compared to those undergoing in-center hemodialysis which may then result in artificially increased death rates in PD groups in later periods of follow-up. Given these stark differences between patient populations it is difficult to compare outcomes across these populations, irrespective of the type of statistical technique employed. Our findings are in agreement with earlier reviews and guidelines. A 2009 guideline from Caring for Australians with Renal Impairment (CARI) offered clinical care suggestions based on Level III or Level IV evidence (low or very low quality) including that PD may provide equivalent or better survival in the first few years, that HD may offer better long-term survival, and that timely transfer from PD to HD may improve survival. Based on opinion, it was suggested that survival be considered in the context of life quality as perceived by the patient when selecting a dialysis modality.

Other reviews have identified health care system, provider, and patient factors that are important in selecting a dialysis modality. Patient education, physician training, nurse training, and staff support for patients and caregivers are essential. In addition to prolonging life with kidney dialysis, patients want to maintain a good quality of life, autonomy, and sense of self. For facilities, the creation of centralized training program and the use of continuous quality improvement cycles to monitor and modify treatment protocols have been suggested. One reviewer urged recognition that treatment modalities may be complementary rather than competing in providing optimal outcomes.

There are limited data on caregiver burden associated with dialysis and whether HHD is more stressful for caregivers. One study from Italy reported that both patients and caregivers thought HHD would be an “overwhelming responsibility” for a caregiver. Caregiving would require “significant personal sacrifices” that would impact work and social lives. Caregivers were concerned about seeing the patient “suffer” while undergoing dialysis, about their ability to assist the patient with treatment and technical problems or complications that might arise, and about their ability to manage “medical responsibilities.” Caregivers also reported that they perceived patients were content with their in-center care and that they benefited from peer support.

### **Applicability**

Twenty of the 32 registry studies were completed in the United States or Canada. Across all registry studies, mean ages ranged from 47 to 75 years and between 50% and 67% of included patients were male. There were few exclusion criteria, suggesting that the patients were representative of the ESRD population. However, the cohort years for all but 7 of the registry studies were prior to 2008.

We found no compelling evidence that HHD and PD differ from in-center HD in survival, quality of life, hospitalizations, or costs. Differences, where they exist, could be due to unmeasured differences in patient populations and strong selection biases (by patients, caregivers, or providers). However, HHD and PD are commonly used as the dialysis method of

choice in other countries. We also found some evidence that caregiver support was an important factor in identifying candidates likely suitable for HHD or PD.

### **Research Gaps/Future Research**

Despite the large number of studies included in this report considerable gaps exist. The comparative effectiveness of HHD or PD to in-center HD (including outcomes of mortality, hospitalizations, quality of life, patient satisfaction, and adverse events) and whether treatment choice and technique success vary by modality, patient, provider, or facility factors remains relatively unknown. This is predominately because considerable differences likely exist among individuals selected for (or selecting) different treatment modalities. While difficult to undertake, a large randomized trial comparing different modalities would be useful. Other research needs would be to evaluate methods to understand barriers to and improve implementation of HHD or PD and provide individuals with sufficient skill building and caregiver support in attempts to maximize benefits. Of note, HHD and PD are widely used as treatment options of choice in other developed countries.

### **Conclusions**

Low-strength evidence suggests that home-based dialysis may provide similar health outcomes and at similar or lower costs for many patients compared to in-center hemodialysis. Therefore, home-based dialysis may be an acceptable and sometimes preferred alternative to in-center hemodialysis. Information is limited on factors important in addressing selection of and barriers to home-based dialysis and remains an area of important research and health policy.