Is home hemodialysis a practical option for older people?

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Abstract

An increasing demand for in-center dialysis services has been largely driven by a rapid growth of the older population progressing to end-stage kidney disease. Since the onset of the COVID-19 pandemic, efforts to encourage home-based dialysis options have increased due to risks of infective transmission for patients receiving hemodialysis in center-based units. There are various practical and clinical advantages for patients receiving hemodialysis at home. However, the lack of caregiver support, cognitive and physical impairment, challenges of vascular access, and preparation and training for home hemodialysis (HHD) initiation may present as barriers to successful implementation of HHD in the older dialysis population. Assessment of an older patient’s frailty status may help clinicians guide patients when making decisions about HHD. The development of an assisted HHD care delivery model and advancement of telehealth and technology in provision of HHD care may increase accessibility of HHD services for older patients. This review examines these factors and explores current unmet needs and barriers to increasing access, inclusion, and opportunities of HHD for the older dialysis population.

KEYWORDS
challenging patients, geriatrics, home hemodialysis

BACKGROUND

The COVID-19 pandemic has reignited efforts to support and encourage home based options for dialysis patients, including home hemodialysis (HHD), given the risks of contagion within unit-led dialysis centers.1,2 Younger populations are particularly suitable and tend to continue in HHD for longer periods, as they typically have greater ability to maintain the technical demands of delivering independent dialysis more effectively compared to older adults.3 The latter represent a growing proportion within the dialysis population. Patient preference for HHD is centralized predominantly on quality of life (QoL) factors and the clinical benefits achieved through high intensity dialysis at home. Qualitative surveys highlight that patients consider the flexibility of HHD affords important benefits, particularly in respect to managing treatment with competing commitments, such as employment.4 However, variables and factors (both known and unknown) important for older patients have been poorly studied. Results from the Dialysis Outcomes and Practice Patterns Study (DOPPS) highlighted that adults age ≥ 75 years form up to 30% of the global prevalent dialysis population.5 The recent United States Renal Data System (USRDS) annual report recorded highest growth rates of dialysis initiation to be among those in age
groups over 75 years old. Despite this demographic shift, there is a lack of understanding and published research on the specific needs of older dialysis patients. The call for transformation in dialysis pathways and the postpandemic reappraisal of care provision provides a timely opportunity to review HHD practice and consider the challenges and barriers in a vulnerable group of patients. This review examines these factors in HHD through the lens of an older population on dialysis.

PREVALENCE AND EPIDEMIOLOGY OF HHD IN THE OLDER POPULATION

The concept of HHD was first introduced in the 1960s, ever since the discovery that maintenance long-term dialysis could be a viable and successful treatment option for permanent kidney failure. However, the original intention of employing HHD for vast majorities of the HD population have not been realized. This may be attributed to an exponential rise in the acceptance of the older advanced chronic kidney disease (CKD) population requiring dialysis over the last decade but also increasing challenges of training, cost and support systems to implement HHD.

There are few studies evaluating the epidemiology of HHD uptake in older adults. The mean age of patients receiving in-center dialysis (ICHD) is significantly higher than that of HHD, by at least 10–20 years. There is also a higher prevalence of HHD in White compared to other ethnic groups. These data suggest a strong disparity and inequity in the offering of HHD as a treatment modality to all dialysis patients. It is also recognized that older adults receiving HD may be more susceptible to adverse clinical outcomes following dialysis compared to their younger counterparts.

Demographic data reflecting key issues of HHD care in older adults, such as living circumstances and social support network, are not well studied. For instance, we are not able to determine how many older patients living alone undertake HHD and the systems needed to support them. HHD survival outcomes focusing specifically on older patient groups are also seldom reported. An international multicenter feasibility study of HHD, which included 79 patients age > 65 years, demonstrated relatively successful survival outcomes. Event-free survival at first and second year following HHD initiation were 92% and 83%, respectively. The median age of this cohort was 68 years and there were few octogenarians and nonagenarians. Selection factors are a major confounder in the interpretation of comparative outcomes data between modalities, yet these selection factors at incidence may hold the key to understanding the drivers of success in the older group of patients on HHD. It remains unclear whether older adults on HHD have overall survival benefits over those on ICHD and peritoneal dialysis (PD). Considering these uncertainties, a HHD decision for the older patient cannot be based on survival outcomes alone, and other outcome measures also need to be considered.

CONSIDERATION OF BENEFITS FOR THE OLDER PATIENT RECEIVING HHD

Initiatives over the past decade, such as the Standardized Outcomes in Nephrology-Hemodialysis (SONG-HD) initiative, have brought clinician and patient perspectives together to develop focused and personalized treatment goals for those receiving HD. Consideration of objectives important to patients can help clinicians and patients reach a shared decision with respect to dialysis modality. Patient choice and autonomy in decision making in dialysis has been associated with improved clinical outcomes in an USRDS study. Depending on individual dialysis goals, HHD may be preferred to ICHD for some older adults, irrespective of comorbidities. Decisions on dialysis modality should be made based on clinical suitability as well as a patient’s lifestyle, preferences, and personal circumstances.

Clinical advantages of implementing HHD for older patients relate to greater flexibility of dialysis sessions and their schedule. Reduction of left ventricular hypertrophy, improved long-term blood pressure control, less myocardial stunning, and optimization of fluid status would more likely be achieved with extended therapies from shorter, high frequency dialysis. Improving clearance of phosphate together with better control of cardiovascular risk factors can also reduce polypharmacy and allow for less restrictive diets. Over the short term, greater intensity of HD may potentially improve physical and cognitive outcomes. QoL outcomes, such as sleep quality and mood, could be improved with increased, effective HD. Current evidence on the benefits of intensive dialysis for older patients are not fully established. Older people often have reduced dietary intake compared to those who are younger, which may translate into a lower protein and salt intake and reduced interdialytic weight gain. Furthermore, the natural aging process correlates usually with a decreasing basal metabolic rate, sarcopenia and altered body water distribution. Considering these biological and clinical factors specific to this population, the role of an intensified HD regime in the older population needs further evaluation.

Other benefits of HHD for older patients are mainly related to the practicalities of treatment. The burden of travel for dialysis, particularly relevant for older patients with significant mobility concerns, is avoided with HHD.
Patients may also experience fewer disruptions to their daily lifestyle and can spend more time with friends and family. The risk of older patients contracting hospital-acquired infections during ICHD could be mitigated with HHD, particularly relevant given the COVID-19 pandemic.\textsuperscript{23,24} Finally, reduced transportation needs could lead to sizeable cost savings for patients, their carers, and the health system.\textsuperscript{25}

**TACKLING BARRIERS TO SUCCESSFUL HHD IMPLEMENTATION IN THE OLDER PATIENT**

Nevertheless, there are several barriers to the implementation of HHD for older patients. Psychosocial barriers, such as lack of caregiver support for older patients receiving HHD, are a key consideration. Even for those with caregiver support present, the burden and stress of caring for an older adult receiving dialysis should not be underestimated. Patients with cognitive impairment may have significant challenges while on HHD. Concerns relating to self-cannulation to obtain satisfactory vascular access and management of treatment complications among older patients receiving HHD are valid.\textsuperscript{26} Other barriers for older adults relate to difficulties with adequate training and preparation prior to HHD initiation.

**Lack of support infrastructure and caregiver burden**

HHD could be a viable option for older adults unable to fully self-care, through training caregivers to provide dialysis at home or by delivering trained dialysis nursing assistance.\textsuperscript{19,27} Close supervision from caregivers while on HHD provides reassurance and address safety concerns regarding complications such as intradialytic hypotension, which are more frequently observed in the older population.\textsuperscript{25} A previous cross-sectional survey highlighted that the majority of caregivers are female and the spouse of patients receiving nocturnal HHD.\textsuperscript{28} The same survey noted that most caregivers had no comorbid illness, and the mean age of caregivers was 51 years (±11).\textsuperscript{28} The spouse of an older patient may be of similar age, living with comorbidity and as time passes, be less able to perform tasks necessary for HHD. In instances where the spouse needs to work for financial sustenance, the additional caregiver responsibilities may be an unmanageable burden. Indeed, a significant proportion of caregivers of patients on nocturnal HD report low mood.\textsuperscript{28} On the other hand, the caregiver may be an older, but well individual without other commitments and able to provide dialysis care for the patient. Caregiver support issues for the older patient receiving HHD should be assessed in a case-to-case basis. Being older does not necessarily mean that there will be increased patient or caregiver burden.

**Cognitive impairment**

A substantial population of older patients receiving HD therapies has cognitive impairment.\textsuperscript{29} Cognitive impairment may not be clearly apparent and often go undiagnosed prior to HD initiation.\textsuperscript{29,30} For patients with cognitive impairment, improved QoL may not be achieved following HHD initiation, but instead deteriorate.\textsuperscript{31} Executive function deficits, mood, and memory problems mean patients with cognitive impairment could have problems managing on HHD. Monitoring the cognitive status of a patient receiving HHD and that of their caregiver is an important consideration. Current research continues to explore improved screening methods to detect cognitive deficits prior to and during HD treatment.\textsuperscript{32,33} It highlights a potential need for timely transition from home based dialysis to a supervised hospital based treatment, supported by the facility infrastructure and capacity.

**Challenges with vascular access**

Vascular access problems in older patients might represent a challenge to implementing effective HHD. Due to preexisting cardiac and vascular disease, high proportions of older HD patients require central venous catheter (CVC) access for dialysis, which increases the risk of infection and mortality.\textsuperscript{34} There is conflicting evidence on an ideal cannulation technique to achieve safe and effective dialysis care for patients with an arteriovenous (AV) fistula.\textsuperscript{35,36} As people get older, poorer vision and intention tremors become more prevalent which may significantly hamper manual dexterity. Consistent success with self-cannulation of an AV fistula may become increasingly difficult. Maintaining vascular access and responding to access-related complications could be challenging in a home environment without medical or nursing expertise, even when carer support is available.\textsuperscript{37}

There is no formalized consensus guidance advising vascular access pathway selection for patients in the old and very old age groups receiving HHD, as the optimal vascular access for HD in older patients is not yet clear.\textsuperscript{38} Retrospective registry data suggest a survival advantage with an AV fistula, though this advantage disappears in
older patients. Therefore, the older population has less to gain from an AV fistula compared to a catheter. A catheter may be a better strategy for the older patient as it avoids an operative procedure and appears noninferior for clinical outcomes. Under these circumstances, catheter-based dialysis could be advantageous for some older patients with preferences for HHD. A well-designed randomized controlled trial is necessary to establish best practice. Current research continues to explore options and identify ways for improved vascular access in both HD and HHD.

Training and preparation prior to HHD initiation

Older patients may have preconceptions that HHD is too challenging and have concerns about the potential burden on family members. The avalanche of new HHD devices being introduced into the market is aimed at simplicity, ease of operation and reduction in treatment burden with HD. Patient-led codesign offers hope and opportunity to deliver more success with HHD, though the participation of older adults is rare in these situations. Qualitative research has acknowledged concerns about lack of formalized patient training modules for older adults prior to HHD initiation. Older adults initiating on HHD may require a longer training time. These concerns could be addressed with increased efforts to pursue a preplanned, extended education program, introduction of new technology and individualized guidance for older patients and their families.

Frailty as a predictor of HHD challenges

Perhaps the generalization that patients from an older age group will have greater difficulties with uptake of HHD is misleading. Previous findings suggest frailty is a more representative measure of capacity to withstand demands of dialysis. Frailty is an age-associated syndrome defined as a state of vulnerability and thought to be the consequence of cumulative physiological decline. The frailty syndrome is highly prevalent in CKD populations. Importantly, frailty is associated with elevated falls risk, hospitalizations, cognitive impairment, and mortality, irrespective of dialysis modality received.

The Fogg Behavior Model shows that three core elements (ability, motivation, and prompts) are required to converge in order for a behavior to take place. According to this model, simplicity or difficulty of the task at hand, ability, and motivational changes over time and impact of prompts received explain for variations in an individual’s health behaviors. The Fogg Behavior Model has been applied to explain for patient adherence toward diabetes treatment. Given the challenges older patients face performing HHD, the Fogg Behavior Model could be a useful tool in this context. Existing literature does not define the impact of age on dialysis modality uptake stratified to components in this model. However, frailty may be a strong determinant and a surrogate for ability. A high level of motivation may help overcome limitations attributed to ability through frailty. Concepts in health psychology such as the Fogg Behavior Model may be adapted to guide clinical decisions on whether a patient is suitable for HHD. Further research is needed to develop tools that can identify biological and psychological traits of self-behavior in older patients.

Assisted HHD

HHD is currently provided with variables levels of support and assistance by spouses, relatives and carers. This has been rarely quantified or received formal support. Promotion of structured assisted HHD services may alleviate the burden faced by older patients and their caregivers at home. The assisted model has been deployed successfully in home PD, with patient reimbursement programs established in some countries. Alternative models could also include initiatives involving “transit dialysis services” (e.g., dialysis buses), which have been introduced for patients living in rural regions of Australia should they require assisted HHD so they would not need to travel to tertiary dialysis centers. The opportunity to commence treatment through a transitioning unit at the start of dialysis also offers a great opportunity to deliver education, higher uptake of home therapies, and a more optimal start to renal replacement therapy. Socio-economic barriers relating to inadequate housing space and increased utilities costs may be addressed with government subsidy and reimbursement schemes, and introduction of community houses catered for HHD. Providing psychological and counseling support for caregivers may be required in some instances. Respite care support services to alleviate demands of caregiver duties are being made more readily available in HD contexts, and might be quite unique for older patients on HHD.

Previous studies have demonstrated significant economic advantages from HHD over ICHD through avoidance of infrastructure costs and lower workforce requirements. However, for an older patient without caregiver support, assisted care models for HHD are not
often offered as part of routine care. Preliminary results however, indicate strong preferences for assisted HHD in older patients currently on ICHD, given the potential QoL benefits of HHD. Assisted HHD care models therefore require further evaluation, particularly with respect to cost-effectiveness and utility analysis.

**ROLE OF TELEHEALTH FOR HHD IMPLEMENTATION IN THE OLDER POPULATION**

Technology advances to support HHD have brought new avenues of care for the older dialysis population. Original objectives of telehealth in HHD were mainly to improve QoL and increase flexibility for patients and their families. Previously underused, there are greater demands for telehealth since the COVID-19 pandemic. Older patients with comorbidities are more susceptible to COVID-19 while on dialysis, where there are higher mortality risks. Telehealth eradicates the pressures of maintaining “social distancing” from in-person consultations and risks of COVID-19 transmission between HHD patients and medical staff. It presents a solution for older patients to access HHD with a reduced exposure to healthcare facilities. Telehealth also enhances regularity of HHD care for older patients living in rural locations, where there may be reduced access to specialized staff during the pandemic. Our center covers both urban and rural geographical regions across Lancashire, UK. Within our center, telehealth has been demonstrated to be a safe and effective way to deliver care to patients on HHD and has been well-received by both patients and staff members.

Despite the advantages of a user-friendly telehealth service for older patients commenced on HHD, there are certain limitations to be aware of. For one, the bruit and physical examination of an arteriovenous fistula cannot be perceived from a “no-touch” examination. Older patients may also not have the necessary health technology literacy and capability to handle devices needed for fluent telehealth consultations. Moreover, security and confidentiality concerns are valid for older patients who are vulnerable. Continued refinement of telehealth platforms is needed to improve patient accessibility and address information governance concerns. Tackling socio-economic barriers is another step needed to improve telehealth uptake in HHD. Some patients do not have access to updated electronic devices and broadband internet to receive an optimal HHD service through telehealth. Ethnic minorities were underrepresented in the uptake of telehealth in a study assessing home dialysis utilization. Creating systems to educate older patients and their carers on new telehealth platforms will be important, considering its emerging role in HHD care. The success of technology in home dialysis therapies will continue to depend on education, accessibility, and training for the technological advances.

**SUMMARY**

The COVID-19 pandemic has led to a call for transformation of dialysis care delivery and allowed us to reflect on the benefits and barriers of implementing HHD for older patients living with advanced kidney disease. There remains a paucity of research on how best to determine HHD suitability in and how best to deliver HHD for older patients. Lack of research to address these dilemmas risks the old and very old dialysis population being left behind as we plan and redesign a new era of dialysis care postpandemic. Concerted efforts to create new models of care catered for older adults, such as assisted HHD, should be explored. Multidisciplinary health professionals should work closely with patients and their families to achieve individualized goals of dialysis and expand awareness and education in the community, considering the foreseeable demands of HHD. The overall goals to improve means of access, inclusion, and opportunities of

**TABLE 1** Future considerations for HHD in the older population

| Future considerations                                                                 |
|----------------------------------------------------------------------------------------|
| Establish an assessment process for HHD suitability in older adults (i.e., age ≥ 70 years), encompassing a clinical, preferential, circumstantial, and self-behavior traits model |
| Determine optimal vascular access to ensure safe and effective HHD delivery while considering the challenges and uncertainties in the older population |
| Develop individualized training programs for older patients and their caregivers to improve preparation for HHD initiation |
| Evaluate the advantages and disadvantages of nonconventional HD schedules in older individuals on dialysis |
| Develop assisted HHD care models, and evaluate their effectiveness in comparison to in-center assisted HD care for the older dialysis population |
| Encourage collaboration with governments to create financial support schemes to encourage uptake of HHD in the older population, where deemed appropriate |
| Widen participation of health education and clinical research opportunities for patient groups and clinicians in the community, to increase awareness of HHD options for the older population |
| Identify areas for continued innovation and industry collaboration to improve existing and new technological platforms in HHD for the older population |
HHD for older patients should be a priority within the international dialysis community to support patient choice and maximize health benefits (Table 1). More comprehensive data on epidemiology, treatment outcomes, and cost-effectiveness of HHD should be generated for healthcare systems to provide answers as to whether, and in what circumstances, HHD be a successful option for an aging global population progressing to end-stage kidney disease. Identification of the unmet needs of older patients will be an important first step to develop targeted innovation, research, and advances in HHD for the fastest growing segment of the dialysis population.

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CONFLICT OF INTEREST
The authors declare there is no conflict of interest for this article.

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