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Key Points:

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To facilitate the desired increase in home dialysis utilization in the United States, multiple factors need to be taken into consideration in order to achieve this complex task. Through policy-level facilitators such as the Advancing American Kidney Health Initiative, as well as the expansion of telehealth utilization, adjustments to the existing payment models, providing health equity incentives, increasing number of provider education materials on home therapies, and allaying patient fears with the expansion of home dialysis education nationwide, we have taken several steps in the right direction. There is still a long way to go and further improvements can be made, while utilizing lessons learned from some of our international peers who have been successful in their implementation of large-scale home dialysis programs.

Disclosures: O. El Shamy reports the following: Honoraria: Home Dialysis University, UpToDate, Outset Medical Inc; Advisory or Leadership Role: International Journal of Nephrology; Other Interests or Relationships: Home Dialysis Academy of Excellence.

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Utilization of Peritoneal Dialysis in the United States: Progress in Tackling Obstacles to Expansion

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Abstract
To facilitate the desired increase in home dialysis utilization in the United States, multiple factors need to be taken into consideration in order to achieve this complex task. Through policy-level facilitators such as the Advancing American Kidney Health Initiative, as well as the expansion of telehealth utilization, adjustments to the existing payment models, providing health equity incentives, increasing number of provider education materials on home therapies, and allaying patient fears with the expansion of home dialysis education nationwide, we have taken several steps in the right direction. There is still a long way to go and further improvements can be made, while utilizing lessons learned from some of our international peers who have been successful in their implementation of large-scale home dialysis programs.

Introduction
The expansion of home dialysis utilization has been an area of particular interest for many years. Driven by the Advancing American Kidney Health Initiative (AAKHI)\(^1\) of 2019, multiple subsequent policy changes, as well as both patient-reported outcomes and clinical data, there has been a concerted effort to turn this vision into a reality. Some of these efforts have been focused on financially incentivizing providers to increase home dialysis and transplantation among end stage kidney disease (ESKD) patients, the expansion of the utilization of telehealth in home dialysis patient care, as well as a focus on expanding the knowledge base of current and future nephrologists in home dialysis therapies.

Peritoneal dialysis (PD) offers numerous benefits over hemodialysis (HD), including increased patient independence, better quality of life\(^2\), greater overall cost-effectiveness\(^3\), and the preservation of residual kidney function\(^4\). The latest United States Renal Data System (USRDS) data\(^5\) showed a historic number of incident peritoneal dialysis patients in the United States in 2018; 14,334 patients, comprising 10.9% of the incident ESKD population. It is important to bear in mind that this data precedes many of the aforementioned policy changes and so it is reasonable to expect that future data from subsequent years will demonstrate an even greater increase in the utilization of peritoneal dialysis in the United States.
In order to brace ourselves as a medical community and healthcare system for the expansion in peritoneal dialysis usage, it is imperative that we understand and familiarize ourselves with the following: 1) Policy-level facilitators of home dialysis expansion, 2) Racial and socioeconomic disparities, 3) Patient-reported factors in ESKD modality choice, 4) Role of telehealth in the future of patient care, 5) Provider education on home therapies, and 6) Lessons in growing home dialysis from our international peers.

**Policy-level Facilitators of Home Dialysis Expansion**

From a policy perspective, there have been some unintended consequences to previous reforms. One such example is the 2004 Centers for Medicare and Medicaid Services (CMS) tiered fee-for-service model, which resulted in a slight decrease in physician payments for home dialysis and a subsequent reduction in home dialysis utilization\(^6\). Since then, the most notable initiative that has been the driving force for home dialysis expansion is the AAKHI of 2019. One of the broad goals of the AAKHI is that 80% of incident American ESKD patients be on home dialysis or receiving a transplant by 2025. This was followed by several policy changes including:

1) Updates to the CMS ESRD prospective payment system (PPS) for 2022 by which there will be an increase of approximately $5 to the current ESKD PPS base rate. CMS projects an increase in total payments to all ESKD facilities by 2.5% (compared to 2021).

2) The Home Dialysis Payment Adjustment (HDPA) to the ESKD Treatment Choices (ETC) model which will result in an upward adjustment on home dialysis and home dialysis-related claims.

3) The Performance Payment Adjustment (PPA) to the ETC model which will depend on participants’ performance on the ETC Model’s home dialysis and transplant rates.

While these policies should incentivize the growth of home dialysis in the United States, the full extent of their effect remains to be seen.
There remains, however, room for improvement. For example: Canada, Australia and many European, Asian, Middle Eastern and South American countries offer assisted peritoneal dialysis (APD). APD is currently not eligible for reimbursement in the United States. This is despite patients aged 65 years and older comprising over 79% of the total number of incident ESKD cases per million people in 2018. APD involves healthcare workers or family members who have been specially trained to help perform PD, often for elderly patients. Multiple studies have shown similar hospitalization rates and quality of life on APD and in-center HD with higher patient satisfaction on APD, making it a viable alternative and avenue for expansion of peritoneal dialysis in the United States.

**Racial and Socioeconomic Disparities**

Of the incident home dialysis ESKD patient cohort, 21% were African American and 15% were Hispanic. Prior studies have shown that Black and Hispanic patients were less likely to be on PD, demonstrating the effect of racial and socioeconomic factors on modality utilization, patient choices and outcomes. In their analysis of all patients enrolled in CMS’ Medicare fee-for-service who received dialysis in 2012, Wallace et al investigated regional variation in home dialysis utilization ratio (UR) in the South, Northeast, Midwest and West regions of the United States. They found that, using the White race as the reference group, home dialysis UR were in the range of 0.505-0.677 for African Americans and 0.685-0.799 for Hispanics. In their analysis of incidence ESRD patients in a large dialysis provider in the United States’ data, Mehrotra et al also found that in their adjusted model, the odds for treatment with a home dialysis modality were lower for every racial and ethnic group when compared to their White counterparts. They also found that African American patients enrolled in home dialysis had significantly higher risk of transfer to in-center HD.

In their report assessing disparities in healthcare with dual eligibility (DE) for Medicare and Medicaid or Low-Income Subsidy (LIS) compared to their non-eligible counterparts, CMS focused on measures of: prevention and screening, respiratory conditions, cardiovascular conditions, diabetes, musculoskeletal conditions, behavioral health, medication management and care coordination, overuse/appropriate use of drugs, as well as
access/availability of care. It is important to note that in 2020, the DE/LIS beneficiaries were approximately 21% Black/African American and 18% Hispanic/Latino. Overall, they found that those who were DE/LIS had worse results on 33% of measures and better results on only 3% of measures\textsuperscript{12}. These disparities were more often in urban areas compared to rural areas\textsuperscript{12}.

To mitigate some of these disparities, CMS added a Health Equity Incentive. ETC participants who show significant improvements in home dialysis and/or transplant rates of patients who are dual-eligible for Medicare and Medicaid or Low-Income Subsidy recipients could earn additional improvement points.

Furthermore, language barriers may play a role in dialysis modality education and affect patient choices. Supplying patients with modality educational materials in their preferred language and providing interpreter services may also be an important avenue to bridge the gap between the status quo in the dialysis landscape and where we hope to be in the future. There are of course societal factors that are difficult to control such as poverty, unemployment and educational level rates which are variable and are complex issues to address. Focusing our strategies to improve recruitment of traditionally underrepresented groups, especially in neighborhoods with large proportions of minority patients, could be a substantial step towards improving the overall utilization of home therapies in the United States.

**Patient-reported Factors in ESKD Modality Choice**

Expanding the utilization of PD starts with the patient. Understanding the factors that influence patient choices is of utmost importance. In a large survey-based study of patients from 38 European countries with ESKD, de Jong et al\textsuperscript{13} found that only 23% of participants had received dialysis education $>12$ months before dialysis initiation. What was even more striking, was that approximately 25% reported not receiving any modality education prior to dialysis initiation. Moreover, 42% of patients were not informed of home hemodialysis and 33% were not aware that comprehensive conservative management was an option. The proportion of patients on
home dialysis was statistically significantly higher in both middle and high-Gross Domestic Product (GDP) countries when compared to their low-GDP counterparts.

Almost all the respondents reported that other people affected their treatment choice: doctors, partners, nurses, and family members. The subset of patients who had chosen PD as their modality reported many reasons for their choice, including: independence, quality of life, possibility to work/study, possibility to travel, preference of doctor, flexibility, life expectancy, and affordability. Those participants who did not choose PD cited the following reasons: not wanting treatment at home, dislike of abdominal catheter, fear of peritonitis, discomfort without supervision, not offered by doctor, lack of information, no assistant available, treatment takes too long, treatment unavailable in hospital, and fear of gaining weight.

It comes as little surprise that some of the factors that led to choosing PD included many of those in the Renal Treatment Satisfaction Questionnaire (RTSQ) scoring system\(^1\)\(^4\), where home modalities consistently score higher than in-center.

Patients’ lack of knowledge of home modalities plays an important role in the under-utilization of home dialysis. It was previously shown that with a pre-dialysis education program anywhere from 45% to 74% of patients choose home dialysis\(^1\(^5\)\(^,\)\(^6\)\(^,\)\(^7\)\). The concern of a lack of supervision or assistance with PD is a valid one and is something that may be rectified with policy changes as mentioned earlier in the manuscript.

Another factor that was cited as a reason for not choosing PD was its lack of availability. Availability and accessibility can be interchangeable factors in patients’ decision-making process. There have been a few studies evaluating the correlation between patients’ travel distance to their nearest home dialysis and in-center HD providing facilities in the United States and their modalities of choice. One study, using straight line distances, found that PD and home hemodialysis utilization increased with increasing travel distance to the nearest home dialysis facility and decreased with greater distance to an in-center dialysis facility\(^1\(^8\)\). Another study, using
driving distances, found that there was no difference in the number of patients who were on PD regardless of whether the PD unit was nearer or farther than the closest HD-providing unit. However, patients who lived 30 miles or more from their nearest HD-providing unit were more likely to be on PD. Employment and pre-ESKD nephrology care were the factors associated with the highest odds ratio of PD utilization. This is in keeping with some of the reported reasons for choosing PD in de Jong et al’s study.

Finally, it is important when discussing initiatives like the AAKHI, with its target percentages of home dialysis and transplantation rates, to ensure that patient choices continue to be respected.

Role of Telehealth in the Future of Patient Care

With a patient-focused approach to care, the Bipartisan Budget Act of 2018 was passed. This expanded Medicare coverage for telehealth services. Of particular interest is its focus on expanding home dialysis. Patients on home dialysis “may choose to receive monthly end stage renal disease-related clinical assessments furnished on or after January 1, 2019 via telehealth.” This use of telehealth was allowed with the following 2 provisions: 1) The first 3 months of home dialysis monthly assessments are conducted face-to-face, and thereafter 2) Face-to-face encounters at least once every 3 months.

Little did we know that a mere few years later, the coronavirus disease 2019 (COVID-19) pandemic would not only broaden/normalize the use of telehealth, but it would result in regulatory waivers allowing providers to bill for services using both Health Insurance Portability and Accountability Act (HIPAA) and non-HIPAA compliant platforms and without geographic restriction. The pandemic resulted in many home dialysis units adopting new policies in their delivery of patient care, a cornerstone of which was telehealth. An additional advantage of PD is the ability to remotely monitor patients’ treatments; this is something that was successfully implemented in units across the United States, Spain and Italy during the peak of the pandemic. Telenephrology for PD patients fosters the patient-clinician relationship, allowing for medical oversight of patients’ dialysis environment while ensuring that they are not receiving substandard treatment.
There are notable barriers to the implementation of telehealth, including: limited physical examination, accessibility to a stable internet connection, as well as security and privacy concerns. Moreover, unforeseen yet unsurprisingly additional disparities emerged in the delivery of telehealth to racial and ethnic minorities, non-native English speakers, patients with low socioeconomic status, as well as patients older than 65 years. Tackling these issues requires mitigating digital literacy and resource disparities, as well as health system-created barriers to the widespread implementation of telehealth amongst these disenfranchised groups. Digital literacy is a problem that many units did not factor in when transitioning to telehealth-based practices. Solutions to this problem include preparing educational materials and training for patients along with having staff that are proficient and able to troubleshoot issues that patients face to make the transition seamless. Developing these materials in patients’ preferred language and providing interpreter services to facilitate the telehealth visit is likely to increase patients’ access and compliance with their scheduled appointments.

If these interventions do not bear fruit, there was the option of audio-only visits during the COVID-19 pandemic. Medicare had approved coverage for telephone-only services and CMS updated the reimbursement rates at a rate comparable to office and outpatient services. Unfortunately, CMS’s 2022 Medicare Physician Fee Schedule final rule limited the use of audio-only visits to mental health services. However, the final rule did extend the inclusion of telehealth services temporarily added to the Medicare telehealth list during the pandemic to December 31, 2023. Advocating for the extension of audio-only visits to include home dialysis patients is another way we can help facilitate equitable telemedicine access.

**Provider Education on Home Therapies**

To position ourselves in a favorable stance to be able to take on the task of expanding the utilization of PD in the United States, we need to ensure that our current and future nephrologists are well educated in PD. A survey of self-perceived competency in PD of recently graduated nephrology fellows conducted by the American Society of Nephrology found that 44.4% of participants reported “little or no training” or “some training but not
enough to feel competent.” Since then, multiple nephrology fellowships – such as Mount Sinai in New York, the University of Washington in Seattle, and Indiana University in Indianapolis – have started offering trainees an additional year of home dialysis fellowship. This is a step in the right direction as general nephrology training, which incorporates home dialysis rotations, tend to be more focused on inpatient acutely complex cases under pressured clinical time\textsuperscript{26}.

A home dialysis fellowship provides fellow the opportunity to learn about equipment- and facility-specific issues, quality assurance and performance improvement metrics, infectious and non-infectious complications, better understanding of the ESRD network structure, CMS conditions for coverage amongst other things\textsuperscript{27}. These are all skills that are much more difficult to master under the pressured conditions of the traditional 2-year nephrology fellowship.

Other resources available for both aspiring and current nephrologists to acquire or sharpen their home dialysis knowledge base include: Home Dialysis University, PD University, PD Academy of Excellence, Home Dialysis Academy of Excellence, Home Dialysis Academy and the ASN Virtual Mentor Curriculum. Other initiatives available include online modules, in-person 2-3 day workshops, and programs with both online and in-person components\textsuperscript{28}. One of the latest innovations is project ECHO, which connects practitioners in rural and underserved areas to specialists in tertiary centers for the care of patients with hepatitis C\textsuperscript{29} – a model coined ‘Hub and Spoke.’ This model has been adopted by many healthcare professionals across different fields with moderate success. Perhaps using this model to develop a virtual home dialysis mentoring program for physicians whereby attendees are provided interactive, live didactic learning session via an online video meeting platform is another avenue that can be explored in growing the home dialysis knowledge base for practicing nephrologists in geographically isolated areas\textsuperscript{28}.

\textbf{Lessons in Growing Home Dialysis from our International Peers}
According to the latest USRDS data report, the United States ranked 14th in the world in regard to the percentage of ESKD patients on PD in 2018. There is much room for improvement. A myriad of factors play a role in a country or region’s ability to provide and expand its utilization of PD. Geographic and regional factors include whether the country is high/medium/low income, the presence/absence of government reimbursements for dialysis, as well as the cost of PD consumables. Several countries have resorted to local production of solutions as well as a reduction in the tax of imported PD solutions. Others have resorted to adopting a “PD-first policy”, such as Hong Kong, Denmark, Latvia, the Philippines, Thailand, and Malaysia. Some governments even adopted a model of providing financial incentives to hospitals and providers who care for patients on PD, however this was found to be less effective and more costly compared to countries who either have no such incentive or adopted a PD-first policy.

In the United States, there was a dip in PD utilization in 2014 owing to the ongoing increase in demand of PD solutions along with an inability to expand manufacturing efforts to meet this demand. To combat this issue, the Food and Drug Administration (FDA) worked with the two main manufacturers in the United States – Baxter Healthcare Corporation and Fresenius Medical Care – to find solutions for this issue. One such solution was the temporary utilization of one of Baxter Healthcare Corporation’s establishments in Ireland for PD fluid production. Through expediting the review process of manufacturing changes, allowing temporary availability from alternate manufacturers, and working closely with manufacturers, the FDA is able to help mitigate these supply shortage issues.

In 2018, 7.5% of prevalent ESKD patients in the United States were on PD. This is far below the target set by the AAKHI. A model that can be used to help increase PD utilization in the United States is the Ontario Renal Network (ORN) Home Dialysis Initiative, which resulted in an increase in PD prevalence from 21.9% in 2012 to 26.2% by 2019. Some of the initiative’s components included: home dialysis coordinator positions in each kidney program, financial bonuses and penalties, promotion of staff-assisted PD in private residences and long-term care homes, mentorship of underperforming programs by experts in home dialysis and the promotion of
urgent-start PD, amongst many others. Some of these policies have been adopted by organizations in the United States, such as Kaiser Permanente Northern California, which resulted in an increase in the number of incident PD patients in their network from 15.2% in 2008 to 33.8% by 2018. It is important to highlight that these changes involved both macro- and micro-level interventions as outlined in the ORN Home Dialysis Initiative, as well as monitoring and continuous quality improvement metrics with both monthly and annual progress trackers.

**Conclusion**

The current utilization rate of PD in the United States and methods that can be applied for its expansion is a complex and multifaceted issue. It requires interventions on the policy-level, while factoring in racial and socioeconomic disparities in healthcare, providing home therapy education for both patients and providers, as well as adopting models from peer countries that have been successful in growing their PD population.

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**Author Contributions:** Osama El Shamy: Conceptualization; Data curation; Investigation; Writing - original draft; Writing - review and editing.
References


Figure 1. Different factors that play a role in the utilization and expansion of peritoneal dialysis in the United States

**Policy-level facilitators**
- Advancing American Kidney Health Initiative
- CMS ESRD PPS for 2022 increase in base rate
- ETC model: Home Dialysis Payment & Performance Payment adjustments

Future expansion of coverage to include assisted PD

**Racial and socioeconomic disparities**
- Hispanic and black patients with lower odds of being on home dialysis
- Black patients with higher risk of transfer to in-center HD
- Dual eligible Medicare/Medicaid and Low-Income Subsidy with worse outcomes

Solutions:
- Health Equity Incentive
- Expanding home dialysis education to areas with majority underrepresented patients
- Providing materials in patients’ preferred languages and expanding interpreter services

**Role of telehealth in future patient care**
- Bipartisan Budget Act of 2018
- Remote monitoring of patients’ PD treatments using online platforms
- COVID emergency waivers allowing providers to bill for telehealth via HIPAA and non-HIPAA compliant platforms without geographic restriction
- CMS 2022 Medicare Physician Fee Schedule including telehealth services

Long-term incorporation of audio-only visits and removing geographic restrictions

**Patient-reported factors in modality choice**
- Low rates of modality education prior to dialysis initiation
- Fear of peritonitis, discomfort without supervision, home dialysis not offered by doctor, long treatment times

Solutions:
- Expansion of home dialysis education nationwide
- Exploring coverage for assisted PD
- Increasing pre-dialysis nephrology care

**Lessons from international peers**
- Coverage for assisted PD
- PD-first policy
- Local production of PD solutions and reducing tax on imported consumables
- Increasing number of home dialysis coordinators, financial bonuses and penalties, mentorship in home dialysis for underperforming programs
- Urgent-start PD
- Continuous monitoring and quality improvement metrics

**Provider education on home therapies**
- Home Dialysis Fellowships
- Home Dialysis University, PD University, PD Academy of Excellence, Home Dialysis Academy of Excellence, ASN-virtual mentor curriculum
- Online modules, in-person workshops, and hybrid initiatives
- Hub and Spoke model

CMS – Centers for Medicare and Medicaid; ESRD – End stage renal disease; PPS – Prospective payment system; ETC – ESKD treatment choices; PD – peritoneal dialysis; COVID – Coronavirus 19