Should More Patients with Kidney Failure Bring Treatment Home? What We Have Learned from COVID-19

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\textbf{Keywords}
Dialysis · Kidney failure · Health services · Peritoneal dialysis · Training

\textbf{Abstract}

\textbf{Background:} The COVID-19 pandemic is challenging healthcare systems worldwide and has placed hospitals and healthcare providers (HCPs) at the center of a global crisis. Disruptions to hospital priorities, and limitations placed on the mobility of societies, have contributed to changes in the way HCPs and patients view and access dialysis for kidney failure, including which dialysis modality is preferred. 

\textbf{Summary:} This article explores the dialysis experience within the COVID-19 pandemic environment in the Asia Pacific region and presents evidence that peritoneal dialysis (PD) provides benefits to patients, HCPs, and health systems. As the number of people infected with COVID-19 has increased, the advantages of PD as a dialysis modality for limiting the spread of COVID-19 infection has been recognized. 

\textbf{Key Message:} The utility of PD has been demonstrated during the COVID-19 pandemic; thus, ensuring that the usage of PD is maintained and increased in a post-pandemic future is key. Such a scenario could enhance our ability to care for patients without interruption in circumstances of unforeseen obstacles and supports the ability of healthcare systems and patients to overcome barriers to dialysis access.

\textbf{Introduction}

We are now 2 years into the COVID-19 pandemic, caused by a novel, highly contagious coronavirus, (severe acute respiratory syndrome coronavirus 2 [SARS-CoV-2]) that spreads human-to-human primarily via airborne respiratory droplets [1]. Efforts to contain COVID-19 infections initially included physical distancing, government-issued stay-at-home orders and mask mandates. One of the key developments that eventually helped control the spread of the virus was the rapid development of effective vaccines, which have protected hundreds of millions of people worldwide, especially from severe disease [2]. However, their deployment has been marked by huge global inequities, which means there is a large residual vulnerable population, especially in poorer countries where vaccine penetration has been suboptimal [3].
Moreover, waning immunity (both vaccine and natural infection induced) and emergence of new variants continue to pose threats, especially to populations vulnerable to severe disease [4]. Finally, many infectious disease experts have warned the world that future pandemics are inevitable, and the healthcare community needs to develop policies to protect those most at risk [5].

Patients with kidney failure, one of the most vulnerable populations at risk of severe disease, experienced changes to the way they view, seek, and access kidney replacement therapy in this environment. Many patients with kidney failure are candidates for one of two dialysis approaches: hemodialysis (HD), typically provided in a hospital or other specialist facility (i.e., in-center), or peritoneal dialysis (PD), usually self-administered at home after training.

This article explores the role that PD can play when routine activities of daily life are restricted, such as during the COVID-19 pandemic, and lessons that can be applied to improve dialysis care from a healthcare system perspective during times of normal activity. An Asia Pacific focus is taken, but experience from other regions is also explored. Home HD (HHD) is an additional home-based dialysis option; however, we do not discuss HHD because most patients in the Asia Pacific region do not have access to the infrastructure required to perform HD in their homes or cannot manage HHD training (average of 6–8 weeks’ training time, often performed in-center), and few data are available to enable comparative analysis. We appreciate that exploring the impact of HHD in the pandemic environment is of interest and is an area for further study.

Patients with Kidney Failure Exhibit Increased Vulnerability to COVID-19

In 2017, there were nearly 700 million people with chronic kidney disease (CKD), equaling approximately 9% of the total global population, almost a third of whom lived in China and India [6]. More than 2.5 million patients receive dialysis worldwide, representing a substantial increase over the last three decades despite continuing access limitations in many regions with high CKD burden [6].

Patients with kidney failure, especially those receiving dialysis, typically exhibit an altered immune state and an aged, frail condition, which increases their susceptibility to COVID-19 and likelihood of experiencing severe disease when infected [7]. Patients with kidney failure also have a high prevalence of comorbidities (e.g., cardiovascular disease, diabetes, cerebrovascular disease) that have been linked to increased risk of severe COVID-19 [8, 9]. Experience during the SARS outbreak in Hong Kong in the early 2000s identified a higher rate of SARS in patients with kidney failure, showing the potential vulnerability of this population to contagious diseases within the coronavirus family [10].

Data suggest that patients with kidney failure and COVID-19 have a higher risk of death from the disease than the general population [11] (Table 1). One study found that the increase in relative risk of COVID-19-related death is highest in younger dialysis patients (i.e., those aged 20–39 years), who have a 430-fold increased risk of death compared with an age-matched general population [23].

Limitations of In-Center HD for Patients with Kidney Failure during the Pandemic

In a pandemic setting, intense pressure can be felt by hospital staff, including increased workloads and a crisis mindset. Healthcare providers (HCPs) may encounter practical challenges such as shortages in critical supplies, as was experienced during the COVID-19 pandemic (respirators, ventilators, and personal protective equipment) [24]. Additional concerns include the risk of HCPs contracting the infection, and difficulty adapting to evolving clinical practice guideline and process changes [25]. Loss of productivity amongst HCPs challenges healthcare systems and is detrimental to patient care. Finally, HCPs, including dialysis staff members, who are highly specialized and difficult to replace, may themselves get infected and not be available. Therefore, strategies to promote the delivery of non-acute patient care such as dialysis outside of the hospital setting are of value [26].

Observational data in multiple countries have identified HD centers as potential high-risk settings during the pandemic [8, 22]. In-center HD patients are 5–20 times more likely to be infected with COVID-19 than the general population [23]. Once infected, patients with kidney failure have a higher risk of death from COVID-19 than the general population [23]. In-center HD patients cannot adhere to elements of quarantine that are incompatible with the goals of in-center treatment [26]; as such, in-center HD has been identified as a ‘special threat’ to patients and healthcare workers as widespread COVID-19 cross-contamination may result between HD patients [22, 27].
Despite precautions such as disinfection of dialysis machinery, social distancing, and personal protective equipment use, COVID-19 infection clustering has been observed in specific units and on specific shifts in HD centers [28]. Impacts on an HD center attended by a known COVID-19 case extend beyond the infected patient to any subsequent cluster, other patients/HCPs with the same and adjacent shifts, lost medical personnel due to quarantine requirements, and increased protocols/processes to identify and prevent further spread of COVID-19 [22].

The Benefits of PD in the COVID-19 Pandemic Are Understood but Not Implemented

PD is a home therapy option for patients with kidney failure. Home-based therapies break the chain of transmission through the dialysis unit, reduce the risk of exposure through travel, and generally preserve resources [29]. Patients and HCPs have been advised to consider PD as a preferred kidney replacement therapy option, especially in the setting of COVID-19, as current best-practice PD provides mortality and quality-of-life outcomes similar to those achieved with HD [30, 31]. Telemedicine approaches can provide further medical oversight and supervision to ensure the safety of patients at home on PD.

Observational data in multiple countries have identified lower rates of COVID-19 infection in patients receiving PD than in those receiving HD (Table 2). In England, a 37.5% COVID-19 infection rate was observed in HD patients, in contrast with 13.7% in patients undergoing PD and HDH. Higher rates of COVID-19 were also seen with in-center HD than with home therapy in Northern Ireland, Scotland, and Wales in the same report [13]. Similar reports have emerged from other countries (Table 2).

Experience in PD-First and PD-Preferred Countries

Some countries have developed PD-first and PD-preferred government policies and reimbursement practices to enable greater access to kidney replacement therapies. Depending in part on government policies and funding, the relative rates of in-center HD and PD vary widely across Asia, from <10% PD and >90% in-center HD in Indonesia, Japan, Malaysia, South Korea, and Taiwan, to around 75% PD and 25% HD in Hong Kong [38].

High-Income Economies

Hong Kong implemented a PD-first policy in 1985. Among the 6,097 patients receiving dialysis in 2018, 75%

Table 1. COVID-19-associated mortality in patients with kidney failure and the general population [12–22]

| Reference | Date range | Rate of COVID-19 infection | Rate of COVID-19 mortality |
|-----------|------------|---------------------------|---------------------------|
| United States Renal Data System* | Feb 2020 to Dec 2020 | 12.1b (47,860/302,128) | 8.7 (28,739,707/330,060,000a) |
| UK Renal Registrya | Sep 2020 to Feb 2022 | 27.8 (17,617/62,756) | 5.4 (3,660,000/68,123,305a) |
| Ontario Canada Renal Network | Mar 2020 to Aug 2020 | 1.5 (187/12,501) | 0.3 (41,000/13,666,667) |
| Japan Renal Registryc | NA to Mar 2021 | 0.3 (1,205/344,640) | 0.3 (428,219/126,500,000) |
| French REIN Registrya | Mar 2020 to May 2020 | 1.7 (1,621/94,643) | 5.6 (3,760,671/67,060,000) |
| Brescia Renal COVID Task Force, Italy | Mar 2020 to Apr 2020 | 14.6 (94,643) | 29 (27/94) |
| COVID-19 Registry of the Spanish Society of Nephrology | Mar 2020 to Apr 2020 | 868 | 23 (198/868) |
| Wuhan, China, single center | NA to Mar 2020 | 18.3 (42/230) | 23.8 (10/42) |

NA, not available. *Certain data and denominators imputed from different sources. a Certain data and denominators imputed from different sources. b Rates among patients with kidney failure receiving dialysis. c Denominators from 2019 Annual Dialysis Data Report, JSDT Renal Data Registry. Japan Renal Registry [15, 16]. d Certain data and denominators imputed from different sources, as cited.
were on PD, while 25% were on HD. Recent data reveal that COVID-19 has not been diagnosed among the dialysis population of >6,000 patients [37]. Data from the USA, a country without a PD-preferred strategy, show increased rates of COVID-19 hospitalizations in patients receiving HD compared with those receiving PD. Data from Medicare beneficiaries undergoing dialysis depict a substantial rise in COVID-19 hospitalizations among HD patients during March and April 2020, reaching 1,237 cases (rate of 4.5 COVID-19 hospitalizations per 1,000 patients), whereas COVID-19 hospitalizations remained much lower among PD patients during this timeframe, peaking at 41 cases (rate of 1.3 COVID-19 hospitalizations per 1,000 patients), whereas COVID-19 hospitalizations remained much lower among PD patients during this timeframe, peaking at 41 cases (rate of 1.3 COVID-19 hospitalizations per 1,000 patients) [36]. In France, compared with COVID-19 incidence estimates of 0.2% in the general population, 3.3% of patients receiving dialysis developed COVID-19, with a nearly 2-fold greater risk among patients receiving in-center HD than in patients receiving home dialysis [39].

**PD Offers a Favorable Dialysis Solution to Multiple Stakeholders in the Healthcare Setting**

**HCP Perspective**

As HCPs experience increased demands in the COVID-19 environment, provision of home-based PD to suitable patients enables preservation of hospital resources for other urgent uses, as fewer HCPs can successfully support a larger number of patients on home-based PD [29], although this entails a different set of requirements, including maintaining active care of their patients through ongoing interaction using telehealth [29]. Clinicians should be vigilant in identifying and managing deleterious patient impacts, and ensure care remains individualized, including monitoring the use of incremental PD in individuals with residual renal function; attending to adequate control of phosphorus, potassium, glucose, and volume; prioritizing catheter insertion in urgent situations; and managing the role of continuous ambulatory PD and/or automated PD in the context of flow rates and automated PD requirements [29].

In India, most patients seek in-center dialysis. Thus, a 3-week lockdown caused more than 28% of patients to miss ≥1 dialysis session. Researchers concluded that lack of preparedness before lockdown resulted in interrupted healthcare services and posed an immediate adverse effect on patients [40]. They also pointed out that anecdotally a reasonably low impact on PD was observed from lockdown; however, unfortunately, the penetration of PD in India is relatively low [40]. Thailand, a PD-first country, established near-universal PD care by 2008, which led to tripled dialysis use, and has been attributed to saving the lives of 50,000 patients with kidney failure [41, 42].

**Low- and Middle-Income Economies**

Table 2. Rate of COVID-19 in patients with kidney failure receiving PD versus HD [8, 13, 15, 16, 32–35, 37]

| Source | Date range | Location | Rate of COVID-19 infection PD patients, % (n/N) | HD patients, % (n/N) |
|--------|------------|----------|-----------------------------------------------|---------------------|
| Xiong et al. [8] | Jan 2020 to Mar 2020 | Wuhan, China | NA | 1.8 (131/7,154) |
| Chen et al. [32] | NA to Mar 2020 | Sichuan Province, China | 0 (0/337) | NA |
| JSĐT [15, 16] | NA to Mar 2020 | Japan | 0.18 (18/9,920) | 0.3 (1,029/334,720) |
| Cho et al. [33] | Feb 2020 to Mar 2020 | South Korea | NA | 0.94 (11/1,175) |
| Arslan et al. [34] | NA to May 2020 | Turkey | NA | 1.2 (7/602) |
| Quintaliani et al. [35] | NA to Apr 2020 | Italy | 1.4 (57/4,139) | 3.5 (1,093/30,821) |
| US Renal Data Systemb [36] | Dec 2019 to Jul 2020 | USA | 41 cases (rate of 1.3) | 1,237 cases (rate of 4.5) |
| UK Renal Registry [13] | Sep 2020 to Feb 2022 | UK | 13.7c (653/4,756) | 37.5d (8,446/22,501) |
| Dr. Philip Li [37] | NA to Jun 2020 | Hong Kong | 0 (0/∼4,500) | 0 (0/∼1,500) |

**HD**, hemodialysis; **NA**, not available; **PD**, peritoneal dialysis; **JSĐT**, Japanese Society for Dialysis Therapy; **HHD**, home hemodialysis.

* Denominator from 2019 Annual Dialysis Data Report, JSĐT Renal Data Registry [15, 16]. ** Data are for COVID-19 hospitalizations. Rates are measured as number of COVID-19 hospitalizations per 1,000 patients. *** Reported percentage is for patients receiving home therapy, which includes patients receiving HHD. **** Reported percentage is for patients receiving in-centre HD only.

HD, hemodialysis; NA, not available; PD, peritoneal dialysis; JSĐT, Japanese Society for Dialysis Therapy; HHD, home hemodialysis.
that peritonitis rates in patients undergoing PD during COVID-19 have improved [44], but robust evidence is required. Finally, HCPs need to recognize the necessity of patient training to support optimal home-based PD and adjust training approaches to facilitate ideal remote learning outcomes.

Patient Perspective

Patients experienced difficulties in accessing HD during lockdown, and those who could travel to clinics risked exposing themselves, their family, and HCPs to COVID-19 infection [45]. Survey data reveal that patients harbored fear of contracting COVID-19 and expressed strong preferences about dialysis modality in the context of COVID-19. Patients seeking in-center dialysis felt their safety would be improved with COVID-19 screening tests for HCPs and patients and perceived healthcare personnel as being at high risk for COVID-19, leading to increased risk for patients [46]. A survey performed by the Kidney Support Association (KSA) in Japan determined that 88% of respondents feared a serious health impact if infected with COVID-19 [47]. Furthermore, remote patient management was highly regarded and desired by the patients surveyed [47]. Survey findings from Sichuan Province People’s Hospital, China, confirmed that existing PD patients felt their PD to be mostly unchanged by the COVID-19 environment [32]. Concerns highlighted by PD patients included the fact that some patients require support that should be led by the managing HCP (e.g., 3% reduced their dialysis because of a shortage of PD solution; 24% stopped erythropoetin injections due to the suspension of outpatient services in some community hospitals) [32]. On the other hand, although studies have identified that patients undergoing in-center HD can experience negative psychosocial impacts related to their treatment, as well as significant distress during confinement [48, 49], other patient surveys identify high levels of patient reluctance to change from in-center HD to home-based dialysis [49]. Integration of patient decision aids into renal care in healthcare systems, as part of a shared decision-making (SDM) approach, can support patient preference and knowledge about PD, empower those who require dialysis, and facilitate improved treatment satisfaction/ outcomes. Patients are also integral to peer-to-peer education, helping develop shared learning experiences, and, ideally, becoming actively engaged in their treatment and care, with the core belief that “there is no decision about me, without me.” With supportive education and SDM, additional patients may elect to receive PD; however, the primary role of SDM is to enable patients to make an informed choice for themselves, rather than guide patients towards a particular modality.

Nephrology Society Perspective

Many kidney societies have published guidance for dialysis units during the COVID-19 pandemic, some of which specifically recommend home dialysis (Table 3) [50–53]. In March 2020, the International Society for Peritoneal Dialysis (ISPD) issued recommendations on managing people on PD during the pandemic [51]. Key themes that emerged emphasized that people receiving PD should stay at home; hospital visits should be reserved for urgent care (e.g., suspected peritonitis); and routine consultations should be conducted by telehealth [51]. Joint renal societies in the UK (British Renal Society, British Transplantation Society, Renal Association) identify people receiving dialysis for kidney failure as part of a clinically extremely vulnerable group that has been prioritized for COVID-19 vaccination [54]. An American Society of Nephrology (ASN), ERA-EDTA, International Society of Nephrology (ISN) joint statement entitled “Ensuring Optimal Care for People with Kidney Diseases during the COVID-19 Pandemic” states that COVID-19 has led to a surge in patients requiring dialysis alongside interruptions in dialysis services to prioritize COVID-19 patients. The statement calls for the global healthcare community and policymakers to “anticipate and address the unique needs of different patient groups such as those with kidney failure” [55]. Although neither the Japanese Society for Peritoneal Dialysis (JSPD) nor the Japanese Society of Dialysis Therapy (JSDT) have issued formal COVID-19 statements, the president of JSDT, Professor Nakamoto, has commented that the society recognizes the COVID-19 pandemic will influence the choice of dialysis therapy among HCPs and patients in Japan, and the importance of home-based PD during this time.

In addition to updating guidelines, societies have sought to directly engage with clinicians and stakeholders. The ISN issued a joint statement with other nephrology societies encouraging policymakers to remove barriers to access, especially in low-resource settings, and conducted two educational webinars along with ISPD, which were heavily subscribed. These initiatives demonstrate knowledge dissemination through unconventional channels such as social media and online conferences to enable rapid uptake and best-practice decision-making among HCPs.
Evidence generated through health technology assessments in Thailand, the Philippines, Indonesia, and India supports the use of PD as a cost-effective dialysis option that provides similar efficacy and survival rates to in-center HD, making PD a favorable dialysis option from a societal perspective [31, 56–58]. Given that data show that PD is cost saving in most global settings, most major pro-

| Group | Guidance | Statement summary |
|-------|----------|-------------------|
| ISN   | https://www.theisn.org/initiatives/covid-19/recommendations/#covid-19-in-patients-with-chronic-kidney-disease | COVID-19 infection presents particular challenges for patients on dialysis, especially in-center HD. Uremic patients are particularly vulnerable to infection and may exhibit greater variations in clinical symptoms and infectivity. |
| ISPD  | https://ispd.org/wp-content/uploads/ISPD-PD-management-in-COVID-19_ENG.pdf | People receiving PD should stay at home; hospital visits should be reserved for urgent care (e.g., suspected peritonitis); routine consultations should be conducted by telehealth. |
| NBCMDA | “Guiding Opinions for Nephrologists in the Prevention and Control of Novel Coronavirus Infection.” Published 1 Feb 2020; available: WeChat public account of the NBCMDA | For new incident dialysis cases, PD should be given priority if there are no absolute contraindications. If a patient on maintenance HD has been judged at a higher risk of novel coronavirus infection, and home treatment would benefit him/her, changing PD mode can be considered. |
| CSN   | http://www.cjn.org.cn/EN/abstract/abstract3298.shtml# | As blood purification centers present relatively dense crowds and large personnel mobility, dialysis patients, caregivers, or blood purification center staff need to strengthen the prevention and control of novel coronavirus infection. |
| NICE  | https://www.nice.org.uk/guidance/ng160 | Home dialysis provision 10.1 Continue and maintain current home dialysis provision (HHD and PD), and maintain adequate supplies and staffing support. Assess the resilience of care reliant on paid or unpaid carers, family, and friends 10.2 Think about whether it is possible to increase home dialysis provision for new incident patients 10.3 Test for COVID-19 in patients, carers, and assistants (paid and unpaid) in the community using any form of home dialysis if they develop symptoms. Test paid assistants carrying out assisted automated PD. |
| British Renal Society/Kidney Care UK | Kidney Care UK: https://www.kidneycareuk.org/news-and-campaigns/coronavirus-advice/#recent | Dialysis at home as a preferred option. Keeping those already on PD home is a priority (NG160 10.1) (1) Maintain adequate supplies and skilled staffing; (2) assess resilience of carers regularly; (3) where available, use remote monitoring technologies. |
| ERA-EDTA | https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7184437/ | HHD and PD: these patients should be assisted at home as far as is possible, using telemapping assistance or other electronic systems for clinical management and to supplement home visits by healthcare staff, as deemed necessary. |
| ASN; US CDC | ASN: https://www.cdc.gov/coronavirus/2019-ncov/hcp/guidance-home-care.html?GaCTrackingID=USCDC_425-DM41258&GaCTrackingLabel=Weekly%20Summary%3A%20COVID-19%20Healthcare%20Quality%20and%20Worker%20Safety%20Information%20-%20October%2026%202020&deliveryName=USCDC_425-DM41258 CDC: https://www.cdc.gov/coronavirus/2019-ncov/hcp/dialysis/home-dialysis.html | Guidance entitled Special Considerations for Patients on Home Dialysis. Dialysis is a lifesaving therapy and patients should not miss treatments. Facilities should ensure that home dialysis patients have all the supplies they need to continue their dialysis treatments and should work with suppliers to understand if shortages are anticipated in items such as PD fluid. |

ISN, International Society of Nephrology; HD, hemodialysis; PD, peritoneal dialysis; ISPD, International Society for Peritoneal Dialysis; ASN, American Society of Nephrology; NBCMDA, Nephrology Branch of the Chinese Medical Doctor Association; CSN, Chinese Society of Nephrology; NICE, National Institute for Health and Care Excellence; HHD, home hemodialysis; CDC, Centers for Disease Control.
fessional societies, including the ISN, recommend PD as the preferred dialysis modality [59].

In the pandemic environment, policymakers and payers have revised governmental policy regarding remote dialysis treatment. For example, the Japanese Ministry of Health, Labour and Welfare (MHLW) approved and reimbursed online consultation; responding to patient needs during prior natural disasters provided experience when facing COVID-related challenges to dialysis care [60]. In the USA, an estimated 85% of Medicare fee-for-service beneficiaries requiring dialysis receive in-center treatment. The Centers for Medicare & Medicaid Services expedited the implementation of changes from the Advancing American Kidney Health Initiative to expand reimbursement practices supporting provision of dialysis treatment at home and encourage the use of telehealth [61, 62]. Similarly, the Australian Federal Government made policy updates to enable billing for telehealth. State governments have also responded by allowing access to remote patient management and broader reimbursement of online consultations [63]. Table 4 summarizes the reasons why PD can be a better choice than HD from the perspective of patients, medical staff, and policymakers in the COVID-19 environment and other scenarios.

Table 4. Comparison of PD and HD in different aspects during COVID-like pandemic or epidemic (based on Chen et al. [64] and other information sources) [56, 65–68]

| Aspects       | PD                                      | HD                                      |
|--------------|-----------------------------------------|-----------------------------------------|
| **Logistical** |                                         |                                         |
| Travel       | Ease of travel; flexibility in schedule | HD units may not be accessible           |
| Contact      | Physicians conduct telemedicine consultations; close contact with healthcare workers is not necessary | Close contact with healthcare workers is needed during needle puncture process |
| Cluster      | PD can be done at home, thereby minimizing the risk of disease clusters | Need for frequent HD unit visits and patient clustering increase the risk of virus spreading |
| **Resources** |                                         |                                         |
| Medical resources | Low risk of PD solution shortage | Need many healthcare workers, protective equipment, clean water, and dialysis machines, which may be lacking in a COVID-like pandemic or epidemic |
| HCP resources | No need for healthcare workers | Healthcare workers may be reduced due to illness or quarantine, resulting in a shortage in the workforce |
| Cost effectiveness | More cost effective/saving than HD in many countries [56, 65–68] (data available on a country-by-country basis) while providing similar outcomes | |

HCP, healthcare provider; HD, hemodialysis; PD, peritoneal dialysis.

Overcoming Obstacles to Make PD More Accessible: Utilizing Telemedicine

The COVID-19 pandemic may lead to a new normal, in which health systems as well as patients with kidney failure increasingly view PD as the preferred dialysis modality. Best practice provision of PD enables patients to remain at home, managing their dialysis needs more autonomously while engaging with HCPs remotely. This approach has been encouraged by nephrology societies and payers and is supported in principle by the treatment preferences expressed by patients balancing the risk and benefits of kidney replacement therapy in the pandemic setting. Indeed, the pandemic may be the catalyst for increased utilization of home dialysis as higher PD penetration helps societies adapt to pandemic situations quickly.

Unfortunately, PD remains underutilized despite its known benefits. Possible reasons for this include patient hesitancy, barriers in catheter insertion, lack of frequent nursing support, less frequent interactions with nephrologists, and the perceived lower levels of clinical oversight with PD. Increased patient and HCP familiarity with telemedicine may help overcome these barriers [69].
How Remote Patient Monitoring Enhances Provision of PD

Increased use of remote patient monitoring tools may positively contribute to PD provision [70–72]. Regular use of remote applications is associated with fewer hospital admissions, shorter hospital length of stay, and lower technique failure rates, potentially improving timely recognition and intervention of complications [73]. A center in Vicenza, Italy stated that “the use of telemedicine and remote management tools has allowed us to continue an optimal care of PD patients without significant increase of complications or technique failure and supported the endeavor to prescribe high-quality goal-directed PD” [70].

The ideal remote patient monitoring platform enables real-time online communication between HCP and patient, monitoring of treatments and maintenance of adherence records, automatic capture of treatment data, and storage of data in a compliant and secure manner (online suppl. Fig. 1; for all online suppl. material, see www.karger.com/doi/10.1159/000525046) [74, 75]. Other technologies, including wearables and environmental sensors, may further automate data collection and provide opportunities for HCPs to be alerted to concerning parameters detected by data capture systems [76]. A survey undertaken prior to the COVID-19 pandemic found that candidate patients with kidney failure were interested in incorporating telemedicine into their care, believing it will reduce their visits and simplify their care [77]. As of 2016, more than half (57%; \(N = 70\)) of WHO member states responding to a survey confirmed specific national telehealth policies in their country or reference to telehealth within their national eHealth policy [78]. Such technology may support necessary adjustments to patient care and enable maintenance of essential services within a pandemic environment.

In India, a survey of 19 major hospitals (8 public sector and 11 private sector) to determine the effect of a 3-week lockdown on patients with kidney disease found a 92% decrease in outpatient attendance, and 28% of HD patients missed ≥1 dialysis session. All hospitals advised patients to use telemedicine, and uptake was seen by a small number of patients, the impact of which has not been evaluated. However, the authors state that the pandemic saw the emergence of telemedicine services in India, provided through existing videoconferencing tools and messaging services (WhatsApp, email, Skype, Zoom, etc.) rather than specialized telemedicine platforms [40]. Within the telemedicine context, an SDM management model, involving a collaborative approach in which clinicians and patients (or their substitute decision makers) work together to make decisions about care that are based on relevant clinical information and the patient’s interests, values, and preferences is optimal in not just the COVID-19 setting, but at all times [79].

Limitations

Our review aims to present a comprehensive view of the challenges that dialysis patients and HCPs face within the COVID-19 environment and provide a plausible solution to these challenges. To achieve this objective, we have focused the scope of our review. Chiefly, as previously mentioned, we do not discuss HHD. Although HHD provides a home-based dialysis option, it is inaccessible to many patients in the Asia Pacific region. Additionally, we recognize the role that testing bias may play in the COVID-19 reporting rates between HD and PD patients. Since HD patients present to the clinic more frequently, there are more opportunities to test and detect COVID-19 infection in HD than PD patients. Although testing bias may account for some differences in the reported infection rates, we believe that PD can protect patients from COVID-19 infection by enabling them to remain at home, while also reducing the risk of barriers to dialysis care. Finally, we appreciate the key role that telemedicine plays in supporting the feasibility of dialysis from home and note that some regions may not have resources to support telemedicine approaches.

Call to Action

COVID-19 has changed healthcare. Patients with kidney disease are at increased risk of complications from COVID-19 (or any future pandemic), and those requiring dialysis may experience reduced access to the usual level of support and disease management they receive due to different healthcare system priorities in a pandemic environment. The experience reported here supports the role that PD can play in providing benefits to appropriate patients with kidney failure, enabling high-quality care to be administered in a home-based setting in the Asian context, and elsewhere. The importance of home-based dialysis has been highlighted by the COVID-19 pandemic, and its usefulness has been demonstrated within an ongoing preparedness approach of continuous adaptation to novel unforeseen obstacles in a post-pandemic future. However, although evidence supporting the benefits...
of PD in the pandemic environment has been described, achievement of increased real-world PD uptake remains elusive. Increasing uptake of PD is critical to improving the readiness and resilience of the health system in its ability to provide dialysis care to patients with kidney failure.

Essential to this goal is the establishment of supportive telehealth platforms to improve confidence amongst the stakeholder community in the delivery of home-based therapies such as PD. Additionally, ongoing efforts to engage patients in SDM conversations using patient decision aids may empower more patients with kidney failure to take an active role in their own home-based care. In so doing, patients and HCPs work together to share information while taking a clinically and cost-effective approach to treatment, enabling patients to be managed with limited infrastructure and human resources. These important strategies, alongside comprehensive immunization drives, including mass vaccination of dialysis consumers as a priority group, will help societies and stretched healthcare systems to redeploy resources where they are needed most acutely, and protect the most vulnerable – those on dialysis.

**Next Steps**

The profile of PD has increased in the current pandemic setting such that it may become the preferred option for an increasing number of patients who require dialysis. With patient benefit in mind, we should continue to leverage the five key drivers listed here, taking positive steps to ensure that the use of PD is maintained and increased in a post-pandemic future:

1. **Adoption of patient-centric models and SDM.** Use of SDM tools provides balanced and complete information to consumers, allowing patients to make decisions and feel that their input matters.

2. **Enabling the patient voice.** Support organizations for CKD/patients with kidney failure can play a role in strengthening the patient voice to influence HCPs and policymakers.

3. **HCP education.** There is a need for practical PD education, patient management, and skills training for HCPs and nurses during their professional courses, as well as skills training such as catheter insertion during resident nephrology courses.

4. **Positive reimbursement policies.** Appropriate reimbursement support encourages clinical adoption of SDM and remote patient monitoring.

5. **Expert clinical leadership.** There is a need to create clinical leadership among nephrologists to establish PD programs that deliver best practice care to patients and serve as centers of excellence.

As dialysis enters the post-pandemic age, we must maintain practices that protect our patients from infection, both viral and bacterial, by reinforcing good hygiene and infection prevention. In addition, the medical community must be aware of current and emerging evidence that confirms PD as an important treatment option that provides critical clinical and economic benefits.

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**Conflict of Interest Statement**

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**Author Contributions**

Xueqing Yu, Vivekanand Jha, and Hidetomo Nakamoto researched the literature and agreed on the need for the manuscript. Xueqing Yu, Vivekanand Jha, and Hidetomo Nakamoto reviewed and edited the manuscript and approved the final version of the manuscript.
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