

## A GLOBAL OVERVIEW OF THE IMPACT OF PERITONEAL DIALYSIS FIRST OR FAVORED POLICIES: AN OPINION

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**Given the ever-increasing burden of end-stage renal disease (ESRD) in a global milieu of limited financial and health resources, interested parties continue to search for ways to optimize dialysis access. Government and payer initiatives to increase access to renal replacement therapies (RRTs), particularly peritoneal dialysis (PD) and hemodialysis (HD), may have meaningful impacts from clinical and health-economic perspectives; and despite similar clinical and humanistic outcomes between the two dialysis modalities, PD may be the more convenient and resource-conscious option. This review assessed country-specific PD-First/Favored policies and their associated background, implementation, and outcomes. It was found that barriers to policy-implementation are broadly associated with government policy, economics, provider or healthcare professional education, modality-related factors, and patient-related factors. Notably, the success of a given country's PD-Favored policy was inversely associated with the extent of HD infrastructure. It is hoped that this review will provide a foundation across countries to share lessons learned during the development and implementation of PD-First/Favored policies.**

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An aging population and modifiable lifestyle risk factors accompanied by a decline in early-life infectious diseases have resulted in the rise of chronic diseases,

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particularly chronic kidney disease (CKD), as a predominant global health threat with profound socioeconomic and public health consequences (1,2). Clinically, CKD is characterized by progressive, irreversible kidney function deterioration culminating in end-stage renal disease (ESRD), the risk of which is mitigated by hemodialysis (HD) or peritoneal dialysis (PD) when kidney transplantation is unavailable or contraindicated.

Over the past 3 decades, many studies have compared outcomes associated with in-center HD (ICHD) vs PD using observational data. Clinically, although early studies consistently showed that patients initiating dialysis on PD had better earlier survival (3–6), contemporary data suggest that there is no significant difference in overall patient survival between PD and ICHD (7,8). These studies were found across the globe, including Canada (9), The Netherlands (5), Taiwan (10,11), Colombia (12), Australia and New Zealand (6), and the United States (13,14). In terms of quality of life (QoL), PD patients reported less illness intrusion, better renal care, higher satisfaction, and the ability to travel (15–18), while ICHD patients reported better staff and social interaction and less fear of isolation (19,20). Overall, there were no statistically significant differences in QoL between PD and ICHD patients, although PD patients tended to have higher QoL scores (the higher the better) (18,21–23). Economically, accumulating evidence demonstrated that PD has been a cost-saving therapy compared to ICHD in most developed countries and some developing countries (24–26). However, the provision of medical care to a large and growing dialysis patient population places a heavy economic burden on healthcare systems globally. In the US, for example, 1.3% of Medicare patients with ESRD accounted for 7.5% of Medicare spending in 2010 (27).

Despite the similar clinical and humanistic outcomes and the economic benefits associated with PD vs ICHD,

80% of prevalent dialysis patients received ICHD in 2010, with PD use ranging from 1.7% in Bangladesh to 76% in Hong Kong (27). The distribution of patients on PD globally does not reflect the view of nephrology professionals and the preference of patients and family caregivers (28–31). As one of the main dialysis modalities, PD is underutilized (32). Recognizing that patients who switch from ICHD to PD have a greater mortality risk (33) and incur more direct medical costs (34) vs patients initiated and maintained on PD, several countries have established “PD-First” (where PD is used as the first treatment modality for appropriate ESRD patients) or “PD-Favored” (where government policy on dialysis encourages the use of PD as the treatment choice while removing any existing disincentives) policies. In these countries, patient, provider, and payer incentives favor PD. In some other countries, “Home Dialysis-First” policies (including PD and home HD) are established as a complimentary strategy. These policies can be important in developing countries where resources are limited and must be optimized to meet disproportionately high ESRD rates (35).

Few studies have thoroughly compared PD-Favored policies regarding their background, implementation, and outcomes. Such information would help policy makers expand their knowledge on the applicability of these policies to their countries, learn from successful examples, and overcome potential barriers. Lessons learned from overcoming or failing to overcome barriers to PD-related policies can be shared among countries to facilitate the development of effective policies that generate better patient outcomes and mitigate health-care expenditures. This review serves as a comprehensive assessment of country-specific PD-related policies so as to understand what worked well and what barriers hampered such efforts.

## GLOBAL POLICY OVERVIEW

Through a targeted assessment of peer-reviewed literature, governmental and associated websites, Hong Kong and Thailand were identified as having PD-First policies, Canada, China, Guatemala, India, Mexico, Spain, Taiwan, and the United States were identified as having PD-Favored policies, and Australia, Finland, and New Zealand were identified as having Home Dialysis-First policies (Figure 1). The most frequently cited motivations for policy initiatives were to increase patient access to care, control costs through lower infrastructure and capital investments, empower patients, and optimize treatment provision.

The timing and mechanism of the implementation of PD-First/Favored policies differed. Hong Kong is the first

territory that has promoted PD-First policy among ESRD patients who required dialysis since 1985, and implemented the policy successfully with contributions from kidney-associated charity organizations (36). Starting in 2008, the Thailand National Health Insurance Fund implemented a PD-First policy by addressing important elements such as training and reimbursement (37). The Canada Ontario Ministry of Health and Long-Term Care established a provincial PD initiative in 2005 to increase use from 18% in 2005 to 30% in 2010 (38). In the United States, the Center for Medicare & Medicaid Services (CMS) implemented a prospective payment system that bundled most of the services provided to dialysis patients starting January 1, 2011 (39,40). As a result, the outcomes of these policies were different. The Hong Kong and Thailand PD-First programs are successful in terms of PD utilization rate, patient and technique survival, quality of life, and complications management (41–43). Ontario did not attain its 2010 goal of 30% PD use (38,44,45). Under the US bundled payment system, the utilization of PD has been growing at a much higher rate than the utilization of HD and the use of expensive drugs, especially erythropoiesis-stimulating agent (ESA), has declined substantially (46–48).

Tables 1, 2, and 3 provide details related to the background, implementation, and outcomes of PD-First, PD-Favored, and Home Dialysis-First dialysis policies, respectively.

## LESSONS LEARNED AND STRATEGIC RECOMMENDATIONS

Lessons on policy implementation were learned from the countries reviewed. Generally, for a PD-Favored policy to be implemented successfully, the country and/or region addressed five key elements systematically: government policies, economic factors, provider/healthcare professional education, modality-related factors, and patient-related factors.

### GOVERNMENT POLICIES

Government reimbursement policies play a crucial role in cost containment for dialysis while ensuring the quality of care without compromising patient outcomes. A recent comparison of the dialysis reimbursement policies across 7 developed countries, including the United States and Ontario, Canada, found that the reimbursement systems were complex and varied significantly between countries (89). Different reimbursement policy could impact PD utilization dramatically. Policies to increase prevalent PD populations may be implemented without

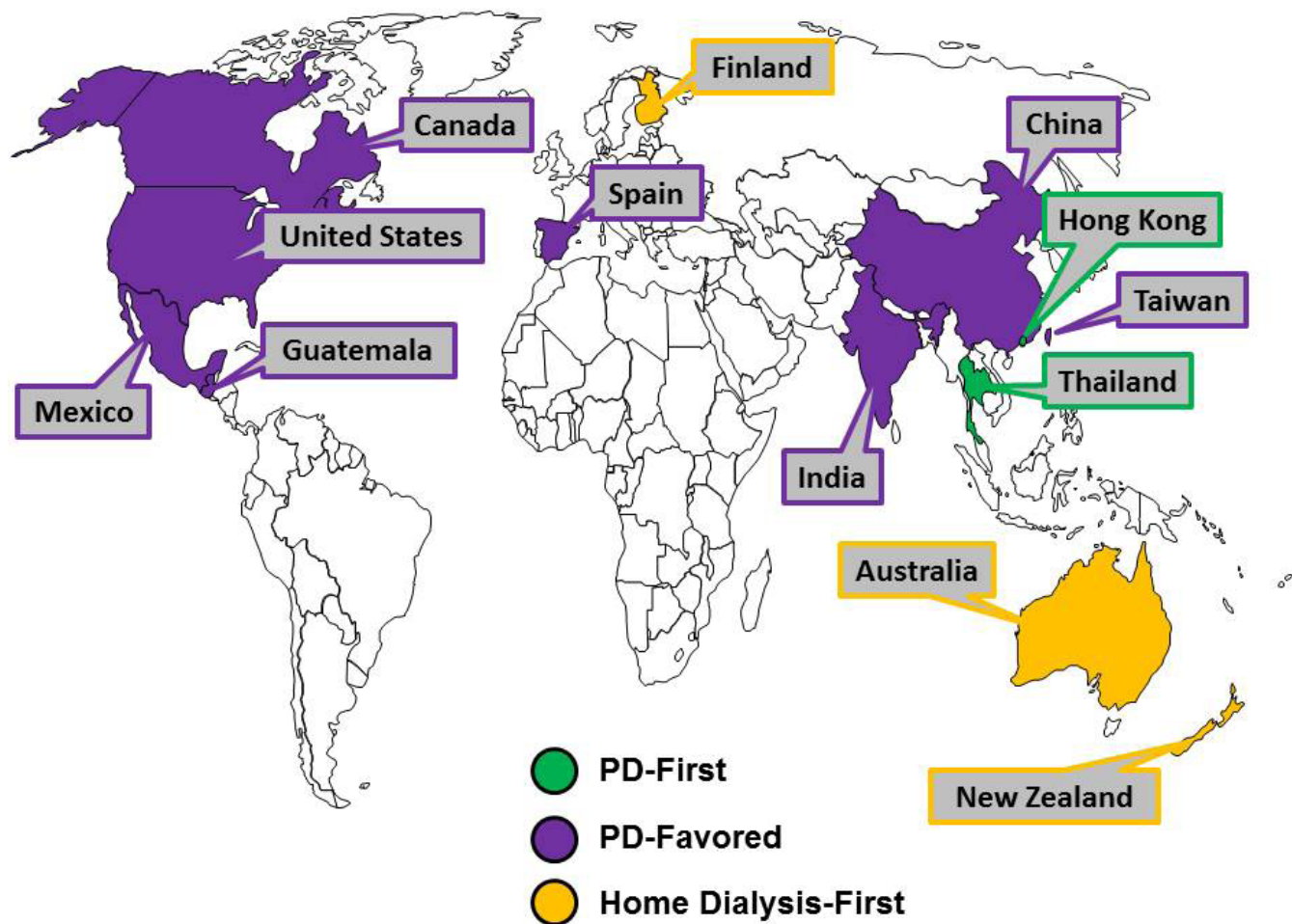


Figure 1 — Geographic summary of country-specific policy types. PD = peritoneal dialysis.

budgetary support and consequently be ineffective without adequate reimbursement (90). PD programs can also be dis-incentivized by government reimbursement policies favoring HD. On the other hand, policies with strong reimbursement incentives could be successful, which has been the case for the US's recently implemented bundled prospective payment system (48). Financial reimbursement policies are the most important non-medical factor contributing to modality selection worldwide (49) and pro-PD reimbursement policies have been associated with varying, yet positive, outcomes in many countries such as Thailand (100% PD reimbursement) and China/Taiwan (both incentivize PD with reimbursement).

Generally, PD rates are low in countries where provider reimbursement for PD is insufficient, when compared to countries where PD is encouraged through adequate reimbursement rates (91). Governments initiating dialysis programs in developing countries tend to invest in more expensive technology perceived to be more advanced (92). In countries with more private dialysis providers, a larger proportion of ESRD patients use ICHD instead of home dialysis (as has been the case in India).

The trend is reversed for government policies utilizing public dialysis providers, for example in Mexico (92), where the same budget could provide RRT access to more patients through PD.

**Strategic recommendations:** Government policies should be developed with in-depth analysis of their background and involvement of all key stakeholders. They should also set benchmarks with detailed funding plans to facilitate patient-centered care, where patients are empowered to make modality choices. As the systematic policy change could have a dramatic impact, pilot tests should be conducted before the full implementation and continuous quality improvement should be maintained after the policy implementation.

#### ECONOMIC FACTORS

In developing countries, financial limitations constrain PD access (49,63,64,93). It was reported that the annual PD provision costs in those countries are much higher than the per capita gross national income. PD costs are

TABLE 1  
Key Point Summary of PD-First Policies

Country	Policy Background	Implementation	Outcomes
Hong Kong (27,36,41,42, 49,50)	<ul style="list-style-type: none"> <li>In the mid-1980s, Hong Kong faced insufficient HD capacity and PD was shown to be cost-effective.</li> <li>Thus, PD-First policy was instituted primarily for economic considerations.</li> </ul>	<ul style="list-style-type: none"> <li>Patients receive PD initially unless medically contraindicated.</li> <li>Pre-dialysis education was organized in all dialysis units.</li> <li>Two charity organizations help subsidize PD at home.</li> <li>In 1995, the Hong Kong Renal Registry was established by the Hong Kong Hospital Authority to serve clinical and administrative purposes.</li> </ul>	<ul style="list-style-type: none"> <li>Hong Kong has the highest PD utilization in the world with 76% of dialysis patients receiving PD.</li> <li>PD patients in Hong Kong enjoy excellent survival. The 5- year survival for patients aged 20–44 was 64% and 25% for patients aged 65–74.</li> <li>The mortality of PD patients has been decreasing over the years. Comparing patients from 2000–2005 with patients from 1995–1999, the 1- and 5-year survival has increased from 87% to 90% and 35% to 38% respectively.</li> <li>The peritonitis rate has improved over the years from 1 episode per 22 patient months in 1996 to 1 episode per 31.8 patient months in 2009.</li> </ul>
Thailand (37,43,50,51)	<ul style="list-style-type: none"> <li>There exists inequity of access to dialysis across the 3 healthcare schemes in Thailand, and patients under the UCS did not have access to RRT.</li> <li>In addition, there is a shortage of RRT facilities and medical personnel in Thailand.</li> <li>CAPD potentially saves costs and is less labor-intensive.</li> <li>A small number of PD patients in each university hospital limited the learning opportunities for nephrology fellows in PD.</li> </ul>	<ul style="list-style-type: none"> <li>7 steps toward PD-First policy instituted in Thailand in 2008:                             <ul style="list-style-type: none"> <li>Feasibility evaluation</li> <li>Pilot test</li> <li>Medical personnel training</li> <li>Patient network</li> <li>Policy &amp; guideline development</li> <li>Insurance coverage</li> <li>Full implementation</li> </ul> </li> <li>National Health Security Office established renal registry to monitor the practices and patient outcomes.</li> </ul>	<ul style="list-style-type: none"> <li>The policy substantially increased ESRD patients' RRT access:                             <ul style="list-style-type: none"> <li>111 PD training centers existed in 2011, up from 51 centers prior to the policy.</li> <li>More physicians are trained to implant PD catheters.</li> <li>46% of dialysis patients on PD in 2011, up from &lt;10% before the policy implementation.</li> </ul> </li> <li>Registry data analyses showed:                             <ul style="list-style-type: none"> <li>The peritonitis rate was 1 episode/23 months and dropout rate was 33% in 3 years.</li> </ul> </li> <li>Current data show that the 1- and 3-year patient survival rates were 79% and 57%.</li> </ul>

HD = hemodialysis; PD = peritoneal dialysis; UCS = universal health coverage scheme; RRT = renal replacement therapy; CAPD = continuous ambulatory peritoneal dialysis; ESRD = end-stage renal disease.

Note: In both Hong Kong and Thailand, patients are not forced to use PD. They can still choose HD, but need to pay prescription drugs and doctor fees themselves. Meanwhile, if patients have contraindications to PD, the doctors will propose to the Central Committee that the patients be covered for HD.

higher than HD costs in some developing countries due to lower labor costs and the high price of importing PD fluids and disposables, although many of these studies did not mention the cost perspective (24,25), an important element in economic evaluation studies. Generally, costs to payers and providers may be more likely to affect practice

patterns, whereas indirect costs are less influential. Indirect costs (e.g., transportation costs related to travel) are overlooked, but vital to accurate health-economic assessments from a societal perspective (94).

In the development of a national PD-First/Favored policy, it is critical to the policy's success to collect necessary

TABLE 2  
Key Point Summary of PD-Favored Policies

Country	Policy Background	Implementation	Outcomes
Canada (27,52–56)	<ul style="list-style-type: none"> <li>• There were insufficient ICHD stations, and patients in rural areas had difficulty in dialysis access.</li> <li>• Publicly funded system through regional renal programs or local hospitals covers all fees for dialysis, but not for prescription drugs.</li> <li>• Nephrologists are paid differently based on province or territory, either by fee-for-service or by prospective payment system.</li> </ul>	<ul style="list-style-type: none"> <li>• Canada established clinical practice guidelines for ESRD care.</li> <li>• In 2006, Ontario initiated a provincial PD initiative to increase PD use to about 30% in 2010.</li> <li>• In May of 2012, the Ontario Renal Network (ORN), established in 2009, announced new ESRD patient care targets to be achieved by 2015 in terms of dialysis care plan, education, modality choice, patient engagement, and the uptake of independent dialysis.<sup>a</sup></li> </ul>	<ul style="list-style-type: none"> <li>• The national PD share in Canada is 18%.</li> <li>• The 2006 Ontario PD joint initiative to increase PD use to 30% by 2010 was not successful.</li> <li>• The initial results of the new plan announced by the ORN demonstrated that both incident and prevalent rates of home dialysis have been increasing consistently.<sup>a</sup></li> </ul>
China (57–60)	<ul style="list-style-type: none"> <li>• Physician and hospital income were based on the number of patient visits. As a result, PD was dis-incentivized as a home therapy.</li> <li>• In 2011, China issued a new policy to increase PD use by changing PD from the drug prescription list into medical supplies list.</li> </ul>	<ul style="list-style-type: none"> <li>• The China Medical Association was entrusted to establish PD Standard Operation Regulations.</li> <li>• PD training centers were established in 31 hospitals across the country.</li> <li>• The Chinese Medical Insurance Agency was formed to provide policy guidance for the national dialysis reimbursement system.</li> <li>• Several cities in Jiangsu have established PD-favored policies recently.</li> <li>• Endorsed by the China Ministry of Health, a partnership between Baxter China and the Chinese National Institute of Hospital Administration was established to deliver home-based dialysis to China's rural areas starting 2013.</li> </ul>	<ul style="list-style-type: none"> <li>• Currently 14% of dialysis patients use PD.</li> <li>• However, it is too early to meaningfully evaluate subsequent outcomes of recently established policy.</li> </ul>
Guatemala (61,62)	<ul style="list-style-type: none"> <li>• Dialysis is universally available for patients who need RRT and PD is used if not contraindicated.</li> </ul>	<ul style="list-style-type: none"> <li>• NA</li> </ul>	<ul style="list-style-type: none"> <li>• 56% of dialysis patients receive PD.</li> </ul>
India (63–68)	<ul style="list-style-type: none"> <li>• India is a “self-pay” market with 80% paying “out of pocket.”<sup>b</sup></li> <li>• About 10% of ESRD patients have RRT access.</li> <li>• HD is dominant in the private market and PD is dominant in public-funded arenas.</li> </ul>	<ul style="list-style-type: none"> <li>• All Indian public organizations have included PD and HD as part of their ESRD reimbursement program.</li> <li>• Two states, Karnataka and Pondicherry<sup>b</sup>, have set up PD-Favored policies.</li> <li>• The Employees' State Insurance Scheme of India has PD-First policy.</li> </ul>	<ul style="list-style-type: none"> <li>• Due to lack of registry, patient survival and adequacy are not available. One center study in Chennai reported 1- and 2-year survival were 80% and 60% respectively.</li> <li>• A recent study found that there was no significant difference in the monthly costs between PD and HD patients paying out-of-pocket.</li> </ul>

TABLE 2 (cont'd)

Country	Policy Background	Implementation	Outcomes
India (cont'd)		<ul style="list-style-type: none"> <li>Novel initiatives, including the 'Once-in-a-lifetime payment' scheme for PD supplies, Suraksha insurance scheme for peritonitis, and renal home care for patient service, have increased PD use in India.</li> </ul>	<ul style="list-style-type: none"> <li>In the public sector, PD penetration is more than 40%, and overall between 18–20%</li> </ul>
Mexico (27,69–72)	<ul style="list-style-type: none"> <li>PD is the most common method of RRT in Mexico.</li> <li>Currently about 80% of the dialysis population is under the care of IMSS.</li> <li>Contrary to the global trend of increasing home dialysis use, the Mexican government has been trying to increase ICHD:PD ratio starting 2000.</li> </ul>	<ul style="list-style-type: none"> <li>About 50% of Mexicans have healthcare coverage from 3 social security institutions and have access to RRT. The rest of the Mexican population have to take care of themselves.</li> <li>Non-nephrologists can run PD but not HD programs.</li> <li>Pre-dialysis patient education exists in some dialysis providers and some public institutions established PD-First policy.</li> </ul>	<ul style="list-style-type: none"> <li>Mexico is one of the countries with the largest PD utilization proportionally in the world. However, PD use decreased from 1999 to 2010.</li> <li>Mortality has not been adequately studied due to lack of national renal registry. Single hospital study showed that 1-, 2-, and 3-year survival rates were 90%, 78%, and 72%, respectively.</li> <li>The goal of 60% PD and 40% HD by 2006 was not attained due to lack of physical infrastructure and human resources for HD.</li> </ul>
Spain (27,52, 73–76)	<ul style="list-style-type: none"> <li>PD use varies across states.</li> <li>The government realized the underutilization of PD and requested an increase of PD use based on the right of patients to choose RRT modality.</li> </ul>	<ul style="list-style-type: none"> <li>The government is trying to empower patients in RRT modality choices.</li> <li>GADDPE supports the actions for PD development.</li> <li>In 2010, GADDPE issued a White Paper including the reasons for the low use of PD and strategies to increase PD use.</li> </ul>	<ul style="list-style-type: none"> <li>PD utilization has been around 10% between 2005 and 2010 in Spain.</li> <li>With the action of GADDPE group, the proportion of dialysis patients using PD has been slightly but steadily increased.</li> <li>The median (mean) survival time was 55 months for PD patients from Andalucia between 1999 and 2010 and 44% of them survived <math>\geq 5</math> years.</li> <li>A recent cost study using data from the Spanish RRT program found the annual total medical costs for PD were €25,828 vs HD €37,968.</li> </ul>
Taiwan (27,77–80)	<ul style="list-style-type: none"> <li>All RRT is covered through a national insurance program.</li> <li>HD use was 90% for prevalent patients in 2010.</li> <li>PD use has been increasing slowly.</li> </ul>	<ul style="list-style-type: none"> <li>PD use may be increasing due to changes in reimbursement instituted in 2004 and revised in 2007.</li> <li>In 2012, the Department of Health announced that by 2016, 14% of dialysis patients shall use PD.</li> <li>PD reimbursement avoids income loss under a capped budget and provides extra payments for higher PD utilization rates.</li> </ul>	<ul style="list-style-type: none"> <li>The 7-year patient survival (technique) rate was 77%.</li> <li>A recent study reported that both the lifetime costs and costs per life year were lower for PD patients than HD patients in Taiwan.</li> <li>Multidisciplinary pre-dialysis education reduced dialysis starts and mortality.</li> </ul>

TABLE 2 (cont'd)

Country	Policy Background	Implementation	Outcomes
The United States (39, 40,46-48)	<ul style="list-style-type: none"> <li>• In 1972, Medicare ESRD program was established.</li> <li>• Since 1983, Medicare reimbursed dialysis providers for their dialysis services in two components: a partially bundled composite rate and separately billable i.v. medications, which was the main profit driver for HD units.</li> <li>• The costly provision of dialysis service plus the increasing prevalence of ESRD patients in the US resulted in a heavy economic burden for Medicare. In 2008, Medicare spent \$26.8 billion in ESRD-related services.</li> </ul>	<ul style="list-style-type: none"> <li>• To control costs, Congress enacted Medicare Improvements for Patients and Providers Act (MIPPA) in 2008, which directed CMS to establish a fixed payment for dialysis services.</li> <li>• In response to MIPPA, Medicare implemented a prospective payment system, which bundled most of the services provided to dialysis patients, especially the expensive separately billable i.v. medications.</li> <li>• In addition, Medicare established a Quality Incentive Program that dialysis facilities must meet for full payment or face a reduction (up to 2%) in their payments.</li> </ul>	<ul style="list-style-type: none"> <li>• The bundled payment system represents the payment model shifting by CMS from traditional fee-for-service to fee-for-value.</li> <li>• Under the new bundle, the growth of PD utilization has been accelerated compared with the utilization of HD, and the use of expensive drugs, especially ESA, has declined substantially.</li> </ul>

ICHHD = in-center hemodialysis; ESRD = end-stage renal disease; PD = peritoneal dialysis; ORN = Ontario Renal Network; RRT = renal replacement therapy; HD = hemodialysis; IMSS = Mexican Institute of Social Security; GADDPE = Grupo de Apoyo para el Desarrollo de la Diálisis Peritoneal en España; CMS = Center for Medicare & Medicaid Services; MIPPA = Medicare Improvements for Patients and Providers Act; ESA = erythropoiesis-stimulating agent.

<sup>a</sup> The new ORN plan is not specifically for PD, it is for independent dialysis (ID, home dialysis), whose target is 40% of new dialysis patients will be on an independent dialysis option within 6 months of initiating dialysis.

<sup>b</sup> Personal communication with experts from India.

Note: With the exception of Canada and US, the pre/post-policy evaluation studies are somewhat limited. Therefore, the information in Table 2 should be interpreted carefully. In addition, our focus in Canada is Ontario due to lack of available data in other provinces.

economic evidence and involve all key stakeholders. The experience of Thailand in providing expensive RRT for patients under its universal health coverage scheme clearly demonstrated its importance (51). In addition, governing bodies might consider intra-country variability in economic and medical resources/infrastructure. Not doing so may result in disparate patient access. For example, in India, better access exists in wealthy urban centers while rural populations have insufficient access to dialysis care (95). Alternatively, the establishment of PD as the first dialysis modality in Thailand increased patient access to dialysis care without increasing the needs for HD infrastructure and staffing. Together with the volume-based negotiated price on PD fluid and PD-supportive program, the PD-First policy lowered costs and increased utilization.

**Strategic recommendations:** Country-specific cost data should be collected and analyzed using standardized cost and resource units. When possible, the economic evaluation should include information on patients'

quality of life and employment status. For example, before the announcement of Thailand's PD-First policy, an economic evaluation was conducted to provide value-for-money information for policymakers to make decisions on whether to provide dialysis treatment for ESRD patients under the universal health coverage scheme (96).

PROVIDER/HEALTHCARE PROFESSIONAL EDUCATION

Peritoneal dialysis experience for nephrologists and dialysis centers is critical to a successful PD program implementation (97). Insufficient PD training for nephrology fellows has been a barrier to PD initiation and retention (92). Less experienced PD centers tend to deal with PD complications by switching the patients to HD (98,99) despite the potential benefits associated with PD, such as delaying the need for vascular access, preserving residual renal function, and bridging the gap to kidney transplantation (92).

Education played a critical role for the successful implementation of Hong Kong's PD-First policy whereby

TABLE 3  
Key Point Summary of Home Dialysis-First Policies

Country	Policy Background	Implementation	Outcomes
Australia (81-85)	<ul style="list-style-type: none"> <li>Dialysis services are organized as hub-and-spoke networks.</li> <li>In 2009, data in ANZDATA showed 30% of patients received home dialysis with 21% on PD.</li> <li>State governments are aware of the clinical and economic benefits with home dialysis vs ICHD.</li> </ul>	<ul style="list-style-type: none"> <li>A range of national health reforms were implemented beginning 01/01/2012.</li> <li>Reforms include: activity-based funding and national quality-control and safety standards, and cost effectiveness.</li> <li>Most states and territories invest in home-based treatment and several states have set benchmarks for the proportions of dialysis patients on PD.</li> <li>Reduced access barriers to home dialysis through more targeted training and education program, more rigorous data collection and increased government engagement.</li> <li>Home dialysis is supported by clinical practice guidelines (KHA, ANZSN, CARI).</li> </ul>	<ul style="list-style-type: none"> <li>50% of home dialysis targets have been set by state governments, but national average falls short currently.</li> <li>Too early to comment.</li> </ul>
Finland (27,86,87)	<ul style="list-style-type: none"> <li>Dialysis is publically funded.</li> <li>Distance to dialysis centers, particularly for patients living in the remote areas may make ICHD a less preferred modality.</li> <li>Home dialysis is the primary dialysis choice in many districts.</li> </ul>	<ul style="list-style-type: none"> <li>Whenever possible, dialysis treatment starts with home dialysis, followed by self-care HD, and then ICHD.</li> <li>Patients choosing home dialysis may be evaluated for either PD or home HD.</li> <li>Pre-dialysis education is available to Finnish patients.</li> </ul>	<ul style="list-style-type: none"> <li>Approximately 19% of prevalent dialysis patients received PD in 2010.</li> <li>A study conducted in 2007 showed that 19% HD patients, 31% PD patients and 40% transplant patients were employed.</li> </ul>
New Zealand (27,88)	<ul style="list-style-type: none"> <li>20 years ago, dialysis patients received only home or self-care dialysis.</li> <li>Currently, dialysis still favors home treatment due to a shortage of healthcare professionals.</li> </ul>	<ul style="list-style-type: none"> <li>Substantial national health reform was implemented 2008-2010, which established a policy of "shifting health care closer to home."</li> </ul>	<ul style="list-style-type: none"> <li>In 2010, 35% of prevalent dialysis patients received PD.</li> <li>Compared with institutional dialysis, home-based dialysis was associated with better patient outcome and decreased costs.</li> </ul>

ANZDATA = Australian and New Zealand Dialysis and Transplantation; PD = peritoneal dialysis; ICHD = in-center hemodialysis; KHA = Kidney Health Australia; ANZSN = Australian and New Zealand Society of Nephrology; CARI = Caring for Australasians with Renal Impairment; HD = hemodialysis.

Note: The pre/post-policy evaluation studies are somewhat limited for the Home Dialysis-First countries. Therefore, the information in Table 3 should be interpreted carefully.

all dialysis units established pre-dialysis education programs (36). In Thailand and China, the barrier of insufficient provider education was overcome through routine provider visits to PD programs, the establishment of model-centers for PD-related care and rural satellite

PD training centers, and institution-wide PD operation regulations (100). In Latin America, where there is a disproportionately large ESRD population, few nephrologists generally receive adequate PD training, and exposure to PD patients is limited (101). Consequently,



non-nephrologists have been running PD clinics in Mexico (69,102).

**Strategic recommendations:** Countries looking to expand PD utilization should identify successful programs or centers of excellence and key subject experts and use these existing resources to train their fellow clinics and nephrology professionals, including training for nephrologists, nurses, and other dialysis staff. They could also form a functional hub-and-spoke service network as in Australia, where the hubs are usually tertiary centers and the spokes are satellite services (82).

#### MODALITY-RELATED FACTORS

A major challenge to PD is inadequate technique survival, which limits its initial survival benefit (8,103). The reasons for poor PD technique survival include infections, ultrafiltration failure, and volume overload (104). Thailand took vital steps to overcome modality-related factors specifically. First, patients and providers attended educational symposia addressing the relative benefits of PD vs HD. Second, anti-PD biases not scientifically grounded were identified and assuaged with continued education. Third, national registry data indicated the clinical success of PD-First. Together with registries, surveys (105) were also used to monitor patient outcomes and to identify programs not meeting established guidelines and/or those that are underperforming. Additionally, social support has been found to reduce the risk of technique failure in Hong Kong (106).

**Strategic recommendations:** All key stakeholders, especially patients and nephrology professionals, should attend educational programs with unbiased data on PD and HD. Anti-PD biases should be identified and appropriately addressed. Patient registry and other monitoring plans (e.g. surveys) should be established and data should be analyzed regularly. The results should be published through national or international conferences and peer-reviewed journals.

#### PATIENT FACTORS

Patient-specific barriers include patients' disinterest in home-based dialysis (107), patient burnout (104), a fear of peritonitis, burden on family members, lack of physicians' encouragement and lack of confidence in the quality of PD care (108). Participation in well-designed patient pre-dialysis educational programs has been shown to help patients choose their treatment modality with increased PD utilization and to improve patient

outcomes (80,109–114) (e.g., Hong Kong). Education should preferably begin several months prior to dialysis initiation, although this may be difficult as patients are not regularly identified early and educational resources are insufficient.

However, patient-related barriers have been overcome in certain countries, such as Thailand and Hong Kong, through the development of clubs fostering PD advocacy and PD-related skill competency (shown to be associated with fewer dialysis initiations and lower mortality rates [115]), social activities, and rehabilitation services. Patient-centered/attended clubs and meetings may also ameliorate fears of medical complications. In addition, family support has been reported to be significantly associated with increased PD utilization among ESRD patients with barriers to self-care in Canada (116).

**Strategic recommendations:** National patient education guidelines and policies should be developed to address patient fears and cultural differences. Web-based and printed materials could also be valuable. Patient network opportunities should be facilitated for patients to educate each other in both medical and non-medical aspects.

#### DISCUSSION AND CONCLUSION

With the increasing economic burden associated with ESRD, several countries have realized the benefits of PD vs HD and implemented PD-First/Favored policies. To make the PD policies successful, policy makers should address 5 important elements systematically: reimbursement policy, economics, provider/healthcare professional education, modality-related factors, and patient-related factors. To facilitate patient-centered care, patient preference for dialysis modality selection should also be taken into account for patients without clinical contraindications in the design and implementation of PD-related programs. Studies have found that patient motivation was associated with improvement in dialysis practices and patient survival (117,118). In this case, comprehensive pre-dialysis education outlining options of all dialysis modalities is critical (32,119), especially for those in developed countries. In developing countries, on the other hand, the key challenge is to provide access to RRT for patients with ESRD. With limited resources and increasing demand, the provision of lower cost therapy of PD can extend patients' life while not compromising the quality of care and patient outcomes (120).

Thailand exemplifies a PD-First country that confronted each barrier successfully by having: 1) created a thorough, national, step-wise implementation plan;

2) set specific goals and milestones by which to evaluate the policy's progress; 3) established and maintained a national database of clinical, economic, and quality-of-life outcomes with which to populate comparative effectiveness analyses; 4) aligned the interests of relevant parties (i.e., patients, providers, and payers). The United States exemplifies a PD-Favored country that addressed the key non-medical barrier of reimbursement for dialysis modality selection by creating a financial incentive for increased use of lower cost dialysis therapies, mainly PD.

Meanwhile, the extent of current HD capacity also impacts the uptake of PD-favoring policies (121). One might look to the example of Canada (specifically Ontario) as an instance where the benefits associated with PD and corresponding reimbursement policy were not sufficient to overcome a pervasive HD infrastructure. Essentially, when HD capacity was there, the providers tended to maximize the use of their HD units because of the relatively low marginal cost of adding a new HD patient to an empty spot (92). Partially due to the situation, PD use was still around 18% in 2010 in Ontario despite its 2005 initiative to increase the use of PD to 30% by the end of 2010 (45,56).

Low PD utilization also appeared to correlate with wide socioeconomic variation due to partitioning by self-sufficient/governing provinces distributed over large areas geographically (e.g., Canada and India). This again reflects the importance of centralized alignment in establishing pro-PD policies and highlights how, in countries without existing national dialysis infrastructure, Thailand's model shows that pro-PD initiatives can be successfully implemented regardless of the economic or development status of the country. One should not overlook the importance a national data registry (representing vital components of comprehensive renal replacement therapy infrastructure and the associated economic factors) used to monitor outcomes and direct resources accordingly.

PD-Favored policies may be integrated into complementary home dialysis-First policies (including both PD and home HD), as has been implemented in Australia, Finland, and New Zealand. Compared with ICHD, the benefits of home-based modalities include better control of health and treatment regimes, better patient quality of life, reduced travel for treatment, ability to work, and reduced non-dialysis related infection rates.

With regard to the aforementioned barriers and strategic recommendations, this review corresponds to previously published assessments of existing and/or potential PD and home dialysis-First policies (103,122–126). However, prior reviews have focused on a given territory,

barrier(s) and solution(s) thereof. For example, as was recommended based on this review, Li *et al.* (103) provided a review of the PD-First policy in Hong Kong and its associated issues and suggested potential implementation strategies, including improving nephrologists' experience and expertise with PD, increasing patients' access to PD catheters, and providing social support to PD patients. Jose *et al.* (125) indicated that insufficient PD uptake results largely from poor patient education and that PD utilization and clinical outcomes/morbidity may improve though targeting this deficiency. Likewise, Gokal (124) noted that unbiased patient education is likely to result in increased PD uptake, but adds that PD utilization rates would benefit from providers being more thoroughly apprised of current PD-related outcomes and advances. Chaudhary *et al.* (123) offers similar sentiments in addition to suggesting economic solutions may be realized through the cost-effective bundling of PD services. From the perspective of this review, this is largely an issue related to reimbursement incentives and infrastructure as categorized by "Government Factors." Burkhart (122) discussed the benefits of the US bundled payment system, along with the advantages of dialysis service consolidation, in particular, coordination and cooperation between government, provider, and patient entities, which may help avoid the biased reimbursement system. Ghaffari *et al.* (126) further pointed out the importance of government and healthcare system support, structured multidisciplinary pre-dialysis education programs, and training of healthcare professionals to the success of a PD-First policy model in the US dialysis setting.

Each country has a unique background in terms of its government role, health insurance coverage (who is covered and what is covered), health system finance (private vs public or mixed), economic status, clinical practice, and patients' view of quality of care (127). To support future design and implementation of PD-related programs, there are insufficient data that any of the specific PD policies has been or can be transferred to another country directly. However, the experience of these reviewed PD-First/Favored policies did show the importance of collecting data, identifying the key barriers, involving key stakeholders in all phases of the program, pilot testing, and objectively evaluating the patient outcomes following the implementation of the program.

As is frequent in literature/policy reviews, this work was limited by a restricted scope. For example, not all countries with PD-Favored policies (e.g., the United Kingdom [128]) were included. Additionally, this review was limited by the restricted availability of outcome data in countries where centralized RRT data registries do not

exist. It is likely that the understanding of outcomes, policies, and implications will continue to evolve alongside the capacities for robust data registries. Finally, the PD-First/Favored policies were usually implemented in an uncontrolled manner and therefore the lessons learned were not tested with scientific rigor. As a result, it is important to do pilot tests and collect data to objectively measure the progress and timely revise the program if necessary.

Nevertheless, the details presented herein reflect opinions and findings published in the dialysis-related literature, and the barriers and recommendations appear relevant despite unique socioeconomic, demographic, and infrastructural factors. It is hoped, therefore, that governments, renal associations (including healthcare professional associations), patient groups, and other policy-making groups will learn from this assessment of country-specific dialysis-focused policies, which took into account PD's capacity to improve clinical outcomes as well as its positive impact on limited healthcare resources.

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