

Can Peritoneal Dialysis Be The First-Line Treatment For End-Stage Kidney Disease? A SWOT Analysis

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Abstract

End-stage kidney disease (ESKD) is a global health challenge, with kidney transplantation being the preferred treatment. However, due to a shortage of donor organs and medical complications, many patients rely on dialysis. Peritoneal dialysis (PD) is a promising alternative but is underused compared to hemodialysis (HD). This study explores whether PD could be considered a first-line treatment for ESKD, using a SWOT analysis to assess its strengths, weaknesses, opportunities, and threats. Method Systematic literature review (2015–2025) with SWOT framework. PD improves patients' quality of life with treatment flexibility and better preservation of kidney function. However, the risk of infection such as peritonitis is a weakness in the widespread use of PD therapy in the elderly and remote areas. The development of PD use requires government support in equalizing the distribution of healthcare professionals skilled in PD and providing reasonable cost reimbursement. PD has the potential to be an effective first-line treatment for ESKD, but its widespread use is constrained by various challenges. Addressing these barriers could enhance its accessibility and efficacy.

Keywords: *Kidney replacement therapy, Peritoneal dialysis, SWOT analysis*

INTRODUCTION

The burden of kidney failure is increasing and has become a significant global health concern. Worldwide, it was estimated that there were 697.5 million cases of chronic kidney failure in 2017. In comparison to 1990, the incidence rate increased by 29.3% (Feng et al., 2023). End-stage kidney disease (ESKD) is ranked as the 12th leading cause of death globally, directly responsible for 1.2 million deaths. Additionally, another 1.4 million deaths attributed to cardiovascular diseases had impaired kidney function as an underlying factor (Chander et al., 2024). This trend underscores the urgent need for effective strategies to address the rising burden of kidney-related health issues.

Chronic kidney disease is classified into five stages based on the degree of kidney damage and remaining kidney function, as measured by the Glomerular Filtration Rate (GFR). If there is a severe decrease in GFR (< 15 ml/min/1.73 m²), patients need kidney replacement therapy (KRT) modalities. Multiple KRT modalities are available, including hemodialysis (HD), peritoneal dialysis (PD), and even kidney transplantation. Kidney transplantation is considered the gold standard for treating ESKD. However, not all patients can undergo this procedure due to a variety of medical and logistical challenges, including a limited availability of donor organs and specific comorbidities that may make transplantation unsuitable. As a result,

dialysis remains the most common treatment for managing kidney failure, with hemodialysis and peritoneal dialysis being the two main types of dialysis used.

PD differs from hemodialysis by using the abdominal peritoneum as a natural filter through the infusion of dialysate into the abdominal cavity (Park et al., 2024). In CAPD, waste products such as urea and electrolytes pass into the dialysate, which is drained and replaced several times daily through a permanent catheter (Afrilia et al., 2024). PD provides a promising alternative to hemodialysis for patients with ESKD. Several previous studies have shown the advantages of peritoneal dialysis, including flexibility for travel, greater technical simplicity, improved cost-effectiveness, fewer dietary restrictions, and a better quality of life (Bello et al., 2022). PD has been shown to better preserve residual kidney function compared to HD and is associated with a lower risk of blood-borne infections. These advantages make PD especially valuable in resource-limited environments, where access to specialized healthcare facilities may be limited. Although it has many advantages, peritoneal dialysis is less popular as a kidney replacement therapy compared to hemodialysis. PD users only make up about 11% of the total dialysis users. Despite its advantages, the widespread adoption of PD faces several challenges. Key issues include the higher risk of peritonitis, a common infection associated with PD, as well as the technical complexity involved in managing PD at home.

A SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis of PD as a kidney replacement therapy may be beneficial in suggesting future strategies for expanding this modality (Puyt et al., 2023). This analysis provides a structured framework for understanding the internal and external factors influencing PD adoption. This analytical tool enables a detailed exploration of the advantages, including its cost-effectiveness and patient autonomy, alongside the limitations, such as the risk of infection and the logistical challenges associated with home dialysis. Furthermore, a SWOT analysis can identify opportunities for improving PD accessibility, such as developing training programs for healthcare workers and implementing policy interventions to reduce the cost of consumables. By systematically evaluating both the benefits and challenges, stakeholders can develop strategies to optimize PD implementation worldwide.

With the increasing demand for KRT in patients with ESKD, there is a growing need for enhanced knowledge and information regarding the selection of appropriate modalities. The choice of therapy modality depends on the patient's condition and the availability of facilities in the patient's region. In some areas, there are limitations in KRT capacity using HD machines, requiring patients to travel long distances for dialysis. The use of PD in Indonesia remains limited due to several factors and considerations. Additionally, the cost of HD can be a significant issue, as it is considered expensive, requiring two to

three sessions per week. Therefore, alternative modality options for ESKD patients need to be considered to address these challenges. Although PD has many advantages, its adoption rate is still low. However, there are still limited comprehensive studies on the potential of PD as a first-line therapy in Indonesia and globally. Therefore, a systematic review was carried out employing the Strengths, Weaknesses, Opportunities, and Threats (SWOT) framework to assess PD potential as a first-line therapy for ESKD patients.

METHODS

The design of this study was a narrative literature review with a systematic approach to article identification and selection, following PRISMA guidelines. The literature search will focus on discussing the strengths, weaknesses, opportunities, and threats of the topic. The research questions for this study were formulated utilizing the Population, Intervention, Comparison, and Outcome (PICO) framework, which guided the development of clear and focused inquiry (Eriksen & Frandsen, 2018). The question used in selecting articles for the research is "How does PD compare to other modalities as a kidney replacement therapy for patients with ESKD when assessed through a SWOT analysis, considering factors such as cost, infection risk, patient autonomy, and treatment outcomes?" Information regarding the research question based on the PICO framework is presented in Table.

Table 1. PICO Elements

PICO	Description
P (Population)	Patients with ESKD requiring KRT
I (Intervention)	PD as a kidney replacement therapy
C (Comparison)	Hemodialysis (HD)
O (Outcome)	SWOT analysis of PD compared to other KRTs

The PRISMA guideline comprises four sequential stages includes identification of records, screening of titles and abstracts, assessment of full-text articles for eligibility, and inclusion of studies that meet all criteria. For identification, literature searches were conducted in May 2025 across three electronic databases included PubMed, SCOPUS, and Web of Science, which were selected due to their comprehensive coverage of peer-reviewed biomedical literature. The process of identifying and selecting relevant articles followed a systematic approach, beginning with the formulation of research topics and the establishment of specific research questions. Literature searches were conducted using keywords (("peritoneal dialysis" OR "CAPD") AND ("kidney replacement therapy" OR "renal replacement therapy")) AND ("SWOT" OR "comparison*" OR "strength*" OR "benefi*" OR "weaknes*" OR "opportunity*" OR "challenge*" OR "threat*"). A total of 1288 records were initially identified from all databases. After removing 370 duplicate records, 918 articles remained for further screening.

Next, all identified records underwent title and abstract screening based on their relevance. After screening, 780 articles were retained for full-text assessment. Inclusion and exclusion criteria were then defined to ensure that only the most pertinent studies were considered. Afterward, the articles and data were carefully selected, ensuring they met the set criteria. The studies included in the review adhered to the following inclusion criteria: (a) the research focused on the application of peritoneal dialysis as a kidney replacement therapy modality; (b) published between 2015 and 2025; (c) appeared in peer-reviewed academic journals; (d) written in English; and (e) accessible as full-text articles without any access restrictions. The exclusion criteria were: (a) conference abstracts, editorials, or non-peer-reviewed publications; (b) studies not directly addressing PD as a modality of kidney replacement therapy; and (c) studies not employing a SWOT or comparable analytical framework.

Finally, 10 studies met all the eligibility criteria and were included in the review. For data analysis, a thematic analysis approach was employed. Extracted findings from the included studies were coded and categorized into key themes, which were then mapped into four domains: strengths, weaknesses, opportunities, and threats (SWOT). Information regarding the flow of article selection is presented in Figure 1.

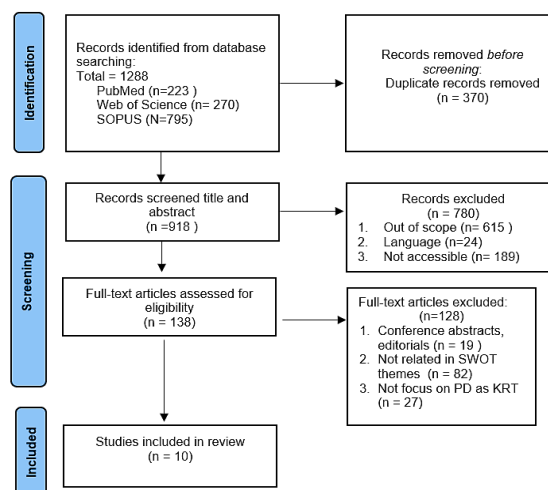


Figure 1. The PRISMA flowchart review identification and selection process.

RESULTS AND DISCUSSION

A SWOT analysis was performed utilizing the themes gathered from the included studies to further illustrate the consideration of peritoneal dialysis selection for patients. Information regarding the list of selected articles is presented in Table 2. The SWOT analysis of peritoneal dialysis as a KRT offers significant insights from the perspective of patients.

Table 2. Selected Articles

No	Author(s)	Year	Country	Findings
1	Moura-Neto, J.A.; Modelli de Andrade, L.G.; Moura, A.F.; Cruz, C.M.S.	2025	Brazil	PD usage declined from 6.5% in 2014 to 4.3% in 2023, with regional disparities. PD is cost-effective compared to hemodialysis (HD) but has declined due to lower reimbursement rates and insufficient public funding.
2	Bello, A.K.; Okpechi, I.G.; Osman, M.A.; Cho, Y.; Cullis, B.; et al.	2022	Global	PD offers advantages over HD, such as better quality of life, lower cost, and better preservation of

			kidney function. Challenges include high fluid costs and infection rates in certain regions.			reducing hospital visits.			
3	Bitar, W.; Helve, J.; Kanerva, M.; Honkanen, E.; et al.	2023	Finland	CAPD has a higher risk of severe infections compared to APD and home HD. Peritonitis remains the most common infection and a significant barrier to PD.	9	Sitjar-Suner, M.; Suner-Soler, R.; Bertran-Noguer, C.; et al.	2022	Spain	PD patients have better general health perception than HD patients, though physical functioning worsens over time. Transplantation provides the best improvement in health outcomes.
4	Li, P.; Cao, X.; Liu, W.; Zhao, D.; et al.	2023	China	There are substantial regional disparities in PD infrastructure, with tertiary hospitals offering better training and resources than secondary hospitals.	10	Badrouchi, S.; Barbouch, S.; Bettaieb, A.; et al.	2022	Tunisia	PD patients had similar mortality outcomes as non-COVID-19 patients, with the advantage of avoiding regular hospital visits and supporting social distancing.
5	Sahib, A.; Choudhury, C.; Wani, I.A.; et al.	2024	India	Inflammation is higher in HD patients compared to PD, suggesting that PD may reduce the inflammatory burden in chronic kidney disease patients.					
6	Matrisch, L.; Rau, Y.	2024	Germany	PD is cost-effective and offers better quality of life compared to HD. However, patient preferences and variability in outcomes are important factors.					
7	Chander, S.; Luhana, S.; Sadarat, F.; et al.	2024	Global	Meta-analysis shows that PD may have a lower mortality risk compared to HD, though variability in study outcomes limits generalizability.					
8	Park, B.H.; Shin, H.S.; Kim, J.; et al.	2024	South Korea	Shared decision-making improves outcomes, such as reduced hospitalization days, with PD's home-based nature providing autonomy and					

Strengths of PD

One of the primary strengths of PD is its flexibility, as it can be performed at home, at work, or even while traveling, offering greater convenience for patients (Bello et al., 2022). With proper training, individuals can carry out CAPD independently without the need for complex machinery. This aspect is particularly beneficial for young patients or those with many activities in their daily routines. PD has better clinical outcomes, such as stable hemodynamic conditions, a reduced incidence of anemia, and a lower risk of vascular infections (Lubitz & Woo, 2024). Studies consistently report PD's cost-effectiveness compared to HD, along with better preservation of residual kidney function and overall quality of life.. Importantly, PD has also been linked to reduced inflammatory burden such as IL-6 and high-sensitivity C-reactive protein (hs-CRP) (Sahib et al., 2024).

Catheter insertion for peritoneal dialysis (PD) is simpler than vascular access placement for hemodialysis (Karkar & Wilkie, 2023). Hemodialysis relies on various vascular access types, which commonly lead to complications such as stenosis, thrombosis, and infections (Lok et al., 2025). Additionally, PD is generally more cost-effective than hemodialysis, offering a practical advantage and reducing the financial burden on government insurance systems especially in resource-limited settings (Tjahjodjati et al., 2023). The study advocates for prioritizing PD as the first-line treatment modality for ESRD, contingent upon meeting the requisite medical criteria and patient-specific considerations (Matrisch & Rau, 2024; Novelia et al., 2017).

PD helps preserve residual kidney function and is associated with fewer dietary restrictions and improves patients quality of life (Bello et al., 2022; Matrisch & Rau, 2024). The quality of life outcomes for patients with PD were significantly better compared to those undergoing HD, as measured by the self-report instruments SF-36, EQ-5D, and KDQOL. Specifically, better quality of life was observed in physical function, emotional problems, and the burden of kidney disease (Chuasuwana et al., 2020; Matrisch & Rau, 2024).

Weaknesses of PD

Despite these advantages, PD presents several notable weaknesses. The most significant concern for patients is the risk of infection, particularly peritonitis, which can lead to complications such as

hospitalization or even treatment failure (Bitar et al., 2023). Infection continues to be the most common complication in PD, with the occurrence of exit-site and tunneling infections. Approximately 20% of peritonitis cases are temporarily associated with exit-site or tunnel infections. Infectious complications in PD can lead to serious clinical outcomes, including hospitalizations, increased healthcare costs, higher mortality, damage to the peritoneal membrane, and the need for conversion to hemodialysis. In the United States, about 25% of patients switch to hemodialysis within two years, primarily due to peritonitis, inadequate dialysis, mechanical issues, and social health determinants (Khan, 2023). Maintaining a healthy and properly functioning peritoneal membrane is essential for ensuring effective ultrafiltration and achieving fluid balance, which represents a fundamental aspect of delivering an optimal dialysis regimen in patients undergoing PD (Morelle et al., 2024).

A cohort study shows that patients with kidney failure on PD still have high morbidity and mortality rates. From a survival perspective, careful consideration must be given for PD as a long-term treatment option, especially for elderly patients who have diabetes mellitus or other comorbid conditions. In these populations, the potential risks of complications and the impact of multiple health conditions, may outweigh the benefits. Therefore, it is crucial to evaluate individual health status, comorbidities, and overall prognosis when

determining the suitability of PD for long-term management. The presence of diabetes and other comorbidities can complicate the outcomes of PD, necessitating a more cautious approach and ongoing monitoring to ensure optimal treatment efficacy and minimize adverse effects (Cheng et al., 2024). Kidney transplantation continues to be the preferred treatment option due to its beneficial impact on various aspects of health, including energy levels, social functioning, and overall health perception (Sitjar-Suñer et al., 2022).

Patients undergoing home-based dialysis may face significant psychological stress. Enhancing the ability of healthcare providers to address the emotional challenges linked with home-based treatment can help achieve improved patient outcomes and maintain the long-term success of this therapy. (Walker et al., 2024). Another challenge is the need for specialized training for both patients and caregivers, which can serve as a barrier in areas with limited access to healthcare professionals. In elderly patients, caregiver education plays an important role in determining the decision to choose the PD method. Moreover, in patients who have multiple complications outside of kidney failure (Ting et al., 2025). The availability of PD is not universal, especially in low-income regions where healthcare infrastructure may be insufficient (Li et al., 2023). In Indonesia, which is included in low-middle income country, the use of PD has been widely carried out in big cities but

has not reached many small cities and island areas. This is due to the limited number of professional health workers who can reach the installation and monitoring of PD through all regions.

Opportunities for PD Development

Peritoneal dialysis as treatment option for end-stage kidney disease presents numerous opportunities for improving patient care and clinical outcomes. Technological advancements, such as remote monitoring and the development of biocompatible solutions, could significantly reduce infection rates and improve treatment outcomes (Karkar & Wilkie, 2023). According to the study in Canada, a logistic regression model was applied to forecast patients who could qualify for PD, utilizing 27 predictor variables such as patient demographics, lab results, and comorbid conditions. The research identified several factors that reduced the probability of PD eligibility, including advanced age, elevated body mass index (BMI), initiation of dialysis in an ICU setting, and the presence of polycystic kidney disease (PKD). On the other hand, factors that enhanced the chances of qualifying for PD included diabetes, coronary artery disease, along with increased creatinine and albumin levels. The model exhibited a high sensitivity rate of 91.3% and an accuracy of 68%, establishing it as an effective screening tool for identifying possible PD candidates following the commencement of HD. In Indonesia, additional clinical assessment

tools are required to verify patient eligibility (Yang et al., 2025). Experiences from countries like India and China highlight that expanding PD infrastructure, training, and government support can substantially increase utilization. This suggests a similar opportunity for Indonesia, where PD adoption is still limited outside major urban centers (Okpechi et al., 2022).

Enhancing patient satisfaction and promoting autonomy can be achieved by integrating shared decision-making approaches and establishing healthcare policies that actively support PD as a priority treatment option (Bello et al., 2022; Bitar et al., 2023). This patient-centered approach allows individuals to be more involved in their treatment decisions, ultimately fostering a sense of control over their care. During pandemics such as COVID-19, PD use can increase because home-based dialysis reduces exposure and lowers transmission risks. However, findings from Tunisia show that PD's complication and mortality rates are not much different from other kidney replacement therapies (Moura-Neto et al., 2025). This indicates that while PD supports autonomy and safety, its clinical results remain similar to other dialysis methods in terms of survival and complications.

Implementation Challenges

Despite the benefits, there are several significant challenges that hinder the broader adoption of PD. One of the primary obstacles is the occurrence of mechanical complications, such as catheter failure.

These complications often require modifications in treatment or a changing to other dialysis modalities (Bello et al., 2022). It is estimated that nearly 40% of individuals undergoing PD will experience mechanical issues, including problems like catheter malposition and fluid leaks. The latter occurs when dialysate fluid escapes from the peritoneal cavity, leading to further medical complications. These issues can arise due to the type of catheter used or specific demographic factors, including anatomical considerations. Disparities in healthcare infrastructure, especially in low- and middle-income countries, present a formidable barrier to the widespread implementation of PD. The lack of sufficient trained healthcare personnel create significant obstacles for making this modality widely available to all patients who could benefit from it. Another factor contributing to the reduced use of PD is the relatively lower reimbursement rates for this treatment compared to hemodialysis, which are often driven by inadequate public funding. This financial challenge discourages healthcare providers from adopting PD as a treatment option, further limiting its accessibility and use, particularly in settings where resources are constrained (Moura-Neto et al., 2025).

Policy Implications

The SWOT findings suggest that while PD offers strong clinical and economic advantages, its sustainability depends on addressing weaknesses and threats through policy reform. Governments in developing countries, should prioritize

PD by improving reimbursement mechanisms, investing in training programs, and expanding infrastructure to rural areas. Such measures could help reduce disparities in access and ensure that PD becomes a more viable first-line therapy for patients with ESKD.

Table 3. Summary of the SWOT analysis

Strengths	Weaknesses
Home-based treatment	Risk of peritonitis
Lower costs than HD	Requires patient and caregiver training
Better quality of life and preservation of residual kidney function	Limited access to trained healthcare in LMIC
Fewer dietary restrictions	Availability limited in some regions
Simple catheter procedure	Difficulty in performing PD for elderly
Opportunities	Threats
Strengthening healthcare policy	Risk of catheter malfunction.
Improving technological innovations	Disparities in healthcare infrastructure
Integrating shared decision-making	Lower reimbursement rates

CONCLUSION

Peritoneal dialysis provides major benefits such as home-based flexibility, lower costs, and preservation of residual kidney function, leading to better patient quality of life. Despite these advantages, infection risks and the need for patient and caregiver training remain significant barriers, particularly in settings with limited healthcare resources. To promote wider utilization, it is essential to implement comprehensive training initiatives, reinforce policy support, and advance research aimed at enhancing safety and expanding equitable access.

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