



EFFECTIVENESS OF SELF-CARE EDUCATIONAL INTERVENTIONS IN PATIENTS UNDERGOING CONTINUOUS AMBULATORY PERITONEAL DIALYSIS: A SYSTEMATIC REVIEW

Nurul Hidayah^{1*}, Masfuri², Chiyar Edison²

¹Master of Nursing Study Program, Faculty of Nursing, Universitas Indonesia, Jl. Prof. Dr. Sudjono D. Puspongoro, Pondok Cina, Beji, Depok, West Java 16424, Indonesia

²Faculty of Nursing, Universitas Indonesia, Jl. Prof. Dr. Sudjono D. Puspongoro, Pondok Cina, Beji, Depok, West Java 16424, Indonesia

*Nurul.hidayah44@ui.ac.id

ABSTRACT

Peritoneal dialysis is a renal replacement therapy that requires patients to perform most of their care independently at home. Lack of patient knowledge, adherence, and skills can increase the risk of complications, such as peritonitis, malnutrition, fluid overload, and reduced quality of life. Educational interventions are an important strategy to improve self-management skills in peritoneal dialysis patients. To determine the effectiveness of educational interventions on knowledge, adherence, self-management, and clinical outcomes in peritoneal dialysis patients. This study used a systematic review design. The reviewed articles included studies on educational interventions for peritoneal dialysis patients, comprising randomized controlled trials and intervention studies. The interventions analyzed included self-care education, dialysis technique retraining, peer support, mobile health applications, problem-based learning, virtual reality, and structured nursing programs. Data were extracted based on author, country, research method, type of educational intervention, and key findings. The systematic literature review was conducted following the PRISMA guidelines by searching four electronic databases (Scopus, ScienceDirect, PubMed, and Taylor & Francis) for English-language articles published between 2020 and 2025. The initial search yielded 7,955 records, of which 24 studies met the eligibility criteria and were included in the final review after the screening and selection process. A total of 10 studies were analyzed. Results indicate that educational interventions generally improve patient knowledge, self-management skills, adherence to diet and fluid restrictions, medication use, hand hygiene, and infection prevention. Retraining with direct supervision has the potential to reduce the risk of peritoneal dialysis-related infections, particularly non-enteric peritonitis and exit site infections. App-based education, peer support, and PBL improve patient engagement, health behaviors, quality of life, and psychosocial support. Furthermore, some interventions have shown improvements in nutritional status, hemoglobin, albumin, fluid management, and blood pressure. However, the impact on overall peritonitis, hospitalization, and patient survival has been inconsistent. Structured, repeated, individualized, and interactive educational interventions effectively improve self-care skills and adherence in peritoneal dialysis patients.

Keywords: adherence; health education; peritoneal dialysis; self-care; self-management

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INTRODUCTION

Chronic Kidney Disease (CKD) remains a growing global health problem. In Indonesia, data from the Indonesian Renal Registry reported 21,050 new hemodialysis patients and 30,554 active patients receiving renal replacement therapy in 2015 (Suryani et al., 2015). Peritoneal dialysis (PD) was used as the initial renal replacement therapy in 9.3% of newly diagnosed CKD patients, while preemptive kidney transplantation accounted for only 2.6% of cases (Suryani et al., 2015). In 2018, the Indonesian Society of Nephrology reported 2,105 active Continuous Ambulatory Peritoneal Dialysis (CAPD) patients, representing an increase from 1,674 patients in 2015 (Suryanti, 2018).

Continuous Ambulatory Peritoneal Dialysis (CAPD) offers several advantages, including greater mobility and the opportunity for home-based treatment. However, the success of CAPD largely

depends on patients' ability to perform self-care activities using appropriate aseptic techniques (Rahmawati et al., 2025). Peritonitis is the most serious complication associated with CAPD and contributes significantly to morbidity and mortality, accounting for approximately 41.3% mortality and 20% technical failure among CAPD patients (Kodrat et al., 2023). Previous studies have reported that nearly 60% of CAPD patients experience at least one episode of peritonitis during the first year of treatment (Prasetyo et al., 2020). The incidence of CAPD-related peritonitis varies across countries, with reported rates of 42.6% in Scotland and 41.7% in London (Yanti, 2023). According to the Indonesian Renal Registry, the incidence of peritonitis among CAPD patients was 10.24% in 2018, resulting in many patients transitioning to hemodialysis therapy (Yanti, 2023).

Insufficient knowledge and inadequate skills related to aseptic techniques, fluid management, and infection recognition increase the risk of peritonitis, malnutrition, fluid-electrolyte imbalance, and recurrent hospitalization (Rahmawati et al., 2025). Several risk factors for peritonitis have been identified, including advanced age, low educational level, low serum albumin, hyponatremia, elevated serum glucose, overhydration, and Gram-negative bacterial infections (Yanti, 2023). Furthermore, hypoalbuminemia (<3.5 g/dL) at the initiation of CAPD has been identified as an independent predictor of bacterial peritonitis, with an odds ratio of 13.718 (Prasetyo et al., 2020).

Structured educational interventions are designed to improve patients' knowledge, practical skills, and attitudes toward self-care during CAPD treatment. Evidence suggests that e-booklet-based education significantly improved the proportion of patients demonstrating good self-care practices from 41.9% to 74.2%, while the proportion of patients with poor self-care decreased to 0% following the intervention ($p < 0.001$) (Rahmawati et al., 2025). In addition, the mobile application "MY Kidney" has been shown to be an effective self-management educational innovation for improving CAPD patient outcomes (Putri et al., 2026). Multimedia-based educational approaches, including smartphone applications, text messaging, and telephone-based interventions, have also demonstrated effectiveness in enhancing treatment adherence and self-care behaviors (Wijaya et al., 2021).

Several international studies further support the effectiveness of educational interventions in CAPD care. Brown et al. (2019) reported that structured education programs reduced peritonitis incidence by 35% and improved adherence to dialysis exchange procedures. Chapman et al. (2020) found that video-based education improved aseptic skills among CAPD patients, with an odds ratio of 2.8 for correct procedural performance compared with conventional education. Smith and Johnson (2021) demonstrated that digital educational interventions delivered through mobile applications improved quality of life scores by an average of 15.3 points ($p = 0.002$). Similarly, Williams et al. (2022) reported that peer-group education reduced recurrent hospitalization rates by 28% among CAPD patients.

Despite these promising findings, substantial heterogeneity exists in educational methods, intervention duration, outcome measures, and study quality, resulting in inconsistent evidence regarding the overall effectiveness of educational interventions. From both clinical and economic perspectives, effective educational programs have the potential to reduce peritonitis incidence, decrease hospitalization frequency, and improve patient self-management, thereby reducing the burden on healthcare systems (Rahmawati et al., 2025). Furthermore, appropriate education may enhance patient confidence, reduce anxiety associated with dialysis procedures, and improve overall quality of life (Rahmawati et al., 2025). This study aimed to systematically review the available evidence on educational interventions for patients undergoing continuous ambulatory peritoneal dialysis (CAPD), identify the most effective interventions and outcome measures, and highlight research gaps for future self-care education programs.

METHOD

This study employed a Systematic Literature Review (SLR) approach following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The PRISMA framework was selected to ensure that the processes of article identification, screening, eligibility assessment, and inclusion were conducted systematically and transparently, thereby minimizing potential bias. The review aimed to evaluate the effectiveness of educational interventions on self-care among patients undergoing Continuous Ambulatory Peritoneal Dialysis (CAPD).

Literature Search Strategy and Databases

A comprehensive literature search was conducted using four international databases: Scopus, ScienceDirect, PubMed, and Taylor & Francis. The search was limited to articles published between 2016 and 2026 to obtain the most recent evidence regarding self-care educational interventions for CAPD patients. The search strategy employed a combination of keywords and Boolean operators as follows:

("peritoneal dialysis") AND (education OR training) AND ("self-care" OR adherence OR knowledge OR "quality of life")

Identification and Screening Process

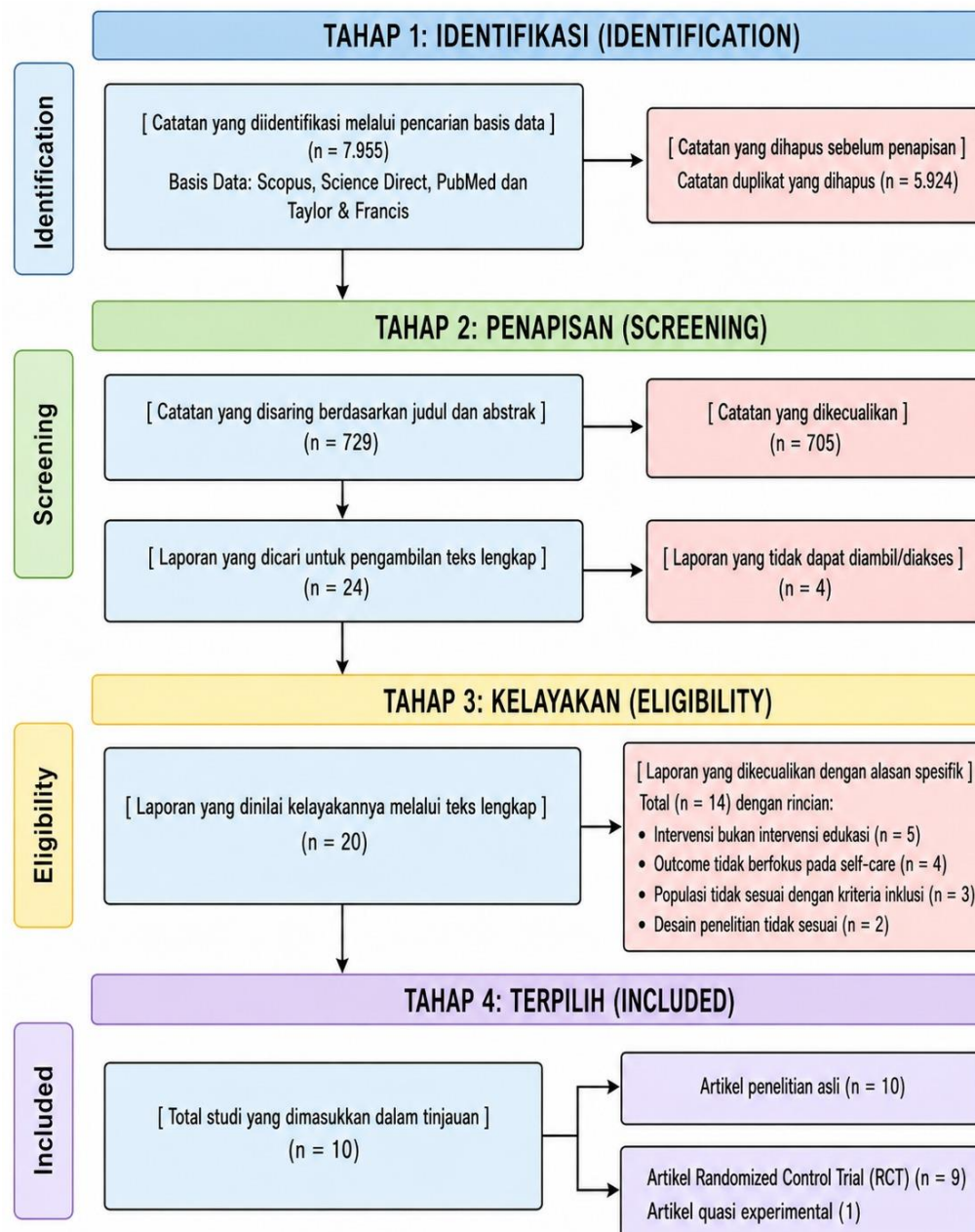
The initial database search yielded 7,955 articles ($n = 7,955$). Subsequently, preliminary screening was conducted by limiting the search to full-text articles, scholarly journals, English-language publications, and studies published between 2016 and 2026. Duplicate and irrelevant articles were removed, resulting in 729 articles eligible for title and abstract screening.

Following title and abstract screening, 24 articles met the eligibility criteria for full-text assessment. These articles were obtained from Scopus ($n = 13$), ScienceDirect ($n = 5$), PubMed ($n = 2$), and Taylor & Francis ($n = 4$). Articles excluded during this stage were those that did not address self-care educational interventions, involved inappropriate study populations, or failed to evaluate self-care outcomes.

Eligibility Assessment

The 24 full-text articles were assessed according to the predefined inclusion and exclusion criteria. During this stage, 14 articles were excluded because their study design did not meet the eligibility criteria, the intervention was not educational in nature, the outcomes were not focused on self-care, or the full text was unavailable.

Ultimately, 10 studies met all inclusion criteria and were included in the final systematic review. These studies consisted of articles indexed in Scopus ($n = 5$), ScienceDirect ($n = 2$), PubMed ($n = 1$), and Taylor & Francis ($n = 2$).



Bagan 1. PRISMA Flow Diagram of Article Selection

Inclusion and Exclusion Criteria

Studies included in this systematic review were published between 2016 and 2026 in national or international peer-reviewed journals. Eligible studies consisted of original research articles employing randomized controlled trial (RCT), quasi-experimental, pre-experimental, or other intervention-based study designs that evaluated the effectiveness of educational interventions on self-care among patients undergoing Continuous Ambulatory Peritoneal Dialysis (CAPD) or Peritoneal Dialysis (PD).

Included studies were required to report at least one self-care-related outcome, such as knowledge, self-care behavior, self-management, treatment adherence, self-efficacy, quality of life, or prevention of complications associated with self-management. In addition, articles had to be available in full-text format and published in either English or Indonesian.

Studies were excluded if they were review articles, systematic reviews, meta-analyses, editorials, conference abstracts, letters to the editor, study protocols, or case reports. Studies that did not use educational interventions as the primary intervention, such as pharmacological interventions, exercise programs, or clinical procedures without an educational component, were also excluded. Furthermore, studies that did not focus on self-care, knowledge, adherence, self-management outcomes, involved populations other than CAPD/PD patients, were unavailable in full-text format, or were identified as duplicate publications across databases were excluded from the review process. Studies with research designs that were not aligned with the objectives of this systematic review were also excluded from the final analysis.

Quality Assessment and Risk of Bias

Methodological quality assessment and risk-of-bias evaluation were conducted according to the study design of each article included in the review. Randomized controlled trials (RCTs) were assessed using the Revised Cochrane Risk of Bias Tool for Randomized Trials (RoB 2), while quasi-experimental and pre-experimental studies were evaluated using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist. The quality assessment indicated that most RCTs demonstrated a low risk of bias across key domains, including the randomization process, deviations from intended interventions, missing outcome data, and outcome measurement. However, several quasi-experimental studies showed a higher risk of bias, primarily due to the absence of control groups and the lack of randomization procedures. Overall, all studies included in this systematic review were considered to have acceptable methodological quality and were deemed sufficiently relevant to address the objectives of the review.

Tabel 1.
Risk of Bias Assessment for RCT Studies Using RoB 2

Article	Randomization Process	Intervention Deviation	Data Lost	Outcome Measurement	Selective Reporting	Global Risk
Cely et al. (2025)	Low Risk	Some Concerns	Low Risk	Some Concerns	Low Risk	Some Concerns
Chae & Kim (2024)	Low Risk	Some Concerns	Low Risk	Some Concerns	Low Risk	Some Concerns
Zhao et al. (2020)	Low Risk	Some Concerns	Low Risk	Low Risk	Some Concerns	Some Concerns
Chang et al. (2018)	Low Risk	Some Concerns	Some Concerns	Low Risk	Low Risk	Some Concerns
Zarmehri et al. (2018)	Some Concerns	Some Concerns	Low Risk	Some Concerns	Low Risk	Some Concerns
Chen et al. (2021)	Some Concerns	Some Concerns	Low Risk	Some Concerns	Some Concerns	Some Concerns
Lee et al. (2023)	Low Risk	Some Concerns	Low Risk	Some Concerns	Some Concerns	Some Concerns
Cao et al. (2023)	Low Risk	Some Concerns	Low Risk	Some Concerns	Some Concerns	Some Concerns
Xu et al. (2020)	Low Risk	Some Concerns	Some Concerns	Low Risk	Low Risk	Some Concerns

Tabel 2.
Methodological Quality Assessment for Quasi-Experimental Studies Using JBI Checklist

Article	Cause and Effect Clarity	Similar Participants	Control Group	Multiple Outcome Measurements	Complete Follow-up	Appropriate Statistical Analysis	Overall Appraisal
Law et al. (2019)	Yes	Yes	No	Yes	Yes	Yes	Moderate Quality

RESULT

Based on the PRISMA 2020 flow diagram, the article search process was conducted through four databases: Scopus, ScienceDirect, PubMed, and Taylor & Francis, resulting in a total of 7,955 identified articles. Following the identification stage, an initial screening was performed to remove duplicate and irrelevant articles, leaving 729 articles for the screening phase.

During the screening stage, articles were evaluated based on their titles and abstracts. Articles that did not align with the study focus, did not discuss educational interventions, did not involve CAPD patients, or did not assess self-care as an outcome were excluded. This screening process resulted in 24 articles being eligible for full-text assessment.

Subsequently, a comprehensive evaluation of the full-text articles was conducted according to the predetermined inclusion and exclusion criteria. At this stage, several articles were excluded because of inappropriate study designs, interventions that were not educational in nature, outcomes that did not focus on self-care, or the unavailability of complete full-text articles. After the entire selection process was completed, 10 articles met the eligibility criteria and were included in the systematic review. The PRISMA 2020 diagram demonstrates that the article selection process was conducted systematically and rigorously in accordance with PRISMA guidelines, ensuring that the studies included in this systematic review were the most relevant and methodologically sound.

Table 1.
Characteristics of the Reviewed Articles

No	Writer	Country	Research methods	Educational Intervention	Key Findings
1.	Cely et al. (2025)	Colombia	Open pilot randomized controlled trial (RCT), two parallel groups; 140 peritoneal dialysis patients (70 MyPD group, 70 standard care), 6-month follow-up.	MyPD mobile health app serves as a remote patient monitoring program. The app provides therapy education and information, self-monitoring (blood pressure, weight, glucose, ultrafiltration, urine output), therapy trends, therapy reminders/history, and patient-clinic communication through the Sharesource platform.	Use of MyPD significantly increased patient and clinic engagement. Clinic-to-patient communication was higher in the MyPD group (4.3 ± 5.2 vs. 1.2 ± 2.3 ; $p < 0.01$). App usability was excellent (MAUQ score 6.5 out of 7). There were no significant differences in peritonitis, hospitalizations, ED visits, preemptive visits, or dialysis prescription changes.
2.	Chae & Kim (2023)	South Korea	A randomized controlled trial (RCT) was conducted at a tertiary hospital in Jeonju. A total of 53 adult peritoneal dialysis patients were analyzed: an intervention group (n=27) and a control group (n=26). The intervention lasted for 10 weeks; the control group received usual care and one 20-minute leaflet education	The “PD With You” self-management application is based on Social Cognitive Theory and the ADDIE model. The materials include education on kidney disease and peritoneal dialysis, medications and diet, videos on sterile procedures and peritonitis prevention, quizzes, self-recording (weight, blood pressure, dialysis fluid, diet, exercise, medications), monitoring charts, reminders/alarms, and feedback from healthcare providers via text messages,	Compared to the control group, the app group experienced significant improvements in knowledge related to peritoneal dialysis, health behaviors, albumin, and hemoglobin ($p < 0.001$). Quality of life also improved in the domains of kidney disease symptoms/problems ($p = 0.046$) and the impact of the disease on daily activities ($p =$

No	Writer	Country	Research methods session.	Educational Intervention weekly phone calls, and monthly interviews.	Key Findings 0.005). There were no significant differences in self-efficacy, potassium, phosphorus, and the physical, psychological, and disease burden domains.
3.	Zhao et al. (2020)	China	A 6-month randomized controlled trial (RCT) at Shaanxi Provincial People's Hospital. A total of 203 chronic kidney disease patients on peritoneal dialysis were randomized to the intervention (101) and control (102) groups; the final analysis included 97 patients per group.	Omaha System-based ongoing nursing program: health education on peritoneal dialysis procedures, diet (high- quality protein, low salt, low phosphorus, potassium regulation), and medications; lectures and group discussions; self- management guidebook; weekly materials and videos via WeChat group; diet log; individualized diet counseling and recommendations by a nutritionist; monitoring via phone, clinic visits, and WeChat.	The nutritional status of the intervention group improved significantly: the proportion of well- nourished patients increased from 6.19% to 29.90%, higher than the control group (9.28%; $p < 0.001$), and severe malnutrition was lower (8.25% vs 26.80%; $p = 0.001$). Anthropometric parameters (BMI, TSF, MAMC, handgrip strength) as well as hemoglobin, albumin, and prealbumin increased significantly compared to the control group.
4.	Chang et al. (2018)	South Korea	A 24-month, multicenter, open- label, randomized controlled trial (RCT) with two parallel groups (TEACH study). A total of 104 new peritoneal dialysis patients were randomized to either <i>frequent retraining</i> (n=51) or <i>conventional</i> <i>retraining</i> (n=53).	Both groups received individualized initial training based on adult learning principles on peritoneal dialysis, aseptic technique/hand hygiene, fluid exchange, <i>exit site</i> <i>care</i> , diet, and complication management. The intervention group received additional periodic home visits for 1-hour retraining at months 4, 5, 6, 7, 8, 10, 12, 15, 18, 21, and 24; topics included exchange procedures, fluid balance, infection prevention, diet, medications, and problem- solving.	Frequent home retraining reduced the risk of <i>exit-site</i> <i>infections</i> and overall peritoneal dialysis- related infections over time compared with conventional training. In patients aged ≥ 60 years, the risk of a first peritonitis episode decreased significantly (adjusted HR 0.01; $p =$ 0.01). There were no significant differences in quality of life, hospitalizations, patient survival, or dialysis technique continuity.
5.	Sadeghi Zarmehri, Hassanzadeh, Aghebati, & Sharifipour (2018)	Iran	A randomized clinical trial with a <i>pre-test-post-test</i> <i>design</i> was conducted on 60 peritoneal dialysis patients at two dialysis centers in Mashhad. Patients were divided into a self <i>-regulation</i>	Both groups received routine education services. The self-care education group received four individual sessions (20–35 minutes, twice/week for 2 weeks) on peritoneal dialysis practices, hand hygiene and infection prevention, diet and fluid intake, and medication use;	Both interventions improved medication/care adherence in peritoneal dialysis patients over 6 weeks ($p < 0.001$). The total adherence score decreased— representing improved adherence—from 99.0 to 80.8 in the SRT

No	Writer	Country	Research methods	Educational Intervention	Key Findings
			theory (SRT) group (n=30) and a self-care education group (n=30). Compliance was measured before the intervention and 3 and 6 weeks after the intervention.	using videos and pamphlets. The SRT group received four individual sessions based on illness perception using <i>the Brief Illness Perception Questionnaire</i> ; the material was tailored to the patient's lowest perception domain, covering disease control, diet, medications, hand hygiene, infection prevention, symptoms, and complications.	group and from 87.4 to 78.3 in the self-care education group. SRT demonstrated superiority primarily in hand hygiene and infection control adherence ($p = 0.02$), while intergroup differences for dialysis practices, medication use, and diet were not significant.
6.	Chen et al. (2021)	China	A randomized controlled trial (RCT) was conducted on 105 peritoneal dialysis patients at a tertiary hospital in Wuxi. Participants were divided into a control group (n=35), a WeChat peer support group (n=35), and a face-to-face peer support group (n=35); 101 patients completed the 6-month follow-up.	The control group received monthly follow-up and individual health education. The intervention group received peer support from trained peritoneal dialysis patient volunteers, through WeChat groups or in-person meetings. The materials covered peritoneal dialysis knowledge/procedures, sterile technique and complication prevention, disease monitoring, diet and fluid management, physical activity, emotional support, communication with healthcare professionals, and experience sharing.	After 6 months, both peer support groups showed significant improvements in self-management skills compared to the control group, particularly in diet management, complication monitoring, emotional management, and social reintegration ($p < 0.01$). Biochemical parameters—prealbumin, hemoglobin, phosphorus, and calcium—also improved significantly in the intervention group. The face-to-face group showed better hemoglobin, phosphorus, and dialysis adequacy (Kt/V) than the control group at the end of the intervention; however, both forms of peer support were generally effective.
7.	Lee et al. (2023)	Hong Kong, China	-blind , randomized controlled trial (RCT) at two centers, involving 23 new peritoneal dialysis patients with cognitive impairment. Intervention ($n = 12$) and control ($n = 11$) groups; outcome assessors were blinded to group allocation.	The intervention group received a minimum of eight non-immersive virtual reality (VR) training sessions (1–2 times/week) using a computer and Leap Motion hand-held motion sensors. The program included video demonstrations, simulations of peritoneal dialysis fluid exchange procedures, step-sequence exercises, immediate visual–audio feedback, written/audio prompts, and automatic	The VR group demonstrated significantly better performance in the overall peritoneal dialysis exchange sequence ($p = 0.05$), particularly in the key critical steps ($p = 0.02$) and the final stage ($p = 0.03$). There were no significant differences in PD knowledge, self-efficacy, nurses' assessment of actual PD technique, memory,

No	Writer	Country	Research methods	Educational Intervention	Key Findings
				execution of correct steps if participants failed to respond. The control group received printed educational materials about CAPD; both groups continued to receive standard CAPD training by nurses.	or executive function. Eighty-nine percent of participants found VR helpful, and 100% would like VR to be integrated into conventional PD training.
8.	Cao, Hong, Ruan, & Lin (2023)	China	A single-center randomized controlled trial (RCT) of 94 peritoneal dialysis patients; participants were randomized to a <i>problem-based learning</i> (PBL) group and a traditional education group (n=47 each). The mean follow-up was 10.6 ± 1.5 months.	A PBL-based patient empowerment interaction model: six educational activities over one year in small groups (9–10 patients). Each 90-minute session includes multimedia learning (40 minutes), problem-solving discussions (30 minutes), peer education (10 minutes), and games/quizzes (10 minutes). The material is structured around peritoneal dialysis knowledge and patient self-management challenges, with patients encouraged to ask questions and share their experiences.	Compared with traditional education, PBL improved PD knowledge (91.19 vs. 84.33; $p < 0.001$), self-management skills (71.47 vs. 61.19; $p < 0.001$), quality of life, and patient satisfaction (98.21 vs. 90.78; $p < 0.001$). PBL also decreased anxiety (46.46 vs. 52.39; $p < 0.001$) and depression (45.80 vs. 49.95; $p = 0.01$).
9.	Xu et al. (2020)	China	A prospective, open-label, randomized controlled trial (RCT) was conducted at Peking University First Hospital. A total of 150 new peritoneal dialysis patients were randomized 1:1:1 to technique inspection, verbal education, or usual care ($n = 50$ each). Retraining was conducted for 2 years; the mean follow-up was approximately 44–51 months.	All patients received individual initial training on dialysis bag exchange and peritonitis prevention. The technical inspection group underwent practice bag exchange under nurse supervision every 2 months, with direct error correction. The oral education group received 2-monthly review of the material through a Q&A/interactive session based on the <i>Nurse Assessment Checklist</i> ; the control group received no retraining. The material covered hand hygiene, mask and headgear use, bag/fluid inspection, connection-disconnection techniques, and contamination prevention.	Retraining did not reduce the overall risk of first peritonitis compared with usual care. However, technical inspection significantly reduced the risk of non-enteric peritonitis compared with usual care (HR 0.33; 95% CI 0.12–0.92) and had a lower incidence (0.02 vs. 0.07 per patient-year; $p < 0.01$). Verbal education did not show a significant benefit on peritonitis compared with control.
10.	Law et al. (2019)	Hong Kong, China	A prospective, single-arm (<i>pre-post intervention study</i>) at a single peritoneal dialysis center. A total of 103 PD patients with extracellular fluid overload (overhydration ≥ 2 L) were recruited; 96 patients	A structured intervention protocol led by a renal specialist nurse, based on <i>bioimpedance spectroscopy</i> (BIS) screening, was used. Education/counseling included salt and fluid restriction, review of a 1-week dietary record, identification of high-salt/high-fluid foods and alternatives, identification	Overhydration volume decreased significantly by 0.96 ± 1.43 L at week 4 and 1.06 ± 1.70 L at week 12 ($p < 0.001$); improvements occurred in both the symptomatic and asymptomatic groups. Systolic blood pressure decreased significantly in the asymptomatic

No	Writer	Country	Research methods	Educational Intervention	Key Findings
			completed 12 weeks of follow-up. Patients were stratified into symptomatic and asymptomatic.	of habits that increase salt/fluid intake, and development of individual lifestyle changes. The symptomatic group also received short-term hypertonic dialysis cycles and PD regimen adjustments. Counseling lasted approximately 1 hour initially, then 15–30 minutes at weeks 4 and 12.	group (from 146.9 to 136.9 mmHg; $p = 0.037$). Knowledge of fluid control, adherence to salt/fluid restriction, and adherence to changes in daily habits increased at week 4 and persisted until week 12.

DISCUSSION

The findings of this systematic review demonstrate that educational interventions play a crucial role in improving self-care abilities, treatment adherence, and selected clinical outcomes among patients undergoing peritoneal dialysis. The identified interventions included individualized face-to-face education, retraining programs for dialysis techniques, peer-support interventions, mobile health applications, problem-based learning (PBL), virtual reality (VR)-based education, and structured nursing programs. Despite variations in intervention type and duration, most studies reported that structured, repeated, and patient-centered educational approaches produced more favorable outcomes than routine education or standard care.

Improvement in patient knowledge and self-management skills emerged as the most consistent finding across studies. Chae and Kim (2023) reported that the PD With You mobile application significantly enhanced patients' knowledge of peritoneal dialysis and health-related behaviors. Similarly, Cao et al. (2023) found that a problem-based learning model improved peritoneal dialysis knowledge, self-management abilities, quality of life, and patient satisfaction. These findings suggest that educational strategies that actively engage patients through problem-solving activities, self-monitoring, quizzes, and professional feedback are more effective than passive information delivery. Given that peritoneal dialysis patients perform most treatment-related activities independently at home, comprehensive understanding of dialysis procedures, dietary management, medication adherence, infection prevention, and complication recognition is essential.

Educational interventions were also found to improve treatment adherence. Sadeghi Zarmehri et al. (2018) demonstrated that self-care education based on self-regulation theory significantly enhanced adherence to dialysis procedures, medication use, dietary recommendations, hand hygiene, and infection prevention practices. Notably, the self-regulation approach appeared particularly effective in promoting hand hygiene and infection control behaviors. These findings indicate that successful educational programs should extend beyond information provision by addressing patients' perceptions of illness, motivation, behavioral barriers, and capacity for goal setting and self-evaluation.

Several studies highlighted the benefits of integrating technology into educational interventions. The MyPD application evaluated by Cely et al. (2025) improved communication between patients and healthcare providers while demonstrating high usability. Likewise, the PD With You application enabled patients to monitor body weight, blood pressure, dialysis fluid balance, dietary intake, physical activity, and medication adherence. Technology-based interventions allow patients to access educational resources repeatedly, monitor their health status regularly, and maintain communication with healthcare professionals without frequent clinic visits. However, the effectiveness of digital interventions may depend on patients' digital literacy, age, cognitive status, and family support.

Retraining in peritoneal dialysis techniques was identified as an important strategy for preventing infectious complications. Chang et al. (2018) found that periodic home-visit retraining reduced the incidence of exit-site infections and dialysis-related infections, particularly among older adults. Similarly, Xu et al. (2020) reported that direct technique inspection every two months reduced the risk of non-enteric organism peritonitis, although it did not significantly decrease overall peritonitis incidence. These findings suggest that direct observation and correction of procedural errors may be more effective than verbal instruction alone. Minor deviations in hand hygiene, mask use, connection-disconnection procedures, or equipment handling can substantially increase contamination risk and lead to peritonitis. Therefore, retraining programs should incorporate demonstrations, supervised practice, direct observation, and individualized feedback.

Social support-based interventions also demonstrated meaningful benefits. Chen et al. (2021) reported that peer-support programs delivered through WeChat or face-to-face interactions improved self-management skills, particularly in dietary management, complication monitoring, emotional regulation, and social reintegration. Peer support enables patients to learn practical experiences from others facing similar health challenges while enhancing motivation, confidence, and emotional well-being. This finding is particularly relevant because peritoneal dialysis patients frequently experience psychological burdens, lifestyle modifications, activity limitations, and concerns regarding treatment complications.

Educational interventions were further associated with improvements in nutritional and clinical parameters. Zhao et al. (2020) found that an Omaha System-based continuous nursing program improved nutritional status, hemoglobin levels, albumin, prealbumin, body mass index, and anthropometric indicators. Similarly, Chen et al. (2021) reported improvements in prealbumin, hemoglobin, phosphorus, and calcium levels following peer-support interventions. These findings indicate that dietary and fluid management education combined with regular monitoring, individualized counseling, and multidisciplinary support can help patients optimize nutritional intake and reduce the risk of malnutrition. Nutritional management remains a critical aspect of peritoneal dialysis care due to the risk of protein loss, electrolyte imbalance, hyperphosphatemia, and weight fluctuations.

In addition to nutritional outcomes, educational interventions contributed to improved fluid management. Law et al. (2019) demonstrated that a nurse-led structured intervention significantly reduced fluid overload at four weeks and sustained these improvements through twelve weeks. The intervention included education on sodium and fluid restriction, dietary assessment, behavioral modification, and fluid status monitoring using bioimpedance spectroscopy. Enhanced knowledge and adherence to fluid restriction were considered key factors contributing to improved hydration status. These findings emphasize the important role of nurses in delivering continuous education and supporting behavioral change among peritoneal dialysis patients.

Although most studies reported positive outcomes, some findings were inconsistent. Lee et al. (2023) found that VR-based training improved procedural sequencing skills but did not significantly affect knowledge, self-efficacy, cognitive function, or nurse-assessed procedural performance. Similarly, Cely et al. (2025) reported improvements in patient engagement and communication without significant reductions in peritonitis, hospitalization, emergency department visits, or dialysis prescription changes. These inconsistencies may be attributable to small sample sizes, short follow-up periods, or the multifactorial nature of clinical outcomes such as peritonitis and hospitalization, which are influenced by comorbidities, family support, healthcare quality, and long-term adherence.

Overall, this review suggests that educational interventions for peritoneal dialysis patients should be continuous, individualized, interactive, and tailored to patient needs. Effective education should

encompass not only knowledge transfer but also skills training, practical evaluation, motivation enhancement, self-monitoring, emotional support, and family or peer involvement. Combining face-to-face education, digital technologies, retraining programs, and nursing support may provide the greatest benefits in promoting self-management and preventing complications among peritoneal dialysis patients.

Several limitations should be acknowledged. The included studies varied considerably in study design, sample size, intervention duration, educational methods, and outcome measures. While some studies employed randomized controlled trial designs, others used single-group pre-post approaches. Furthermore, several studies included relatively small samples and short follow-up periods. Such heterogeneity limits direct comparison across studies and precludes definitive conclusions regarding the most effective educational strategy. Future research should employ large-scale randomized controlled trials with longer follow-up periods and standardized outcome measures, including peritonitis incidence, treatment adherence, quality of life, nutritional status, and hospitalization rates.

CONCLUSION

This systematic review demonstrates that educational interventions are beneficial in improving knowledge, self-management abilities, adherence to dietary recommendations, fluid restrictions, medication regimens, hand hygiene practices, and infection prevention among peritoneal dialysis patients. Various educational approaches, including retraining programs, self-care education, peer support, mobile health applications, problem-based learning, virtual reality, and structured nursing interventions, showed positive effects on both behavioral and clinical outcomes.

Structured, repeated, individualized, and interactive educational interventions appear to be more effective than routine education or one-way information delivery. Retraining programs involving direct practice and nursing supervision may reduce the risk of dialysis-related infections, while technology-based education and peer-support interventions can enhance patient engagement, self-monitoring, and psychosocial support.

In addition to improving self-care behaviors, educational interventions may positively influence nutritional status, hemoglobin and albumin levels, fluid management, blood pressure control, quality of life, anxiety, and depression. However, evidence regarding long-term clinical outcomes, including overall peritonitis incidence, hospitalization rates, and patient survival, remains inconsistent.

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