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REVIEW

Peritoneal Dialysis Patient Training Program to Enhance independence and Prevent Complications: A Scoping Review

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Background: Peritoneal dialysis (PD) training is essential to ensure patient independence and prevent life-threatening complications, such as peritonitis. The International Society for Peritoneal Dialysis (ISPD) recommends that every PD unit worldwide implement local PD training programs with the goal of improving self-care capabilities. This scoping review aims to give an overview of recent literature and recommendations on PD training programs aiming to improve the quality of care and outcomes for PD patients.

Methods: The literature search was conducted using the PC (Population, Concept) approach. The population of interest in this study is PD patients, and the study concept is the PD training program. Several databases were used to conduct the literature search, including PubMed, Science Direct, and CINAHL. The search process began from July 2022 until January 2023. The inclusion criteria for the search included research articles and recommendations.

Results: The search yielded 22 articles recommending training programs lasting from 5–8 days, with 1–3-hour sessions and a nurse-to-patient ratio of 1:1. A cumulative training time of 15 hours or more is recommended to enhance patient independence and reduce peritonitis rates. Home-based or in-unit PD training, conducted by experienced nurses using adult learning strategies, has shown significant value in improving self-care and preventing peritonitis. Evaluating training outcomes should encompass knowledge, skills, and attitudes, and the impact on peritonitis rates. Training programs should be flexible and consider physiological and psychosocial barriers to achieving the best results.

Conclusion: There are a variety of strategies for dialysis training concerning duration, session length, patient-to-trainer ratio, timing, methods, location, compliance, and the need for retraining. More evidence is needed to assess the impact of PD patient training programs on self-care capabilities and peritonitis incidence. Future studies should investigate the effects of training programs on compliance, self-efficacy, and patient and nurse perspectives.

Keywords: training program, peritoneal dialysis, chronic kidney disease, patient education, nursing

Introduction

The United States Renal Data System (USRDS) has reported that hemodialysis (HD) is the dominant form of Renal Replacement Therapy (RRT), with the number of HD users ranging from 111,000 to 113,000 over the course of four consecutive years up to 2018. Meanwhile, despite a yearly upward trend, the utilization of PD as a form of RRT only reached 18,631 cases. Evidence suggests that RRT is underutilized worldwide, particularly in low-to-middle-income countries, where RRT is often unavailable and inaccessible.[1] This data aligns with the findings of the Indonesian Renal Registry (IRR) 2018 report, which shows that HD is the most commonly used form of RRT in the country, and only 2% of patients use PD in the form of Continuous Ambulatory Peritoneal Dialysis (CAPD). A significant difference was found between PD and HD patients in Indonesia, despite the increasing end-stage-kidney-disease (ESKD) population. The percentage of patients using HD increased to 40% within five years, contributing to 98–99% of all dialysis patients.[2]

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PD is a well-established RRT option that is associated with several advantages, including the ability to preserve residual renal function, offer greater empowerment to patients and families, efficiently remove solutes and solvents, decrease the burden on neutering, improve survival rates and overall quality of life, which are comparable or even superior to those observed in HD.[3] However, PD is also associated with a number of risks of complications, including infectious and non-infectious complications that can lead to PD failure. Among infectious, peritonitis and catheter-related infections, such as exit-site or tunnel infection, are the most common causes of PD failure in patients undergoing CAPD. Non-infectious complications, such as catheter malfunctions caused by changes in catheter position, can also contribute to PD failure. The incidence of infection, including peritonitis, exhibits variability across developed and developing countries. However, the International Society for Peritoneal Dialysis (ISPD) recommends a peritonitis incidence rate of no more than 0.4–0.5 episodes per year for patients with risk factors, with the condition that no more than 80% of patients experience peritonitis within a given year.[4,5] Peritonitis is a significant predictor of PD technique failure, mortality, and method switching to HD.[6–9]

Patients undergoing PD, including CAPD, require robust self-care support to mitigate the risks of complications. ISPD has recommended guidelines for preventing peritonitis through optimal training programs. However, there is still uncertainty about the best methods, location, timing, and trainers recommended for effective PD training.[4,5] Given the importance of patient training in reducing the incidence of peritonitis and the discontinuation of PD, ensuring the adequacy of self-care support and training programs is paramount.[10,11] While several studies have identified risk factors for peritonitis, little attention has been paid to the role of PD training in reducing this complication. Several studies have recommended observing a suitable training program that improves patient outcomes, particularly in reducing complications such as peritonitis.[12–31]

The use of PD in Indonesia is hindered by various obstacles. These include the high cost of PD, lack of medical facilities and trained personnel, particularly in remote areas, and insufficient awareness and knowledge about PD among the community and healthcare professionals.[2] Additionally, there is no national standard for PD training, which leads to PD units conducting training programs based on their own practices and procedures. The training programs often lack specified durations or standardized nurse-to-patient ratio, and the training evaluation is either non-existent or performed with non-standardized formats. Moreover, the absence of structured home visits or telenursing programs hinders the assessment of patient compliance with PD procedures. These issues emphasize the need to develop and implement standardized PD training programs to ensure patient independence and prevent life-threatening complications such as peritonitis, in Indonesia. Thus, there is a need for current evidence-based guidelines and recommendations to optimize PD training programs. This scoping review identifies and summarizes recent literature studies and recommendations regarding PD training programs worldwide. The findings of this review can inform the development of a standardized and effective PD training program to improve the quality of care and outcomes for PD patients.

Method

The search and selection criteria used in this scoping review study are based on the recommendations of The Joanna Briggs Institute (JBI) in 2014 with the PC (Population & Concept) approach. The study population includes PD patients, and the concept is the training program. The question in the study refers to the PC component: "How is the self-care training program in Peritoneal Dialysis (PD) patients based on the existing literature?".

The literature sources were obtained from multiple databases, including PubMed, Science Direct, and CINAHL, with Medical Subject Headings (MeSH), used as an alternative search for articles (Table 1). The search process was conducted from the beginning of July 2022 until January 2023.

During the initial search for this study, the database was searched using the keywords "Population" and "Concept" for a limited period between 2002–2023, with full-text English articles only. The search results were imported into Mendeley, and duplicate results were removed using a reference tool. The screening process involved manually sorting the title and abstract to identify articles relevant to the research objectives. The articles that fulfilled the inclusion criteria, namely research articles and recommendations specific to the research questions, were included, while non-research letters, editorials, invited commentary, reviews, abstract-only articles, and other nonspecific articles about the PD training program were excluded. Disagreements were resolved through discussion with other authors. The next step involved a detailed analysis of the full text, resulting in 22 studies for inclusion. The review process is presented in a PRISMA diagram, as shown in Figure 1.

Table 1 Data Search

	Concept	Keyword	Mesh	Keyword Alternative
P (Population)	Peritoneal Dialysis (PD)	Peritoneal Dialysis (PD)	("Renal Replacement Therapy"[Mesh]) OR "Renal Dialysis"[Mesh]) OR "Peritoneal Dialysis"[Mesh] OR "Peritoneal Dialysis, Continuous Ambulatory"[Mesh] OR "CAPD"[Mesh]	(a) Renal Replacement Therapy, (b) Renal Dialysis, (c) Peritoneal Dialysis, (d) Peritoneal Dialysis, Continuous Ambulatory (e) CAPD
C (Concept)	Training	Training	("Training"[Mesh] OR "Training Programs"[Mesh] OR "Program, Training"[Mesh] OR "Programs, Training"[Mesh] OR "Training Program"[Mesh] OR "Education"[Mesh] OR "Educational Activities"[Mesh] OR "Activity, Educational"[Mesh] OR "Activities, Educational"[Mesh] OR "Educational Activity"[Mesh])	(a) Training (b) Training Program (c) Education (d) Educational Activity

Abbreviations: PD, Peritoneal Dialysis; CAPD, Continuous Ambulatory Peritoneal Dialysis.

Data Extraction

Standardized forms were used, which contained information such as the author, year, title, location, sample, and results. The results were then categorized based on the length or duration of the training program, trainer-to-patient ratio, timing, location, compliance, retraining, and home visits, as well as the qualifications of the trainer staff.

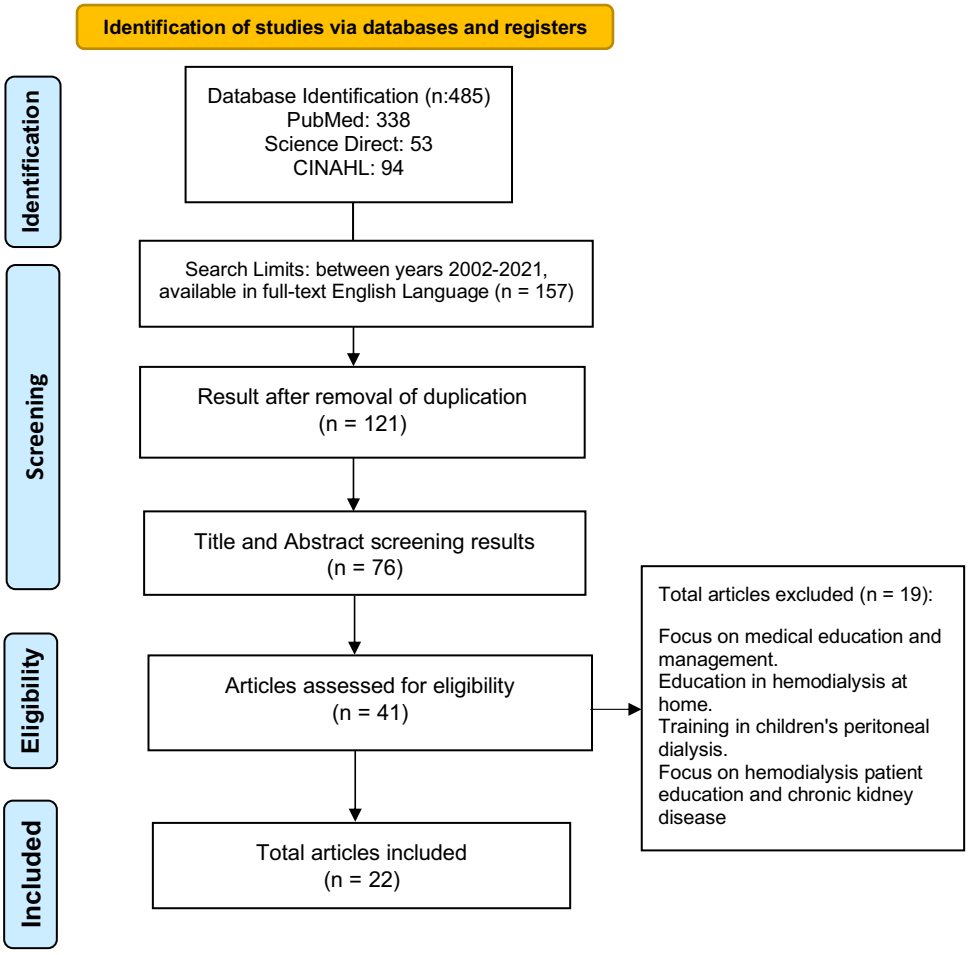

Figure 1 PRISMA literature search flowchart.

Result

Study Selection

The literature search for this study was conducted from July 2022 until January 2023. The initial search pooled 487 articles, after which 157 articles remained. After removing duplicates, 121 articles were eligible for screening based on their titles and abstracts. Subsequently, 76 articles were selected, and 41 underwent a feasibility assessment. Finally, 22 articles were deemed eligible and included in the study.

Characteristics of Study

The study includes 22 articles with the following designs: five prospective observational research articles, five retrospective observational articles, three articles on experimental studies, one article containing mixed-method, two articles on a randomized control trial, one qualitative article, one comparative article, one article on prospective cohort study, one article on the retrospective case-control study, one article on an international survey, and one article on training recommendations. The studies were conducted in various settings, including Europe (seven articles), America (one article), Latin America (two articles), Asia (six articles), the Middle East (one article), and a multi-centred study (4 articles). The characteristics of the included studies are summarized in Table 2.

Time and Duration of Peritoneal Dialysis Training

There are ten articles discussing training time. Four articles recommend a training duration of five days with a range of 1–3 hours/session,[11,14,45] and one article recommends seven days with a duration of 2 hours/session.[24] The cumulative recommended training hours are at least 15 hours.[13] One study mentions a duration of 5.1 ±1.5 hours per day or per session,[17] and one article reports 29 hours of training on adult learning concepts and 22.6 hours with conventional learning.[16]

Other studies conducted training for 7–8 days without specifying the number of sessions.[18] One article emphasizes that longer training leads to errors and a greater risk of complications.[40] Another study shows that the shortest training time is 2–3 days and the longest is > 7 days, but with short training hours, averaging 3.03 hours/day, and both durations show no risk of peritonitis.[44]

The Ratio of Nurse-to-Patient During Peritoneal Dialysis Training

Six articles discuss the nurse-to-patient ratio during PD training. Two of them suggest that the ratio of nurses has an insignificant impact on the incidence of peritonitis. Three articles recommend a 1:1 nurse-to-patient ratio, while the remaining articles suggest a larger ratio.[14,18,24,32,34,44]

Time of Training

Training time recommended before catheter insertion was reported in three studies.[14,23,40] One study found that more training was conducted 1–2 weeks after catheter insertion (78%), while the rest was carried out after catheter insertion or a combination of before and after catheter insertion, particularly in Japan.[44] Another article found greater benefits in combining training before and after catheter insertion.[40] Generally, training conducted before catheter insertion is recommended, but following local policy, it may be appropriate to consider training before and after catheter insertion. This aligns with the principle that PD training should not be done in patients with catheters to avoid the risk of infections during the training.

Training Strategy

Four studies recommend training with adult learning methods to achieve patient independence.[14,16,17,26] Such training should be adjusted based on the patient's ability and assessment of learning needs. In one article, conventional learning was compared with adult learning methods in terms of their effectiveness, cumulative duration, and incidence of peritonitis.

Table 2 Characteristics of the Included Studies

No.	Authors	Year	Title	Location	Study Design	Sample	Result
1.	Mehrotra et al[32]	2002	An analysis of dialysis training in the United States and Canada	United States and Canada	Descriptive Analytic Quantitative	67 Training Program	The nurse-to-patient ratio varies from 1:1 to 1:80, with an overall ratio of 1:6.7 in the US and 1:35 in Canada.
2.	Castro et al[33]	2002	Home training experience in peritoneal dialysis patients	Spain	Retrospective observational study	84 patients	Most patients have given positive feedback about home training, with only one patient refusing the presence of a nurse at home. Social conditions are crucial in determining whether PD patients will continue with CAPD. The incidence of peritonitis has significantly decreased since the implementation of home training programs. Home-based training is an effective tool to achieve all the skills in self-care, social environment, patient's psychological status, and adaptation process to PD. Home training is considered a crucial component and an effective approach.
3.	Hall et al[16]	2004	New directions in peritoneal dialysis patient training.	United States	Quasi-experimental	32 patients	Theory-based training methods for adults in the PG took longer (29 hours) in achieving patient's self-care ability compared to the CG, which used the conventional method (22.6 hours). The time required for retraining in the CG was 12.5 hours, and the PG was 8.7 hours. The peritonitis rate was lower in the PG (28.2 / 1000 patients/month) compared to the CG (36.7 /1000 patients/ month).
4.	Kavanagh et al[34]	2004	Peritoneal dialysis-associated peritonitis in Scotland (1999–2002)	Scotland	Prospective observational study	1205 patients	Nurse-to-patient ratio ranges between 1:7.1 to 1:29.8 and is not correlated with the risk of peritonitis.
5.	Bernardini et al[14]	2006	Peritoneal dialysis patient training	-	Guidelines / Recommendation	-	The ideal nurse-to-patient ratio for PD training is 1:1, which is considered better for achieving self-care abilities because it allows for more focus, better privacy protection, and more opportunities for discussion. However, the practice of one nurse training 2–3 simultaneously has not been studied. PD trainers should have PD certification, other relevant training, such as Training of Trainees (TOT), and training based on adult learning theory. The trainers themselves may be either experienced or inexperienced. Training is provided to patients and their families, relatives, partners, or caregivers. The training curriculum covers the basic concepts of CAPD, treatment procedures, complications, documentation of activities, hospital visits, and how to contact PD staff. Training can be conducted in the PD clinic, at the patient's home, at the hospital, or a location designated for PD training. Ideally, training sessions should be conducted in a dedicated room within the CAPD unit, with no other activities taking place. The duration of training should be adjusted according to the achievement of goals. Training strategies based on adult learning theory, including role-playing, are effective, while training involving catheters should be avoided.

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Table 2 (Continued).

No.	Authors	Year	Title	Location	Study Design	Sample	Result
6.	Bernardini et al[35]	2006	International survey of peritoneal dialysis training programs	United States, Canada, South America (Brazil, Columbia), The Netherlands, and Hong Kong.	International survey, Kruskal–Wallis was used to evaluate differences in responses, Associations between variables were tested with Pearson correlation, Univariate regression analysis was used to evaluate the impact		The mean duration of training is five days, but it is unclear whether training for 4 or more hours each day for 5 days per week is more effective than training for 2 or more hours each day for 10 days. Nurses are advised to record the total hours and days of teaching. Training before catheter insertion has been shown to have greater benefits, including a one-third reduction in peritonitis rates among South American and Hong Kong patients. The remaining patients were trained after catheter insertion or through a combination of pre-and post-insertion training.
7.	Russo et al[18]	2006	Patient re-training in peritoneal dialysis: Why and when it is needed	Italy	Prospective observational study	353 patients	The need to enhance knowledge to strengthen compliance through home visits and retraining is demonstrated, as there is a significant relationship between low adherence and the risk of peritonitis. The mean staff-to-patient ratio is 1:15, with the highest ratio being 1:8.4, and the lowest being 1:21.2. PD units that do not dedicate their staff specifically and do not make home visits are at greater risk of peritonitis, particularly when the training duration is 7–8 days. Peritonitis is more prevalent in PD units that do not dedicate specialized nursing care, lack PD training, lack adult learning programs, serve both PD and HD patients simultaneously, and do not conduct home visits. These conditions hinder the optimal development of self-care skills during the training program.
8.	Bordin et al[24]	2007	Patient education in peritoneal dialysis: An observational study in Italy.	Italy	Prospective observational study	150 Dialysis Centers	The training program consisted of 7 days, with an average session length of 2 hours and a 40% focus on theoretical aspects. The daily patient care for CAPD is conducted with an average patient-to-nurse ratio of 1:15 (ranging from 1:4–52). The ability of self-care dedicated to preventing peritonitis is associated with pre-dialysis education, home visits, and retraining, but not associated with the presence of specialized or trained personnel, nurse-to-patient ratio, and training time. The training was conducted by nurses (99.2%).
9.	Chow et al[17]	2007	Influence of peritoneal dialysis training nurses' experience on peritonitis rates	China	Retrospective observational study	200 patients	The mean training of PD persists for 5.1 ±1.5 hours. The trainers have an average of 4.9 years of experience (from 0.3 to 15.6 years) — A negative correlation was found between the trainer's experience and incidence of peritonitis. Active and continuous learning, as well as the application of applying adult learning principles, are key to effectively teaching patients in improving self-care abilities. It is important to develop nursing competencies, regardless of the level of experience gained during practice.
10.	Chow, Szeto, Leung et al[36]	2007	Adherence to the peritoneal dialysis training schedule	Single center Hong Kong	Prospective observational study	159 patients	A late arrival in over 20% of the PD training sessions is associated with a greater than 50% increased risk of future peritonitis, as indicated by an adjusted risk ratio of 1.56 (95% confidence interval, 1.02–2.39; P¼0.04).

11.	Kazancioglu et al[37]	2008	Can using a questionnaire for the assessment of home visits to peritoneal dialysis patients make a difference to the treatment outcome?	Turkey	Randomized controlled trial	32 patients	Effective training leads to a better understanding that significantly correlates with skills and abilities to adapt the environment for independent PD practice, resulting in a reduced occurrence of peritonitis. Based on the results of the home visit, peritonitis was significantly correlated with the "knowledge and abilities" score and the "environment" score. While training is important in PD practice, the environment at the dialysis center is equally critical, along with the patient's knowledge and acquired skills.
12.	Souqiyyeh et al[38]	2008	Effectiveness of a Separate Training Center for Peritoneal Dialysis Patients	Saudi Arabia	Retrospective observational study	376 patients	This emphasizes the significance of training an expert team conducts and the need to establish unified training standards. The duration of training is flexible, spanning up to 5 days, depending on the previous training on PD. The adoption of training patterns from the Baxter Renal Education Center (BREC) demonstrates its effectiveness in improving self-care capabilities such as compliance and outcomes to knowledge and skills. This method has also been shown to significantly reduce termination.
13.	Su et al[39]	2009	Promoting self-management improves the health status of patients having peritoneal dialysis	China	A pre–post design experimental group without a control group.	33 patients	To increase the patient's self-efficacy and self-management capacity, nurses should employ various tactics based on the self-efficacy theory.
14.	Barone et al[40]	2011	The importance of the Patient's training in chronic peritoneal dialysis and peritonitis.	Argentina	Retrospective observational study	90 patients	There was no significant difference between the number of training topics provided and the incidence of peritonitis. A higher level of education contributes to efficient training. Longer training sessions can increase the risk of mistakes and complications. Ongoing retraining is essential, and starting the training before catheter insertion has been shown to have a better impact.
15.	Gadola et al[41]	2013	Using a multidisciplinary training program to reduce peritonitis in peritoneal dialysis patients	Uruguay	Retrospective observational study	87 patients	Following the PDEP recommendation of 1:1 teaching in a comfortable environment can significantly reduce the incidence of peritonitis. The Objective Structured Assessment (OSA) has demonstrated that the program is well received. Compliance is a critical factor in determining the effectiveness of the training, and it has a direct or indirect impact on the incidence of peritonitis. Implementing multidisciplinary programs has been found to reduce overall peritonitis significantly. ($P < 0.05$)
16.	Martino, et al	2014	Home Visit Program Improves Technique Survival in Peritoneal Dialysis	Vicenza Italy	Retrospective case-control study	Case group: 96 patients Control Group: 92 patients	The home visit program has been shown to increase the survival rate of PD patients. It may reduce the incidence of peritonitis caused by Gram-positive bacteria and the need for hospitalization.

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Table 2 (Continued).

No.	Authors	Year	Title	Location	Study Design	Sample	Result
17.	Figueiredo et al[23]	2015	Impact of patient training patterns on peritonitis rates in a large national cohort study.	Brazil	Prospective observational study multicenter.	2240 patients	A high risk of peritonitis is associated with a low cumulative training time (<15 hours or 1–2 hours per session) with short training durations (<1 hour/day), as well as with longer training times (>2 hours/day). Training after catheter implantation time (>10 days post-implantation) is also associated with an increased risk of peritonitis. PD units with more experience have been found to have a lower risk of peritonitis (P=0.003). It is recommended to start the training 10 days before catheter insertion. The incidence of peritonitis reflects the extent to which the training method given enhances patients' independence, knowledge and ability to prevent peritonitis.
18.	Bergjan M, Schaepe C.[26]	2016	Educational strategies and challenges in peritoneal dialysis: A qualitative study of renal nurses' experiences	Germany	Thematic qualitative text analysis. Methods.	20 Nurse from 5 CAPD units	Nurses encountered education barriers. It is necessary to gain a more thorough understanding of affective learning objectives, and existing teaching methods and materials should be revised to consider the patient's perspective. Patients often feel overwhelmed when they return home; thus, adult learning concepts are needed, and flexibility must be applied according to the patient's condition. Training is still focused on skills and needs to improve training composition to improve knowledge and ensure compliance.
19.	Leung et al[30]	2019	The Effectiveness of an Evidence-based Continuous Ambulatory Peritoneal Dialysis (CAPD) Retraining Program to Reduce Peritonitis among Incident CAPD Patients	Hong Kong	Quasi-experimental	160 patients	The CAPD retraining program is important for observing, enhancing, and evaluating patients' self-care abilities. Patients who were not retrained showed a twofold higher trend in exit-site infection. Participation in CAPD retraining programs resulted in shorter hospital stays, fewer emergency department visits, and increased cost-effectiveness. Thus, CAPD retraining program leads to lower incidence rates of peritonitis.
20.	Pungchompoo et al[42]	2020	Effectiveness of a self-management retraining program improving the quality of life of people receiving continuous ambulatory peritoneal dialysis.	Thailand	Mixed-methods	41 patients	People receiving CAPD benefited from retraining programs regarding self-management, self-efficacy behaviors, and health-related quality of life.
21.	Xu et al[43]	2020	Prevention of peritoneal dialysis-related peritonitis by regular patient retraining via technique inspection or oral education: A randomized controlled trial	Peking University First Hospital	Randomized controlled trial	150 patients	The technical inspection group, oral education group, and usual care group (n=50 for each group) were followed up for 47.5 ± 22.9 months. Peritonitis occurred more frequently in the group the usual care group (0.07/patient-year) compared to the infection control group (0.02/patient-year; P < 0.01) and oral education group (0.06/patient-year). Although there is a risk of infection, the method is more effective in reducing peritonitis. There was no significant difference between the groups in all-cause mortality or transition to hemodialysis.

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22.	Cheetam et al[44]	2022	International peritoneal dialysis training practices and the risk of peritonitis	Australia and New Zealand, Canada, Japan, Thailand, the United Kingdom, the United States	Prospective Cohort Study	1376 patients	Training is most often done in health facilities (81%), by nurses (87%), using a 1:1 training ratio (79%). In the UK, most healthcare facilities receive training from qualified PD nurses and outside experts, associated with a reduced risk of peritonitis compared to training solely by PD nurses. Training duration varies widely, with the shortest training conducted in England over 2–3 days and the longest in Japan for > 7 days but with shorter training hours of 3.03 hours/day on average. The majority of training is done 1–2 weeks after catheter insertion (78%). There is no evidence to support an association between peritonitis risk and the timing, location, duration, or method of PD training. All training methods in this study demonstrate that the improvement of patients' self-care abilities depends on individuals' capacity to effectively receive the provided training.

Abbreviations: PD, Peritoneal Dialysis; CAPD, Continuous Ambulatory Peritoneal Dialysis; PG, experimental group; CG, Control Group; TOT, Training of Trainees; PDEP, Peritoneal Dialysis Education Program; OSA, Objective Structured Assessment.

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Training Location

Four articles discuss the PD training locations, in which one explains that larger and more experienced dialysis locations provide more significant benefits in reducing peritonitis.[14,23,33,44] Another recommendation offers more comprehensive options for training locations, though it does not specify which is better. In contrast, one study observed more benefits when training was conducted in the patient's home,[33] while another study found that more training was conducted in healthcare facilities, with no evidence to support peritonitis.

Compliance, Retraining, and Home Visits

Six articles found that home visits and retraining can reduce peritonitis related to compliance, knowledge, and skills from training outcomes.[18,24,33,37,43,46] One other article found that training is associated with compliance and the incidence of peritonitis.[41] One study examined that non-compliance with training schedules, such as late arrival, can increase the risk of peritonitis.[17] Two articles found that retraining is linked to decreased peritonitis, hospitalizations, and low ER visits.[16,30] Two other articles resulted in training with reasonable strategies to improve self-efficacy, which leads to adherence during home care.[39,42] One RCT found that retraining through monitoring the engineering inspection group, the oral education group, and the ordinary treatment group showed that the peritonitis clearance time for the groups with infection and oral education had a lower risk than regular treatment and those who were transferred to hemodialysis. All causes of death did not differ significantly between groups.[43]

Trainer Staff Qualifications

Six articles specifically mention the qualifications of trainer staff.[14,17,18,24,44] The trainer must have PD certification and supporting training certification for the healthcare worker. All articles discuss the correlation between a trainer's certification and experience in improving a patient's self-care abilities and reducing the incidence of peritonitis.

Discussion

Time and Duration of Peritoneal Dialysis Training

The included study provides an overview of the initial training time for PD patients with varying durations of independence. The use of adult learning methods for initial training may take longer, but it is considered effective and can result in shorter retraining times in achieving patient independence and reducing peritonitis.[16] The duration of training per session will determine how long the training is conducted. The recommended duration ranges from 1–3 hours per session, with a total training duration of more than 15 hours spread over 5–8 days, according to ISPD and numerous studies. This has been shown to improve independence outcomes and reduce peritonitis rates.[13,17,24,35,47] However, longer sessions and durations (>13 sessions) are statistically significant risk factors for higher peritonitis risk but are not associated with shorter permanence in PD.[48]

The important role of patients is found in training programs that are conducted within a duration of fewer than 5 days, with flexible session durations and topics in accordance with ISPD recommendations, in order to achieve independence. The importance of repeated training and adherence to ISPD standards was found in studies with a total training duration of 25–40 hours per week.[49] Other studies showed that there was no significant training duration associated with a reduction in the risk of peritonitis.[24,44] Similarly, the timing of training initiation, training duration, location, or use of competency assessment did not predict the risk of peritonitis.[24] However, they were associated with pre-dialysis education, home visits, and retraining.

The duration of training can affect the effectiveness of a program in achieving self-care abilities, as it is related to changes in patient's physiological conditions, boredom, and decreased patient concentration, which can increase the risk of errors in the learned procedures.[23] A study showed that the shortest training duration was 2–3 days, while the longest was over 7 days, but with shorter training hours, averaging 3.03 hours per day. Neither duration showed a risk of peritonitis while yielding similar improvements in self-care abilities.[44] A flexible 5-day training program with variable training durations based on the patient's condition and prior independent PD knowledge was found to be effective.[38] Nearly all studies regarding training duration provided insights into outcomes such as peritonitis and self-care abilities.

Longer training periods with manipulation of patient catheters increased the risk of peritonitis.[38] All training durations should be adapted based on the assessment of training needs and the achievement of goals in attaining patient independence.[4,45]

The duration, timing and session length of the training will be adjusted according to each individual patient and the unit's experience in providing training. Assessment of patient needs during training recommended ISPD using the VARK instrument (Visual, Aural, Read/Write & Kinesthetic).[50,51] Training time may also differ for the elderly population, people with comorbidities, and those with a low educational status who may require longer training to acquire self-care skills due to the higher risk of peritonitis.[11] Many studies have shown that elderly age (>65th) is a risk factor for peritonitis.[44] Other studies have found that training for parents, patients with comorbidities, and those with low educational status requires longer training to achieve self-care abilities and is more likely to develop peritonitis.[11] It is also necessary to consider specific issues related to the aging process, such as weakness, dementia, loneliness, vision and hearing impairments, cognitive dysfunction, and mobility issues.[45]

ISPD has provided recommendations to increase studies related to training programs, especially regarding the number of training hours per day, total hours, and teaching days. Studies are also recommended to accommodate the local uniqueness of each unit to be developed and report on its results, primarily related to the incidence of peritonitis and exit site infection. Nevertheless, ISPD emphasizes that not only the time, pattern, and criteria of training alone are important but also the achievement of the educational objectives of the planned program to achieve patient independence and prevent peritonitis.[4,5]

The Nurse-to-Patient Ratio During Peritoneal Dialysis Training

Training has become an essential responsibility of nurses, with 99.2% of training being performed by them.[24] Training should be conducted in a comfortable and private setting, ensuring nurses are not disturbed during training.[41] A 1:1 ratio of nurse-to-patient has shown better outcomes in achieving self-care abilities, which is associated with increased focus, privacy and more opportunities for discussion.[32,35,45] Additionally, the dedication of nurses solely serving PD patients, without concurrent HD services, has shown superior outcomes in improving self-care abilities and reducing peritonitis.[45,52] However, other studies have found no relationship between the nurse-to-patient ratio and the dedicated self-care abilities for preventing peritonitis.[24,34]

Time of Training

The optimal timing for PD training is 10 days before catheter placement, as the incidence of peritonitis increases with training conducted 10 days or more after catheter insertion.[23] It is not recommended to provide training for patient independence directly on an already placed catheter when the patient has not been confirmed to be capable of performing self-care. Training that begins with simulation on a manikin is recommended in the ISPD syllabus, and direct self-care of the catheter is performed once the patient has been deemed capable during the simulation phase.[4] Consideration should be given to the risk of infection when manipulating the catheter for learning purposes, and the patient's readiness to cope with the new condition of self-care should be prepared in advance. While early training for CAPD is recommended, adherence to proper procedures is important in preventing the risk of infection.

Training Strategy

The adult learning method is more effective for training patients in PD. This method focuses on patients' abilities, needs, and responses, providing them with a comfortable and easily understood learning experience. The ultimate goal is to improve the patient's adherence to the procedure and reduce infection-related complications, particularly peritonitis. In adult learning, it is crucial to prioritize relevant and updated information that can be applied relatively quickly and facilitate changes in patients' knowledge and behaviors to support their health.[23]

Training initiation with adult learning principles yields good self-care abilities and lower rates of peritonitis.[17] Trainers should be willing to develop appropriate training skills based on adult learning principles.[16,17,26,35] PD training can be provided to the patient themselves, family members, relatives, partners or third-party caregivers, depending on the capabilities of the patient and their family. Other studies have shown that training programs conducted by a third party

connected with PD nurses yield better results in improving self-care.[38] Patients should be facilitated to determine their own learning pace. When training individual patients, nurses should consider the response to uremic impacts and other medical conditions that may hinder training.[4,22,45] A study of 280 PD patients found that 33.9% required assistance, particularly due to physical (62.1%) or operational (66.3%) disabilities, and showed better outcomes. Patients who had barriers to PD self-care but still performed PD without assistance and were older exhibited a higher prevalence of diabetic nephropathy and PD-related infections, lower educational levels, and lower serum albumin ($p < 0.05$).[53]

The focus of patient self-care training is to increase knowledge and the ability to perform fluid exchange procedures, exit site care, and ensure an attitude conducive to preventing complications.[4] Therefore, a safe, effective, and well-planned training program should be prepared by the PD unit to train patients.[13,35] Patient self-care abilities can be obtained through structured training patterns or criteria to enhance knowledge, skills, and attitudes.[54,55] Poorly performed self-care procedures such as skipping the use of masks and other standard procedures are independent risk factors for peritonitis.[9,21]

A training program utilizing computerized guidelines (Cycler Training Curriculum) can achieve the goal of increasing patient independence, even in the presence of barriers such as physical disabilities, differences in education, and technical experience in computer or technology usage.[56] Guidance from the PD team is an essential part of achieving the goal of improving self-care abilities. All of these conditions indicate that the acceptance of training program patterns or criteria is highly influenced by the capabilities and involvement of individual participants, companions, or family members, as well as the competencies of the trainers themselves.[35,44,54,57]

Various media such as video playback, booklets, and manikins greatly facilitate the accelerated improvement of patient self-care abilities, particularly during training intervals or when training is conducted. Several concept-or-theory-based learning approaches, such as the Health Belief Model (HBM)[58] and Orem's nursing theory,[59,60] have been proven to enhance knowledge, skills, attitudes and create a supportive environment for PD patients' self-care at home.

Study Location

The study can be conducted at various locations, such as PD clinics, hospitals, patients' homes, or appropriate areas facilitated with PD training, ideally in a specialized room in the CAPD unit.[15] A larger HD unit contributes to a lower risk of peritonitis as experienced units have implemented good standards and have trainers with capable skills who handle more frequent and complex cases and procedures. In the absence of a home visit, training in patients' homes is crucial to ensure a safe environment, including a safe place for a procedure, sanitation, lighting, and air circulation. Home visit-based training has shown better results in evaluating compliance and self-care by enhancing knowledge and skills.[11,33,37]

Compliance, Retraining, and Home Visits

The training program is believed to improve compliance, self-efficacy, and quality of life in PD patients.[39,41,42] Studies have shown that adherence and compliance can be improved through initial training programs, and the need for retraining can indicate areas where patients require further education. Compliance can be assessed through home visits or hospital visits. Retraining will be shorter in duration for patients who have received comprehensive initial training using adult learning methods.[16] Retraining programs can help improve self-care abilities, especially in patients with specific barriers.[49] Retraining program is believed to play a major role in reducing the risk of peritonitis and enhancing self-care abilities.[61] These findings are consistent with other studies that have found a relationship between home visits and retraining with dedicated self-care abilities to prevent peritonitis.[24]

Long-term therapy can cause fatigue and procedural errors leading to complications, making the maintenance of retraining programs crucial for patient safety.[40] The ISPD recommends retraining for patients undergoing extended hospitalization, post-peritonitis, altered mental status, changes in the products used, completion of the CAPD program after HD, and catheter infection. The recommendations are in line with the guideline from the United Kingdom, which recommends patients must undergo retraining every year or more frequently if there is associated with infection.[14,23,62] Home visits are essential for observing practical procedures, assessing compliance, and creating a supportive environment. An article by Bordin et al (2007) stated home visit correlates with a lower peritonitis rate. Schaepe et al (2015)

found improved training outcomes through home visits. Home visits determine the need for retraining in reducing various complications, including peritonitis, and became part of observing observational procedures of action, environment, and psychosocial support.[16,18–21,23,30,42] Another study that the importance of home visits to ascertain the weakest point in patients in carrying out PD procedures.[63] Video training is also an effective alternative that can significantly reduce the number of home visits.[64] Once training is complete and the patient begins PD, home visits by PD nurses are critical for detecting compliance with all procedures taught in training and reducing the risk of peritonitis.[5,24] In conclusion, home visits are an important tool for observing technique procedures, assessing compliance, and improving training outcomes, ultimately reducing the risk of peritonitis.

Trainers Staff Qualifications

All of the selected studies emphasize the importance of trainers having basic PD training and specialized training for teaching PD patients using the adult learning method to lower the risk of peritonitis and enhance patient independence. While trainer experience is essential, active training of nurses is necessary to maintain their competence in teaching PD patients, as this competence cannot be solely acquired through experience alone.[17] Some studies measure experience in terms of years worked, but the selected studies define experience as the duration of work in a specialized PD unit.

The qualifications of the nurses should also be seen by who is training them. As described in some studies in China and Hong Kong, there is a different impact with junior and senior trainers, where senior nurses will serve patients with more complicated conditions, and vice versa. The involvement of third-party nurse trainers was implemented in the United Kingdom, which showed a decrease in the peritonitis rate. However, the training is mainly conducted by nurses working in PD units (87%).[44] Nonetheless, some recommendations and studies acknowledge the limitations of PD nurses who may lack competence and training in adult education.[40] It is essential to qualify competent staff in conducting training evaluations to identify training programs, obstacles, and ways to overcome them by the medical and nurse care team.[65]

However, other studies have found a negative relationship between trainer experience and self-care abilities as well as the incidence of peritonitis, emphasizing the importance of training for nursing staff.[17] Therefore, training and retraining are needed for the CAPD team to improve their experience and skills so that CAPD can become a more acceptable modality of RRT with better outcomes.[7]

Conclusion

Our review included a total of 22 training programs for PD patients to achieve self-reliance. Despite current training recommendations, the study showed variations in PD patient training program strategies, and various outcomes regarding the incidence of peritonitis were observed across studies. Several studies and ISPD recommendations acknowledge the lack of evidence regarding training criteria or patterns. Therefore, existing recommendations can serve as a starting point for PD centers to develop relevant training patterns that suit their local unit conditions. These patterns should aim to achieve the same training objectives and include evaluations of their impact on self-care abilities and various complications, including peritonitis. Home visits are considered the best method for assessing knowledge and compliance with procedural practices and identifying the need for retraining. Additionally, the peritonitis rate is an important indicator to evaluate training effectiveness in the long term. The findings of this review highlight the importance of developing an evidence-based PD training program that can be implemented in countries that have not yet established standardized PD training programs, such as Indonesia. By implementing a well-structured training program, patients can achieve independence and minimize life-threatening complications such as peritonitis, leading to better patient outcomes.

Recommendation

More studies need to be conducted to look for various patterns of PD patients' self-reliance training and their impact on complications, compliance assessments, and self-efficacy. The effectiveness of local training programs and combinations with ISPD recommendations need to be evaluated for evidence in the future. The perspectives of patients and trainers will help provide an overview of the direct and indirect effects of PD training programs on various risks of PD complications.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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