



Targeted Education ApproaCH to improve Peritoneal Dialysis Outcomes (TEACH-PD): A feasibility study

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Abstract

Background: There is substantial variation in peritonitis rates across peritoneal dialysis (PD) units globally. This may, in part, be related to the wide variability in the content and delivery of training for PD nurse trainers and patients.

Aim: The aim of this study was to test the feasibility of implementing the Targeted Education ApproaCH to improve Peritoneal Dialysis Outcomes (TEACH-PD) curriculum in real clinical practice settings.

Methods: This study used mixed methods including questionnaires and semi-structured interviews (pretraining and post-training) with nurse trainers and patients to test the acceptability and usability of the PD training modules implemented in two PD units over 6 months. Quantitative data from the questionnaires were analysed descriptively. Interviews were analysed using thematic analysis.

Results: Ten PD trainers and 14 incident PD patients were included. Mean training duration to complete the modules were 10.9 h (range 6–17) and 24.9 h (range 15–35), for PD trainers and patients, respectively. None of the PD patients experienced PD-related complications at 30 days follow-up. Three (21%) patients were transferred to haemodialysis due to non-PD-related complications. Ten trainers and 14 PD patients participated in the interviews. Four themes were identified including use of adult learning principles (trainers), comprehension of online modules (trainers), time to complete the modules (trainers) and patient usability of the manuals (patient).

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Conclusion: This TEACH-PD study has demonstrated feasibility of implementation in a real clinical setting. The outcomes of this study have informed refinement of the TEACH-PD modules prior to rigorous evaluation of its efficacy and cost-effectiveness in a large-scale study.

Keywords

Adult learning principle, competency assessment, peritoneal dialysis, qualitative, training

Introduction

There is an increasing number of people developing end-stage kidney disease (ESKD) requiring kidney replacement therapy every year.^{1,2} Most patients with ESKD require dialysis – either haemodialysis (HD) or peritoneal dialysis (PD). Compared with HD, patients on PD may have better opportunities for rehabilitation, return to work, flexibility in dialysis schedules, time and cost savings from reduced travel to dialysis centres and improved quality of life.^{3,4} Survival on PD is comparable to HD while also being less costly with estimated per-patient dialysis costs of around AU\$53,000 per year for PD compared to AU\$79,000 for unit-based HD.⁵ Despite these advantages, the uptake of PD has been diminishing worldwide^{1,6} including in Australia, where the rates have decreased from 32% of the total dialysis population in 1995 to 19% in 2016.^{7–11}

The PD peritonitis and PD technique failure rates in Australia are higher than many other countries with resultant poor retention of PD.¹² Peritonitis, a major catheter-associated infectious complication of PD, directly contributes to 65% of PD technique failures and 7% of deaths.¹³ Peritonitis has also been associated with an increased risk of mortality for up to 6 months after an episode.¹⁴

There is substantial variation in peritonitis rates across units globally, such as in Australia, France, New Zealand, Scotland, Taiwan and the United Kingdom.^{15–22} This may be predominantly attributable to centre-related factors such as PD training practices.²³ A recent survey on training practice across Australian PD units demonstrated wide variability in training practices, content of the education and its delivery, which is consistent with international studies.^{23–27}

To improve consistency of evidence-based training delivery, Targeted Education approach to improve Peritoneal Dialysis Outcomes (TEACH-PD) training modules were developed by a core group of renal nurses, doctors, educationalists and consumer representatives in line with the International Society for Peritoneal Dialysis (ISPD) guidelines, using modern adult learning principles, which have been shown to enhance effectiveness of learning.²⁸

This feasibility study aimed to assess the acceptability and usability of the TEACH-PD training implementation targeted at PD trainers and patients in two PD units over 6 months.

Method

This study was registered with the Australian New Zealand Clinical Trial Registry (ACTRN12617001012369p), and

the study protocol was approved by the Hunter New England Human Research Ethics Committee (HREC/17/HNE/423). All participants provided written informed consent prior to trial participation.

The TEACH-PD feasibility study was an investigator-initiated, dual centre, non-randomised study of a standardised education training programme for PD trainers and their patients. The study was conducted in two Australian PD units in New South Wales, Australia (The John Hunter PD Unit, Charlestown and the Wollongong Hospital PD Unit, Wollongong; Figure 1). The Trial Steering Committee conceived, designed and supervised the trial and the data analysis plan. Site investigators and their PD trainers collected the patient data at each site.

Study populations

All PD trainers ($n = 10$) from the two participating PD units involved in training new PD patients during the trial period were invited to participate in the feasibility study. Since sites participating in the feasibility study would subsequently be ineligible to participate in the larger study as they had been exposed to the intervention, it was important to select a relatively small number of feasibility sites that were sufficiently diverse to allow generalisability. The two sites purposively selected conferred sufficient diversity of setting (metropolitan vs. regional and breadth of trainer experience to permit this).

Prior to commencing TEACH-PD training modules, the trainers were required to demonstrate nursing-level understanding of all clinical content areas, including a combination of theory-based and practical knowledge relevant to the PD training environment and the nurse trainer's role. To demonstrate this nursing-level understanding, the trainers completed a multiple-choice test (20 questions, pass rate 90%) prior to commencing TEACH-PD training modules. A trainer was not eligible to commence the modules until they had achieved a 90% pass rate of the multiple-choice test.

The TEACH-PD feasibility study also included adult (18 years or over) incident (first-time) PD patients (at least one patient trained by each PD trainer) due to commence PD training for the first time and were willing to be trained by a TEACH-PD-accredited PD trainer using the TEACH-PD training manuals designed for patients.

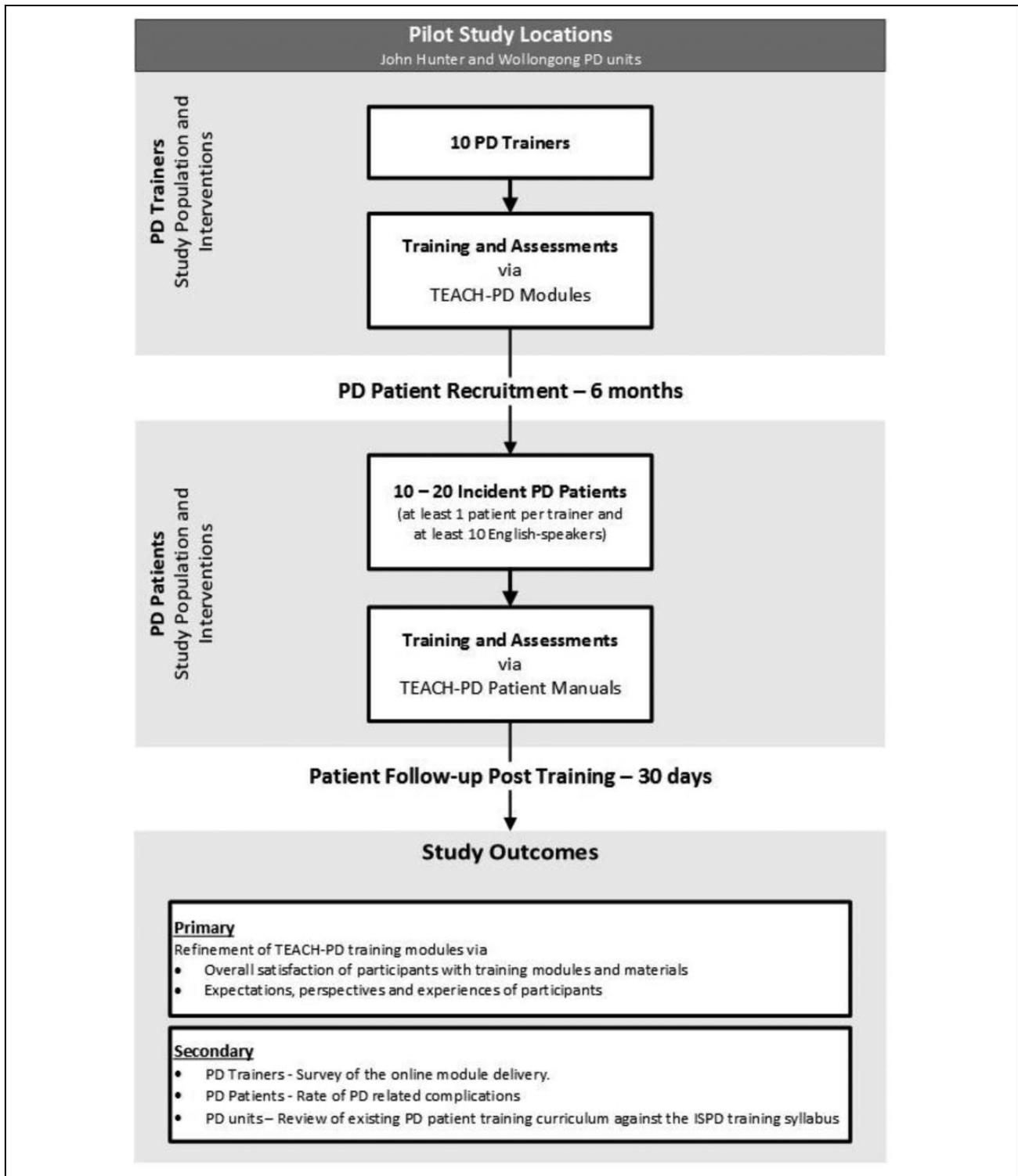


Figure 1. Study schema.

Study intervention

TEACH-PD trainer modules for PD nurses

The TEACH-PD training modules have been developed as a standardised, evidence-based curriculum for PD trainers and patients aligned with ISPD guidelines, utilising modern

adult learning principles and best practice pedagogy and including a large number of multidisciplinary stakeholders from different backgrounds.²⁹ The first two modules considered the principles of home PD training, including an overview of the organisational needs, an overview of the clinical practice for home dialysis training and the learning

TEACH-PD (Train the Trainer for Peritoneal Dialysis) | Modules > Module 1A: Home Dialysis Training - An Overview (New)

MODULE 1A. HOME DIALYSIS TRAINING - AN OVERVIEW (NEW)

1. Introduction	+
1.1. Educational philosophy	+
1.2. Structure of the programme	+
1.3 Learning outcomes for this module	-

On completion of this module you will be able to:

- List the six optimal attributes demonstrated by a home dialysis trainer.
- State the six key components that comprise an effective home dialysis training programme.
- Describe the strategic intent of education for patients provided before, during and after the home dialysis training process.
- List seven important factors that contribute to an optimal home dialysis training environment.
- List six barriers or influences that may impact on patients during home dialysis training.
- For three specific patient barriers, describe practical approaches you might take to minimise their impact on patients during home dialysis training.

Figure 2. Online modules for TEACH-PD trainers (screenshot). TEACH-PD: Targeted Education approach to improve Peritoneal Dialysis Outcomes.

Assessments

Assessment

The Home Dialysis Train-the-Trainer Programme is assessed progressively upon completion of each module and throughout the programme.

The programme utilises a combination of:

- Multiple-choice questionnaires
- Case study-based assessment
- Competencies-based assessment.

You can review the [Participant handbook](#) for more information. Access the Module assessments using the links in the table below.

Assessment	Module	Type	When to complete	Pass rate
Pre-assessment	Pre-requisite knowledge	Multiple-choice questionnaire 20 questions	Before starting Module 1a	90%
Revisions			After	

Figure 3. Online modules reassessment for TEACH-PD trainers (screenshot). TEACH-PD: Targeted Education approach to improve Peritoneal Dialysis Outcomes.

process, as it applied to personalised home training (Figure 2). The remaining two modules are clinical case studies with scenarios and issues that the trainer may encounter during home dialysis training.

All electronic modules in the programme applied a conversational approach, modelling the patient-to-trainer (or learner-to-teacher) feedback cycle consistent with optimal learning processes.³⁰ Each stage of the modules included an online multiple-choice assessment, which required successful completion before proceeding to the next module (Figure 3).

TEACH-PD patient manuals

Two manuals were delivered, one prior to PD training commencement and one during PD training.²⁹ Once patients were planned for PD, they were provided with 'PD Patient Training Manual 1: Getting Ready for Peritoneal Dialysis', which had been designed to prepare patients for PD training (Figure 4). Once PD training had commenced, 'PD Patient Training Manual 2: Peritoneal Dialysis Training and Competencies' was used to guide training and was provided for patients to use as a reference guide.

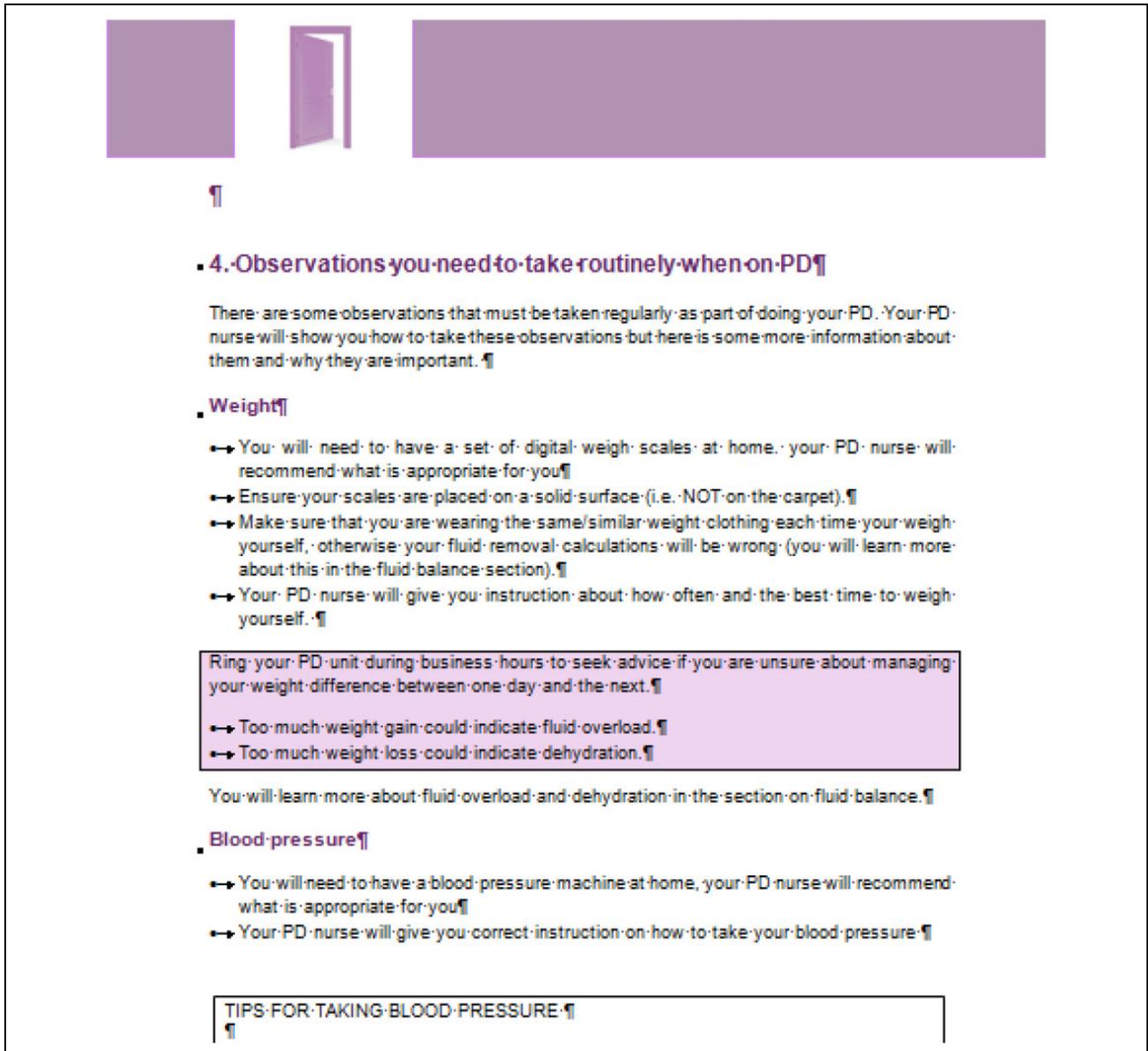


Figure 4. Sample of the patient training manual (screenshot).

This manual does not replace the information the patient receives from the PD trainer; instead, it was used as a supplement to that information. A PD training schedule explains how the patient's training is included and might be broken down into a series of steps. It shows how they will learn to do their own PD step-by-step each day, building on what they have learnt already. It is based on the schedule described in the ISPD guidelines,²⁴ which outlines the international standards for training PD patients around the world.

Standardised competency assessments were embedded within specified stages of the training manuals and upon completion of modules for PD patients. The patients are required to work through the following questionnaires to test their own understanding about the information covered

in the manual and during their PD training. The six questionnaires test their understanding of:

- PD and how it works;
- caring for their PD catheter and exit site;
- infection control;
- managing fluid balance;
- PD complications and problem solving; and
- ordering their supplies.

If participants were unable to successfully pass the competency assessments, they were required to undergo repeat training. PD trainers conducted patient training at the hospital, clinic or within the patient's own home according to local policy and practice.

The Patient Training Manuals were developed with and reviewed by 21 PD patients from 4 PD Units throughout the development. The patients from the other two non-pilot test sites were established PD patients who were ineligible to participate in the trial as they were not incident PD patients. This active involvement of consumers in the development of the TEACH-PD curriculum was an integral component of the process.²⁹ The readability of the Patient Training Manuals was determined by the use of the Flesch–Kincaid Grade Level (FKGL). The FKGL score for the Patient Training Manual was 8 which was in line with the recommended reading grade level for patients.³¹

Measures and analysis

All PD trainers completed the TEACH-PD curriculum over a 4-week period; an experienced PD nurse from The HOME Network³² then assessed them for competency. Study follow-up continued until all PD trainers had trained at least one PD patient, and at least 10 English-speaking patients had completed the semi-structured interviews. PD patients trained using the TEACH-PD curriculum was followed until 30 days after they had completed their TEACH-PD training and their trainer had assessed them as competent. The duration required for PD patients to complete the newly developed curriculum was one of the outcomes measured in this feasibility study.

Prospective semi-structured interviews were conducted by a researcher with PD trainers and PD patients prior to training and 2 weeks after completion of the TEACH-PD training. The interview guide was developed based on the research question, literature review and discussion among the investigators. It was designed to provide the interviewees enough space to tell their stories and provide the investigator with meaningful data. It was also created so the structure of the interview followed a logical order and flows naturally (Table 1). The interviews (30 min) were conducted in a location convenient for the participant or via Skype/telephone. All interviews were recorded and transcribed verbatim. All transcripts were entered into HyperRESEARCH 3.0 which was used to assist with storage, coding and searching of data. Inductive preliminary coding was completed by one of the investigators to identify concepts specifically on the acceptability and usability of the TEACH-PD intervention. Similar concepts were grouped into themes and re-examined to ensure that all the data from each theme were accounted for and compared. Four investigators who read the transcripts reviewed the analysis to ensure that it captured the full range and depth of the data.

Satisfaction questionnaires were conducted on completion of TEACH-PD training modules for PD trainers and patients and after training the first PD patient using the TEACH-PD module for PD trainers. Quantitative data from the questionnaires were analysed descriptively using

Table 1. Interview guide and questions – post-training (within 2 weeks).

PD trainers	Patients
1. Perspectives on PD training <ul style="list-style-type: none"> • What did you like most/least about the training – why? • Did it meet your expectations – why/why not? • Are there any issues, concerns you have that have not been addressed by training? 	<ul style="list-style-type: none"> • Perspectives on PD training • What did you like most/least about the training – why? • Did it meet your expectations – why/why not? • Has it helped you manage PD – why/how? • Are there any issues, concerns you have that have not been addressed by training?
2. Suggestions for PD training/trial <ul style="list-style-type: none"> • What would you suggest to improve PD training – why? 	<ul style="list-style-type: none"> • Suggestions for PD training/trial • What would you suggest to improve PD training – why?
3. Implementation <ul style="list-style-type: none"> • What do you think are the opportunities/barriers to implementing the PD training module in your unit/across units more broadly? 	<ul style="list-style-type: none"> • Close • Is there something else you would like to add that you think might be important to mention?
4. Close <ul style="list-style-type: none"> • Is there something else you would like to add that you think might be important to mention? 	

PD: peritoneal dialysis.

Microsoft Excel and IBM Statistical Package for the Social Sciences, version 24.

Results

All 10 PD trainers participating in this study had variable experience as renal and non-renal nurses (renal nurse: mean 8.4 ± 6.9 years; non-renal nurse: 20.7 ± 11.2 years). All the PD trainers were female with a mean age of 45.3 years. Five PD trainers had completed formal postgraduate training in nephrology nursing (either graduate certificate or master's degree) and the others received no formal training in nephrology nursing. Trainers without postgraduate training in renal nursing tended to have been renal nurses for a longer period (median time 10.1 years) compared with those who held postgraduate qualification in renal education (median 5.0 years). The average time to complete training modules was 10.9 h (range 6–17 h) – trainers with postgraduate training: mean 8.0 ± 1.0 h; trainers without postgraduate training: 14.5 ± 2.7 h.

All PD trainers completed the modules and passed competency assessments on their first attempt. The modules were universally found by PD trainers to be practical and

Table 2. PD trainers' responses to the satisfaction questionnaire ($n = 10$).

Question	Scoring	Median	Range
Overall, how easy were the modules to complete?	0 = Impossible to complete 10 = Very easy to complete	5	3–8
Are you satisfied with the contents of the modules?	0 = Very dissatisfied 10 = Very satisfied	6.5	3–10
Did you feel you were well-prepared for the competency assessments?	0 = Completely unprepared 10 = Well prepared	7.5	2–10
Were you happy with how long the modules took to complete?	0 = Not enough time 5 = Perfect amount of time 10 = Too much time	6	0–10
After completing the modules, has your ability to train PD patients improved?	0 = Not at all 10 = Completely	7	0–10
Would you recommend the TEACH-PD training modules to others?	0 = Never 10 = Highly recommend	7	3–10

TEACH-PD: Targeted Education approaCH to improve Peritoneal Dialysis Outcomes.

Table 3. PD patients' responses to satisfaction questionnaire ($n = 14$).

Question	Scoring	Median	Range
Overall, how easy was the manual to complete?	0 = Impossible to complete 10 = Very easy to complete	9	7–10
Did you like the layout of the manuals?	0 = Hated the layout 10 = Loved the layout	8	3–10
Did you feel you were well-prepared for the assessments?	0 = Completely unprepared 10 = Well prepared	9.5	5–10
Were you happy with how long the training took to complete?	0 = Not enough time 5 = Perfect amount of time 10 = Too much time	5	3–10
How ready do you feel to start PD at home?	0 = Not ready at all 10 = Completely ready	9	5–10
Would you recommend the TEACH-PD training manuals to others?	0 = Never 10 = Highly recommend	10	6–10

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helpful particularly for those unfamiliar with adult learning principle-based training. The PD trainers indicated that the curriculum improved their effectiveness as 'teachers' in training PD patients and recommended the training curriculum for other PD nurses to help improve quality of training received. The main area for improvement related to time taken to complete each module, extended by inclusion of repetitive information, which limited the ability to complete each module within a work setting (Table 2).

Fourteen incident PD patients were trained by the TEACH-PD trainers. The mean age was 62.8 ± 16.4 years and eight were female (57%). The majority of patients (8 of 14) did not complete grade 12. The other patients did complete grade 12 ($n = 2$) or had a diploma/bachelor's degree ($n = 4$).

Patients reported that the training modules were easy to follow, were comprehensive, prepared them adequately for competency assessments (100% pass rate on first attempt) and empowered them to start PD confidently at home (Table 3). None of the PD patients experienced peritonitis at 30 days follow-up. Three (21%) patients transferred to

HD due to mechanical complications, including exit site leak, catheter malfunction and flipped PD catheter.

Perspectives on the acceptability and usability of TEACH-PD

A total of 46 pre- and post-TEACH-PD training interviews were conducted with trainers ($n = 10$) and PD patients ($n = 14$). One patient missed the pretraining interview due to scheduling difficulties, and one patient missed the post-training interview.

Interview themes: PD trainer

Use of adult learning principles. The PD trainers acknowledged that the TEACH-PD curriculum provided a good refresher of adult learning principles on how to train patients with different types of learning, that is, to identify what type of learner they were and what tools could be used to assist their learning. PD trainers appreciated the focus on individualised patient training. The reflection activities and case studies were considered very beneficial as PD trainers

were able to put what they learnt into action. The written learning plan assessment was also regarded as a practical and useful resource.

Comprehension of online modules. The PD trainers reported that the TEACH-PD modules were an excellent resource but were 'overwhelming to look at' due to the length and number of pages. Some PD trainers found the online modules onerous and difficult to navigate due to the usability and format of the online portal. PD trainers recommended for the modules to be rearranged into smaller sections, so that each module could be completed within 30–45 min. PD trainers thought there were sections of the modules with repetitious and non-essential information. The PD trainers also reported that a number of the multiple-choice questions were ambiguous and 'worded to trick you', which resulted in frustration when attempting the prerequisite test.

Time to complete the modules. Some of the PD trainers reported that the training took longer to complete than expected. They found it difficult to complete the modules during working hours when the PD unit was busy or short of staffing. The concerns around overall time allocation and management to complete the modules and training reflected the personal expectation of the trainers, the format of the material and the organisation and rostering of the PD unit towards staff training.

Interview themes: PD patient

Usability of the manual. Patients who received and read the TEACH-PD training manuals prior to commencement of training found that they were comprehensive but not self-explanatory and thus found it difficult to understand the information. They felt that the practical training with the PD trainers was necessary to fully understand the PD process. Some patients commented that after completing the training, they continued to use the manual as a reference guide for when they had questions or issues. They perceived this to be beneficial as it reduced the amount of information they would have had to otherwise remember. However, some patients suggested that the format of the manual could be improved, including increasing the size of the font and reducing the amount of information on each page. Patients recommended an improved index page so that they could easily navigate the manual, which would be important, particularly during emergency situations.

Discussion

The TEACH-PD feasibility study was an investigator-initiated, dual centre, non-randomised study of a standardised education training programme for PD trainers and their patients. The PD trainers found the TEACH-PD modules helpful. However, they collectively underestimated the extent of the TEACH-PD modules, activities and assessments. All PD trainers, independent of their background

experience and level of training, found training modules challenging to complete within the confines of usual dialysis unit practice. The challenge was not related to the difficulty in content, but rather related to practical issues including difficulties in completion of each module within 10–15 min blocks to fit in within their clinical day. The different levels of nursing experience and various learning styles of the trainers meant that some took longer to complete the training than others. This might be due to the fact that they were more experienced, they wanted to get it right and felt obliged to get it corrected. Also, the longer duration was related to each section rather than the whole content, largely from repetitious content and the usability of online content. Apart from the time issues and ambiguous wording of some multiple-choice assessment questions, there were no other major concerns related to the PD trainers' assessments.

Most of the PD trainers tried to complete the modules during office hours. Due to the length of each module, it was challenging from a practical point of view to complete, which in turn may have had a negative impact on their experience, as supported by results from thematic analysis. PD trainers needed to be allocated adequate time within the workplace.

Even though the PD trainers who participated in this feasibility study had extensive experience as renal nurses (mean 8.4 years), they still found that the modules helped improve their knowledge (median score 7). The invaluable feedback received from the feasibility study has played a key role in refinement of the TEACH-PD training modules, particularly for PD trainers, which has facilitated creation of subsections, improvement in user-friendliness of content layout and navigation and allowed removal of ambiguity in wording of competency assessment.

The on-screen formatting for the online platform (Blackboard®) has been updated to improve usability and engagement with the online modules. In the initial version, the user needed to navigate through each section of each module via a page-based navigation system, where a new page was loaded for each content section. The new on-screen formatting allows for all of the content from a single module to appear on one page. The user can toggle each content section to expand or compress the information. The adaptiveness of online content has also been improved so that learners can engage with the online modules from a variety of devices (such as smartphones or tablets).

Overall, TEACH-PD patient training manuals were well received by PD patients. PD patients also identified the documents as helpful ongoing reference guide to be utilised at home on PD initiation. They rated the TEACH-PD training manuals highly for all questions, including 'were you happy with how long the training took to complete'. The average duration to complete PD training for patients was 24.9 ± 5.0 h, which was shorter than the average duration reported in the recent national survey of Australian PD units (32–40 h in 54.3% PD units).²⁵ PD trainers agreed

the contents to be in accordance with the ISPD guidelines and acknowledged their benefits especially in PD units without embedded training curriculum. However, there was concern about the level of health literacy expected to follow the manual and format to improve ease in comprehension and utilisation. Patients felt their training adequately prepared them for competency assessments. Health literacy concepts were incorporated in the development of the patient training manuals. Manuals were also reviewed by a patient participant who is now a member of the TEACH-PD Trial Steering Committee and has provided invaluable input for the larger scale study.

One interesting observation was that PD patients' satisfaction scores were much higher (over 8 or up to 10) than those of the PD trainers (below 7–7.5). The reasons for the discrepancy in satisfaction scoring between the trainers and the patients might be differing levels of expectation. Research has shown greater patient satisfaction with positive patient–health carer interactions, particularly among patients enrolling in clinical trials, and this may explain the difference in patient and trainer responses.³³

The 'Learning Styles' theory that people learn better by different methods has been incorporated into the TEACH-PD learning material. This theory has been critiqued by a wide variety of neuroscientists, psychologists and others.^{34,35} However, in more recent articles on adult learning styles,³⁶ there is evidence that teaching to only one style is flawed.³⁷

The evidence on wide variation in PD peritonitis risk seems to be predominantly related to centre rather than patient-level factors.^{23–27,38} PD training practices may be an important contributor to centre-level variation as studies have demonstrated highly variable PD training practices including low levels of competency assessments for PD trainers and PD patients and lack of a standardised curriculum for PD trainers and patients.^{23–27}

The refined TEACH-PD curriculum and training materials were reviewed by five PD trainers and seven PD patients who participated in the feasibility study. All of them strongly agreed that the alterations of the TEACH-PD training materials were acceptable and aligned with their comments provided during the study. The PD trainers indicated that the revised curriculum had improved from previous version in (1) Overall, how easy were the modules to complete? (median score improved from 5.0 to 7.0); (2) Are you satisfied with the contents of the modules? (median score improved from 6.5 to 8.8); and (3) Would you recommend the TEACH-PD training modules to others? (median score improved from 7.0 to 9.0).

This feasibility study was conducted with the explicit aim to evaluate acceptability and usability of the TEACH-PD training modules developed for PD trainers and patients in a real clinical setting. Up until now, the development of PD training curricula has been organic, ad hoc and left to individual training units. This article uniquely and innovatively maps out an approach to developing training

modules and competency assessments through co-production between clinicians, multidisciplinary team and patients and specifically evaluates the perspectives of both trainers and patients in different clinical settings to further refine and guide a PD training intervention in preparation for a full-scale trial. The effect of the refined PD training intervention on the primary efficacy end point of PD-related infection will be evaluated in a full-scale, cluster-randomised controlled trial, which commenced in March 2019.

Conclusion

The TEACH-PD training modules have been developed as a standardised, evidence-based curriculum for PD trainers and patients aligned with the international guidelines, utilising modern adult learning principles and best practice pedagogy. The TEACH-PD feasibility study data obtained from two Australian PD units demonstrated acceptability and usability in real clinical setting implementation, and the participants were overall satisfied with the training modules and materials. Although this study was not designed to provide a justification for a shift in clinical practice using these modules, it will allow use of the highest possible quality of materials for the planned larger scale randomised controlled trial.

Declaration of conflicting interests

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