

Telehealth Service for Patients Receiving Continuous Ambulatory Peritoneal Dialysis: A Pilot Study

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ABSTRACT

Objective: This study aimed to assess the feasibility and acceptability of delivering a telehealth intervention, called PD Telehealth, for improving health outcomes among Thai patients receiving continuous ambulatory peritoneal dialysis (CAPD).

Materials and Methods: This pilot study enrolled 104 patients receiving CAPD, who were randomly classified into two groups: PD Telehealth group (PD Telehealth service plus usual care; n = 52) and usual care group (usual care only; n = 52). The 6-month telehealth service was provided to participants to deliver self-management support and telemonitoring while they received home-based treatment. Further, the repeated measures mixed analysis of variance test was used to assess health outcomes at baseline, 3 months, and 6 months. Additionally, feasibility and acceptability were assessed.

Results: Notably, the measured baseline characteristics of the two groups were not different. Regarding quality of life, a significant interaction effect was observed on two domains of the 36-Item Short Form Survey-general health ($p = 0.002$) and reported health transition ($p = 0.018$). However, self-management and clinical outcomes did not differ significantly between the two groups over 6 months. The PD Telehealth group demonstrated high acceptability and feasibility of the application.

Conclusion: The PD Telehealth service has been demonstrated to be feasible and acceptable for providing care to patients receiving CAPD. However, there were no significant differences in the main outcomes of the study. Further research studies involving a larger and more diverse sample population and conducted over a longer period are needed.

Keywords: PD Telehealth; peritoneal dialysis; telehealth (Siriraj Med J 2023; 75: 46-54)

INTRODUCTION

In 2008, the Thai government implemented the PD First policy to increase the access to dialysis treatment among Thai citizens. Under universal health coverage, people can access dialysis treatment for free in the form of continuous ambulatory peritoneal dialysis (CAPD) as the first dialysis modality unless contraindicated.¹ Notably, CAPD has fewer technical requirements and lesser need for medical staff,² and it is more cost-effective.³ Therefore,

the number of patients receiving CAPD in Thailand has increased. According to the Thai Renal Replacement Therapy registry, the number of patients receiving PD has increased from 5,133 in 2009 to 34,467 in 2020.⁴ Of all patients receiving PD in Thailand, 97% were receiving CAPD, and only 3% were receiving automated PD.¹

The challenges associated with CAPD care include complication management and prevention, technique failure intervention, long-term CAPD sustenance, and

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Received 22 September 2022 Revised 9 December 2022 Accepted 11 December 2022

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<http://dx.doi.org/10.33192/smj.v75i1.260529>



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quality of life (QOL) improvement. However, currently available healthcare services for CAPD do not support patients and their families to effectively and safely perform dialysis at home. Thus, a well-designed healthcare service is required to support home-based treatment and provide effective care to this population.

Telehealth was developed to promote PD regimen adherence and ensure continuous safety and effectiveness.^{5,6} Although evidence suggests improved patient outcomes by telehealth programs among those receiving PD,⁷⁻⁹ in Thailand, there is a lack of tailored telehealth to support patients receiving CAPD. Therefore, PD Telehealth was developed for Thai patients receiving CAPD as well as caregivers and healthcare professionals to provide self-management support, monitor home dialysis, and enhance patient health and professional communication as required by all key stakeholders.¹⁰ PD Telehealth aimed to transform its current care delivery model, support home-based treatment, and improve health outcomes in patients receiving CAPD. This study reports the results of a pilot study designed to assess the effects of PD Telehealth on self-management behaviors, QOL, and clinical outcomes and to evaluate the feasibility and acceptability of PD Telehealth in Thai contexts.

MATERIALS AND METHODS

Study design and participants

This two parallel-group randomized controlled pilot

study was conducted at Banphaeo Dialysis Center, Bangkok, Thailand (Thai Clinical Trials Registry identification number: TCTR20221121004). Eligibility criteria were as follows: patients aged >18 years, those who had received CAPD for at least 3 months and were actively undergoing dialysis procedures, those who had no prior peritonitis in the last 3 months, and those using a smartphone or tablet with an android operating system of $\geq$ version 6 and internet access. Patients who were bedridden or had cognitive impairment, psychiatric illness, or serious illness/condition were excluded from the study. Notably, participants who discontinued CAPD treatment or were referred to other PD clinics were withdrawn from the study sample. The sample size was calculated using power analysis. The required sample size calculation for repeated measures mixed analysis of variance (ANOVA) test indicated a sample of 104 participants (52 per group), with a power (p) of 0.80, significance level (α) of 0.05, medium effect size (f) of 0.25,¹¹ and attrition rate of 20%.

The study objectives, protocol, benefits, risks, privacy, and confidentiality were explained to all eligible participants. The participants were then randomly assigned to group receiving PD Telehealth plus usual care or that receiving usual care alone over 6 months after obtaining their informed consent and preforming the baseline assessment (Fig 1). They were evaluated using a questionnaire at 3 and 6 months, and their health information was obtained from medical records.

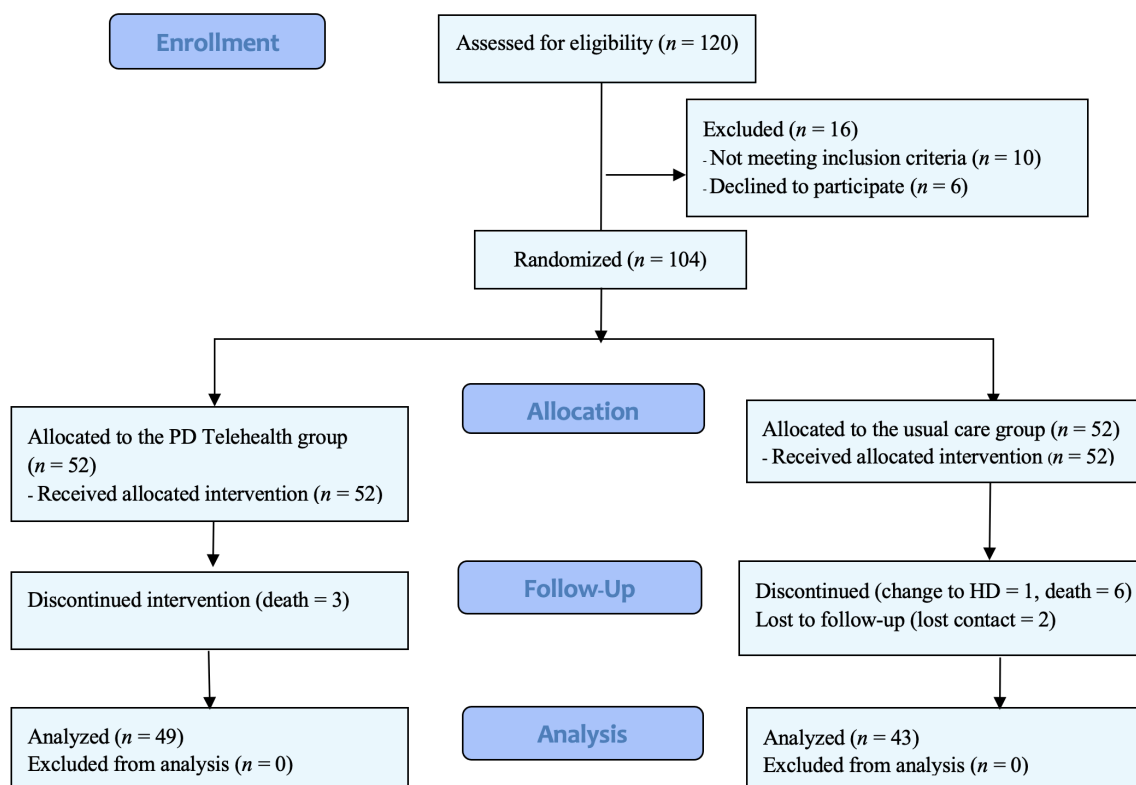


Fig 1. Flow diagram of participant eligibility and randomization process

Intervention

PD Telehealth is a service operated through a mobile application (patient side) and a web application (dialysis center side) called PD Easy. It was developed by a multidisciplinary team based on a user-centered approach. Both applications comprise multiple features to serve the needs of patients, caregivers, and healthcare professionals.¹⁰ These features were linked using the central database and processing unit at the server.

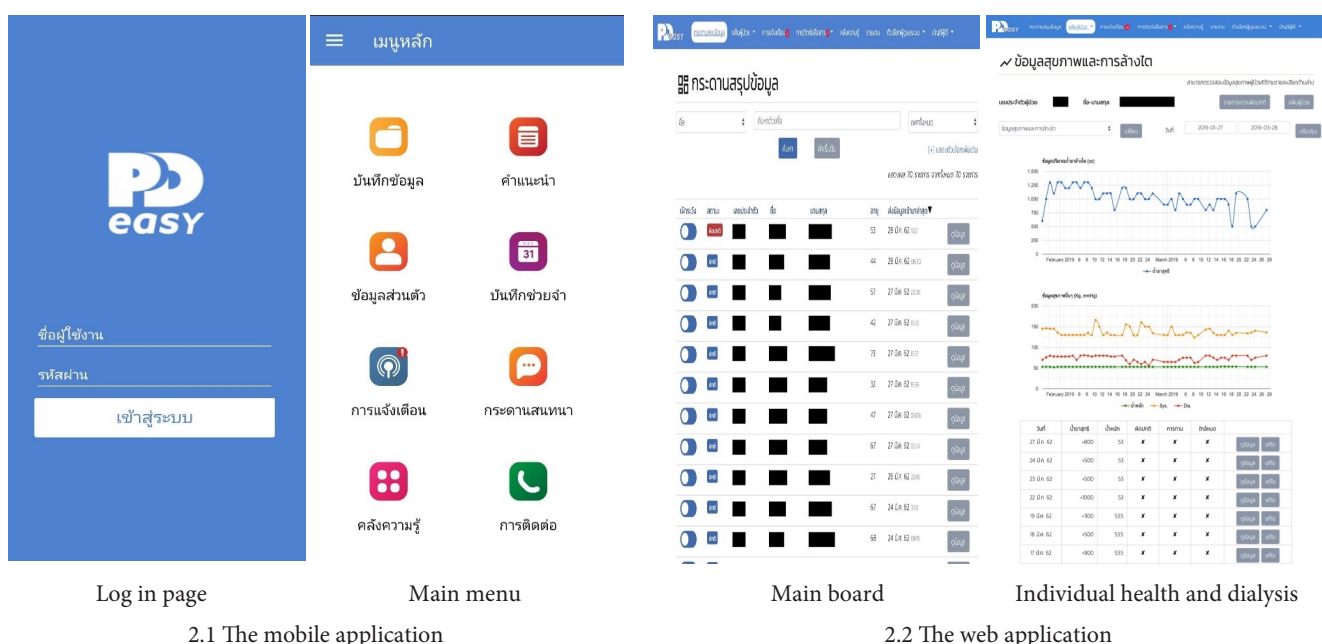
The patient-side mobile application included eight core functions: (a) daily health and dialysis records, (b) information, (c) health advice, (d) reminders, (e) health alerts, (f) social forum, (g) news and knowledge management, and (h) contacts (Fig 2.1). The participants in the intervention group installed the application on their smartphone or tablet and were trained about its use. They were instructed to send the daily dialysis records and health-related information to the dialysis center. They were notified when the recorded data exceeded the set value. They could review PD-related resources using video clips and text-based materials. In addition, they were informed about follow-up and treatment appointments at the clinic through personal health alerts and reminders. The social forum allowed participants to share and learn from each other. Participants' contacts were used to remotely connect with healthcare providers, which potentially reduced patient visits to the clinic; moreover, participants could upload photos of, for example, exit site and dialysis fluid and contact healthcare providers for advice via the chat box. However, participants were informed that the data they sent would be checked regularly but not in real time.

They had to call the healthcare providers for urgent or immediate medical assistance because PD Telehealth was not designed to support emergency services.

A web application was used to manage the PD Telehealth service at the dialysis center (Fig 2.2). Healthcare providers monitored patients by reviewing their health records through a secure password-protected web application. The clinic's health team, including a PD nurse, a dietitian, and two public health technical officers, regularly reviewed alerts based on their assigned responsibilities. The team was notified via the web application when participants entered the alert zone, and the team coordinated with other healthcare providers as needed to provide care. Appropriate contacts and follow-up were established through the application, telephone call, and home or clinic visit as required.

Outcome measurement

The study outcomes included self-management (using the PD Self-Management Scale [PDSMS]),¹² QOL (using the Choice Health Experience Questionnaire [CHEQ] Thai version),¹³ and clinical outcomes (obtained from patient's medical records). Furthermore, the feasibility and acceptability of PD Telehealth services among Thai patients receiving CAPD were evaluated. Notably, the feasibility was determined by application usage (obtained from Google Analytics) and retention rates, and the acceptability was assessed using the Perceived Benefits of the PD Telehealth Questionnaire developed by the research team.



Statistical analysis

All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS Inc., Chicago, IL). Descriptive statistical analysis was used to summarize patient characteristics, feasibility, and acceptability. The chi-square, Fisher's exact, or independent *t* test was used to compare baseline characteristics between the two groups. Repeated measures mixed ANOVA test was used to compare self-management, QOL, and clinical outcomes between the two groups at baseline, 3 months, and 6 months. Furthermore, intention-to-treat analysis was used for study analysis.

RESULTS

Patient characteristics

Overall, 104 participants completed the pretest. Of these, 3 and 9 from the intervention and control groups withdrew from the study, respectively. In contrast, 92 participants completed the post-test at the end of the study (49 and 43 from the experimental and control groups, respectively). Furthermore, there was no difference between the two groups at baseline (Table 1).

Self-management

Self-management was assessed using PDSMS, and there was no difference in self-management in the overall scores or each of the five domains between the two groups at any time point (Table 2).

QOL

In this study, the QOL was determined using the CHEQ Thai version, which included the general health 36-Item Short Form Survey (SF-36) and end-stage kidney disease (ESKD)-specific domains. Notably, there was a significant interaction effect between groups and time on two domains of the 36-Item Short Form Survey—general health ($p = 0.002$) and reported health transition ($p = 0.018$). There was no significant difference between the two groups in the ESKD domains throughout the study period (Table 3).

Clinical outcomes

Clinical outcomes (i.e., hematocrit, albumin, and phosphate levels) were measured at baseline, 3 months, and 6 months. There was no significant difference at any time point in this study (Table 4). Additionally, no significant difference in other clinical outcomes, including overhydration (OH) value and peritonitis, exit site infection, and mortality rates, was found between the two groups.

Feasibility of PD Telehealth

Overall, 52 participants received the intervention (PD Telehealth); of these, 49 (94.2%) completed the study, and 3 (5.8%) did not complete the planned follow-up because of death. Notably, PD Telehealth adherence was high. In the intervention group, 70.2% participants used

TABLE 1. Participant characteristics at baseline ($n = 104$).

Characteristics	Experimental group ($n = 52$) n (%) or mean $\pm$ SD	Control group ($n = 52$) n (%) or mean $\pm$ SD	<i>P</i> value
Age (years)	52.8 $\pm$ 13.9	51.7 $\pm$ 11.5	0.524 ^c
Gender (male)	31 (59.6)	29 (55.8)	0.691 ^a
Marital status (married)	30 (57.7)	29 (55.8)	0.749 ^a
Income (<15,000/month)	36 (69.2)	28 (53.8)	0.362 ^b
Education (primary school)	24 (46.2)	19 (36.5)	0.714 ^a
Employment status (unemployed)	30 (57.7)	26 (50.0)	0.241 ^a
Healthcare scheme (universal coverage)	44 (84.6)	43 (82.7)	0.798 ^b
Duration of dialysis (months)	32.5 $\pm$ 23.7	35.4 $\pm$ 25.6	0.362 ^c

^aChi-square test. ^bFisher's exact test. ^cIndependent *t* test.

TABLE 2. Self-management at baseline, 3 months, and 6 months between the two groups.

Self-management		Intervention		Control		Repeated measures*		
		n	Mean $\pm$ SD	n	Mean $\pm$ SD	Within times, <i>p</i>	Between groups, <i>p</i>	Interaction effect, <i>p</i>
Overall score ^b	Baseline	52	80.9 $\pm$ 10.3	52	83.0 $\pm$ 8.3	0.765	0.795	0.772
	3 months	50	81.5 $\pm$ 9.0	51	82.8 $\pm$ 9.5			
	6 months	49	80.8 $\pm$ 8.9	43	81.2 $\pm$ 10.2			
Dialysis ^a	Baseline	52	36.0 $\pm$ 4.1	52	36.8 $\pm$ 3.6	0.616	0.621	0.455
	3 months	50	36.5 $\pm$ 3.7	51	36.6 $\pm$ 4.1			
	6 months	49	36.3 $\pm$ 3.7	43	36.1 $\pm$ 4.5			
Diet and fluid intake ^a	Baseline	52	12.4 $\pm$ 2.4	52	12.1 $\pm$ 2.6	0.800	0.961	0.122
	3 months	50	12.1 $\pm$ 2.3	51	12.5 $\pm$ 2.5			
	6 months	49	12.3 $\pm$ 2.0	43	11.9 $\pm$ 2.4			
Medication ^b	Baseline	52	10.1 $\pm$ 2.4	52	10.8 $\pm$ 1.5	0.837	0.794	0.820
	3 months	50	10.5 $\pm$ 1.4	51	10.6 $\pm$ 1.5			
	6 months	49	10.1 $\pm$ 2.1	43	10.7 $\pm$ 1.5			
Self-assessment ^a	Baseline	52	13.0 $\pm$ 2.1	52	12.8 $\pm$ 2.1	0.357	0.866	0.102
	3 months	50	12.5 $\pm$ 2.4	51	13.1 $\pm$ 2.0			
	6 months	49	12.7 $\pm$ 2.4	43	12.5 $\pm$ 1.9			
Complication management ^a	Baseline	52	9.3 $\pm$ 2.2	52	9.6 $\pm$ 2.2	0.463	0.709	0.903
	3 months	50	9.9 $\pm$ 2.0	51	9.8 $\pm$ 2.0			
	6 months	49	9.6 $\pm$ 2.1	43	9.7 $\pm$ 1.7			

^aSphericity assumed. ^bWithin-group effects by Greenhouse–Geisser test.

the application more than thrice a week, 55.3% used it daily to report dialysis and health-related information, and 4.3% used it once a month. Over a 6-month period, the top three most frequently used features were personal health and dialysis records (5,788 times), social forums (1,092 times), and personal health alerts (814 times).

PD Telehealth acceptability

At the end of the study, the PD Telehealth group rated the mobile application as useful (8.73 ± 1.70). The top three advantages were health problem management (8.71 ± 1.59), health information provision (8.67 ± 1.77), and home healthcare support (8.59 ± 1.80 ; Table 5).

DISCUSSION

To the best of our knowledge, this is the first pilot study in Thailand to develop a telehealth service for CAPD. The efficacy of PD Telehealth demonstrated fewer opportunities to improve the measured outcomes. In this study, participants' self-management scores were good

at baseline and throughout all follow-up periods. Based on the inclusion criteria, all participants were required to actively perform CAPD themselves, indicating that they were able to manage their own care. Therefore, the mobile application in CAPD care in this study did not contribute to changes in self-management.

In terms of QOL, the results showed that the SF-36 general health and reported health transition scores improved in the PD Telehealth group after 3 and 6 months, respectively, whereas these scores declined in the control group. Notably, our study results are consistent with previous systematic reviews by Cartwright et al.,⁸ Yang et al.,⁶ and Lunney et al.,⁵ which reported that some domains of QOL were significantly improved in patients receiving PD and chronic dialysis after telehealth interventions. Our telehealth service provided remote monitoring, supported home-based treatment, and fulfilled the healthcare needs of such patients. However, the effects were small; therefore, its effects on QOL should be investigated further in Thai patients receiving CAPD.

TABLE 3. Quality of life at baseline, 3 months, and 6 months between the two groups.

QOL	Group	Treatment time			Repeated measures		
		Baseline	3 months	6 months	Within times, <i>p</i>	Between groups, <i>p</i>	Interaction effect, <i>p</i>
SF-36							
PF ^a	Intervention	51.9 ± 24.6	56.4 ± 24.1	59.1 ± 23.9	0.479	0.847	0.234
	Control	57.9 ± 28.1	52.2 ± 28.9	57.9 ± 23.8			
RP ^a	Intervention	48.1 ± 41.1	57.0 ± 41.7	47.4 ± 44.0	0.694	0.353	0.168
	Control	46.1 ± 43.0	41.7 ± 41.7	45.3 ± 43.7			
BP ^a	Intervention	67.3 ± 23.9	69.6 ± 23.3	68.3 ± 22.7	0.637	0.322	0.842
	Control	65.5 ± 25.2	65.6 ± 28.3	63.3 ± 25.6			
MH ^a	Intervention	63.8 ± 10.7	63.6 ± 11.1	62.9 ± 9.4	0.254	0.612	0.857
	Control	69.0 ± 17.3	66.0 ± 15.7	67.0 ± 16.8			
RE ^a	Intervention	61.1 ± 42.4	66.5 ± 43.6	57.1 ± 46.5	0.326	0.383	0.057
	Control	63.5 ± 41.5	48.5 ± 44.5	53.5 ± 44.5			
SF ^a	Intervention	80.0 ± 18.1	77.5 ± 19.8	79.3 ± 23.0	0.890	0.704	0.768
	Control	78.4 ± 22.6	79.0 ± 20.3	77.6 ± 19.6			
VT ^a	Intervention	59.7 ± 14.8	59.7 ± 10.7	60.8 ± 11.2	0.764	0.235	0.865
	Control	58.2 ± 18.8	58.2 ± 18.8	58.2 ± 16.9			
GH ^a	Intervention	54.1 ± 18.8	46.6 ± 18.4	50.8 ± 14.1	0.336	0.149	0.002
	Control	49.1 ± 25.1	47.1 ± 21.4	45.3 ± 20.7			
HT ^a	Intervention	69.7 ± 25.4	65.3 ± 25.9	74.0 ± 22.8	0.882	0.764	0.018
	Control	67.8 ± 22.9	70.0 ± 26.2	65.7 ± 25.6			
ESKD							
CRP ^a	Intervention	78.8 ± 25.9	74.5 ± 26.5	75.5 ± 24.2	0.463	0.240	0.791
	Control	84.6 ± 19.9	82.8 ± 26.4	80.2 ± 22.2			
CMH ^a	Intervention	74.8 ± 19.3	74.0 ± 15.3	72.6 ± 17.8	0.509	0.421	0.396
	Control	71.6 ± 20.6	74.6 ± 20.1	72.6 ± 17.2			
CGH ^a	Intervention	59.2 ± 31.7	59.6 ± 28.1	63.3 ± 24.3	0.900	0.861	0.579
	Control	66.9 ± 34.0	63.5 ± 33.8	60.9 ± 33.5			
FRE ^b	Intervention	55.6 ± 26.5	54.6 ± 29.9	58.8 ± 23.9	0.497	0.391	0.755
	Control	62.3 ± 24.0	64.6 ± 29.8	62.3 ± 25.4			
TRV ^a	Intervention	73.6 ± 25.9	71.8 ± 30.2	70.4 ± 26.4	0.453	0.747	0.280
	Control	74.5 ± 29.5	79.7 ± 23.4	73.2 ± 26.1			
CF ^a	Intervention	64.5 ± 19.7	65.8 ± 24.0	66.3 ± 21.5	0.481	0.785	0.692
	Control	67.9 ± 20.1	68.3 ± 21.8	65.7 ± 18.5			
FIN ^a	Intervention	75.0 ± 27.6	72.9 ± 28.6	71.9 ± 27.3	0.654	0.774	0.961
	Control	75.0 ± 27.6	76.0 ± 26.8	74.4 ± 31.6			
DR ^a	Intervention	61.1 ± 24.5	60.4 ± 26.7	61.7 ± 25.6	0.332	0.439	0.254
	Control	64.4 ± 31.4	62.5 ± 30.5	69.8 ± 24.1			
REC ^a	Intervention	65.4 ± 23.8	67.7 ± 25.8	64.6 ± 25.2	0.534	0.989	0.634
	Control	71.6 ± 32.5	66.1 ± 28.9	66.3 ± 25.5			

TABLE 3. Quality of life at baseline, 3 months, and 6 months between the two groups. (Continued)

QOL	Group	Treatment time			Repeated measures		
		Baseline	3 months	6 months	Within times, <i>p</i>	Between groups, <i>p</i>	Interaction effect, <i>p</i>
ESKD							
WRK ^a	Intervention	58.6 ± 38.9	55.2 ± 38.9	58.2 ± 37.6	0.264	0.018	0.627
	Control	78.8 ± 29.4	68.7 ± 37.0	66.3 ± 35.3			
BI ^b	Intervention	81.7 ± 21.6	84.0 ± 21.9	80.7 ± 23.8	0.518	0.028	0.980
	Control	88.5 ± 20.7	90.5 ± 16.7	88.4 ± 17.5			
SYM ^a	Intervention	20.3 ± 12.1	20.1 ± 13.2	18.9 ± 11.3	0.631	0.100	0.951
	Control	23.0 ± 14.3	21.5 ± 14.5	23.2 ± 13.3			
SEX ^b	Intervention	79.6 ± 29.8	80.2 ± 27.1	74.0 ± 28.3	<0.001	0.613	0.125
	Control	85.1 ± 25.0	76.8 ± 31.9	77.2 ± 26.1			
SLP ^a	Intervention	46.7 ± 16.3	46.9 ± 16.5	48.3 ± 16.4	0.482	0.366	0.307
	Control	44.1 ± 18.1	48.4 ± 21.5	49.5 ± 20.8			
DAC ^a	Intervention	80.2 ± 16.5	83.6 ± 16.0	78.7 ± 22.7	0.002	0.204	0.594
	Control	85.9 ± 19.1	88.0 ± 16.7	80.6 ± 20.6			
QOL ^a	Intervention	66.9 ± 19.9	64.6 ± 19.5	66.1 ± 18.9	0.101	0.588	0.733
	Control	64.6 ± 21.4	60.8 ± 16.4	62.9 ± 18.9			

Abbreviations: BI, body image; BP, bodily pain; CF, cognitive function; CGH, CHEQ general health; CMH, CHEQ mental health; CRP, CHEQ role physical; DAC, dialysis access-related problems; DR, dietary restrictions; FIN, finances; FRE, freedom; GH, general health; HT, reported health transition; MH, mental health; PF, physical functioning; QOL, quality of life; RE, role emotional; REC, recreation; RP, role physical; SEX, sexual functioning; SF, social functioning; SLP, sleep; SYM, symptoms; TRV, travel restrictions; VT, vitality; WRK, work.

^aSphericity assumed. ^bWithin-group effects by Greenhouse–Geisser test.

TABLE 4. Clinical outcomes at baseline, 3 months, and 6 months between the two groups

Items	Group	Treatment time			Repeated measures		
		Baseline	3 months	6 months	Within times, <i>p</i>	Between groups, <i>p</i>	Interaction effect, <i>p</i>
Hematocrit ^b	Intervention	30.2 ± 6.2	30.1 ± 6.0	29.7 ± 6.3	0.320	0.681	0.386
	Control	31.3 ± 6.3	29.5 ± 6.6	30.6 ± 6.7			
Albumin ^a	Intervention	3.3 ± 0.5	3.4 ± 0.6	3.3 ± 0.5	0.791	0.809	0.051
	Control	3.3 ± 0.6	3.2 ± 0.6	3.3 ± 0.6			
Phosphate ^b	Intervention	4.3 ± 1.6	4.6 ± 1.6	4.5 ± 1.5	0.915	0.963	0.080
	Control	4.8 ± 2.0	4.5 ± 1.6	4.7 ± 1.7			

^aSphericity assumed.

^bWithin-group effects by Greenhouse–Geisser test.

TABLE 5. Perceived benefits of the PD Telehealth service (n = 49).

PD Telehealth usefulness	n	Possible range	Actual range	Mean	SD
Overall	49	0–10	2–10	8.73	1.70
Managing health problems more appropriately	49	0–10	2–10	8.71	1.59
Receiving useful health information	49	0–10	2–10	8.67	1.77
Taking care own health more appropriately	49	0–10	2–10	8.59	1.80
Motivating to take care of oneself	49	0–10	2–10	8.53	1.73
More access to health information	49	0–10	2–10	8.49	1.82
Enhancing learning	48	0–10	2–10	8.42	1.92
Reducing anxiety related to health	49	0–10	2–10	8.39	1.80
More access to healthcare services	49	0–10	2–10	8.35	1.95
Being assessed and monitored	49	0–10	2–10	8.31	1.88
Receiving more healthcare	49	0–10	2–10	8.20	1.87

Clinical results revealed no statistically significant changes in laboratory measures. Moreover, no statistically significant differences were found between the two groups, although the control group had a higher number of participants who had peritonitis and died during the study. These results were consistent with the findings of a systematic review on the impact of telehealth interventions in patients with ESKD, including PD and HD.⁵ More effective strategies and a longer period may be required to determine clinical outcome changes caused by the PD Telehealth service.

The intervention group's application use and retention rates were accepted in terms of feasibility and acceptability. Only two participants, who rarely used the mobile application, rated its benefits as minor. PD Telehealth development was focused on those with low computer skill levels and vision problems because most patients receiving CAPD under universal coverage in Thailand are in their middle and late adulthood. Hence, most participants, particularly the older adults, reported no difficulties in using the application. The results of this study demonstrated that this platform is acceptable for patients receiving CAPD. All available functions were used, with high-level benefits reported. The main features of PD Telehealth were designed to meet the needs of key stakeholders to solve their problems related to health service.¹⁰ Therefore, PD Telehealth can be used in Thai contexts. Some findings of this study are consistent

with those reported in pilot studies, which revealed that telehealth programs are a viable solution for monitoring and optimizing the care of patients receiving PD.^{14,15}

Our results underscore the potential of telehealth services for the delivery of CAPD care in Thailand. This platform is intended for use by healthcare providers in PD centers and eventually as part of their routine practice. The service can be used to engage patients with CAPD in their own care, as proposed by the World Kidney Day Steering Committee.¹⁶ However, more research is needed to demonstrate the ability of PD Telehealth to improve patient outcomes and the quality of healthcare. A larger longer-term controlled study is needed to confirm the effectiveness of PD Telehealth in patients receiving CAPD.

This study has some limitations. The sample size was small and the study duration was short; thus, the differences in health outcomes could not be observed. Furthermore, this study was limited by its single-center nature and sample population size as the participants were recruited from only one dialysis center in Bangkok, Thailand.

ACKNOWLEDGMENTS

This work was funded by the Health Systems Research Institute, Thailand. We would like to thank all the patients and healthcare providers who were involved in this study.

Ethics Statement: The present study was approved by the Institution Review Board, Faculty of Nursing Mahidol University (COA: No. IRB-NS2018/455.1307).

Conflict of interest: All authors declare that they have no personal or professional conflict of interest.

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