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Effects of a transtheoretical model-based WeChat health education programme on self-management among haemodialysis patients: A longitudinal experimental intervention study

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Abstract

Aim: To examine the effects of a transtheoretical model-based WeChat health education programme on self-management in haemodialysis patients in China.

Design: A longitudinal experimental intervention study.

Methods: Patients (N = 120) who underwent haemodialysis from December 2015–November 2017 were recruited and randomly allocated to either group 1 (who received a 3-month WeChat health education immediately after randomization) or group 2 (who was combined with group 1 and received the same intervention at the 5th month after enrolment in the study). Self-management, knowledge and self-efficacy were assessed at baseline (T_0), 3 months after enrolment in the study (T_1), 21 months after enrolment in the study (T_2).

Results: There were significant group effects on self-efficacy; time effects on partnership, self-care, emotion management with total self-management; interaction effects on problem-solving and emotion management within total self-management according to the two-way repeated measures ANCOVA. Further between-group comparisons indicated that patients in group 1 had better self-management than those in group 2 at T_1. Within-group comparisons demonstrated that, compared with the baseline values, group 1 had significantly improved self-management at T_1; however, group 2 had improved self-management at T_2.

Conclusion: The transtheoretical model-based WeChat health education programme had a potentially positive effect on improving the self-management of haemodialysis patients.

Impact: Self-management is often difficult yet crucial for haemodialysis patients. This study indicated that the transtheoretical model-based WeChat health education resulted in improved self-management in haemodialysis patients and can be implemented in continuing care during the interdialysis period to improve self-management in patients.

Trial registration: ChiCTR1800018172.

1 | INTRODUCTION

Chronic kidney disease is a global public health problem (Webster, Nagler, Morton, & Masson, 2017). A great number of patients eventually progress to end-stage renal disease (ESRD). Patients with ESRD are confronted with a poor quality of life and a significant burden (Heiwe & Jacobson, 2011; Tsai, Chao, Chang, Hung, & Grp, 2017; Tsay & Hung, 2004). Haemodialysis has become a life-prolonging primary measure for ESRD patients (Zakharov et al., 2014). Self-management is often difficult yet crucial for haemodialysis patients.

Especially during the interdialysis period, the level of self-management by the patient not only affects their hospitalization episodes, mortality rate and quality of life (Shirazian et al., 2016; Song, Ward, Hladik, Bridgman, & Gilet, 2016), but also directly determines the treatment modality and ultrafiltration quantity of the next procedure (Ong, Jassal, Porter, Logan, & Miller, 2013). These finding demonstrate the need to explore effective methods to improve self-management in haemodialysis patients. Recent studies have indicated that mobile information technology has a positive effect on the management of chronic diseases. However, few studies have reported the effect of its application on self-management of haemodialysis patients (Diamantidis & Becker, 2014). WeChat, a mobile application, has an extremely high number of users and is available in more than 200 countries (China Tech Insights, 2017). It is necessary to conduct a study with a robust study design to examine the effects of a WeChat health education programme on the self-management of haemodialysis patients.

1.1 | Background

The incidence and prevalence of ESRD have been increasing rapidly in China. Until 2013, approximately 246,000 patients were documented to be undergoing haemodialysis in China (Cui & Wan, 2013). Self-management is an important aspect of effective care in chronic kidney disease patients (Lin, Liu, Hsu, & Tsai, 2017). As reported, the self-management of haemodialysis patients is poor worldwide, especially in low- and middle-income countries, including China (Dou, 2010; Sutton, Ovington, & Engel, 2014; Tao, Chow, & Wong, 2015). In China, due to personnel shortages, patients often received limited knowledge or training in self-management. Few studies have focused on self-management education in continuing care during the interdialysis period. Moreover, traditional health education is generally conducted through the dissemination of printed materials and oral education focusing on general information; this is incongruent with patient needs. To fill this research gap, a vivid and lively multimedia health education programme is needed to enhance the self-management of patients and their learning outcomes (Chan, Green, Fiatarone Singh, Barnard, & Cheema, 2016).

Recently, to improve the level of patients' self-care and health behaviours after hospital discharge, the use of mobile information technology as an intervention strategy has become increasingly popular (Diamantidis & Becker, 2014; Karavetian, de Vries, Rizk, & Elzein, 2014; Lin, Wu, & Smith, 2014; Ong et al., 2013). However, few such programmes have been employed in populations with kidney disease (Diamantidis & Becker, 2014). Studies are needed to examine the effect of a mobile device-based health education programme on ESRD patients during the interdialysis period (Wileman et al., 2016).

WeChat, one of the most popular multimedia social platforms in China, reported 889 million monthly active users (China Tech Insights, 2017). WeChat has the advantages of low cost, easy operation, a large amount of information, the ability for real-time dialogue, etc. Users can quickly send voice messages, videos, pictures, texts, tables and web pages to other users from their mobile phones via WeChat and WeChat supports multigroup chatting. All information can be retained for reference at any time anywhere as long as there is an internet connection. Recent studies have indicated that interventions delivered via WeChat regarding health management resulted in an improvement in adherence in orthodontic patients (Li et al., 2016) and chronic rhinosinusitis patients (Feng et al., 2017). Hence, WeChat may be an appropriate tool for improving the self-management of haemodialysis patients.

The most effective educational approaches are theory-driven practices (Ghahremani, Faryabi, & Kaveh, 2014). As reported, the transtheoretical model (TTM) is a dynamic and comprehensive model for eliciting behaviour changes; the model divides human behaviour changes into five stages and providing stage-matched interventions has been widely used to promote health behaviours (Dobbels et al., 2017; Orouji, Shojaeizadeh, Sadeghi, & Rafiei, 2017). Thus, this study was based on the TTM (1983 & 1984) and Bandura's (1991) self-efficacy theory. In addition, there is a significant positive correlation between self-management and self-efficacy (Zhao, Suhonen, Koskinen, & Leino-Kilpi, 2017). Self-efficacy is a crucial mediator between knowledge and self-care (Wu, Hsieh, Lin, & Tsai, 2016). Thus, with WeChat reinforcement and verbal persuasion, this proposed study evaluated the effects of a 3-month WeChat health education programme based on the TTM on haemodialysis knowledge, self-efficacy and self-management in haemodialysis patients (See web Appendix S1 for the theoretical frameworks).

2 | THE STUDY

2.1 | Aims

The study aimed to develop and evaluate the effects of a WeChat health education programme based on the TTM and self-efficacy

theory on improving self-management, haemodialysis knowledge and self-efficacy among haemodialysis patients.

2.2 | Design

This was a longitudinal experimental intervention study. Data were collected at baseline (T_0), 3 months after enrolment in the study (T_1) and 21 months after enrolment in the study (T_2). It should be noted that the short-term effect of WeChat health education has been published in Chinese elsewhere (Ren et al., 2017).

2.3 | Participants

Patients were recruited for study participation at a tertiary hospital in southern China. Patients were included if they were aged 18 years or older, had more than 3 months of treatment duration, had undergone dialysis at least twice a week, had the ability to communicate in both oral and written formats without assistance and were willing to use the WeChat software. Patients who were suffering from mental illness, had severe audiovisual disorders, or had undergone a renal transplant were excluded from this study. A full-time nurse enrolled participants. If patients agreed to participate in the study, they were recruited. After signing the consent form, an associate chief nurse randomly assigned the patients into one of two groups according to a random number table with a ratio of 1:1. All eligible patients were labelled from 001-120, according to the hospitalization number from lowest to highest. Then, three digits ranging from 001-120 were produced by the random number table without duplication. The patients whose numbers corresponded to the first 60 valid digits were assigned to group 1 and the rest were assigned to group 2. According to a previous study, the level of self-management would be improved by 13.89 for the medium effect size (Dou, 2010). A sample size of 120 with 60 patients per group was required according to two-sample mean formulas with a power of 80%, a significance level of 5% and a dropout rate of 20%.

2.4 | Procedures

Patients in group 1 received the 3-month WeChat health education programme in addition to routine care immediately after the baseline data collection. The detailed contents of the intervention have been published elsewhere (Ren et al., 2017). During the 3-month intervention period, the time for sending health education texts in the WeChat group was 7–8 p.m. every night after consultation with the patients. During this time, there were professional nurses online in the WeChat group, urging patients to read and participate in patient discussions and answering questions. The focus of this intervention was to encourage patients to explore their own abilities, clarify their needs and maximize the use of existing resources to achieve the goal of changing their health behaviours. Briefly, the three main contexts were leading a healthy lifestyle, psychological support and cognitive-behavioural skill building, which were adapted to the regional culture (Minnan culture).

This programme was guided by the TTM and self-efficacy theory. In different stages, patients have different needs and motivations. Due to personnel shortages, it was impossible for nurses to assess each patient stage. This was well compensated by health education via WeChat, as all the information can be preserved indefinitely. Thus, patients can adjust their own pace of learning according to their needs. Through the WeChat group, patients can communicate with health educators at any time anywhere.

The routine care provided to patients in this study consisted of two specialist haemodialysis educators instructing patients on how to use printed material relating to haemodialysis and diet and fluid intake. Patients were also encouraged to participate in regular seminars held at the centre.

Patients in group 2 received routine care during the first 3 months but then were combined with WeChat group 1 and received the same 3-month WeChat health education from the 5th month onward after enrolment in the study. Subsequently, all the participants were followed up for 14 months. During the follow-up period, every Monday between 7 p.m.–8 p.m., there would be professional nurses in the WeChat group to remind every patient to read the materials and to answer questions raised by the patients.

2.5 | Data collection

Data collection took place from December 2015–November 2017. Baseline data (T_0) were collected immediately after group randomization. One week after the 3-month intervention period, data were collected for a second time (T_1, post-test 1 data collection). The second data collection time point was based on a study where mobile information technology was shown to be effective after 3 months (Gilliland et al., 2015). One month after the T_1 data collection, namely, 4 months after the patients' enrolment in the study, patients in group 2 were combined with group 1 as one large group and received the same intervention. The third data collection event was carried out at 21 months after the patient's entry into the study (T_2, post-test 2 data collection). Studies showed that 12–18 months of follow-up was optional to validate the sustained effectiveness of the intervention (Chan, Cheung, Yeung, & Lee, 2018; Kazawa, Takeshita, Yorioka, & Moriyama, 2015). The instruments included in this study are discussed below.

The self-management scale for haemodialysis patients, which was developed by Song (2009), consists of four dimensions: partnership, self-care, problem-solving skills and emotion management. The scale contains a total of 20 items with a four-tiered Likert scoring system. The total score ranges from 20–80 points, with a high score indicating good self-management. After adjusting for cultural factors in mainland China, the Cronbach's alpha was over 0.80 and the content validity index was 0.96 (Li, Cao, Jiang, & Wang, 2015).

A Chinese version of the questionnaire regarding haemodialysis patient knowledge, which was originally developed by Curtin, Sitter, Schatell, and Chewning (2004) and translated into Chinese by Li (2011), was used in this study. The questionnaire consists of 24 items, with a high score indicating a high knowledge level. Scores

are calculated according to the patients' judgment. If the patients' judgment is correct, they receive 1 point; otherwise, patients receive 0 points. For the Chinese version of the questionnaire, the construct validity was 0.94 ($α$ = 0.70) (Li, 2011).

The 6-item Chronic Disease Self-Efficacy Scale (CDSES) (Lorig, Sobel, Ritter, Laurent, & Hobbs, 2001), was employed to evaluate the patients' self-efficacy in this study. Each item is rated on a 1–10 point scale, with 1 point representing no confidence and 10 points representing a high level of confidence. The self-efficacy score is calculated based on the overall average score, with a high score indicating high self-efficacy. For the Chinese version of the questionnaire, the internal consistency was 0.96 and the test–retest reliability was 0.98 (Chow & Wong, 2014).

The demographic and clinical information of the patients were measured only at baseline. Demographic information included patient age, sex, educational level, employment status, income, marital status and medical insurance status. Clinical information included dialysis duration, dialysis frequency and complications.

2.6 | Ethical considerations

Ethical permission was obtained from the Health Research Ethics Review Committee of the university (No. 2018003). Patients were provided with a written information statement clarifying that participation was voluntary and that they could withdraw from the study at any time without compromising treatment. Data collection methods and confidentiality requirements were explained to patients prior to signing the consent form.

2.7 | Data analysis

In the data collation phase, questionnaires were excluded if logic errors or missing data were present for more than 20% of the total items. The missing data were replaced by mean values.

Data analysis was carried out using IBM SPSS statistics software version 18.0. Demographic information was expressed as frequencies, percentages, means and standard deviations (SDs). Chi-square tests and independent *t*-tests were used to compare the demographic and clinical data, as well as the baseline outcome measurements between groups 1–2. Furthermore, to compare the mean differences in the outcome variables, two-way repeated measures ANCOVA and one-way ANCOVA adjusted for confounding factors were performed. To compare the differences within the groups, paired sample *t*-tests were performed. The significance level was set at 0.05.

2.8 | Validity, reliability and rigour

All instruments in this study were tested and showed adequate validity and reliability. Participants were randomly allocated into the two groups. The intervention contents were reviewed and revised by a WeChat health education team (including an academic expert, a doctor, two haemodialysis specialist nurses, an associate chief nurse and a researcher).

3 | RESULTS

Initially, 120 eligible patients agreed to participate in this study. However, one patient in group 2 was excluded from the study due to an incomplete questionnaire at T_1. At T_2, 34 patients were excluded because they refused to continue (N = 18), died (N = 5), were transferred (N = 7) or had incomplete questionnaires (N = 4). The detailed reasons for the discontinuations are shown in Figure 1. Finally, a total of 85 patients (49 patients in group 1 and 36 patients in group 2) completed the whole study (Figure 1). Due to the small sample size, the calculation of the effect size was performed after the intervention. The overall effect size on self-management was 0.99.

3.1 | Characteristics of patients

The average age of the 85 patients was 48.86 (*SD* 4.75) years old; 57.6% were male and 81.2% were married. More than half of the patients had an education level lower than junior high school (54.6%) and a monthly household income less than ¥3,000 (56.5%). Approximately one-third of the patients (37.6%) were office workers. At baseline, there were no significant differences in the patient demographic, except for age (p < .01) and employment status (p < .05) and clinical characteristics between the two groups (Table 1). The patients in group 1 were more likely to be younger and have a better employment status than those in group 2.

3.2 | Change in self-management

As shown in Figure 2, the mean scores of self-management were notably increased in both groups from T_0–T_1, with the increase in group 1 being larger than that in group 2 at T_1. However, the mean self-management score in group 1 was decreased from T_1–T_2, with the mean score at T_2 being higher than that at T_0, whereas the mean self-management score in group 2 continued to increase from T_1–T_2, with the mean score at T_2 being similar to that of group 1 at T_1.

The two-way repeated ANCOVA adjusted for age and employment status showed that there was no significant group effect on the total scores of self-management as well as the four dimensions of self-management; there were significant time effects on the dimensions of partnership (F = 9.55, p < .01), self-care (F = 7.21, p < .01) and emotion management (F = 5.65, p < .01) and there were significant interaction effects on the dimensions of problem-solving skills (F = 3.42, p < .05) and emotion management (F = 2.65, p < .05) (Table 2).

Further between-group comparisons indicated that the patients in group 1 showed a greater increase in the mean scores of total self-management than those in group 2 at T_1 (F = 4.13, p < .05), whereas this positive effect disappeared at T_2 (Table 3). Within-group comparisons demonstrated that, compared with baseline, group 1 showed significant increases in the mean scores of self-management (t = 3.59, p < .01) and the dimensions of partnership (t = 2.64, p = .01), self-care (t = 3.27, p < .01) and emotion management (t = 3.27, p < .01)
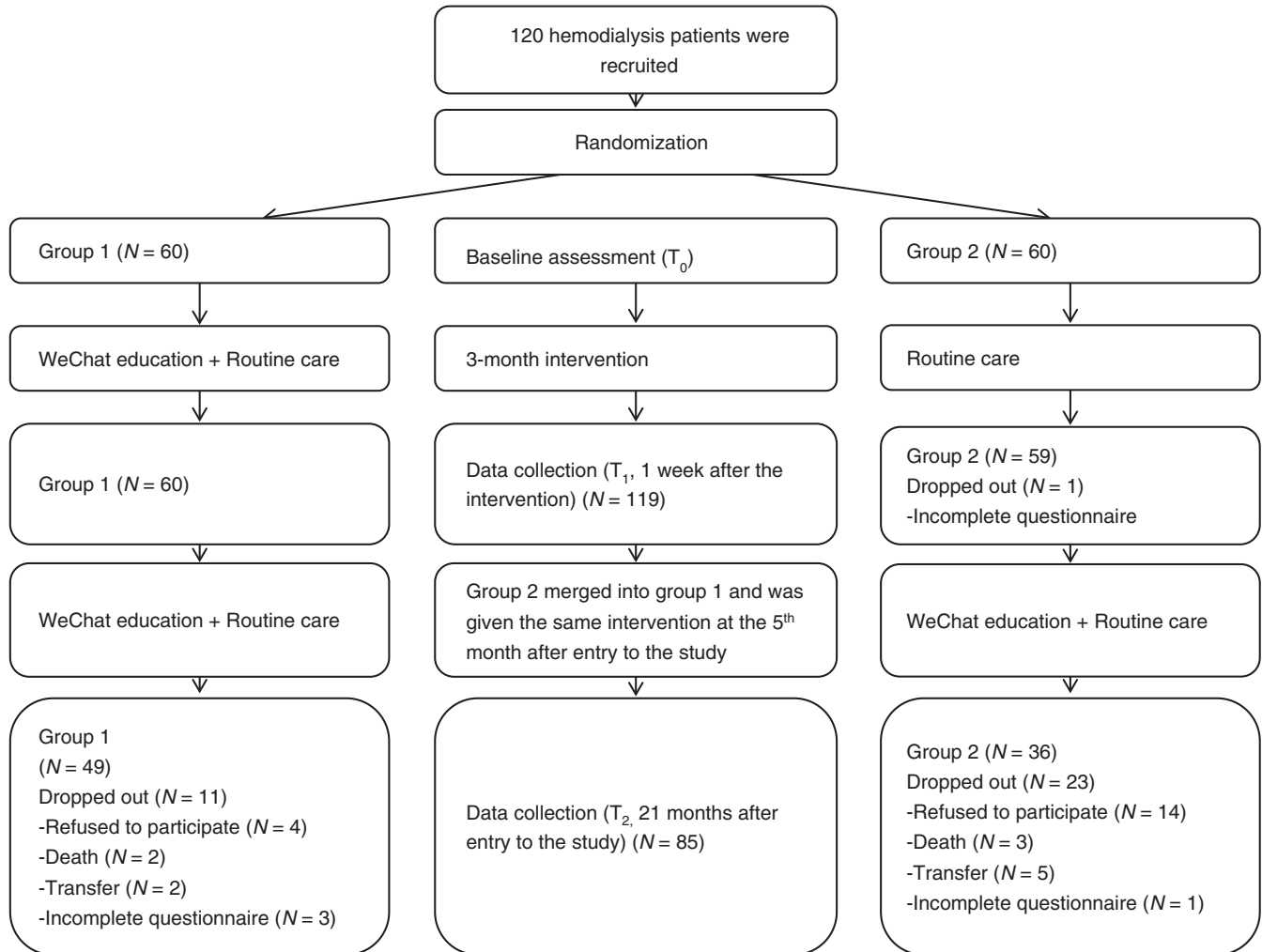
FIGURE 1 The flow chart of the study

at T_1, but all of these significant differences disappeared at T_2; group 2 showed significant increases in the mean scores of self-management (t = 2.43, $p < .05$) and the dimensions of problem-solving skills (t = 3.27, $p < .01$) and emotion management (t = 2.82, $p < .01$) at T_2 (Table 3).

3.3 | Change in haemodialysis knowledge

As shown in Figure 2, the mean knowledge score in group 1 dramatically increased from T_0–T_1, whereas it dramatically decreased from T_1–T_2, with the mean score at T_2 being lower than at T_0. However, the mean score of knowledge in group 2 was slightly increased from T_0–T_1 and declined only slightly from T_1–T_2, with the mean score being higher than that of group 1 at T_2.

The two-way repeated ANCOVA adjusted for age and employment status showed that there were no significant group, time and interaction effects on knowledge (Table 2). In addition, there were no significant differences in the changes in the mean scores of knowledge when between or within-group comparisons were performed after adjusting for age and employment status (Table 3).

3.4 | Change in self-efficacy

Similarly, the mean score of self-efficacy in group 1 increased from T_0–T_1 and decreased from T_1–T_2 with the mean score nearly returning back to the baseline level (Figure 2). Conversely, the mean score of self-efficacy in group 2 remained stable from T_0–T_1, but steadily increased from T_1–T_2 (Figure 2).

There was a significant group effect on the mean score of self-efficacy (F = 6.07, $p < .05$); however, there were no significant time and interaction effects on the mean scores of self-efficacy according to the two-way repeated measures ANCOVA adjusted for age and employment status (Table 2). No significant differences in the changes in the mean scores of self-efficacy were found when further between- and within-group comparisons were carried out after adjusting for age and employment status (Table 3).

4 | DISCUSSION

This was the first longitudinal experimental intervention study to examine the effects of the WeChat health education programme

TABLE 1 Demographics of the study population (N = 85)

Variable	Group 1 (N = 49) N (%)	Group 2 (N = 36) N (%)	χ^2	p-value
Gender (male)	31 (63)	18 (50)	1.50	.16
Education level				
Junior high school or below	21 (43)	22 (62)	3.17	.21
Senior high school	11 (22)	7 (19)		
College or above	17 (35)	7 (19)		
Employment status				
Working	24 (49)	8 (22)	6.33	.01*
Not working	25 (51)	28 (78)		
Monthly household income				
¥1,999 and below	21 (43)	12 (33)	7.62	.10
¥2,000–2,999	5 (10)	10 (28)		
¥3,000–3,999	9 (19)	5 (14)		
¥4,000–4,999	4 (8)	6 (17)		
¥5,000 or above	10 (20)	3 (8)		
Marital status				
Single/Divorced/Widowed	12 (25)	4 (11)	2.43	.16
Married	37 (75)	32 (89)		
Medical insurance				
Self-pay	1 (2)	1 (3)	0.05	1.00
Government insurance	48 (98)	35 (97)		
Dialysis frequency				
<3 times/week	6 (12)	7 (19)	0.83	.38
≥3 times/week	43 (88)	29 (81)		
Complication				
No	15 (31)	14 (39)	0.63	.50
Yes	34 (69)	22 (61)		

	Mean (SD)	Mean (SD)	t	p-value
Age (years)	44 (13)	56 (15)	−4.14	.01**
Dialysis duration (months)	49 (45)	55 (35)	−0.68	.50

Abbreviation: SD, standard deviation.
*p < .05.
**p < .01.

based on the TTM and self-efficacy theory on the self-management of haemodialysis patients in China. The findings from this study showed that patients in group 1 had increased mean scores of self-management, haemodialysis knowledge and self-efficacy immediately after the 3-month WeChat health education (T_1) compared with the baseline (T_0), whereas the mean scores of all these outcomes sharply decreased at 18 months after the intervention (T_2). Conversely, patients in group 2 had slightly increased mean scores of self-management, haemodialysis knowledge and

self-efficacy from T_0–T_1, whereas the mean scores of all the outcomes were largely increased at T_2, except for the mean score of haemodialysis knowledge, which showed a minor decrease at T_2. These change trends may be because patients in group 2 received the same intervention one month after group 1 completed the 3-month intervention. The total change trends in both groups suggest that the intervention had clinically positive effects on self-management, haemodialysis knowledge and self-efficacy in haemodialysis patients.

Further between-group comparisons indicated that patients in group 1 presented significantly better self-management than those in group 2 at T_1, whereas this positive effect disappeared at T_2. Within-group comparisons demonstrated that group 1 also indicated significantly increased total self-management scores and improvements in the dimensions of partnership, self-care and emotion management at T_1 compared with T_0, but all of these positive results disappeared at T_2 and group 2 showed significantly increased self-management scores at T_2. Findings from this study showed that there was a significantly positive effect of the programme on self-management; this results was similar to those of studies that examined the effect of a similar design on self-management (Kang et al., 2017; Wu, Lin, Pan, Pan, & Yang, 2016). One possible explanation for the positive effect may be the TTM. Based on the TTM, we provided information support at each stage matched to the needs of patients. Another possible reason may be the novel design of the intervention. In this study, health education was delivered via WeChat and the patient motivation for the behaviour change was provided by case education, pictures and verbal persuasion. WeChat is a very popular multimedia social platform in China, with nearly 900 million users. WeChat has many advantages such as being user friendly; supporting real-time dialogue; enhancing communication through voice messages, videos, pictures and texts; and supporting multi-group chatting with a mobile phone. These advantages of WeChat likely contributed to the positive effect of health education on self-management in this study.

Although positive change trends in the outcomes were observed in this study, there were no significant differences between the two groups in the dimensions of self-management, haemodialysis knowledge and self-efficacy. This finding was similar to those in another study (Goncalves, Ciol, Dantas, Farina Junior, & Rossi, 2016) where burn patients participated in an educational programme with telephone reinforcement; that study also showed no significant difference in self-management between the intervention and control groups. The non-significant findings in this study may be explained by the following. First, the small sample size may be a factor. Although a total of 120 patients were recruited, only 85 patients completed the whole study and were included in the data analyses. Thus, future studies with a large sample size to further examine the effects of WeChat health education programmes are suggested. Second, the intervention duration may be a factor. The findings from this study demonstrated that patients in group 2 improved self-management and self-efficacy from T_1–T_2, whereas those in group 1 had decreasing trends in all three outcomes from T_1–T_2. These findings may be because all the patients in
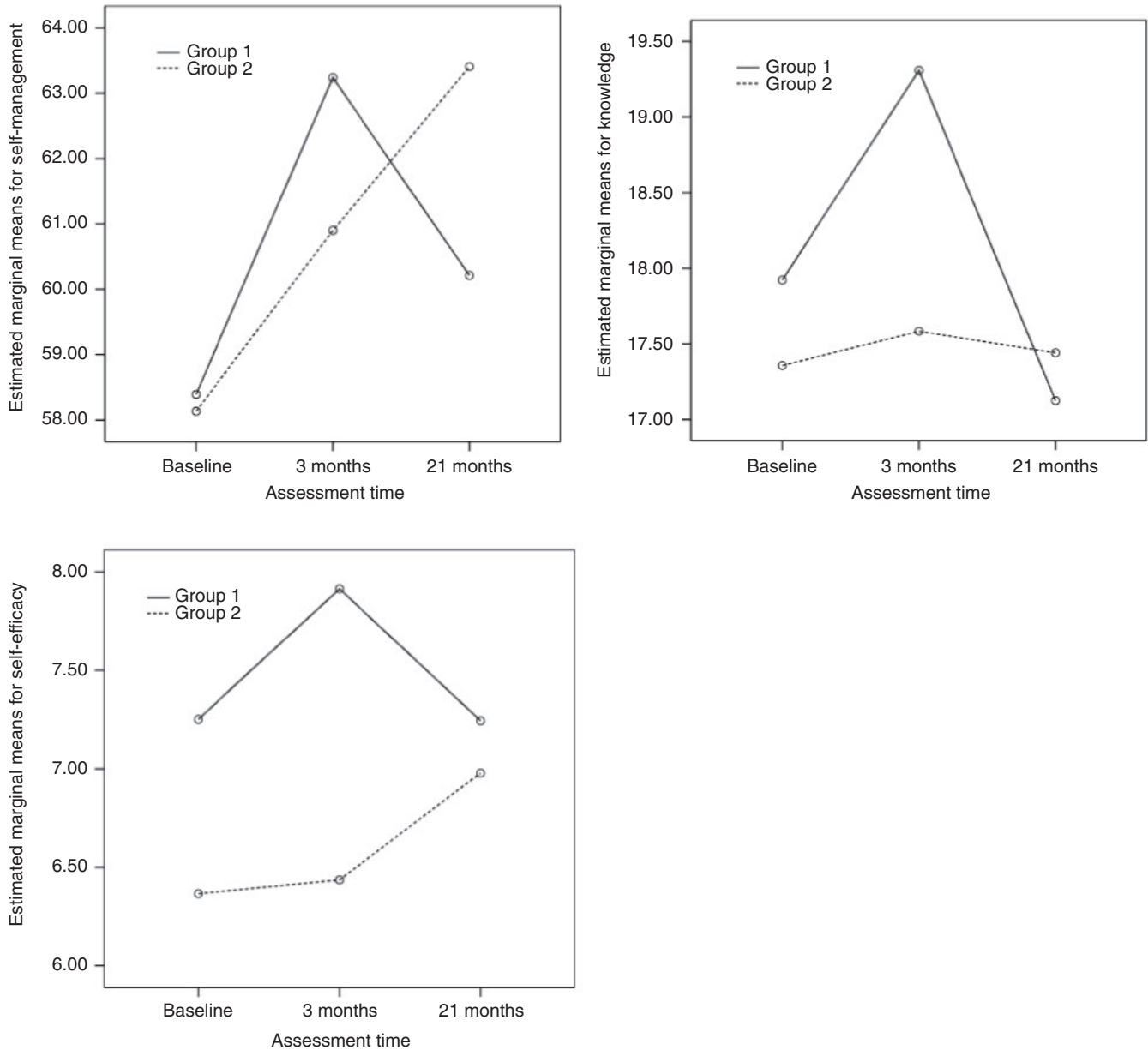
FIGURE 2 The trend of change in the mean scores of self-management, knowledge and self-efficacy over time

group 2 received the same intervention at the 5th month, whereas the repeated 3-month intervention was no longer new for those in group 1. These findings suggested that the 3-month duration of the WeChat intervention did not affect the intervention effect and a 3-month intervention duration might have positive effects on haemodialysis patients regardless of when the patients participants in the programme. In addition, when the WeChat intervention is carried out repeatedly for the same group of patients, it is suggested to appropriately adjust the content and mode and diversify the forms of education to improve the effect of the intervention.

Another important finding of the study was that all patients had a low level of emotion management within total self-management, but there was a significant improvement in emotion management in both groups after the intervention, which was in line with previous

studies conducted in China (Li, 2011; Song, 2009). This result may be explained by the fact that haemodialysis patients experience a long treatment course, a complex condition and increased economic and psychological burdens. With the development of a network and faceless interactions by WeChat, patients may be more willing to express their feelings and communicate with each other. Therefore, the intervention delivered via WeChat may be a potential effective means of providing support for patients. Similar findings were also reported by another study (Yu, Seow, Seow, & Tan, 2016). Providing social interaction could allay psychosocial problems such as anxiety. In this study, the intervention time points occurred during the intervals between dialysis to avoid patient fatigue and weakness. Hence, the WeChat group communication not only met the needs of patients and their families regarding knowledge (Feng et al., 2017)

TABLE 2 Comparisons of each outcome after adjusting for the impact of covariates in two groups (N = 85)

	T_0		T_1		T_2		p-value		
Variable	Group 1 Mean (SD)	Group 2 Mean (SD)	Group 1 Mean (SD)	Group 2 Mean (SD)	Group 1 Mean (SD)	Group 2 Mean (SD)	Group	Time	Group*time
Self-management	58.49 (9.61)	58.00 (11.66)	63.22 (10.11)	60.92 (9.97)	60.51 (10.59)	63.00 (9.50)	.91	.47	.16
Partnership	12.47 (2.46)	12.83 (2.49)	13.41 (2.25)	13.03 (2.40)	12.63 (2.13)	13.19 (2.04)	.14	.01**	.50
Problem-solving skills	16.04 (2.51)	14.47 (3.55)	16.49 (2.84)	15.36 (2.86)	16.04 (2.72)	16.31 (2.77)	.61	.22	.04*
Self-care	20.27 (3.91)	21.06 (4.24)	22.14 (3.89)	22.17 (4.12)	21.51 (5.11)	22.03 (3.93)	.10	.01**	.33
Emotion management	9.71 (3.08)	9.64 (3.15)	11.18 (2.86)	10.36 (3.03)	10.33 (3.14)	11.47 (3.01)	.11	.01**	.03*
Knowledge	18.29 (3.03)	16.86 (4.32)	19.29 (2.32)	17.61 (3.16)	17.49 (3.89)	16.94 (3.28)	.23	.57	.15
Self-efficacy	7.31 (1.99)	6.28 (2.69)	7.81 (1.86)	6.58 (1.97)	7.34 (2.05)	6.84 (2.69)	.03**	.20	.14

Note: T_0, Data collected at baseline; T_1, Data collected at one week after the 1st intervention (three months after entry to the study); T_2, Data collected at 21 months after entry to the study.

p-values from analyzing data by two-way repeated measures ANCOVA adjusted for age and employment status.

Abbreviation: SD, standard deviation.

*p < .05.

**p < .01.

but also provided patients with easily accessible psychological support. Considering the shortages in nursing staff and time in China, multimedia education may be a great strategy to enhance education outcomes and these strategies can be adopted by nursing managers.

The findings of this study also demonstrated that patients in both groups improved their level of haemodialysis knowledge from T_0–T_1, but this knowledge gain decreased at T_2. Moreover, there were no significant differences between or within-group comparisons. This finding was incongruent with the report by Diamantidis and Becker (2014), where there was an improvement in knowledge after using health information technology. The reason may be that all the patients had been afflicted with the disease for a long time, ranging from 49–55 months. In China, there is a phrase that stated "being sick for a long time will make you a doctor". Thus, patients with ESRD in this study may have explored and learned about haemodialysis after they were diagnosed with the disease. This can explain why all patients in this study had a relatively high level of haemodialysis knowledge. The level of haemodialysis knowledge was expected to increase after the intervention; however, this trend was not clear in this study. One possible reason may be that the data collection point at T_2 was too long after the completion of the 3-month intervention in both groups. Knowledge retention may be shorter than the follow-up period. Thus, data collection with shorter intervals may better reflect the change trend in the knowledge level after the implementation of education programmes, which is recommended in future similar studies.

Self-efficacy can be helpful to ease the physical and psychological burdens of haemodialysis patients. The findings from this study demonstrated that the self-efficacy of patients was improved after the 3-month intervention and there was a significant group effect after adjusting for age and employment status, although there was no significant difference between the two groups at each time point. These findings also indicated that the intervention had a potential positive effect on self-efficacy, which was consistent with the results of other studies (Gilliland et al., 2015; Wu, Hsieh, et al., 2016). The non-significant differences between the two groups may be due to the small sample size and providing only a single 3-month intervention programme to patients in each group in this study. Thus, we suggest studies are conducted with a sufficient sample size and extended the intervention duration to further examine its effects on self-efficacy.

The ultimate benefit of health education is a change in behaviour (Srisuk, Cameron, Ski, & Thompson, 2017). Based on the TTM and self-efficacy, health education using a social networking platform may be an effective method to improve health outcomes and can be applied to a wide range of people. However, the effects of WeChat health education on outcomes first increased and then decreased. Several limited studies intended to improve the self-management of patients and deliver health education via a social networking platform have shown the long-term effectiveness (Wang et al., 2018). Thus, studies on maintaining the long-term effects of health education programmes in haemodialysis patients are suggested for future research.

TABLE 3 Between and within group comparisons on each outcome (N = 85)

Variable Groups	T_1-T_0 Mean (SD)	Within group t (p-value)[a]	T_2-T_0 Mean (SD)	Within group t (p-value)[a]
Self-management				
Group 1	4.73 (9.23)	3.59 (.01**)	2.02 (12.17)	1.16 (.25)
Group 2	2.92 (12.76)	1.37 (.18)	5.00 (12.33)	2.43 (.02*)
F (p-value)[b]	4.13 (0.04*)		0.04 (0.84)	
Partnership				
Group 1	0.94 (2.49)	2.64 (.01*)	0.16 (2.79)	0.41 (.68)
Group 2	0.20 (3.38)	0.35 (.73)	0.36 (2.52)	0.86 (.40)
F (p-value)[b]	2.66 (0.11)		0.00 (0.99)	
Problem-solving skills				
Group 1	0.45 (3.05)	1.03 (.31)	0.00 (3.29)	0.00 (1.00)
Group 2	0.89 (4.10)	1.30 (.20)	1.83 (3.37)	3.27 (.01**)
F (p-value)[b]	0.93 (0.34)		3.37 (0.07)	
Self-care				
Group 1	1.87 (3.53)	3.72 (.01**)	1.24 (5.38)	1.62 (.11)
Group 2	1.11 (4.81)	1.39 (.17)	0.97 (4.72)	1.24 (.23)
F (p-value)[b]	3.51 (0.07)		1.05 (0.31)	
Emotion management				
Group 1	1.47 (3.15)	3.27 (.01**)	0.62 (3.76)	1.14 (.26)
Group 2	0.72 (3.31)	1.31 (.20)	1.83 (3.90)	2.82 (.01**)
F (p-value)[b]	2.71 (0.10)		0.37 (0.54)	
Knowledge				
Group 1	1.00 (3.62)	1.93 (.06)	−0.80 (4.97)	−1.12 (.27)
Group 2	0.75 (4.00)	1.26 (.27)	0.08 (4.70)	0.11 (.92)
F (p-value)[b]	1.44 (0.24)		0.00 (0.96)	
Self-efficacy				
Group 1	0.50 (1.87)	1.84 (.07)	0.03 (2.53)	0.09 (.93)
Group 2	0.30 (2.61)	0.69 (.49)	0.56 (3.09)	1.09 (.28)
F (p-value)[b]	2.29 (0.14)		0.14 (0.71)	

Note: T_0, Data collected at baseline; T_1, Data collected at one week after the 1st intervention (three months after entry to the study); T_2, Data collected at 21 months after entry to the study.
Abbreviation: SD, standard deviation.
[a]Within group comparisons by paired *t*-test.
[b]Between group comparisons by one-way ANCOVA adjusted for age and employment status.
*$p < .05$.
**$p < .01$.

WeChat health education may be a potentially effective strategy for promoting self-management in patients, although some improvements are needed to achieve the desired results. For example the contents of the intervention can be enhanced by face-to-face interviews to seek feedback and opinions from the patients participating in this study to improve the programme. To make the intervention more successful considering the current situation of the hospital, hospital nursing managers can participate in and use the intervention data from this study to improve patients' satisfaction. Importantly, this novel method of delivering patient health education is a potential effective method for nursing practice among the existing haemodialysis population in China, potentially making up for the gap in continuing care during the interdialysis period. This study also provides evidence for its benefits in clinical practice.

4.1 | Limitations

Several limitations existed in this study. First, the demographic and clinical characteristics of the patients were not comparable between the two groups at baseline. The patients in group 1 were more likely to be younger and currently employed than those in group 2. This may explained by the following: (a) patients were recruited by convenience sampling; and (b) there were more

dropouts in group 2. The participants who withdrew from the study may have been more likely to be older with more serious conditions and had heavy economic burdens from the disease due to the inability to work. The detailed analyses of the patients' demographic and clinical characteristics between the dropouts and completers will be presented in another paper. In this study, one-way and two-way repeated measure ANCOVAs were used to analyse the data to avoid the impact of covariates on the outcomes. Second, a small number of patients completed the whole study. Future studies with a sufficient sample size to further examine the effects of the intervention are recommended. Third, there was no control group in this study. With a control group, the effects of the intervention, especially the long-term effects, may be relatively clearer. Finally, in this study, the outcome measures were collected at baseline, 3 months after enrolment in the study and 21 months after enrolment in the study. The 18-month data collection interval between the 2nd and 3rd time points may have been too long. Data collection at relatively shorter intervals may clarify the change trends and effects of the intervention. Thus, future studies with relatively shorter data collection intervals are suggested.

5 | CONCLUSION

The findings of this study suggested that the 3-month WeChat health education programme based on the TTM and self-efficacy theory had a positive clinical effect on the self-management of haemodialysis patients in China. This programme can be incorporated into the current routine nursing care of haemodialysis patients. However, obtaining feedback and opinions from the participants to further improve the contents of the intervention is suggested. Moreover, providing booster interventions during the follow-up period may improve the effects of the intervention, especially the long-term effects and is also recommended. In addition, multicentre research should be performed to verify the effect of the WeChat intervention mode. Future studies with large sample sizes, short data collection interval and robust study designs with control groups are suggested to further examine the effects of WeChat health education programme.

CONFLICTS OF INTEREST

The authors have no competing interests to disclose.

AUTHOR CONTRIBUTIONS

QR, QS, ML, LZ, YL: Made substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data; QR, QS, LZ, CT-H: Involved in drafting the manuscript or revising it critically for important intellectual content; QR, LZ, QS, YL, CT-H, ML: Given final approval of the version to be published. Each author should have participated sufficiently in the work to take public responsibility for appropriate portions of the content; QR, LZ, QS, YL, ML, CT-H: Agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

All authors have agreed on the final version and meet at least one of the following criteria [recommended by the ICMJE (http://www.icmje.org/recommendations/)]:

- Substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data;
- Drafting the article or revising it critically for important intellectual content.

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