Tehran University of Medical Sciences

Nursing Practice Today

2024; Volume 11, No 3, pp. 272-282

Original Article

The effect of education through a mobile application on self-care behavior in patients undergoing percutaneous coronary: A randomized clinical trial

Khatereh Salavati[1], Nahid Rejeh[2]*, Farhad Rohani[3], Alireza Dehghan Nayeri[4]

[1]Department of Nursing, Faculty of Nursing and Midwifery, Shahed University, Tehran, Iran
[2]Elderly Care Research Center, Department of Nursing, Faculty of Nursing and Midwifery, Shahed University, Tehran, Iran
[3]Department of Geriatric Health and Psychiatric Nursing, Faculty of Nursing, Gonabad University of Medical Sciences, Gonabad, Iran
[4]Cardiologist, Cardiovascular Research Center, Alborz University of Medical Sciences, Karaj, Iran

ARTICLE INFO

Received 13 March 2024
Accepted 02 July 2024

Available online at:
http://npt.tums.ac.ir

Keywords:
education;
mobile application;
self-care;
percutaneous coronary intervention

Corresponding Author:
Nahid Rejeh, Elderly Care Research Center, Department of Nursing, Faculty of Nursing and Midwifery, Shahed University, Opposite of Holy Shrine of Imam Khomeini-Khalij Fars Expressway, Postal/zip code: 3319118651, Tehran, Iran.
E-mail: reje@shahed.ac.ir

DOI: 10.18502/npt.v11i3.16174

ABSTRACT

Background & Aim: Patients who receive percutaneous coronary interventions often display inadequate levels of self-care actions, which could create difficulties in managing the disease and achieving favorable treatment results. This study investigates the impact of using an educational mobile application on self-care behaviors in patients undergoing percutaneous coronary intervention.

Methods & Materials: A randomized clinical trial was conducted with 110 patients undergoing percutaneous coronary interventions at Shahid Rajaei Hospital in Karaj, Iran, in 2023. The study enrolled and assigned them to either the intervention group (n=55) or the control group (n=55) by block randomization. In addition to training upon discharge, the experimental group received educational resources via a mobile phone application. The data collection instruments included MSCBS. Patients completed the MSCBS before the intervention and 4 weeks later. The data were analyzed with SPSS 21. The study's level of significance was set to $P<0.05$.

Results: Before the intervention, there was no significant difference in the self-care scores and the subscales between the two groups ($P>0.05$). Nonetheless, After the intervention, a significant difference was observed in the self-care scores and the subscales between the control and intervention groups, ($p=0.001$), and the difference in scores between the control and intervention groups increased significantly after the intervention and the scores of the intervention group had a significant increase compared to the scores of the control group.

Conclusion: The study showed that the mobile phone educational application could improve self-care behaviors in patients undergoing percutaneous coronary interventions. Therefore, it can be recommended that nurses working in medical centers use this educational application to enhance self-care in these patients.

Introduction

Cardiovascular diseases rank as the fourth most common cause of mortality globally, as stated in the latest report from the World Health Organization. Indeed, 17.9 million people die each year from cardiovascular diseases (1). In Iran, cardiovascular diseases account for 20%–23% of the disease burden and 46% of all deaths (2).

Percutaneous coronary interventions (PCI) have emerged as a routine and low-risk approach to restoring blood flow in coronary arteries, and their use has increased significantly in recent years (3). Certain patients hold the belief that their occlusive heart disease has been resolved following angioplasty. Nevertheless, this procedure does not eliminate the risk (3).

Coronary artery re-stenosis entails re-stenting, which is linked to adverse physiological, psychological, and physical consequences in patients (4). Patients undergoing PCIs experience satisfactory treatment and medication adherence during hospitalization, thanks to the presence of nurses and their recommendations (5). If the treatment is successful, the patient may be discharged on the same day of the operation. These brief hospital stays are cost-effective, but there is a risk of mistakenly if the patients have completely recovered, resulting in

Please cite this article as: Salavati K, Rejeh N, Rohani F, Dehghan Nayeri A. The effect of education through a mobile application on self-care behavior in patients undergoing percutaneous coronary: A Randomized Clinical Trial. Nursing Practice Today. 2024; 11(3): 272-82

a substantial underestimation of PCIs and the chronic nature of coronary artery disease (3). Due to the shortened duration of patient hospital stays, patients lack sufficient opportunity to interact with nurses for training before discharge, resulting in limited access to information. The swift transfer of care responsibility from medical personnel to the patient ultimately lowers the ability of patients and their family members to manage the disease effectively after discharge. As a result, patients who undergo these invasive interventions may not have a thorough understanding of care after discharge, which harms their self-care behaviors (6).

Self-care is a dynamic, interactive, and ongoing process whereby individuals actively engage in their chronic illness management and gain related knowledge and skills, including adherence to medication regimens, dietary intake, and exercise (7). Patients who undergo coronary interventions after treatment see it as a treatment option and consider it as acute rather than chronic. As a result, they exhibit poor self-care behaviors (8). According to statistics, 42% of these patients ignore their health behaviors , resulting in poor clinical outcomes, increased morbidity and mortality, higher readmission rates, and higher healthcare costs (9).

According to what went above, modifying patients' self-care behaviors as a dynamic, interactive, and daily process is highly beneficial in reducing complications. A key component of self-care for coronary artery disease is having the right knowledge and understanding of the disease (10). Therefore, focusing on educational solutions that can increase patient knowledge and improve self-care behaviors in this patient group is crucial (11). Patients undergoing PCIs require continuous care . Thus, interventions using healthcare information technology, such as mobile health (mHealth) applications, can be deemed a viable option for educating these patients with no time or location constraints. Since mobile phones are more common than personal computers and other contemporary devices with Internet access, they offer a new approach to overcoming various obstacles to compliance and maintaining self-care behaviors. Additionally, they can offer specialized mHealth applications and introduce innovative approaches in the realm of health behaviors (12). Using mHealth technology to manage chronic diseases can lead to notable cost reductions in treatment and hospitalization, all while eliminating the need for constant supervision from healthcare professionals. By harnessing the power of this technology, patients can experience improved conditions through better activity planning, clinical decision-making, and symptom management (13). Studies have shown that mobile phones can help educate patients about managing chronic diseases, (13, 14). Inglis et al. (2017) found that installing health applications on cardiac patients' phones increased their knowledge and helped them follow drug treatments, diet, and exercise (15).

Additionally, nurses can considerably contribute to enhancing self-care behaviors in patients undergoing coronary interventions. By establishing the appropriate foundation for devising and executing interventions that foster self-care behaviors, nurses can take proactive measures to attain positive results, including speeding up the recovery process, minimizing hospital stay duration, and reducing the expenses incurred by patients undergoing coronary interventions in hospitals (16). Given the importance of disease management and the potential of smartphones in facilitating patient education, the current study aimed to assess the impact of a mobile phone educational application on self-care behaviors in patients undergoing PCIs.

Methods

Design

A randomized, controlled clinical trial was conducted in 2023 with patients undergoing PCIs at Shahid Rajaei Hospital, affiliated with Alborz University of Medical Sciences and Health Services, Karaj, Iran. The research protocol was registered with the clinical registry trial under the code IRCT20110912007529N27.

Sampling

Initially, samples were selected using consecutive non-probability sampling and if they met the inclusion criteria, the study's objectives and procedure were explained to the participants upon their entry, and informed consent was obtained using a consent form. Participants signed the informed consent form themselves. and then they completed the initial questionnaires.

The sample size was estimated using a similar study (29) and the formula for the difference in means between two independent samples, assuming an alpha of 0.05 and a power of 80%. With an anticipated dropout rate of 5%, the sample size was calculated to be 55 participants per group. The sampling process continued until a sufficient number of participants were recruited into each group.

Randomization

To eliminate selection bias, participants were randomly allocated to study groups using a concealed randomization procedure. To achieve concealment, each generated sequence was randomly written on a card and placed in an opaque envelope. This sequence remained concealed until the interventions were conducted. Randomization was performed using a block randomization method with a block size of four.

The randomization list was generated in consultation with a statistician and based on the online randomization tool (https://www.sealedenvelope.com/simple-randomiser/v1/lists). Participants were allocated to either the intervention group (education using an application) or the control group. A research assistant administered questionnaires to participants for self-completion. Random allocation of participants is expected to have controlled for confounding factors.

Blinding

The statistician remained blinded to group allocation, further preventing analyst bias. Consequently, this study employed single-blind randomization.

Eligibility Criteria

The study's inclusion criteria were as follows: age range of 18 to 60 years; proficiency in reading and comprehending Persian; hearing and vision for communication purposes; first experience with PCI; no concurrent participation in another study; possession of a smartphone; absence of malignancy or chronic diseases such as cancer, kidney failure, or neurological problems (Parkinson's, Multiple Sclerosis); and consent to participate. The exclusion criteria comprised patient discontinuation or withdrawal of participation, physician withdrawing consent, lack of mobile phone access, unavailability within six weeks of study initiation, referral to other medical facilities, acute mental cognitive disorders or severe orthopedic/musculoskeletal complications, and the need for non-emergency PCI or later procedures.

Measures

Data were collected using a demographics form and Miller's Self-Care Behavior Scale (MSCBS).

The demographic characteristics form

The demographic characteristics form consisted of the following variables: age, gender, level of education, marital status, employment status, current diagnosis, stent implantation, primary source of information about the current disease, body mass index, smoking history, comorbidities, family history of coronary artery disease, and drug category.

Miller's Self-Care Behavior Scale (MSCBS)

The MSCBS (1982) has 20 items responded on a five-point Likert scale in the domains of adherence to the prescribed diet, smoking, physical activity, adherence to the prescribed drug regimen, and stress management. Every domain consists of four items. Scores on this questionnaire range from 20 (the lowest possible) to 100 (the highest possible). Based on the Likert scale, a score of 1-4 suggests a lower likelihood, while a score of 5 suggests a higher likelihood of following self-care behaviors. Hence, a score between 20 and 79 suggests unfavorable self-care behaviors, while a score between 80 and 100 suggests favorable self-care behaviors.

Niyakan et al. (2013) evaluated and confirmed the validity and reliability of this questionnaire using psychometric techniques. The Cronbach's alpha coefficients for the domains of adhering to the prescribed diet, not smoking, physical activities, taking the prescribed drug regimen, and managing stress were 0.81, 0.92, 0.95, 0.98, and 0.80, respectively. These findings confirm the internal

consistency of the domains (17). The reliability of this study was calculated using Cronbach's alpha method, which yielded a coefficient of 0.81.

Interventions

The training intervention using the mobile phone application was implemented for the experimental group once they were discharged from the hospital. Before the intervention began, the researcher installed an educational application designed specifically for the experimental group's patients, through which the patients received Health educational content. The application included educational materials for patients following PCI. The educational materials provided comprehensive information on cardiovascular diseases, including concepts, definitions, symptoms, risk factors, treatment options, control methods, rehabilitation, patient abilities, and the benefits of exercise therapy. These materials were designed to be helpful and informative for patients seeking knowledge about heart disease. As for nutritional training, we discussed the importance of diet management to improve lifestyle. We emphasized the need for a balanced and nutritious diet with low salt and fat intake. In exercise training, attention was directed to the correct techniques for various activities and the way to manage physical movements effectively. The researcher collaborated with an IT expert to design the offline application software. In addition to being user-friendly, the application's design included a suitable font and color scheme, as well as multimedia (pictures, videos, and instructional text) that were prepared and used by reference books to draw further attraction. Every weekend, the experimental group received a phone call or a reminder to review the educational content through the application.

Control group

Patients in the control group received standard hospital care, which includes limited and identical routine training during discharge from the hospital, and both control and intervention groups received this training routinely.

Ethical considerations

This study was approved by the Ethical Research Committee of Shahed University (decree code: IR.SHAHED.REC.1401.102). This research was approved by the Research and Ethics Committee affiliated with the university in which the corresponding author (N.R.) worked (decree code: no. IR. SHAHED.REC.1401.102). It was also registered on the website of the Registry of Clinical Trials (decree code: IRCT20110912007529N27).

The objectives and method of the study were completely explained to the patients. The confidentiality of data and anonymity of the participants were ensured by using numbers instead of names. Additionally, they were informed that they could withdraw from the study without any impact on their care process. Written informed consent was obtained from the willing patients. After the study was completed, the patients in the control group received educational materials and a summary of the sessions' contents.

Statistical analysis

The data analysis was conducted using SPSS software version 21. First, the Shapiro-Wilk statistical test was used to determine whether the data for variables in both the intervention and control groups had a normal distribution. Subsequently, independent t, Fisher, Mann-Whitney, and chi-square tests were used to evaluate the results. To compare within-group mean score changes of self-care and its dimensions, Wilcoxon's statistical test was employed.

Additionally, the Mann-Whitney statistical test was used to compare the changes in the scores of self-care and its dimensions between groups. The significance level in this study was set to $P<0.05$.

Results

The study process follows the CONSORT flow diagram (Figure 1).

All of the 110 patients undergoing PCIs were evaluated in this study in two groups, (the intervention group (n=55) and the control group (n=55); no samples were excluded or withdrawn. The intervention continued from 22 June to 22 September 2023.

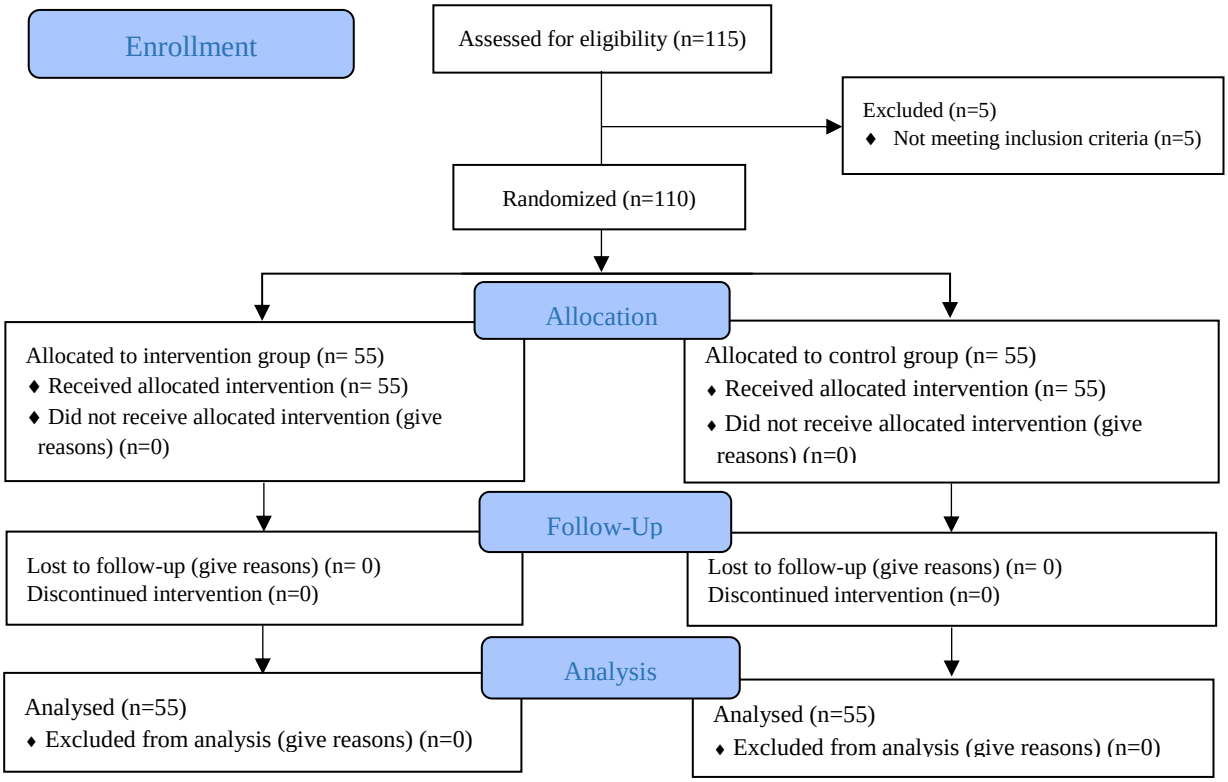

Figure 1. CONSORT participant flow diagram with response rates

Demographic characteristics of the patients

The mean age of the patients in the control group was 52.45±6.30 years, while in the experimental group, it was 53.75±4.83 years. Both groups had a normal distribution regarding age, and there was no significant difference in terms of age between the two groups (P=0.453). The distribution of demographic variables in the two groups was found to be similar, with no statistically significant difference between them (P>0.05) (Table 1).

Table 1. Comparison of the demographic characteristics of the patients between the groups

Variables		Groups		P-value
		Control Group Mean± SD	Experimental group Mean± SD	
Age (years)		52.45±6.30	53.75 ± 4.83	P= 0.453 *
body mass index (kg/m2)		28.68±1.83	29.43 ± 2.15	P= 0.051 **
Characteristic		**n (%)**	**n (%)**	**P-value**
Gender	Male	32 (55.2)	26 (44.8)	P= 0.340 ***
	Female	23 (44.2)	29 (55.8)	
Occupation	Homemaker	16 (48.5)	17 (51.5)	P= 0.920 ****
	Employed	20 (48.8)	21 (51.2)	
	Retired	19 (52.8)	17 (47.2)	
Education level	Elementary	27 (62.8)	16 (37.2)	P= 0.060 ****
	High school	13 (36.1)	23 (63.9)	
	University	15 (48.4)	16 (51.6)	
Smoking	Yes	28 (60.9)	18 (39.1)	P= 0.081 ***
	No	27 (42.2)	37 (57.8)	
Family history of coronary heart disease	Yes	28 (53.8)	24 (46.2)	P = 0.567 ***
	No	27 (46.6)	31 (53.4)	
Having of stent	Yes	44 (50.6)	43 (49.4)	P = 0.999 ***
	No	11 (47.8)	12 (52.2)	
Underlying disease	Yes	36 (48.6)	38 (51.4)	P = 0.839 ***
	No	19 (52.8)	17 (47.2)	
Having of balloon angioplasty	Yes	38 (48.1)	41 (51.9)	P = 0.672 ***
	No	17 (54.8)	14 (45.2)	

*Mann-Whitney test **Independent t-test ***Fisher's test **** Chi-square test

Self-care behavior

As you can see in Table 2 regarding the Mann-Whitney statistical test, there were no significant differences in the self-care scores and the subscales between the intervention and control groups before the intervention (P>0.05). However, After the intervention, a significant difference was observed in the self-care scores and the subscales between the control and intervention groups, (p=0.001).

Table 2. Comparison of the self-care and its dimensions in the participants between the groups

Self-care dimension		Groups		P-value
		Control Group Median (Q1-Q3)	Experimental group Median (Q1-Q3)	
Diet (out of 20)	Before intervention	12 (9-13)	11 (7-13)	0.085 *
	Post-intervention	11 (9-13)	14 (12-15)	0.001 *
	P-value	0.349 **	0.001 **	
Smoking (out of 20)	Before intervention	19 (9-20)	14 (8-20)	0.190 *
	Post-intervention	18 (11-20)	18 (14-20)	0.409 *
	P-value	0.461 **	0.001 **	
Drug regimen (out of 20)	Before intervention	14 (12-16)	13 (12-16)	0.611 *
	Post-intervention	13 (12-15)	17 (15-18)	0.001 *
	P-value	0.115 **	0.001 **	
Stress management (out of 20)	Before intervention	11 (9-14)	10 (8-13)	0.137 *
	Post-intervention	11 (10-14)	14 (11-16)	0.024 *
	Significance level	0.765 **	0.001 **	
Physical activity (out of 20)	Before intervention	10 (7-13)	10 (8-13)	0.728 *
	Post-intervention	10 (8-14)	12 (14-16)	0.001 *
	P-value	0.218 **	0.001 **	
Self-care (out of 100)	Before intervention	61 (53-72)	60 (51-67)	0.161 *
	Post-intervention	60 (55-75)	74 (69-84)	0.001 *
	P-value	0.449 **	0.001**	

* Mann-Whitney **Wilcoxon

Discussion

This study aimed to investigate the impact of using a mobile phone educational application on self-care behaviors in patients undergoing PCIs. After the intervention, a significant difference was observed in the self-care scores and the subscales between the control and intervention groups, and the difference in scores between the control and intervention groups increased significantly after the intervention.

Indeed, the intervention group showed a statistically significant increase of at least 2 to 3 points in the median scores of self-care behavior dimensions (diet, smoking cessation, medication adherence, stress management, and physical activity). However, it was not observed in the control group. These results suggest that the use of a mobile phone application-based educational intervention was highly effective in improving the above-mentioned aspects among patients. Consequently, the mobile phone educational application can be recommended as a powerful tool for improving self-care behaviors and their dimensions in patients undergoing PCIs during the post-discharge period. Meanwhile, no significant increase was observed in the control group. According to the current study's findings, patients in the experimental group exhibited significantly higher mean scores in self-care behaviors.

Regarding the application's positive outcomes among the studied patients, it can be stated that self-care behaviors for patients with heart disease are complex and multifaceted, and patients frequently struggle to understand how to monitor symptoms after PCI (18). It appears that the training provided to patients via the mobile phone application has resulted in a change in their behavior by increasing their level of self-care knowledge. Thus, there has been a notable increase in the adoption of a healthy diet, a decrease in smoking habits, greater compliance with drug treatment, improved management of stress through therapeutic intervention, and enhanced alleviation of physical symptoms.

Physical limitations, lack of 24-hour access to treatment staff, and lack of contact with the doctor between follow-up sessions all contribute to a lower level of self-care in patients

with chronic heart disease (19). Mobile applications, on the other hand, provide good alternatives for monitoring patient progress (as a secondary outcome), receiving personalized cues and support, collecting data, and implementing self-management interventions whenever and wherever necessary (20). As a result, patients who receive training via mobile phone applications can improve their adaptation to disease conditions and motivate them to practice self-care as much as possible (4). In light of this, the present study justifies why self-care behaviors are enhanced among patients undergoing PCIs who receive training via mobile phone applications.

In line with the current study, Athilingam et al. (2017) demonstrated that using mobile applications for education positively impacted the self-care behaviors of heart failure patients. This intervention resulted in an improvement in the patients' self-care level over one month (18). In line with the findings of Lao et al. (2023), the current study revealed that implementing a mobile phone application led to substantial enhancements in self-care behaviors among patients undergoing PCI. These improvements included aspects such as physical, mental, diet, adherence to treatment, smoking, alcohol consumption, and physical activity. The intervention spanned 3 months and yielded positive outcomes (21). This research confirms the effectiveness of mobile applications for improving self-care skills, aligning with previous studies like Lao et al. These applications offer accessible information and support, encouraging healthier behaviors, especially for patients after procedures like PCIs. While this study shows benefits up to one month later, Lao et al. found effects lasting up to three months, suggesting both short- and long-term positive impacts on self-care from mobile application interventions.

The findings of Arulnathan et al.'s study (2019) revealed that using a mobile phone application to train patients with heart failure could have a positive impact on their self-care. A comprehensive program promoting healthy lifestyles and self-management of factors such as weight, blood pressure, and heart rate was implemented, leading to increased participant motivation and demonstrably positive outcomes within a four-week timeframe. The consistency between our findings with this study suggests that mobile phone application-based educational programs empower patients with heart disease to acquire knowledge about their condition and its complications, develop the skills necessary to prevent disease-related adverse events, actively modify their lifestyles, and ultimately, engage in a greater range of self-care behaviors (22).

Along similar lines, Kitsiou et al. (2021) showcased the effects of a patient-centered health technology intervention on improving self-care in patients with chronic heart failure over three months. Such similarity between findings suggests that educational topics delivered through mobile phone applications may meet the needs of patients with heart diseases. By fostering a sense of inner balance, mHealth applications can empower heart patients to navigate health-related challenges with serenity. This enables them to take advantage of the various features of the mobile application, which offers a plethora of content and strategies to enhance their self-care behaviors (23).

The findings of Athilingam et al. (2020) corroborate those of the present study by demonstrating the positive impact of smartphone applications on enhancing self-care behaviors among patients with heart failure three months post-intervention. This convergence of findings supports the hypothesis that mobile phone-based education can effectively induce lifestyle behavior change. Patients who have chronic diseases can develop self-care into a habit through behavior modification, as postulated by behavior change theories (24). Therefore, mobile phone applications are anticipated to enhance self-care behaviors in heart patients who receive education through this medium.

The findings of Negarandeh et al. (2019) (25) in Iran demonstrate the efficacy of smartphone application-based interventions in enhancing medication adherence and self-care behaviors among patients with heart failure within 1-3 months of hospital discharge, aligning with the present study's results. Additionally, the findings of Kiyarosta et al. (2018) in Iran confirm the present study by showing the positive effect of the smartphone application on improving the self-care of patients with heart failure during a period of 3 month (26). These studies collectively highlight the growing popularity of mobile phone-based applications as a novel educational approach for

patients with heart failure in Iran. The provided education has proven effective in promoting self-care behaviors, medication adherence, and quality of life among these patients. Given Iran's dispersed population, vast geographical expanse, mountainous and inaccessible regions, frequent natural disasters, and concentration of specialists in major cities, patients exhibit a strong preference for non-face-to-face healthcare services to enhance accessibility, improve healthcare quality, and reduce costs. This preference has not gone unnoticed. Advanced technologies, such as smartphones and their accompanying applications, empower individuals to access healthcare services more readily (27). Therefore, the effectiveness of training through mobile phone applications in improving self-care behaviors, adherence to treatment, and quality of life can be justified for these reasons.

Li et al.'s (2022) study also revealed that education via mobile phone applications effectively improves self-care dimensions such as physical symptoms, adherence to medication regimens, and diet in patients with heart disease over a year. These findings comply with ours, showing that the nutrition education provided to the patients results in the effective selection of useful foods and the desired and necessary dietary style for better disease control. In addition, it is possible that the notable increase in treatment adherence observed in this study, as well as in Li et al.'s study, can be attributed to the emphasis and reminders provided through mobile phones. These educational interventions and follow-ups serve to reinforce the importance of regularly taking medication to prevent severe complications associated with heart disease (28). A study conducted by Perez-Idarraga et al. (2015) found that incorporating a proper diet, exercise, and lifestyle modifications can significantly decrease the incidence of risk factors and complications associated with heart disease. This approach has proven to be effective in improving physical well-being, adherence to the recommended diet, and a decrease in smoking (29), which is consistent with the results of the current study. Therefore, mobile phone application-based dietary education programs can target behavior-guiding beliefs, thereby promoting healthier lifestyle choices among the target population. In other words, identifying and addressing these beliefs may lead to the design of more effective interventions and, ultimately, a healthier lifestyle for the target group. Tajri et al. (2019) found that training patients with type 2 diabetes using a mobile phone application can substantially improve their knowledge and sense of self-efficacy. This, in turn, leads to better adherence to drug therapy even three months after the intervention (30), consistent with the results of the current study. These results suggest that patients face challenges when it comes to managing their treatment. Hence, such a hypothesis is reinforced that mobile phone applications considerably enhance self-care behaviors among patients with chronic diseases by boosting knowledge and elevating self-efficacy.

Consistent with the current study, Maddison et al.'s study (2021) demonstrated the effectiveness of mobile phone-based education in enhancing self-care behaviors, adherence to medication, dietary habits, and reduced smoking among patients with heart disease over 52 weeks (31). The results of the present study can be compared to this study, as both highlight the impact of mobile phone applications on patients with heart disease. These applications promote self-care behaviors and ultimately lead to a positive change in the lifestyle of these patients by encouraging them to practice self-care more frequently. As a result, the notable improvement in various aspects of self-care among individuals with heart conditions can be justified, implying that mobile phone education may have a long-term impact on adherence to self-care practices among heart patients.

The findings of this study contradict those of Dorsch et al.'s (2021) study, which indicated that the educational intervention using a mobile phone application did not lead to any improvement in self-care among patients with heart failure throughout a three-month intervention (32).

Several factors could explain the discrepancy between the findings of the present study and those of Dorsch et al. Adherence to self-care behaviors in patients with heart failure is reportedly influenced by socioeconomic status, knowledge, skill level, and personal acceptance (33). Differences in these factors among the study populations of Dorsch et al. and the present study could account for the observed variations in results. Furthermore, the variation in the type of heart

disease and the intervention methods used for the patients and associated complications in the current study compared to Dorsch et al.'s study may contribute to the disparity in their findings.

The educational needs of cardiac patients vary depending on the specific conditions of their disease. Consequently, the educational approach for these patients may also be influenced and may not effectively promote the adoption of self-care behaviors. Therefore, researchers must carefully consider these factors when developing educational programs for patients with heart disease. Tailoring interventions to address individual needs can enhance the likelihood of promoting positive self-care behaviors and improving patient outcomes (32).

The findings of this study demonstrate that the mobile phone educational application has a positive impact on patients undergoing PCIs. Enhancing knowledge levels effectively encourages self-care behaviors and contributes to the overall improvement of the disease condition. This training method in nursing is highly effective for enhancing patient care during PCIs and enables providing services to this patient group regardless of time and location. As a result, using this educational method reduces the need to re-hospitalize patients undergoing PCIs in medical centers (25).

Furthermore, it enhances patients' autonomy and self-care abilities, ultimately resulting in enhanced medical services and decreased healthcare expenses for patients.

Moreover, this educational approach in nursing can significantly enhance the care provided to patients undergoing PCIs. The time and location flexibility of this method allows for widespread service delivery to this patient population. By implementing this educational approach, the likelihood of readmission for PCI patients can be reduced, patient autonomy and self-management can be improved, and overall healthcare quality can be enhanced, leading to a reduction in healthcare and treatment costs for patients.

Given the inclusion criteria, the results of this study cannot be generalized to a population without Persian language proficiency. Therefore, it is recommended that this study be replicated with a population that does not have this inclusion criterion.

One limitation of the present study is that the emotional state of participants at the time of responding to the questionnaires may have influenced their responses. While efforts were made to mitigate this by administering the questionnaires at an appropriate time and place, the potential impact of emotional state on responses cannot be fully ruled out.

Conclusion

Based on the findings of this study, mobile education can have the potential to enhance the self-care behaviors of patients undergoing PCIs. Therefore, using a mobile phone educational application to provide self-care training can effectively enhance the health of patients undergoing PCIs. As such, this intervention program could be proposed to hospital and medical center officials as a means to enhance self-care behaviors among patients undergoing PCI. This intervention can then be implemented by nurses working in the facilities. By entering this field, nurses can enhance the care and treatment of patients undergoing PCIs and expand their role in self-care behaviors. It is recommended that future research efforts extend the duration of patient follow-up beyond four weeks to elevate the enduring impact of this intervention on self-care behaviors. In addition, it is advisable to consider alternative approaches for assessing self-care behaviors, such as observation.

Acknowledgments

This article is derived from a master's thesis in critical care nursing approved by the Shahid University Ethics Committee with the code IR.SHAHED.REC.140.102 and registered with the Iranian Register of Clinical Trials with the identifier IRCT20110912007529N27. The authors would like to express their gratitude to all the patients who participated in this research project.

Conflict of interest

The authors declare no conflict of interest in this article.

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