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The Effect of Family-Centered Intervention via SMS on Life Expectancy and Self-Efficacy in Medication Regimen Compliance in Patients With Acute MI: A Randomized Clinical Trial

Leila Ebrahimi Sheikh-Shabani[1], Fatemeh Aliakbari[2], Arsalan Khaledifar[3], Fatemeh Deris[4], Fereshteh Aein[5]

Original Article

Abstract

BACKGROUND: Myocardial infarction (MI) is a life-threatening condition affecting an individual's physical and social circumstances. Life expectancy and self-efficacy are required to determine the risk of cardiac complications associated with this disease. This study examined the effect of family-centered intervention via short message service (SMS) on patients with acute MI's life expectancy and self-efficacy in medication regimens.

METHOD: This study was a randomized, single-blind clinical trial. In 2018, 80 patients hospitalized with acute MI at educational centers affiliated with Shahrekord University were randomly assigned to the control and experimental groups. Routine intervention was performed in the control group. The experimental group was sent four educational text messages weekly for three months. Both groups' life expectancy and belief in their ability to adhere to their prescribed medication regimen were evaluated before and after the intervention. The data were analyzed using descriptive statistics, independent t, paired t, and chi-square tests via SPSS software.

RESULTS: The results showed that the mean difference score of total life expectancy change was significantly different between the experimental (12.23± 10.48) and the control group (0.06±7.16) (P < 0.001). The mean difference score of self-efficacy in the experimental group (21.94±12.76) was significantly higher than that in the control group (4.66±9.49) (P<0.001).

CONCLUSIONS: In patients with acute MI, using a text message intervention improved life expectancy and self-efficacy regarding medication regimens. Therefore, this intervention can be used as a low-cost and readily accessible tool to improve these patients' self-efficacy and life expectancy.

Keywords: Myocardial infarction, Self-efficacy, Life expectancy, Short message service

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Introduction

Cardiac events are the leading cause of death and disability worldwide, the prevalence of which has increased dramatically in recent decades [1]. Cardiovascular diseases (CVDs) cause annual mortality of 17.3 million people worldwide. By 2030, this number is expected to exceed 23 million annually [2]. CVDs are the leading cause of death in Iran [3-5].

The most common coronary artery disease is myocardial infarction (MI). Through angioplasty, medication therapy, and coronary artery bypass grafting, approximately 70% of these patients are able to survive. However, these patients require ongoing care [6-9] due to complications such as the second acute MI, arrhythmia, social isolation, depression, and decreased life expectancy [9-11]. One of the most important aspects of their care is considering

1- MSc in nursing, Shahrekord University of Medical Sciences, School of nursing and midwifery, Shahr-e-Kord, Iran
2- Assistant Professor, Community-Oriented Nursing Midwifery Research Center, Nursing and Midwifery School, Shahr-e-Kord University of Medical Sciences, Shahr-e-Kord, Iran
3- Associate Professor of Cardiovascular Surgery, Department of Cardiology, School of Medicine, Modeling in Health Research Center, Hajar Hospital, Shahrekord University of Medical Sciences, Shahr-e-Kord, Iran
4- MSC, Department OF Epidemiology and Biostatistics, School of public health, Shahr-e-Kord University of Medical Sciences, Shahr-e-Kord, Iran
5- Associate Professor, PhD, RN, Community-Oriented Nursing Midwifery Research Center, Shahrekord University of Medical Sciences, Shahr-e-Kord, Iran
Address for correspondence: Fereshteh Aein, Associate Professor, PhD, RN, Community-Oriented Nursing Midwifery Research Center, Shahrekord University of Medical Sciences, Shahr-e-Kord, Iran. E-mail address: fereshtehaein@yahoo.com

life expectancy and self-efficacy in adherence to the medication regimen [12-15].

The number of years a person can reasonably expect to live is referred to as life expectancy [16]. Life expectancy is a positive state of mind directly related to heart disease and leads one to important life goals, improving mental health, life satisfaction, coping with illness, controlling pain, and the patient's disability [15, 17, 18]. The occurrence of acute MI creates physical limitations for patients and gives them a sense of hopelessness [19, 20]. This sense of hopelessness contributes to readmission, depression, and death. The results of previous studies also showed low life expectancy in cardiac patients [15, 21, 22].

One of the factors affecting life expectancy is self-efficacy [17]. Self-efficacy means having self-confidence concerning one's ability to do things such as taking medication [23, 24]. A higher level of self-efficacy, as proposed by Bandura (1977), is associated with increased performance [25]. Self-efficacy increases self-care, reducing the severe complications of coronary artery disease, re-hospitalization, successful treatment, and medication forgetfulness [23, 26-28].

Rong et al. (2015) in the United States demonstrated that self-efficacy in medication regimen compliance increases medication adherence [29]. A study conducted in the United States by Bronner et al. (2015) evidenced that self-efficacy in compliance with the medication regimen improves adherence to the medication regimen and has clinically promising outcomes for the patient [26]. Many patients with a history of MI require family support to adhere to a prescribed treatment plan. However, as a chronic disease, cardiac disease challenges the family and alters their entire way of life. The family is the most valuable resource for chronic patients [30] and the determining factor for the success of follow-up care, disease adaptation, and cardiovascular treatment process follow-up. Active family presence as a source of support is an effective method for encouraging treatment adherence [31, 32].

According to research, family support improves patient care, reduces treatment costs, increases life expectancy and self-efficacy, and improves adherence to medication regimens [4, 33-35]. Due to alterations in their social, financial, and familial circumstances, the families of patients with a history of MI quickly grow weary of providing care.

Nurses are essential members of the healthcare system and play a crucial role in family support [30]. In the Iranian medical system, the nurse-patient relationship is severed after the patient is discharged from the hospital. In contrast, successful care following the occurrence of MI requires continuous communication between nurses, patients, and their families to provide informational support [36]. Adopting new telemedicine technologies without face-to-face contact can facilitate post-discharge care for nurses and families [32]. One of the technologies for distance learning is sending SMS via mobile phone. This method sends messages to the client or family to remind them of necessary home care [37-39].

Limited studies on the use of text messaging to communicate with the patient as a telemedicine technology has confirmed its effect on reducing the relative risk of worsening diabetes in pre-diabetics in Hong Kong [40], improving the self-efficacy of patients with rheumatoid arthritis in Denmark [41] and diabetic patients in Iran [42], as well as the care outcome of patients with heart failure in Belgium [43]. In the studies above, SMS messages were sent directly to the patient; however, involving the patient's family as an effective support system may have additional positive effects. Therefore, the present study aimed to determine the effect of family-centered intervention via SMS on life expectancy and self-efficacy in medication regimen adherence in patients with acute MI.

Materials and Methods

Study Design and Participants

This study is a single-blind, randomized clinical trial conducted between April and March 2018 on 80 patients with MI at two university hospitals affiliated with Shahrekord University

of Medical Sciences. The randomization method was utilized to ensure an equal allocation to each group. The researcher and study staff were blinded to randomization and data collection. Simple random sampling was used to select the samples, and 40 cases were randomly assigned to the control and intervention groups Figure 1.

Ethical Consideration

The study was approved by the Ethics Committee of Shahrekord University of Medical Sciences (Rec IR SKUMS 1396234) and registered with the Iranian clinical trial system under code IRCT20180127038530N1. All participants in this study provided written informed consent. In addition, the participants were reassured that their participation was voluntary and could be terminated at any time. Per the Helsinki Declaration on the Ethical Conduct of Research, the investigator respected the participants' rights.

Sample size calculation

Based on the data of a similar study [44] and the formula using MedCalc statistical software (MedCalc Software Ltd; Ostend, Belgium), the number of samples was calculated as 66 individuals in each group with a power of 80%, α of 0.05, and an effect size of 0.75. With a 10% attrition rate during the trial, this study required eighty patients with acute MI.

Inclusion and Exclusion Criteria

Inclusion criteria for the study included the patient's and family member's desire to continue cooperation in the absence of vision, speech, or hearing impairments, a recent diagnosis of acute MI from a physician, the capability of sending messages to active family members, and the ability to receive messages. Exclusion criteria included the unwillingness of the family member or patient to continue cooperation, a change in the medication trend, inaccessibility to the patient, and re-hospitalization of the patient. Participants who did not meet the study's inclusion criteria were excluded.

Intervention

In the experimental group, one active family member of each patient received training and reminders via mobile phone four times per week for a period of 12 weeks. Text messages were sent four times weekly between 8 am and 12 pm. When the researcher received the "successful message sent" report, they were confident that the active family member had received the message.

The text messages were prepared based on the priority of the patient's needs after discharge and, according to the cardiologist's opinion, by an MS student of the medical-surgical nursing student based on proper guidelines and approved by a cardiologist. In addition, the experimental group also received their standard hospital intervention. Table 1 presents the content of the text messages. Standard hospital interventions such as in-hospital education, medication therapy, and discharge education were provided in the control group. Per ethical considerations, the educational content sent as short messages to the intervention group were provided to the control group patients in the form of a booklet following data collection at the conclusion of the study.

Outcome Evaluation

Demographic Information Questionnaire

Before beginning the intervention, participants completed a demographic information questionnaire that included age, education, medication experience, gender, marital status, and diabetes and hypertension. The research outcome variables included life expectancy and self-efficacy regarding medication regimen compliance.

Life Expectancy

The Schneider Life Expectancy Questionnaire was used to assess life expectancy. Schneider et al. formulated this questionnaire in 1991, which was psychometrically evaluated in Iran in 2011. This questionnaire is a scale that measures a person's hope as a relatively stable personality trait, and it is administered to everyone over the age of 15. The questionnaire consists of 12 questions with a Likert scale ranging from 1 (completely disagree) to 8 (completely

Table 1. Text message content

Message No.	Message content
1	Disease symptoms
2	How to recognize the various disease symptoms
3	Instructions on the actions to take in the event of breathlessness
4	Essential measures for dealing with chest pain
5	How to relieve the patient's pain
6	The cause of the disease
7	The possible complications after acute MI
8	The measures necessary to address potential complications after acute MI
9	Taking medications for the remainder of the patient's life
10	Indicating the time of the doctor's office visit
11	How to administer medication
12	How to administer diuretics
13	How to administer nitrate drugs
14	How to administer beta-blocker drugs
15	How to administer drugs that inhibit platelet aggregation
16	Diuretic side effects
17	Nitrate drug's side effects
18	Beta-blocker drugs side effects
19	Side effects of drugs that inhibit platelet aggregation
20	Measures required during the side effects of diuretics
21	Measures required during the side effects of nitrate drugs
22	Measures required during the side effects of beta-blocker drugs
23	Measures required during the side effects of platelet
24	Prerequisites for leaving home
25	Required actions in the event of foot fatigue
26	Required actions in the event of dizziness
27	Required actions in the event of general fatigue
28	Familiarity with stressors
29	Familiarity with the symptoms of stress
30	Required actions for dealing with stressors
31	Required actions when faced with stress due to fear of death
32	The dangers of smoking
33	Prerequisites for beginning a physical activity
34	Conditions necessary for physical exercise
35	How to interact socially
36	Prerequisites for membership in a community
37	Steps required to conduct group work
38	Information on a patient's diet
39	Essential measures to correct poor dietary practices
40	Essential conditions for adequate sleep
41	Essential conditions for gradual desensitization
42	Essential conditions for self-expression
43	Relationship between mood and thought
44	Information on negative automatic thoughts
45	Essential measures to improve lifestyle
46	Required actions for optimism
47	Essential activities for a meaningful existence
48	General information about the disease

agree). Scale questions are designed in three dimensions: contemplative factor (questions 2, 9, 10, and 12), paths (questions 1, 4, 6, and 8), and distraction (questions 3, 5, 7, and 11).

To improve accuracy, four distracting questions were eliminated during scoring. The score range was 8 to 64. The lowest life expectancy score was 8, while the highest life expectancy score was 64. This questionnaire is also utilized used in Iran, where the reliability of this tool through Cronbach's alpha was obtained at 0.7, and its validity was confirmed [18]. The present study used Cronbach's alpha to determine the reliability (α=0.89).

Self-Efficacy Concerning Medication Regimen Compliance

The Appropriate Medication Use Scale (SEAM) was used to measure self-efficacy in medication regimen adherence. This questionnaire was developed in 2007 by Risser et al. in accordance with Bandura's cognitive-social theory and measured the patient's self-efficacy and ability to use medication for all chronic diseases correctly. The questionnaire is written in simple language for use among individuals who lack education. This questionnaire has 21 items. Patients express their level of ability and self-confidence to take the medication in three ways: with a score of one for lack of ability and self-confidence, two for ability and moderate self-confidence, and three for high ability and self-confidence. The minimum and maximum possible scores range from 21 to 63.

The higher the score, the greater the patient's skill and confidence. Resser et al. used this questionnaire in the United States in 2007. Cronbach's alpha revealed a reliability of 0.90 for this instrument, and its validity was also confirmed. Rong et al. utilized this questionnaire on patients with heart failure in Chapel Hill, United States, in 2015, and its validity was confirmed.

The questionnaire was translated and retranslated between English and Persian to measure SEAM in the Iranian population. Two independent Persian-speaking researchers in the same field of study independently performed the forward translation into Persian. Combining these two translations resulted in the creation a primary Persian version of the SEQ. A native English speaker then implemented the reverse translation into English and rectified any inconsistencies.

The subsequent step involved psychometric testing. Ten patients with MI and eleven Department of Adult and Geriatric Nursing faculty members evaluated the face validity. High face validity was found for this measure (2/6-4/11). The content validity and reliability investigation revealed that the SEQ was valid and reliable (Cronbach's alpha =0.709). Ten patients were asked to evaluate the questionnaire and rate the significance of each item on a 5-point Likert scale so that the 'Item Impact Score' could be calculated. Additionally, the same patients were asked about the items 'relevancy,' 'ambiguity,' and 'difficulty,' and minor modifications were made to the preliminary tool.

To calculate the content validity ratio (CVR=0.83), 11 Department of Adults and Geriatric Nursing faculty members were asked to rate each item on a three-point Likert scale: "1 = essential, 2 = useful but not essential, and 3 = unessential." To calculate the content validity index (CVI), the same panel was asked to rate the items on a four-point Likert scale based on their relevance, clarity, and simplicity. Four items with a CVI less than 0.79 were eliminated at this step. Prior versions of this instrument demonstrated high content validity of individual items (I-CVI range: 0.50 to 1.00) and high content validity of the Persian version as a whole (S- CVI/Ave = 0.90). Cronbach's alpha coefficient (α=0.709) was utilized to determine reliability.

Statistical Analysis

SPSS software was utilized for data analysis (v. 16, SPSS Inc, Chicago, IL, USA). The Kolmogorov-Smirnov test was used to investigate the common assumption of quantitative variables. Variables were characterized through descriptive analysis (mean, frequency distribution tables, and standard deviation [SD]). For other variables, analytic evaluation was conducted (independent-samples t-test, Kolmogorov-Smirnov, paired t-test, and chi-square). The measured variables

before and after the intervention were analyzed using paired t-tests to determine the variation between groups. A statistical significance level of $P < 0.05$ was considered.

Results

Demographic Information of Both Groups

Table 2 summarizes the findings concerning the research participants' demographic information. Other demographic variables were identical between the experimental and control groups ($P > 0.05$), except for residence ($P < 0.05$).

The majority of research samples were male (67.1%), married (91.4%), residing in the city (68.6%), had a high school diploma or lower (51.4%), and were employed (42.9%).

In addition, the majority (57.1%) had a history of taking medications, including losartan, metformin, insulin, and others. Approximately 57.1% had diseases such as hypertension and diabetes.

Table 2. Comparative analysis of the demographic characteristics of the intervention and control groups

Demographic variables	Groups		P-value
	Control	Intervention	
Gender			
Male	22 (62.9)	25 (71.4)	0.44*
Female	13 (37.1)	10 (28.6)	
Marital status			
Single	2 (5.7)	4 (11.4)	0.39*
Married	33 (94.3)	31 (88.6)	
Residence			
City	19 (54.3)	29 (82.9)	0.01*
Village	16 (45.7)	6 (17.1)	
Education			
No education	14 (40)	12 (34.3)	0.32*
Undergraduate Diploma	19 (54.3)	17 (48.6)	
Above Diploma	2 (5.71)	6 (17.1)	
Employment status			
Employed	12 (34.3)	18 (51.4)	0.35*
Unemployed	12 (34.3)	9 (25.7)	
housewife	11 (31.4)	8 (22.9)	
Medication			
No medication	13 (37.1)	17 (48.6)	0.52**
Losartan	7 (20.0)	4 (11.4)	
Metformin	0 (0)	1 (2.85)	
Insulin	1 (2.85)	0 (0)	
All of the above	14 (40.0)	13 (37.1)	
Diagnosis			
No disease	13 (37.1)	17 (48.6)	0.65**
Hypertension	8 (22.9)	4 (11.4)	
Diabetes	1 (2.85)	1 (2.85)	
Both	13 (37.1)	13 (37.1)	
Age Mean + SD	60.50±9.57	57.4±11.02	0.21***
Duration of illness (days) Mean + SD	77.2±134.0	111.5±333.1	0.57***
Number of hospitalizations Mean + SD	1.54±0.95	1.37±0.94	0.53***

*Chi-square test, **Fisher's exact test, ***independent t-test

Patients' life expectancy before and after intervention

The independent t-test (Table 3) revealed that the mean life expectancy and its domains in the intervention and control groups were not significantly different before the intervention (P> 0.05), but after the intervention, they were significantly higher in the experimental group than in the control group (P <0.001). The mean score changes during the study in the experimental group were significantly higher than the control group (P <0.001).

The paired t-test results indicated that, in the experimental group, the mean life expectancy score in each dimension and the overall score were significantly higher after the study than before (P <0.001). However, there was no difference between the control group before and after the experiment (P >0.05).

Table 3. Comparison of the two groups' mean life expectancy scores and their domains before and after the study

Life Expectancy and Areas	Time of intervention	Control Mean ± Standard error	Intervention Mean ± Standard error	P-value***
Agency subscale score	Before	20.0±3.62	20.3±4.11	0.5
	After	20.3±2.58	26.8±3.8	<0.001
P-value**		0.46	<0.001	
Post-pre intervention		-0.57±4.51	6.57±5.01	<0.001
Pathway subscale score	Before	21.1±3.16	20.7±4.83	0.64
	After	21.8±2.62	26.3±4.65	<0.001
P-value**		0.303	<0.001	
Post-pre intervention		0.63±3.56	5.66±6.24	<0.001
Life expectancy	Before	42.0±6.17	40.9±8.53	0.54
	After	42.1±4.87	53.2±7.79	<0.001
P-value**		0.96	<0.001	
Post-pre intervention		0.06±7.16	12.2±10.5	<0.001

***Independent t-test,**paired t-test

Table 4. Comparison of mean self-efficacy scores in adherence to the medication regimen in the studied groups before and after the study

Self-efficacy	Intervention time	Control Mean ± Standard error	Intervention Mean ± Standard error	P-value***
	Before	29.7±5.81	32.1±6.90	0.12
	After	34.3±8.41	54.1±8.62	<0.001
p-value**		0.01	<0.001	
Post-pre intervention		4.66±9.49	21.9±12.8	<0.001

***Independent t-test,**paired t-test

Self-efficacy in Adherence to the Prescribed Medication Regimen

The independent t-test revealed that the mean scores of self-efficacy in medication adherence were not significantly different between the two groups before intervention (P >0.05) (Table 4). After the study, the mean score of self-efficacy in medication adherence was significantly higher in the experimental group than in the control group (P <0.001), and the mean score

by Kamalpour et al. revealed that face-to-face education increased cardiac patients' life expectancy [1].

The study by Farazmand et al. also demonstrated that telephone follow-up after discharge increased heart patients' life expectancy [49]. However, Shojaei et al. found that educating patients alone did not increase their optimism [50]. In the study by Shojaei et al., patient education was provided in a one-hour

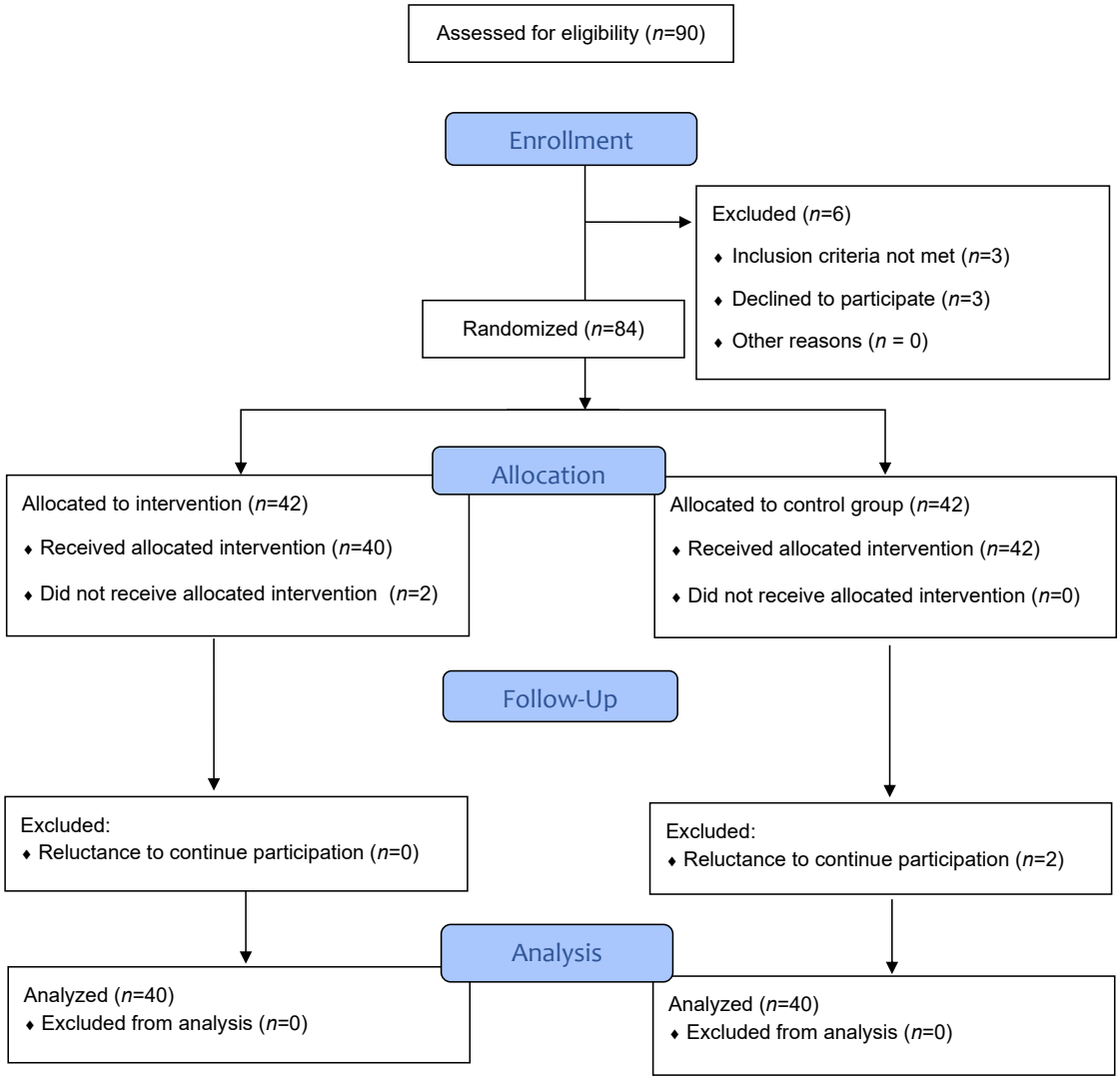

Figure 1. The flow of patients through the trial

of changes during the study was significantly higher in the experimental group than in the control group (P <0.001).

The paired t-test results indicated a significant increase in the mean self-efficacy scores for medication adherence in two groups following intervention (P <0.01).

Discussion

The results of this study indicated that family-centered intervention using the SMS method positively impacted life expectancy and self-efficacy in medication adherence among patients with MI. Several studies have indicated that these patients have a low life expectancy and low self-efficacy [1, 15, 45, 46].

To our knowledge, no study has examined the effect of family-centered and SMS interventions on the life expectancy of cardiac or other patients. However, the present study's findings are consistent with Choobdari et al. regarding the impact of self-care education on life expectancy in patients with acute coronary syndrome [47].

The findings of Zare et al. indicated that a telephone follow-up intervention increased cardiac patients' life expectancy [48]. The study

session at the time of discharge. In contrast, in our study, the educational intervention consisted of three months of text messages sent to an active family member.

Seto (2012) investigated the Design and Evaluation of a Mobile Phone-based Remote Patient Monitoring System for HF Management in Canada. Monitoring patients with heart failure via cell phone with an emphasis on self-care does not increase life expectancy or decrease mortality [51], contradicting the findings of our study. This contradiction can be attributed to the direct telephone intervention performed on the patient in the cited study. One month was the duration of the intervention. In the current study, the educational intervention consisted of sending the active family member 48 short educational messages over three months. Sending a text message to the family member of a patient with acute MI about post-MI care may have increased the life expectancy of these patients.

Studies conducted in Sweden [46, 52] and Thailand [27] on patients' self-efficacy after MI found that person-centered education improves self-efficacy in cardiac patients, consistent with the current study. Before these studies, it was reported that the self-efficacy of patients with acute MI was low, indicating that it requires special attention. After the intervention, self-efficacy increased in the current study's intervention and control groups. Despite this, the rate of growth in the intervention group was five times that of the control group. The increase in self-efficacy in the control group was due to time effects, as self-efficacy has been found to be strongly associated with changes in health behavior and medication use during this period.

The study results indicated that both groups improved their self-efficacy in adhering to their medication regimens. Still, the rate of improvement in the intervention group was five times that of the control group. The reason for the increase in self-efficacy in the control group after the study could be the length of time since the onset of MI or the duration of the intervention performed on the study participants. For instance, in Pulsuk et al. (2016), the shorter time interval (four weeks) between the pre-test and post-test may have contributed to the control group's lack of change in self-efficacy regarding medication adherence [27]; one year had passed since the onset of acute MI in the study conducted by Wolf et al. (2016) [46]. As the family pays more attention to the patients in the immediate recovery period after MI, it may improve their self-efficacy in adhering to their medication regimen compared to the period immediately following MI. Quality of life may also be stable within a year of initial recovery.

However, family-centered intervention by the SMS method had a greater effect on improving patients' self-efficacy in compliance with the medication regimen, such that the mean score of self-efficacy changes in compliance with the medication regimen was approximately five times greater in the experimental group than in the control group.

Study limitations

The current study's limitations were the small sample size and the participants' awareness that they were partaking in a research study that may influence the results.

Conclusion

The findings of this study indicate that distance education programs, particularly those utilizing SMS in family-centered care, can effectively increase patients' life expectancy and self-efficacy after MI. This method can therefore be used to follow up with these patients due to its low cost and accessibility. Since the length of hospitalization does not differ significantly between the two groups, the authors recommend conducting future research with larger samples.

Authors' contribution

Ebrahimi L., Aein F., Deris F., Khaledifar A., and Aliakbari F. were involved in the study conception/design. Aein F., Ebrahimi L., Aliakbari F., Deris F., and Khaledifar A.

contributed to the data collection/analysis. Ebrahimi L. drafted the manuscript. Ebrahimi L., Aein F., Deris F., Khaledifar A., and Aliakbari F. were involved in revisions for important intellectual content and technical/material/administrative support.

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Conflict of interest

None

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