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Original Article

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The Effectiveness of an Intervention Based on the Information, Motivation, and Behavioral Skills Model on Treatment Adherence and Self-Efficacy in Patients with Coronary Artery Diseases: An Explanatory Mixed Method Study

Zahra Khademian[1], Nasrin Zahmatkeshan[2]*, Mahnaz Rakhshan[1] and Ladan Zarshenas[3]

1. Department of Nursing, School of Nursing and Midwifery, Shiraz University of Medical Sciences, Shiraz, Iran
2. Department of Operating Room, School of Para Medicine, Yasuj University of Medical Sciences, Yasuj, Iran
3. Department of Nursing, School of Nursing and Midwifery, Community Based Psychiatric Care Research Center, Shiraz University of Medical Sciences, Shiraz, Iran

Abstract

Background: Promoting adherence to treatment and self-efficacy in patients with coronary artery diseases helps to improve patient outcomes. The present study was conducted to explain the effectiveness of interventions based on information, motivation, and behavioral skills model on treatment adherence and self-efficacy in patients with coronary artery diseases.

Methods: This explanatory-sequential study was conducted on patients with coronary artery diseases in Shiraz, Iran. First, a quasi-experimental study was conducted on 112 patients who were randomly assigned to two intervention and control groups. The intervention consisted of ten motivational training sessions that were designed based on Information, Motivation, and Behavioral Skills (IMBS) model and continued with six months of telephone follow-up and counseling. Data were collected before, three months, and six months after the end of the intervention. Then, in the second phase, a qualitative study including 20 in-depth interviews with 18 participants from the intervention group was conducted. The data were analyzed by deductive and inductive qualitative content analysis. Finally, quantitative findings were explained with the help of qualitative findings.

Results: The findings showed that the mean score of treatment adherence, medication adherence, and self-efficacy in the intervention group was significantly higher than the control group 3 and 6 months after the intervention ($p<0.001$). The results of the qualitative phase of the study also showed that the four main categories include receiving targeted information, encouragement to care, gained self-efficacy/doubt in care, and improvement/non-improvement of treatment adherence behaviors can explain quantitative phase results.

Conclusion: The results showed that receiving training with effective methods, strengthening the support system, self-confidence and positive attitudes about care, and promoting self-management and proper management of emotional distress contributed to the effectiveness of the interventions. However, receiving conflicting information, limited financial resources, and the inability to face challenges were among the obstacles to strengthening self-efficacy and adherence to treatment.

Keywords: Coronary artery disease, Follow-up studies, Iran, Medication adherence, Motivation, Psychological distress, Self efficacy, Self-management

*** Corresponding author**

Nasrin Zahmatkeshan, PhD
Department of Operating Room, School of Para Medicine, Yasuj University of Medical Sciences, Yasuj, Iran
Tel: +98 9173439654
Email:nasrinzahmatkeshan@chmail.ir, N.Zahmatkeshan@yums.ac.ir

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Introduction

Coronary Heart Disease (CAD) is the most common cause of death worldwide (1). These diseases are responsible for 16 million deaths in the world, 82% of which occur in developing countries, and it is estimated that by 2030, the mentioned diseases will account for 37% of premature deaths before the age of 70 (2). Iran is one of the countries with records in the field of CAD deaths. The diseases are the most important cause of death in Iran and account for 43% of deaths caused by non-communicable diseases1. Due to the chronic nature of CAD, patients with these diseases face major problems in the long term, including symptom exacerbation, disease progression, and readmissions (3). The most important actions in controlling the complications of this disease are lifestyle modification, improving self-efficacy, and adherence to the treatments recommended by care providers (4). Evidence shows that non-adherence to treatment and weak self-efficacy is one of the important reasons for the continuity and complexity of problems in patients with CAD, and this issue has caused many concerns among health system workers around the world (5).

Studies have recommended various strategies such as social support, training in psychological methods, self-management, and follow-up care to improve adherence to treatment and self-efficacy in patients with CAD (6,7). However, the studies that explain the results obtained from the interventions used in patients with CAD are very few (8). For example, previous studies have rarely addressed how an intervention can promote adherence to treatment and self-efficacy. Or why an intervention is more effective in some people and less effective in others? In addition, it is believed that quantitative or qualitative studies alone are not able to answer some questions. Therefore, it is necessary to combine qualitative and quantitative data to obtain more comprehensive evidence and identify unknown aspects that can be the basis of the success or failure of interventions in the field of improving adherence to treatment and self-efficacy in patients with coronary heart disease (9).

Considering the multi-dimensional nature of treatment adherence and patients' self-efficacy, perhaps the use of well-known patterns in the field of behavior change can be considered an effective solution in this field. The model of Information, Motivation, and Behavioral Skills (IMBS) is recommended to design practical interventions for special groups and the effectiveness of interventions based on this model has been confirmed in some chronic diseases, including those with acquired immunodeficiency and kidney patients (10,11). The main structures of this model, *i.e.* information, motivation, and behavioral skills, are conceptually and empirically associated with performance in the field of health-related lifestyle and are known as the main elements that determine behavior (12). But despite the use of this model in adherence to treatment in some chronic diseases, its use in coronary heart disease patients has been limited. Therefore, according to the comprehensiveness of the mentioned model in the field of promoting health behaviors in chronic patients and to know the areas of better impact of nursing interventions, this mixed method study aims to explain the effectiveness of interventions based on the model of information, motivation, and behavioral skills on adherence to treatment and self-efficacy was conducted in patients with CAD.

Materials and Methods

The current research was an explanatory sequential mixed-method study that was conducted from October 2019 to August 2020 in Namazi and Al-Zahra hospitals, in Shiraz, Iran. In the first (quantitative) phase, researchers designed interventions to improve adherence to treatment and self-efficacy of patients with CAD and examined their effectiveness. Then, in the second phase (qualitative), the results of the first phase were explained with the help of a qualitative study.

Quantitative phase

This phase was a quasi-experimental study. First, the intervention program based on the model (IMBS) was designed after reviewing the texts and asking for opinions from experts in the form of three categories of educational, motivational, and behavioral interventions. The participants of the quantitative phase were 112 patients over 18 years of age whose coronary artery disease was confirmed by a cardiologist. They had a mobile phone, were able to read and write, and had no other known disease.

In addition, in case of absence of more than two sessions in the intervention, lack of stability in health conditions, and failure to respond to weekly calls, they were excluded from the study. After completing the questionnaires and matching, the participants were randomly allocated into two intervention (56 individuals) and control (56 individuals) groups (13).

Intervention and quantitative phase data collection

This program included 10 educational-motivational sessions and 6 months of telephone follow-up. The content of the educational-motivational program consisted of training on the control of CAD risk factors, individual and group motivational interviews, and behavioral interventions on how to perform care at home. This content was presented to the study group in the form of face-to-face and non-attendance meetings. After completing the training session, follow-up programs were conducted for 6 months, and the study group was guided and consulted on home care by telephone. In time intervals of 3 and 6 months after the completion of the educational-motivational interventions, the questionnaires on treatment adherence, medication adherence, and self-efficacy were completed again by the two study groups. In the end, two patients of the control group died during the follow-up of the second trimester and were excluded from the study, and the data of 110 patients were analyzed (13).

Data collection tools

Data collection tools in this study included a demographic information form, a questionnaire on adherence to treatment in chronic diseases, medication adherence, and Sullivan's Cardiac Self-Efficacy Questionnaire. The demographic information form was comprised of information on age, sex, occupation, marital status, and medical history. The questionnaire on adherence to medication in chronic diseases is a 7-item instrument that is answered based on a five-point Likert scale. The range of scores of this questionnaire is from 0 to 28. Scores less than 20 indicate poor adherence to medication, 21-26 moderate adherence, and 27 or higher show good adherence (14). The reliability of this questionnaire in the initial study was 0.75 (15). Validity and reliability of this tool in Iran were confirmed through translation and back translation and test of the questionnaire with the target group and its reliability has been confirmed with Cronbach's alpha of 0.8513. The questionnaire of adherence to treatment in chronic diseases was designed and psychometrically evaluated by Seyed Fatemi *et al* in Iran in 2013. This questionnaire contains 40 questions and 7 dimensions. The range of changes of this questionnaire is 40-200. Based on the principles of linear standardization, the overall scores of this questionnaire have been converted into a zero-to-hundred scale, and based on this, a score of 75-100 means adherence to very good treatment, and 50-74 means adherence to good treatment, 26-49 is considered as average treatment adherence and 0-25 means poor treatment adherence (16). This questionnaire was used in other studies in Iran (17,18) and its reliability was confirmed in the present study by calculating Cronbach's alpha of 0.8513. Sullivan's Cardiac Self-Efficacy Questionnaire was designed in 1998 and has 16 items graded on a 5-item Likert scale. The range of its scores is 0-64, and higher scores indicate better self-efficacy. The correlation coefficient for convergence validity between this tool and similar tools was 0.28-0.4 (19). This questionnaire was used in previous studies in Iran (20,21) and in the present study, its reliability was confirmed with Cronbach's alpha value of 0.8913.

Data analysis

The data collected after coding was analyzed using SPSS statistical software version (22). Descriptive statistics were utilized to describe the variables, chi-square was used to examine the relationship between qualitative variables, and independent t-test was used for comparing the mean of quantitative variables between groups. Also, analysis of variance with repeated measurements was utilized to compare the mean changes in treatment adherence scores and its different dimensions, medication adherence, and self-efficacy in three stages of the intervention; Also, Benferroni's post hoc test was used to examine the changes of the above variables between different stages of the study. In addition, to investigate the trend of mean change and prevent the effect of group-time interaction on the findings, the variable data of treatment adherence, medication adherence,

and self-efficacy were separated by group, and in both groups, analysis of variance with repeated measurement was performed.

Qualitative stage

After the completion of the quantitative phase, the qualitative phase of the study started sequentially. This part was a qualitative content analysis that was conducted to explain the results of the quantitative phase so that the patient's experience of the effectiveness of the intervention program on adherence to treatment and their self-efficacy was explained.

Participants of the qualitative phase

The participants of this phase were selected purposefully from the participants of the first phase. These individuals were the ones whose mean scores of treatment adherence and self-efficacy questionnaires after/before were at both ends of the spectrum. Another entry criterion was having unexpected results in the dimensions of treatment adherence and self-efficacy questionnaires in the post-test phase. Thus, 15 patients were included in the study. Further, to complete the data and based on purposeful sampling, two patient companions and a nurse with experience working in the CCU department were also included in the study. Finally, there were 18 participants in this phase (Table 1).

Data generation in the qualitative phase

To generate data, 20 semi-structured interviews

Table 1. Individual characteristics of the participants in the qualitative phase of the study

Participants' Number	Gender	Age	Marital Status	Education	Occupation	Illness duration	Role
1	Male	67	Married	Guidance	Retired	3Y/o	Patient
2	Male	62	Married	Guidance	Retired	4	Patient
3	Female	64	Married	Guidance	House Keeper	2	Patient
4	Male	48	Married	Academic	Employee	2	Patient
5	Female	65	Single	Elementary	House Keeper	5	Patient
6	Female	49	Married	Academic	Employee	2	Patient
7	Male	69	Married	Guidance	Self-employed	5	Patient
8	Male	72	Married	Elementary	Self-employed	6	Patient
9	Male	60	Married	Guidance	Retired	4	Patient
10	Female	48	Married	High School	House Keeper	2	Patient
11	Female	62	Married	Guidance	House Keeper	3	Patient
12	Male	62	Married	Guidance	Self-employed	5	Patient
13	Male	57	Married	High School	Retired	4	Patient
14	Female	60	Married	High School	House Keeper	4	Patient companion
15	Male	51	Single	High School	Self-employed	2	Patient
16	Female	45	Married	Academic	Nurse	-------	CCU Nurse
17	Female	54	Married	Guidance	House Keeper	3	Patient companion
18	Male	58	Married	Guidance	Self-employed	4	Patient

were conducted with the participants so that two participating patients were interviewed twice. The interviews were conducted online after prior coordination with the participants through video communication on WhatsApp. The duration of the interviews was about 45-60 *min* based on the objectives of the research and the tolerance of the participants. During the interview, the researcher tried to explain the results obtained from the first stage and how and why the impact or lack of impact of the interventions on self-efficacy and their adherence to the recommended treatments by asking open-ended questions. Also, based on the responses of the participants, exploratory questions were asked about the effectiveness of the intervention program and it is facilitating and hindering factors. In addition to interviews, memo-writing methods and observation of nurse-patient interactions were also used to collect information. Data generation continued until data saturation, which is when no new information was obtained.

Analysis of data

The interviews were implemented verbatim in Word file format immediately after being conducted and after several times of listening. Then, the entire text of the interviews was re-read and reviewed several times and simultaneously analyzed and coded for deeper understanding. The analysis of the findings was done using the qualitative content analysis method in a deductive and inductive manner as suggested by Elo and Kyngas (22). In this way, in the preparation stage, codes and initial subcategories were created, and in the organization phase, the unconstrained matrix was developed for the data analysis according to the context of the findings and IMBS components. Additionally, other meaning units, not necessarily associated with main categories, but related to the treatment adherence and self-efficacy in CAD, were also coded. Next, the grouping, categorization, and abstraction steps were fulfilled until generic categories were developed; the categories nested into the main categories in the matrix or new categories were created. To ensure the trustworthiness of the data, prolonged engagement was used through continuous engagement with the research environment and data. In addition, a part of the data was returned to the participants and checked for compatibility with their experiences, and the codes that failed to reflect their experience according to the participants were modified. Furthermore, samples of the interviews conducted after the implementation along with the relevant codes, concepts, and categories that appeared by experts in qualitative research were reviewed. An audit trail was also utilized to achieve reliability. For this purpose, all information related to the research was kept so that it can be audited by other people (9).

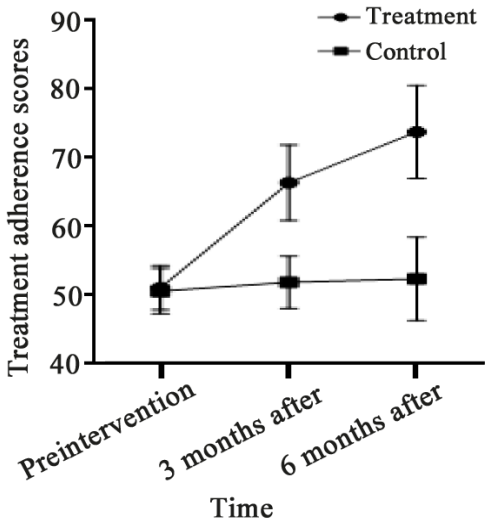
Ethical considerations

In this study, all the methods were performed according to the Declaration of Helsinki and its related guidelines and regulations, and ethical considerations were observed in the quantitative and qualitative phases of the study. Permission was obtained from the Research Ethics Committee of Shiraz University of Medical Sciences (IR.SUMS.REC.1398.575) and the study participants signed the informed consent form of a process in different phases of the research. The participants were assured that the data would be kept confidential for research purposes. Also, during the interviews, whenever they felt tired, they announced to end the interview. Permission for voice recording of the interviews was also obtained from the individuals.

Quantitative phase findings

The findings of the quantitative phase of the study showed that 73.2% of the studied samples were male, 89.3% were married, 48.2% were self-employed, and 42% had a high school education. Also, 31% had a history of at least one hospitalization and in 48% of cases, one year had passed since the diagnosis of their disease. Also, the findings of the first phase of the study demonstrated that before the intervention, the two studied groups had no statistically significant differences in the mean scores of treatment adherence, medication adherence, and self-efficacy, but three and six months after the intervention, the mean scores in the intervention group were significantly higher than in the control group ($p<0.001$). The intra-group changes in the studied groups also indicated that in the intervention group in the previous period, three and six months after the intervention, the mean scores of treatment adherence and its dimensions, medication adherence, and self-efficacy had an

increasing and significant trend (p<0.001). In the control group, although Benferroni's post hoc test showed three months after the intervention in the dimensions of interest in treatment (p=0.018), desire to participate in treatment (p=0.002), adaptation to treatment (p=0.001) and medication adherence (p=0.001) have represented statistical improvement compared to before the intervention, six months after the intervention, these changes were not statistically significant (p=0.31) and medication adherence showed a statistically significant decrease six months after the interventions (Graphs 1 and 2). The findings also demonstrated that the self-efficacy scores in the intervention group had a statistically significant change compared to the control group (p<0.001). Also, the repeated measurements ANOVA showed positive and significant changes in the intervention group at the intervals before, three, and six months after the intervention (p<0.001), while these changes were not significant in the control group (p=0.86) (Graph 3).

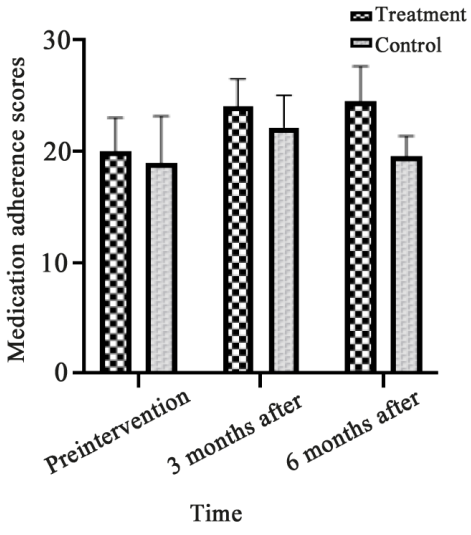


Graph 1. Comparing the mean scores of treatment adherence before and after the intervention in the intervention and control groups

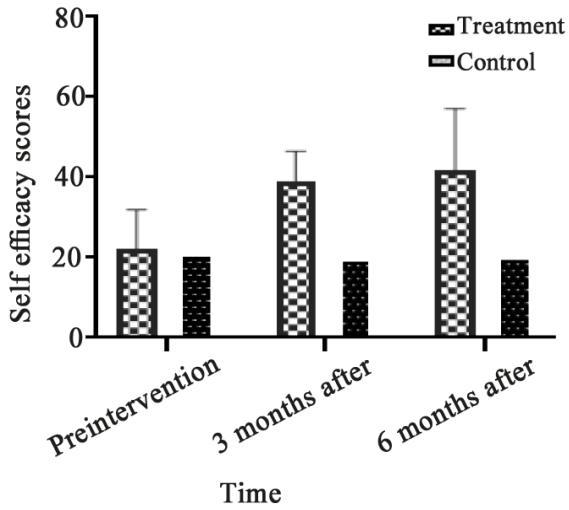
Findings of the qualitative phase

From the total of 20 conducted interviews, 1346 primary codes were obtained, excluding duplicate codes, and 25 subcategories were obtained from their integration. The obtained sub-categories were placed in eight generic categories and four main categories based on the model of information, motivation, and behavioral skills (Table 2). As shown in the table, the difference between the experiences of the individuals who were affected by the intervention and those who were not affected by the intervention is presented in the form of a spectrum in two categories. These include "improvement or lack of improvement in treatment adherence behaviors" and "acquired self-efficacy or doubt in care".

The first category obtained in this section was "receiving targeted information" with generic categories "acquiring proper knowledge of the care program" and "need to receive practical training". Most of the participants emphasized the role of the



Graph 2. Comparing the mean scores of medication adherence before and after the intervention in the intervention and control groups



Graph 3. Comparing the mean self-efficacy scores before and after the intervention in the intervention and control groups

Table 2. Sub-categories, generic categories, and main categories of treatment adherence and self-efficacy based on information, motivation, and behavioral skills model

Main Category	Generic Categories	Subcategory
Receive targeted information	Acquiring proper knowledge of the care program	Applying training based on the patient's understanding and needs
	Need to receive practical training	- Insufficient hospital training - Using unreliable information sources
Encouragement to care	Perceived supports	- Attention to care in the shadow of confidence in the treatment team - Continuing to accompany the family in the treatment process - Benefiting from the support and positive experiences of friends and peers - The need for organizational support
	Existence of personal motivations regarding treatment	- Gaining a positive attitude about health and treatment plan - The existence of false beliefs about treatment - Ignoring advice due to forgetfulness
Improvement/ non-improvement of treatment adherence behaviors	Self-management in the treatment process	- Try to apply the recommendations - Attention to the process of taking medicine -Strengthening chest pain management skills - Being on the way to quitting smoking
	Managing unwanted tensions	- Trying to improve the mental state - Inability to deal with mental conflicts
Gained self-efficacy/doubt in care	Self-reliance in care	- Focus on capacities by promoting independence - Improving capacity in care
	Inability to deal with therapeutic challenges	- Feeling unable to control the disease - Dependence on disease control and aspects

training provided in this study in such a way that this training created the ability to take care of themselves without the need of the people around them after being discharged from the hospital. A participant stated:

"When I went home from here [hospital], I did not know what would happen. Once you are separated from the doctor and nurse, you are left alone. They have to tell us what to do at home. We needed this program" (P15, 51 years old).

In their statements, the participants considered the training that was designed based on their needs and presented easily and in understandable ways as practical training in self-care. According to these participants, participation in discussions, integration of different educational methods, and understanding why care is taken helped them to better comply with the treatment plan. A participant expressed:

"The nurse who was teaching [researcher]explained everything very well... I mean, I want to say that you have to speak simply to the patient. He must understand so that he can do it easily. When you know why you have to do everything yourself, you better

comply" (P3, 64 years old).

However, some participants with lower scores in the treatment adherence and self-efficacy questionnaires considered receiving conflicting information from unreliable sources as a factor in poor adherence to treatment or self-efficacy. A participant maintained:

"After I was discharged, I was taking my medicines regularly. I was very weak. My sister said that these are too strong for you, do not take them. She has had a heart problem for several years. I did not know what to do. I did not eat for several days. At the end, I also went to another doctor" (P5, 65 years old).

The second main category obtained in this phase was "encouragement to care" with generic categories "perceived supports" and "existence of personal motivations regarding treatment". Based on the findings, the participants who had higher mean scores in the treatment adherence and self-efficacy questionnaires considered the received support an important factor in better adherence to the treatment program and achieving a sense of self-efficacy. According to these individuals, the support of the treatment team, family, and friends was an important factor in taking better care of themselves. A participant stated:

"My wife attended the classes with me. She did everything she said in the classes. The children take me to the doctor's appointments. They take care of me. If it was not for them, my condition would not be like this" (Patient 1, 67 years old).

According to the opinions of the participants, insurance support and financial resources were other sources of support that both positively and negatively affected the adherence to treatment and the sense of self-efficacy so that the participants who had better adherence and they had higher self-efficacy, were often those who had more financial and support resources at their disposal. For example, a participant maintained:

"Cardiac medicines and tests are expensive. You must have good financial support to be able to handle it well. I had no problems with financial issues" (Patient 7, 69 years old).

Also, the participants whose mean scores after and before the intervention were less than the others, mentioned financial problems as one of the important factors in non-adherence to treatments. A participant expressed:

"Since I got sick, I cannot work anymore. I have a lot of financial problems. My children help me. I don not put the cost of my doctor's medicine on them anymore. I do not go to the doctor" (P9, 60 years old).

In addition to the required support, personal motivations regarding treatment were another factor that positively and negatively overshadowed adherence to treatment and achieving self-efficacy. This, the participants who had more improvement in treatment adherence and self-efficacy scores considered things such as positivity and positive attitudes about health and treatment to be important factors in self-care. As one of the participants stated:

"After the heart attack, I understand the value of my life more. I feel that God has given me another chance that I should use properly and take care of myself more" (P15, 51 years old).

On the contrary, the participants with a smaller mean difference after and before the intervention expressed false beliefs about care and forgetting as an important factor in poor treatment adherence. Most of these participants did not properly understand the chronic nature of heart disease and felt tired from continuing long-term treatments, so that they became unmotivated and weak in adherence. A participant says:

"No matter what medicine I take. It is like my heart has become resistant to the medicine and nothing works. I take medicine or not, diet or not. It does not matter to me" (P7, 69 years old).

Having a lot to do and in some cases, the forgetfulness caused after that was another factor in the non-compliance of some of the participants. A participant stated:

"I have so many conflicts during the day that I often forget to take my medicine. I see that the time has passed. I do not take it anymore" (P18, 58 years old).

Another main category obtained in the qualitative section of the present study was "improvement/non-improvement of treatment adherence behaviors" with generic categories "self-management in the treatment process" and "managing unwanted tensions". The results of the study showed that the participants with higher mean difference scores in the questionnaires of adherence to treatment and self-efficacy, as a result of participating in the intervention program, had

achieved self-management in the treatment so that they exactly followed the information obtained from the care plan regarding diet, activity, medical visits, *etc*. Also, they had acquired the ability to effectively deal with unwanted tensions in life. A participant expressed:

"I try not to involve myself too much in additional issues and think more about my health. I plan for myself to take care of myself based on the things I learned" (P6, 49 years old).

On the other hand, several participants with a smaller difference between the mean scores after/before considered the inability to deal with the unwanted tensions of life as a factor for the inability to control and manage the treatment plan and adhere to it so that in some cases these tensions prevented the patient from continuing the treatments. These participants considered issues such as the death of loved ones and the feeling of depression following it, family problems, many responsibilities in life, and fatigue caused by continuing treatments as a factor in not complying with treatment plans. A participant maintained:

"How much can a person take medicine, go on a diet? There are so many problems that you get tired somewhere else, you get nervous and say to let them all go, to put them aside. I have had this situation many times that I do not take medicine at all for several months" (P11, 62 years old).

The last main category obtained in the study was "gained self-efficacy/doubt in care". Based on the findings of the study, the participants who had better performance and a higher mean difference before/after in the questionnaires of treatment adherence and self-efficacy had reached self-reliance in self-care, while in the participants who showed a lower mean difference had given, they considered hesitation in care as an obstacle to acquiring the necessary capabilities in this field. From the view of the participants in the study, self-reliance in care and achieving a sense of independence and empowerment was an important factor in achieving a sense of self-efficacy in self-care. A contributor stated:

"I am much better than before. I know a lot about taking care of myself. I plan for myself, I'm very precise about my food, exercise, and medications and I do not let problems happen to me" (P12, 62 years old). On the other hand, in several participants with less improvement in self-efficacy, the inability to deal with treatment challenges and their aspects caused them to depend on others to perform care and faced challenges in achieving self-efficacy. A participant expressed:

"I have diabetes, I also have a heart disease. I have to inject insulin, but I am afraid I will not be able to inject it properly. Every day, my sister has to come and inject me" (P14, 60 years old).

Discussion

The current research was conducted to explain the effectiveness of interventions based on the information, motivation, and behavioral skills model on treatment adherence and self-efficacy in patients with coronary artery disease. The results showed that interventions based on this model improve treatment adherence and its dimensions, medication adherence, and self-efficacy in patients. In addition, the results of the qualitative part of the study demonstrated that receiving targeted information, being encouraged to care, improving or not improving treatment adherence behaviors, and gaining self-efficacy or doubts about care can explain why and how the intervention is effective or ineffective in improving treatment adherence and self-efficacy of the patients. Here, with the integration of quantitative and qualitative findings, the final results of the study are discussed.

Based on the findings of the study, receiving targeted information through receiving practical training and knowing the appropriate treatment plan can help to explain the effectiveness of the intervention. In this regard, Desveaux *et al* consider proper training based on patients' needs to be an important factor in adherence to treatment and medication8. In addition, in the current study, gaining knowledge about the consequences of following and not following the treatment plan, getting to know how the drugs work in disease control, and understanding why the treatment plan and how the drugs affect side effects were important factors in improving adherence to treatment and medication. In this context, Farooghi *et al* revealed in their study that knowing the consequences of adherence and non-adherence to the recommended treatments and emphasizing them, improves the treatment adherence. Also, they

consider the use of appropriate models as a factor in the direction of better impact of interventions (23).

Also, the explanation of the results of the quantitative phase with the help of the qualitative phase showed that being encouraged to care with the help of motivators such as receiving support and beliefs and attitudes of people played an important role in the effectiveness of the intervention. The results demonstrated that positive beliefs and attitudes about the results of adherence, along with the support received, can explain the effect of the intervention in improving treatment adherence. Based on the results of this study, when the implemented intervention components were combined with the promotion of patients' awareness and social support from the treatment team, family, and friends, they led to better adherence to treatments. In line with these results, the findings of other studies have also shown that some individual components, optimistic beliefs, and attitudes are associated with positive outcomes of treatment adherence (24,25).

Qualitative phase findings also indicated that the improvement of treatment adherence behaviors through self-management in the treatment process and management of emotional tensions also help to explain the effectiveness of the intervention. The individuals on whom the intervention had a positive effect had acquired self-management skills, thus they actively acted in the field of controlling the effects of heart disease, risk factors, and preventing the recurrence or exacerbation of symptoms. According to the participants in the study, their ability to take care of themselves improved due to participating in the intervention program. In this regard, other studies have also shown the positive outcomes of interventions promoting self-management in chronic diseases, including coronary artery disorders (26,27).

In addition to the above, the management of unwanted tensions and the use of effective coping strategies against these tensions have been other factors in improving adherence to treatment in these patients. Therefore, the participants managed the unwanted tensions by applying different approaches to adapt to the conditions of the disease, and these measures helped to improve adherence to the treatment. In line with the results of similar studies, measures such as communication with God as the supreme factor (28), positive communication with friends and family (29), positive thinking (27), and paying attention to the values in life8 are important factors in improving treatment adherence.

The results of the present study also showed that the intervention program designed based on the information, motivation, and behavioral skills model has improved self-efficacy in patients with CAD. Other studies conducted in the field of self-efficacy have revealed that interventions based on motivational methods (30), training, and improving care behaviors are effective in improving the self-efficacy of the patients (20), although the scope and extent of the impact of the interventions have been different. In the present study, the results of the qualitative part represented that the improvement of self-efficacy by improving the individual's capabilities in self-care and achieving a sense of independence and self-reliance in care was associated so that patients with better self-efficacy managed their care plan in a better way and used their learning more effectively. In this context, improving self-efficacy has been an important factor in managing health status and shifting patients from non-adherence to adherence to recommended treatments (26).

The findings of the qualitative phase of the study also explained why and how the intervention was less effective in improving the adherence and self-efficacy of some participants. The lack of significant impact of interventions in some patients can be related to receiving limited and insufficient information and in some cases, contradictory information from unreliable sources. Thus, unreliable sources of information in some cases led to confusion in the field of treatment plans and in some cases non-adherence to treatment. Similar research results also showed that the lack of nurse-patient ratio in treatment departments will face challenges in providing effective training (31). Also, receiving contradictory information, especially from unreliable sources such as relatives and cyberspace, overshadow adherence to recommended treatments and in some cases prevent patients from continuing treatments (32,33). The above cases point to the requirement and emphasis on the effective role of treatment team members, especially nurses, in providing effective and practical training (34). In addition, in this study, lack of social support and

negative attitudes were associated with weak self-efficacy and adherence to the treatment of the patients. Lack of financial and organizational support made the patients unable to use the learned information despite receiving appropriate teaching from the treatment team. Also, the lack of financial resources was one of the most important factors in poor medication adherence, diet, and periodical follow-ups. Kumar et *al*'s, zahmatkeshan *et al*'s and Vahedparast *et al* studies also associate the unfavorable economic situation with poor medication adherence and periodical visits (27,35,36).

Another factor explaining the non-adherence and weak self-efficacy that was observed in some of the participants was unwanted emotional tensions and the inability to manage them. In some cases, lack of management of adverse emotional consequences discouraged patients from continuing treatment. Some of the participants considered the feeling of depression, mental tension, family problems, and forgetfulness as factors for neglecting the treatment plan and taking medications, which have also been mentioned in other studies (27,35). In addition, the prevalence of mood disorders following cardiac events is high (37). Therefore, using appropriate coping strategies in managing these emotions will help to better control these events and promote treatment adherence (38). Various studies refer to interventions such as psychological counseling (39), rehabilitation programs (40), and telephone follow-ups (18) to improve the conditions of these patients. Thus, paying attention to the psychological aspects of people has resulted in better adherence and treatment results (41).

Strengths and limitations

One of the unique features of the current study was the use of a mixed study design. In this study, the results obtained in the first phase of the study were explained with a qualitative study. In addition, the method of conducting the study in the form of a two-group design and six-month follow-up of the patients in the quantitative phase helped to increase the depth and richness of the study findings. Unlike other studies conducted in the past, in the present study, in addition to paying attention to medication adherence, the concept of treatment adherence was also evaluated more comprehensively with the questionnaire on adherence to treatment in chronic diseases. In addition to the mentioned cases, the present study was also associated with limitations. for instance, due to the outbreak of the COVID-19 pandemic, the data collection six months later, the quantitative phase, and the interviews of the qualitative phase were conducted virtually.

Conclusion

The general results of the study demonstrated that the use of programs based on the IMBS model improves adherence to treatment and self-efficacy in patients with coronary heart disease. Also, the combination of quantitative and qualitative findings showed that targeted information, encouragement to care, gaining self-efficacy, and improving treatment adherence behaviors explain the effectiveness of the intervention. In addition, it is possible to provide targeted information by creating a correct understanding of the treatment plan and providing practical training based on the needs of the patients. However, limited resources, negative beliefs, and unwanted emotional tensions in some cases make the effectiveness of the programs associated with challenges. Therefore, knowledge of the results of this study can be a solution for designing future rehabilitation programs to increase the effects of the mentioned programs in patients with CAD disorders. Therefore, knowledge of the results of this study can be an approach for designing future rehabilitation programs to increase the effects of the mentioned programs in patients with coronary heart disease disorders.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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