Original Article

The Effect of an Educational Intervention based on Pender's Health Promotion Model on Treatment Adherence in the Patients with Coronary Artery Disease

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Abstract

Background: Increasing of hospitalization rates of Coronary Artery Disease (CAD) management have created major challenge for the health system. Poor adherence to treatment is one of the main reasons for treatment failure, prolongation of treatment, and increase care costs. The aim of this research was to determine the effect of educational intervention based on Pender's Health Promotion Model (HPM) on adherence in patients with CAD. **Materials and Methods:** This randomized controlled clinical trial was held in an educational hospital in Isfahan, Iran, February 2018–May 2019. Data were collected from 64 patients with CAD, before, 1 and 3 months after the intervention. The instrument used included treatment adherence questionnaire and a checklist Pender's HPM. The study group received dietary, exercise, and medication education based on Pender's HPM in four sessions which were held in 4 weeks. The control group received the routine educational program of the hospital. The data was analyzed using descriptive statistics, repeated measures ANOVA, independent *t*, Chi-square, and Mann–Whitney tests via SPSS software. **Results:** The mean score of treatment adherence was significantly different between two groups in one ($z = 5.28$, $df = 2$, $p < 0.001$) and three ($z = 4.51$, $df = 2$, $p < 0.001$) months after the intervention. The mean (SD) of treatment adherence in the study group was 139.82 (27.44) 3 months after the intervention. **Conclusions:** Educational intervention based on Pender's HPM is more effective on treatment adherence than the routine method in the patients with CAD. It is recommended to integrate the Pender's HPM as a nursing care program for these patients.

Keywords: *Coronary artery disease, health promotion, Iran, nursing, treatment adherence and compliance*

Introduction

Cardiovascular diseases, especially Coronary Artery Disease (CAD) are the most common causes of disability and mortality in the most of the countries in the world wide.[1] The prevalence of CAD and subsequent mortality are increasing in Iran and account for almost 43% of all deaths per year[2] and in Isfahan is 19.4%.[3] Considering the increase in the number of the people with chronic diseases in recent years, healthcare providing systems have experienced many problems in providing care for these patients. In this regard, many believe that in order to organize these patients for recovery and health promotion, care must be provided by the individual.[4] Based on definition of the World Health Organization (WHO), adherence is the level of behavior performed by a person includes medication, diet or lifestyle changes in accordance with the recommendations provided by health care personnel.[5]

Non-adherence treatment is one of the reasons for treatment failure, increased complications, prolonged treatment, and increased in health costs.[6] The Pender's Health Promotion Model (HPM) is comprehensiveness and application in recognizing behavioral determinants to predict health-promoting behaviors in the field of lifestyle, exercise, and eating habits.[7] The predictive and explanatory structures of health behavior in this model include of perceived benefits, perceived barriers, feelings related to behavior, perceived self-efficacy, interpersonal and situational influences.[8] Pender's HPM tries to promote the health status by

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benefiting from individual's experiences and characteristics, their emotions, specific cognition, and behavioral outcomes.[9] This model is mostly used in chronic diseases such as diabetes and kidney diseases. In the study of Gulumser *et al*., application of Pender's HPM was used in post myocardial infarction patients.[10]

Regarding the widespread prevalence of cardiovascular diseases and their complications, unsuccessful current methods on improve of adherence treatment and lack of studies about effects of application of Pender's HPM on adherence treatment in patients with CAD. This research aimed to investigate the effect of Pender's HPM on the treatment adherence in the patients with CAD.

Materials and Methods

This 2-group, 3-stage clinical trial (IRCT20180227038886N1) was conducted from February 2018 to May 2019. 64 participants were recruited from patients who admitted to the cardiac wards of an educational hospital in Isfahan, Iran. The sample size considering similar studies[11] and the confidence interval of 95% and test power of 80% was calculated as 25 subjects in the study and control group. Based on the researcher's assumption of a 20% drop in the number of subjects, 32 subjects were assigned to each of the two groups. The subjects were selected in terms of the inclusion criteria using convenience sampling method, and were then random allocation assigned into two groups of study and control. To fulfil this, one Card No. 1 and one Card No. 2 were placed in closed pocket. The people who selected Card No. 1 were placed in the study group and the people who selected Card No. 2 were placed in the control group. Inclusion criteria included the patients diagnosed with CAD, a history of at least 6 months of CAD, the physician's permission regarding the patient's participation in the program, patients aged 30–75 years old, lack of simultaneous participation in the educational intervention during the research, and having at least a reading and writing literacy for the patient or family caregivers. Exclusion criteria were as follows: unwillingness to continue participating in the intervention, irregular participation in the educational program or being absent in more than two sessions, failure to complete the questionnaire, and patient death or any problem in a way that the patient cannot continue participating in the research.

The data collection tool was a four-section questionnaire and a check list of constructs of Pender's HPM. The first part included demographic characteristics. The second part contained of 30 questions on dietary regimen. This part of the questionnaire was scored based on 5-point likert scale ranging from 0 (non-healthy diet behaviors) to 4 (completely healthy diet behaviors). The maximum and minimum scores were from 0 to 120. The third part consisted of 10 questions on medication adherence. These items were from 0 (non- optimal adherence) to 4 (optimal adherence). The maximum and minimum scores were from 0 to 40. The fourth part of the questionnaire was related to the exercise scale with 14 items, which scoring from 0 (non-optimal adherence) to 4 (optimal adherence). The maximum and minimum scores were from 0 to 56. Finally total scoring for this questionnaire was from 0 to 216. The scores below 50% (scores below 108), 50–75% (scores between 108 and 162), and above 75% (scores above 162), were indicated the non-optimal, relatively optimal, and optimal adherence, respectively.[12] A checklist with 112-item was used to evaluate the constructs of Pender's HPM in three domains of dietary, exercise, and medication. Perceived benefits were categorized into all three domains using a 4-pont Likert scale (agree, to some extent agree, disagree, to some extent disagree) and other questions were divided into three domains using a Likert scale (high, somewhat, low). The possible score range in Pender's model was 0–352 and the scores were then turned into percentages. The non-optimal, relatively optimal, and optimal adherence rates were indicated using the scores below 50% (scores below 176), 50–75% (scores between 176 and 264) and above 75% (scores above 264), respectively.[7] Validity and reliability of the questionnaire on adherence to the treatment regimen was measured by Sanaei *et al*. The reliability of this instrument has been estimated as $r = 0.83$ based on test–retest. Content validity was used to determine the validity of this tool.[13] Validity and reliability of the Pender's model checklist were determined by Khodaveisi. The validity of this checklist was examined by 10 experts in the field, and the reliability of that was reviewed using test–retest method.[7]

After getting informed written consents and giving information to the all participants and his/her companion about the questionnaire and checklist, they were completed by samples of two groups before the discharge from hospital. In this research, based on the extracted valid texts and educational needs and the views of the expert physician and the research team, important aspects of adherence to the dietary, medication, and exercise regimen of the CAD patients were extracted. Lecture, question and answer; and group and individual discussion methods were used to eliminate the treatment adherence barriers and move toward increased treatment adherence and use of group experiences in the training sessions. In the study group, in order to establish better communication and create better dynamics among the subjects, the samples were divided into one group consisting of 10 individuals and two groups with 11 individuals. The researcher then coordinated with them for the training sessions. The sessions were held in the research environment during the morning shift. To remind the individuals their sessions, they were contacted the day before each session. The Pender's HPM-based group care program was held for each of the three groups in four consecutive sessions in each week by researcher team. Each session lasted 45–60 min. The training of each course was

delivered to the participants as a manual at the end of each session. After conducting this educational program, the telephone follow-up was done by the researcher once every 2 weeks for 5–10 min. and the patients talked about the care program, the removal of implementation barriers, and the questions. In control group, a session was held on the importance of the medication, dietary, and exercise regimen. In addition, they received a booklet on the importance of the treatment regimen. By passing 1 month and 3 months from the completion of the interventions,[14] the questionnaire was recompleted by both of the groups after the coordinating with them regarding the right time, we had three drop-out cases in the samples of each groups [Figure 1]. In order to achieve the research results, the data was collected and analyzed by descriptive, repeated measures ANOVA to measure the effect of intervention at different times, independent *t*-test, Chi-square, and Mann–Whitney tests to measure demographic data and mean score via SPSS ver. 18 (version 18, SPSS Inc., Chicago, IL, USA).

Ethical considerations

This study was approved by the Ethics Committee in Research (IR.MUI.REC.1396.3.916). The participants were informed of the purpose and procedure of the study. Also, participation was voluntary and written informed consent was obtained and they could leave the study at any stage. In addition all the participants were assured about the confidentiality of their personal data.

Results

A total of 58 patients participated in the research. Chi-square and Mann–Whitney tests showed no significant difference between two groups in terms of their mean age, height, frequency distribution of gender, and education level. Independent *t* and Mann–Whitney tests showed differences between two groups in terms of the pre-intervention weight and BMI variables, respectively. By covariance analysis, control effect of these two variables were performed and showed that weight and BMI had no effect on the results of this research [Table 1]. Results of the independent *t* and Mann–Whitney tests on Pender's model showed no significant difference between two groups in Pender's dietary exercise and medication variable [Table 2].

Independent *t*-test showed no significant difference between two groups in terms of the mean scores of adherence to the medication, dietary, and exercise regimen before the intervention (t = 1.69, $P = 0.09$). This test also showed a significant difference between two groups in terms of the mean score of adherence to the medication, dietary, and exercise regimen between one (z = 5.28, df = 2, $p < 0.001$) and three (z = 4.51, df = 2, $p < 0.001$) months after the intervention. To compare the medication, dietary, and exercise adherence for two groups before, 1 month and 3 months after the intervention; repeated measures ANOVA was performed by assuming the normal data distribution. The results showed that, medication, dietary, and exercise adherence were significantly different between the study and control groups at three times of before, 1 month and 3 months after the intervention; that is, it was higher in the study group. Also, the results of Bonferroni-corrected post-hoc test showed the significant differences between two groups before and 1 month after intervention and before and 3 months after the intervention and there

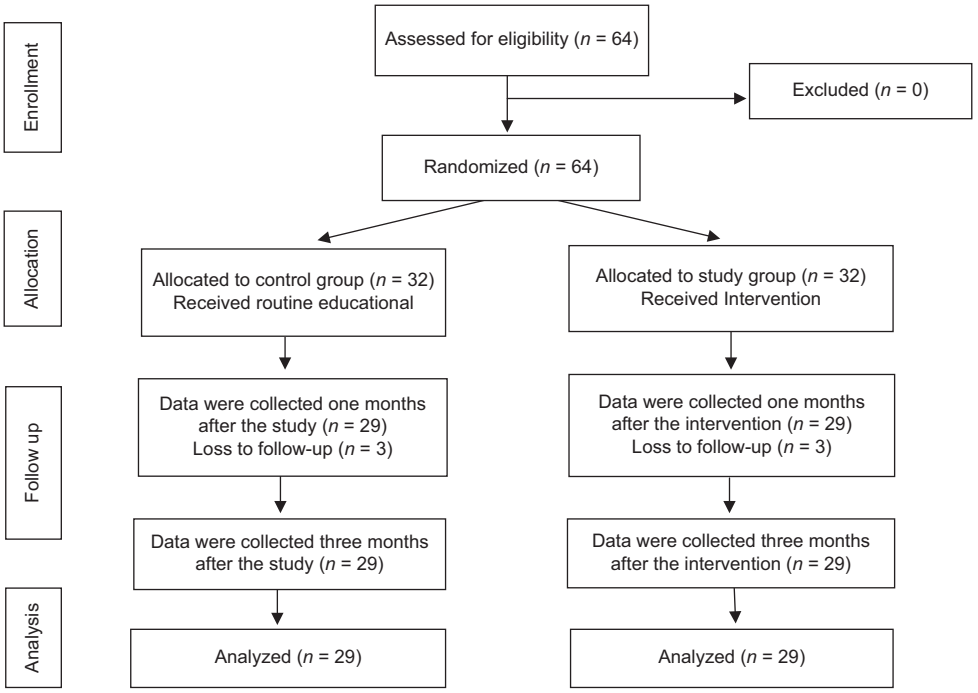

Figure 1: Consort flow diagram

Table 1: Demographic characteristics of the study and control group

Variable	Study group Mean (SD)	Control group Mean (SD)	Statistical test	df	*p*
Age	58.75 (8.83)	63.13 (11.14)	-1.85*	56	0.06
Height	167.34 (7.15)	166.48 (9.14)	-0.29*	56	0.76
Weight	78.55 (11.32)	70.10 (11.29)	2.84**	56	0.006
BMI	28.02 (3.47)	25.22 (3.20)	-2.58*	56	0.01
	***n* (%)**	***n* (%)**	**Statistical test**	**df**	***p***
Gender	13 (44.80)	17 (58.60)	1.10***	56	0.29
Female	16 (55.20)	12 (41.40)			
Male					
Education	15 (51.10)	13 (45.50)	0.11****	56	0.73
Under diploma	14 (48.90)	16 (54.50)			
Level					
Higher diploma					

*Mann-Whitney. **Independent *t*-test. *** Chi-square. *****Fisher exact test

Table 2: Mean Pender score in the study and control groups before intervention

Variable	Study group Mean (SD)	Control group Mean (SD)	Statistical test	df	*p*
Pender's dietary					
Perceived benefits	28.06 (3.58)	29.13 (2.57)	-1.11*	56	0.26
Perceived barriers	20.37 (4.60)	19.37 (3.05)	-0.97**	56	0.33
Related feeling	28.41 (3.64)	28.03 (2.59)	-0.45**	56	0.65
Self-efficacy	20.93 (4.92)	21.24 (3.69)	0.27**		0.78
Interpersonal and situational influencing factors	23.00 (5.54)	23.31 (4.14)	0.24**		0.81
Pender's exercise					
Perceived benefits	15.86 (3.23)	17.00 (2.34)	-1.12*		0.26
Perceived barriers	8.86 (1.66)	8.51 (1.70)	-0.64*		0.51
Related feeling	16.44 (2.44)	16.13 (2.32)	-0.49**		0.62
Self-efficacy	1.31 (0.54)	1.24 (0.43)	-0.36*		0.71
Interpersonal and situational influencing factors	17.44 (3.53)	17.00 (4.97)	-1.31*		0.18
Pender's medication					
Perceived benefits	8.68 (1.73)	9.20 (1.69)	-1.50*		0.13
Perceived barriers	7.72 (2.23)	8.03 (1.86)	0.57**		0.56
Related feeling	18.96 (3.04)	17.93 (3.10)	-1.12*		0.26
Self-efficacy	7.13 (1.74)	7.14 (1.48)	-0.03*		0.97
Interpersonal and situational influencing factors	23.03 (5.60)	23.25 (4.57)	-0.27*		0.78

*Mann-Whitney. **Independent *t*-test

was also no statistically significant difference between 1 and 3 months after the intervention [Tables 3-5].

Discussion

The aim of this research was the effect of an educational intervention based on Pender's HPM on treatment adherence in the patients with CAD. Based on the result, there was significant difference in medication adherence between two groups 1 and 3 months after the intervention. The results of Fakhri research showed that theory planned behavior affected the improvement of medication adherence in hypertensive elderly.[15] It is in line with the results of the present study, which can be because of the evaluation of the patient's needs and attention to them and coverage of the needs of the study group during the intervention. However, the study of Luu showed that the level of adherence to anticoagulants gradually decreased over the follow-up period at 1 month, 6 months, and 1 year after the onset of drug usage.[16] The study of Matsuda and Kohno showed that education program was effective in accepting the drug therapy; however, it did not change their knowledge on the disease and the complications of drug therapy.[17] The difference in the results of these researches may be because of the different patients under research, the different clinical environment, the different durations of follow-ups, and the difference in intervention methods.

Table 3: Comparison of time effect, intervention effect and contrast effect of intervention and time in treatment adherence

Variable	Time effect		Intervention effect		Contrast effect of Intervention and time	
	F	*p*	*F*	*p*	*F*	*p*
Medication adherence	74.97	<0.001	24.68	<0.001	41.52	<0.001
Dietary Adherence	54.13	<0.001	14.62	<0.001	7.55	0.001
Exercise adherence	35.46	<0.001	22.02	<0.001	23.31	<0.001
Treatment adherence	50.02	<0.001	31.65	<0.001	20.84	<0.001

Table 4: Comparison of mean and results of ANOVA with repeated measures of treatment adherence between two groups

Variable		Mean (SD)			ANOVA with repeated measures	Bonferroni test		
		Before intervention	One month after intervention	Three months after intervention	before, one month and three months after intervention	Before and one month after intervention	Before and three months after intervention	One and three months after intervention
Medication adherence	Study	22.20 (6.58)	29.06 (3.94)	29.75 (4.33)	<0.001	<0.001	<0.001	0.35
	Control	21.06 (3.76)	22.03 (3.47)	22.20 (3.25)	0.02	0.02	0.02	1
Dietary adherence	Study	72.03 (8.65)	85.75 (8.26)	85.79 (8.48)	<0.001	<0.001	<0.001	1
	Control	69.89 (8.05)	75.86 (9.68)	76.48 (8.39)	0.002	0.005	0.005	1
Exercise adherence	Study	26.43 (6.40)	37.82 (4.36)	39.11 (4.19)	<0.001	<0.001	<0.001	1
	Control	25.45 (4.71)	26.54 (3.77)	26.90 (3.92)	0.38	0.58	0.49	1
Treatment adherence	Study	108.82 (21.68)	144.82 (22.03)	139.82 (27.44)	<0.001	<0.001	<0.001	0.22
	Control	100.62 (14.52)	107.96 (17.13)	107.96 (15.67)	0.001	0.001	0.008	1

Table 5: Comparison of treatment adherence between two groups

Variable	Time	statistics Test	*p*
Medication Adherence	Before	-0.80*	0.423*
	One month	-7.20*	<0.001*
	Three month	-7.49*	<0.001*
Dietary adherence	Before	0.97*	0.334*
	One month	4.18*	<0.001*
	Three month	4.25**	<0.001**
Exercise adherence	Before	0.43*	0.669*
	One month	7.34*	<0.001*
	Three month	7.53*	<0.001*
Treatment adherence	Before	1.69*	0.09*
	One month	5.28**	<0.001**
	Three month	4.51**	<0.001**

* = Independent *t*-test. ** = Mann-Whitney

Results showed no significant difference between two groups in terms of the mean score of adherence to the dietary regimen before the intervention, but there was a significant difference between two groups 1 and 3 months after the intervention. The results of Karimi *et al*.'s research showed that the health belief model based on education model can remove the perceived barriers and improve the performance of this group of mothers in terms of dietary adherence by increasing their perceptions of risk factors and making them aware of the benefits of behavioral changes.[18] When the effective factors of non-adherence to the patient's treatment are identified in the training program and during the training to try to eliminate them and emphasize the benefits of adherence and the patient is encouraged to improve the current situation and maintain interaction with the patient can help increase treatment adherence. Research of Shively showed in their research that self-management program has a positive effect on improving the patients' adherence to dietary regimen, but this effect is not statistically significant.[19] The difference between the results of the above-mentioned research and the present research may be because of the differences in the durations of the follow-ups, difference in natures of the disease, difference in the patients under the research and difference in the intervention methods are among other reasons for such discrepancy.

There was no significant difference between two groups in terms of the mean score of exercise regimen before the intervention, but there was a significant difference between the study and control groups one and three months after the intervention. The study of Noroozi showed that an education by using constructs of perceived self-efficacy, perceived benefits and barriers, family support, and previous related behaviors could improve the mean of physical activity in the study group in the third and sixth months, which is consistent with the results of the present

research.[20] The results of Moosavifar also demonstrated that telephone follow-up has a positive effect on improving the adherence to the exercise programs.[14]

There was no significant difference between two groups in terms of the mean score of treatment adherence that includes dietary, medication, and exercise adherence before intervention, but there was a significant difference between the study and control groups 1 and 3 months after the intervention. The study of Shahsavari showed that nurse-led telephone follow-up was an effective method for improving the glycemic and treatment adherence among the patients with type 2 diabetes, which is consistent with the results of the present research.[21] In addition, the results of Esmkhani showed that the implementation of educational program, lecture, discussion, exchange of views on treatment adherence would improve the quality of life of the patients with schizophrenia.[22]

Sedri's research showed that there was a significant difference among the three groups in terms of the adherence to the anticoagulant regimen after 3 months. The mean score of post-intervention adherence to the treatment regimen in the interactive group was higher than the other two groups, which is consistent with the results of the present research.[23] Deif *et al.* indicated that nurses can help the patients to learn the problem solving skills, determine their goals, and understand their progressions in managing multiple aspects of their disease. An educational approach can support the patient's self-management and be effective on increasing the adherence to the treatment regimen by combining beliefs, behaviors, and feelings of the patient, culture, economic status, ability, and knowledge of the disease and its treatment.[24] Explaining this finding, it can be said that the purpose of Pender's HPM is to encourage people to perform health behaviors by training and managing them properly, helping them to do properly and convincing people to change unhealthy habits. Motivating to want change by increasing one's sense of self-efficacy and changing one's attitudes and beliefs is one of the key steps to growth and self-fulfillment.

The study of Dehdari showed that Pender's model can improve interpersonal communication, increase the power of perception and self-efficacy, and improve the health culture and dietary patterns.[25] Educational intervention based on Pender's HPM has been more effective than routine training programs by paying more attention to the characteristics and experiences of the samples and focusing on the perceived barriers and perceived benefits, feelings, self-efficacy, interpersonal and situational influences and behavioral outcomes. A limitation of this study was that patients might not participate in the training classes, so attempts were made to partly resolve this problem by changing the session time to a time when they all can participate in it after coordinating with them but we had drop-out cases.

Conclusion

The results indicate that the application of the Pender's HPM has been more effective on the various components of therapeutic adherence, including medication, dietary, and exercise adherence in patients with CAD. Since adherence to the treatment regimen, in addition to playing an important role in controlling the patient's disease, will also be effective on controlling the costs imposed to the health system; the necessary training should be given to these patients on the value of adherence to the treatment regimen including medication, dietary and exercise and we suggest that an educational intervention based on Pender's HPM is implemented in patients with CAD and other researchers are advised to conduct such a study for a longer period of time.

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Conflicts of interest

Nothing to declare.

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