



Original Article

Effect of an Educational Program Based on the Partnership Care Model on Treatment Adherence in Patients with Heart Failure: A Randomized Controlled Trial

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Received: 6 Dec. 2025

Revised: 24 Feb. 2026

Accepted: 10 Mar. 2026

Published: 20 Mar. 2026

Article Info

Keywords:

Partnership Care Model
Treatment Adherence
Heart Failure
Patient Compliance
Cooperative Behavior

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How to Cite This Article:

Gheiasi SF, Cheraghi MA, Dastjerdi M, Navid H, Khoshavi M, Kamali K, Navab E. Effect of an Educational Program Based on the Partnership Care Model on Treatment Adherence in Patients with Heart Failure: A Randomized Controlled Trial. Prev Care Nurs Midwifery J. 2026;16(2):81-94.

Abstract

Background: Treatment adherence is a cornerstone of heart failure management and is closely associated with reduced hospital readmissions and improved clinical outcomes. Despite advances in patient education and disease management, achieving sustained patient engagement in the care process remains challenging.

Objectives: To evaluate the effect of an educational program based on the partnership care model on treatment adherence among patients with heart failure.

Methods: This randomized controlled trial enrolled 100 patients with heart failure who attended the Heart Failure Clinic at Tehran Heart Center, Iran, in 2022. Participants were allocated to either the intervention or control group using permuted block randomization with a block size of four and a 1:1 allocation ratio. The intervention group participated in an educational program based on the partnership care model, which comprised four collaborative educational sessions followed by two collaborative follow-up sessions. The control group received routine educational care provided by the clinic. Data were collected using a demographic and clinical characteristics questionnaire and a researcher-developed treatment adherence questionnaire. Statistical analyses were performed using the chi-square test, independent-sample *t* test, and paired-sample *t* test.

Results: Following the intervention, the intervention group demonstrated significantly higher mean scores for medication adherence, lifestyle adherence, and overall treatment adherence than the control group (all $p < 0.001$). Within-group analysis also showed a significant improvement in treatment adherence after the intervention among participants in the intervention group. In contrast, no statistically significant change was observed in the control group ($p > 0.05$).

Conclusion: An educational program based on the partnership care model improved treatment adherence among patients with heart failure. Incorporating this approach into routine nursing care may help improve treatment adherence and support patient participation in the management of heart failure.

Implications for Nursing and Midwifery Preventive Care

- Integrating the Partnership Care Model into preventive nursing practice may improve treatment adherence through greater patient and family engagement.
- These findings may guide interventions to enhance self-care, reduce hospital readmissions, and improve clinical outcomes.



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Introduction

Heart failure is a complex and debilitating clinical syndrome in which the heart is unable to pump sufficient blood to meet the body's metabolic demands [1]. Despite substantial advances in its diagnosis and treatment, the prevalence of heart failure continues to increase. It is estimated that approximately 7.5 million people in the United States [2] and 64.34 million individuals worldwide are living with heart failure [3]. Although reliable epidemiological data on the prevalence of heart failure in Iran remain limited, the growing life expectancy and aging population are expected to increase the burden of the disease in the coming years [4]. Heart failure is associated with considerable morbidity and mortality [5], with the one-year mortality rate in Iran reported to be approximately 32% [6].

Beyond its adverse effects on physical function, heart failure substantially impairs patients' quality of life. Effective disease management therefore requires adherence to both pharmacological and non-pharmacological treatment recommendations, including dietary modification, regular physical activity, and consistent medication use [7]. Current international guidelines recommend an integrated approach that combines pharmacological and non-pharmacological interventions for the management of heart failure [8].

Treatment adherence is a fundamental component of care for individuals with chronic diseases [9]. The World Health Organization defines treatment adherence as the extent to which a person's behaviors, including medication use, dietary practices, and lifestyle modification, correspond to recommendations provided by healthcare professionals [10]. In heart failure, treatment adherence is particularly important because of the chronic nature of the disease, the complexity of treatment regimens, polypharmacy, restrictions on sodium and fluid intake, and the need for sustained lifestyle modification. Consequently, maintaining treatment adherence remains a major challenge in the management of heart failure [11,12].

Poor treatment adherence, particularly with respect to medication use and lifestyle modification, is

common among patients with heart failure and is associated with adverse consequences, including symptom exacerbation, disease recurrence, hospital readmission, increased healthcare costs, and mortality [13,14]. In contrast, adherence to recommended treatment contributes to physiological stability, slows disease progression, improves quality of life, and reduces both hospital readmissions and mortality [15]. From a nursing perspective, promoting treatment adherence is a key component of preventive care, particularly secondary prevention, for patients with heart failure. Through educational and collaborative interventions, nurses can strengthen self-care, improve adherence to treatment recommendations, facilitate the early recognition of worsening symptoms, and ultimately reduce complications, prevent avoidable hospital readmissions, and improve health outcomes. Nevertheless, treatment nonadherence remains common, with reported rates ranging from 10% to 93% among patients with heart failure [16–18] and continues to represent a major challenge for healthcare systems [19]. Although a variety of interventions have been developed to improve treatment adherence, overall adherence rates have shown little meaningful improvement [20].

Several educational interventions have demonstrated positive effects on treatment adherence [21,22], whereas others have reported limited effectiveness [23,24]. One possible explanation for these inconsistent findings is the limited emphasis placed on the active involvement of patients and their families in the care process and treatment decision-making. Collaborative care has therefore emerged as an important approach to the management of chronic diseases by promoting constructive partnerships among patients, family members, and healthcare professionals.

As a knowledge-based profession, nursing draws on conceptual models and theories to improve the quality of care for individuals with chronic conditions [25, 26]. The partnership care model, originally developed and evaluated by Mohammadi and colleagues to improve hypertension control [27], emphasizes active collaboration among patients, family members, nurses, physicians, and other

healthcare professionals throughout the care process [25-27]. Within this model, informed and responsible patient participation is regarded as the foundation of care and is expected to improve treatment adherence by strengthening therapeutic relationships, motivation, and accountability [27]. Despite these potential advantages, the application of partnership-based approaches in routine heart failure care requires further investigation.

Given the importance of treatment adherence in the management of heart failure, the inconsistent findings regarding the effectiveness of educational interventions, and the limited evidence on the application of the partnership care model in patients with heart failure, further research is warranted.

Objectives

This study aimed to compare the effects of an educational program based on the partnership care model with those of routine education on treatment adherence among patients with heart failure.

Methods

Study design

This study was a parallel-group, assessor-blinded randomized controlled trial. Due to the educational and behavioral nature of the intervention, blinding of participants and intervention providers was not feasible. However, to minimize detection bias, the outcome assessor and the statistician were blinded to group allocation throughout the study. The trial was conducted among 100 patients with heart failure who were referred to the Heart Failure Clinic at Tehran Heart Center, Tehran, Iran, between January and April 2023, and was reported in accordance with the Consolidated Standards of Reporting Trials (CONSORT) guideline [Figure 1]

Participants

Participants were recruited through convenience sampling from eligible patients referred to the Heart Failure Clinic. The sample size was calculated using the formula for comparing two independent means based on the mean and standard deviation of treatment adherence scores reported by Granger et al.

[28]. Assuming a significance level of 0.05 and 90% power, the required sample size was estimated at 44 participants per group. The corresponding effect size (Cohen's *d*) was 0.68. To account for an anticipated attrition rate of approximately 10% while preserving the study power, the final sample size was increased to 50 participants per group, yielding a total sample of 100 participants.

After confirming eligibility and obtaining written informed consent, participants were randomly assigned to the intervention or control group using permuted block randomization with a block size of four and a 1:1 allocation ratio. The randomization sequence was generated by an independent statistician using R software. To ensure allocation concealment, the randomization sequence was accessible only to the research supervisor until each participant had been enrolled, and the principal investigator had no access to the allocation sequence. Following enrollment, group assignment was determined by the research supervisor according to the randomization codes (A and B). Outcome assessment was performed under blinded conditions, with the outcome assessor remaining unaware of group allocation throughout the study. Data analysis was also conducted by a statistician who was blinded to group coding.

Eligible patients were aged 18 years or older, had a confirmed diagnosis of heart failure with New York Heart Association (NYHA) functional class I–III established by a heart failure specialist, had lived with the disease for at least six months, and were able to read and write. Family caregivers were required to have participated in the patient's care during the previous six months and to possess basic literacy skills.

Patients and family caregivers were excluded if they were simultaneously participating in another educational program. In addition, family caregivers with a self-reported history of chronic physical or psychiatric illness were not eligible for participation. The withdrawal criterion for patients was the development of clinical instability during the study period. No participants withdrew from the study, and all 100 participants were included in the final analysis.

Intervention

Following the baseline assessment, participants in the intervention group received an educational program based on the partnership care model. In contrast, those in the control group received routine care provided by the clinic. Routine care consisted of standard outpatient visits together with the usual verbal education delivered by nurses or physicians regarding medication use, dietary recommendations, fluid restriction, physical activity, and follow-up care. The intervention was designed according to the four phases of the partnership care model, namely motivation, preparation, involvement, and evaluation, and all sessions were delivered by the principal investigator in collaboration with a heart failure specialist.

During the motivation phase, one 30- to 45-minute session was conducted to discuss the participants' current condition, the objectives of the program, their roles and responsibilities in the care process, and the consequences of poor treatment adherence, to encourage active participation throughout the intervention.

The preparation phase comprised four weekly collaborative educational visits followed by two monthly collaborative follow-up visits. Educational sessions addressed heart failure, risk factors, dietary recommendations, physical activity, infection prevention, stress management, symptom monitoring, appropriate medication use, and self-care principles. During follow-up visits, participants' concerns, adherence to treatment recommendations, barriers to adherence, and strategies for overcoming these barriers were reviewed, and individualized feedback was provided.

During the involvement phase, patients and their family caregivers actively participated in implementing the care plan, shared decision-making, and modifying self-care behaviors throughout the intervention.

During the evaluation phase, achievement of the educational objectives and participants' level of engagement were assessed at the end of each session and again after completion of the intervention. A summary of the intervention phases, educational

content, delivery methods, facilitators, and session duration is presented in [Table 1](#).

Instruments and Measures

Two instruments were used for data collection: a demographic and clinical characteristics questionnaire and a researcher-developed treatment adherence questionnaire. All participants completed the treatment adherence questionnaire before and after the intervention, whereas only the demographic and clinical characteristics questionnaire was completed at baseline.

The demographic and clinical characteristics questionnaire collected information on patients' demographic characteristics, including age, sex, marital status, educational level, living arrangement, income, and place of residence, as well as clinical characteristics, including left ventricular ejection fraction and duration of heart failure. Information on family caregivers, including age, sex, educational level, and relationship to the patient, was also recorded.

To identify an appropriate instrument for assessing treatment adherence among patients with heart failure, a comprehensive literature search was conducted in national and international electronic databases, including Magiran, SID, Elsevier, PubMed, and Google Scholar, using the Persian and English keywords *treatment adherence*, *treatment compliance*, *tools*, and *questionnaire*. The search identified no standardized questionnaire specifically designed to comprehensively assess treatment adherence in patients with heart failure. Available instruments were either not specific to heart failure [29] or assessed only a single dimension of treatment adherence, such as adherence to self-care behaviors [30,31] or medication adherence [32,33]. In addition, several studies had used researcher-developed questionnaires to assess treatment adherence in patients with heart failure; however, these instruments lacked comprehensiveness or had not undergone adequate psychometric evaluation [17,34-35]. Therefore, the research team developed a researcher-designed questionnaire specifically for assessing treatment adherence in patients with heart failure.

The questionnaire items were developed based on findings from the qualitative phase of the study, relevant textbooks and published literature, and existing instruments, including the European Heart Failure Self-care Behavior Scale, the Self-Care of Heart Failure Index, the Morisky Medication Adherence Questionnaire, the researcher-developed treatment adherence questionnaire used by Silva et al [17], and the researcher-developed treatment adherence questionnaire reported by Tam et al [34]. The preliminary version of the questionnaire consisted of 25 items scored on a five-point Likert scale ranging from 1 (never) to 5 (always). The instrument included two domains: medication adherence (5 items) and lifestyle modification (19 items). The lifestyle modification domain comprised healthy diet (3 items), fluid intake (2 items), avoidance of risk factors (2 items), self-monitoring (2 items), exercise and physical activity (2 items), stress management (1 item), prevention of respiratory infections (2 items), communication with healthcare providers (3 items), and treatment follow-up (2 items).

The medication adherence domain yielded scores ranging from 5 to 25, whereas the lifestyle modification domain ranged from 19 to 95. The total questionnaire score ranged from 24 to 120, with higher scores indicating better treatment adherence. Scores exceeding 70% of the maximum possible score were considered indicative of desirable treatment adherence, corresponding to scores ≥ 17.5 for medication adherence, ≥ 66.5 for lifestyle modification, and ≥ 84 for the total treatment adherence score.

Content validity was evaluated using both qualitative and quantitative approaches. For the qualitative assessment, the questionnaire was reviewed by 12 experts in heart failure, who provided feedback on the relevance, clarity, and wording of the items. Quantitative content validity assessment showed that the content validity ratio (CVR) ranged from 0.66 to 1.00, the item-level content validity index (I-CVI) ranged from 0.91 to 1.00, and the scale-level content validity index (S-CVI) was 0.96. Following expert review, two items within the fluid intake subdomain of the lifestyle modification domain were merged

because of conceptual overlap, resulting in a final questionnaire comprising 24 items.

Face validity was also assessed using qualitative and quantitative methods. For the qualitative assessment, the questionnaire was administered through face-to-face interviews with 10 participants representing diverse demographic backgrounds. Participants were asked to evaluate each item in terms of comprehensibility, ambiguity, wording, and interpretability. The impact score for every item exceeded 1.5, and no items were removed. Internal consistency was used to assess reliability, and Cronbach's alpha coefficient for the final questionnaire was 0.81.

Outcome Measures

The primary outcome was the change in treatment adherence scores among patients with heart failure from baseline to post-intervention. Treatment adherence was assessed using the researcher-developed questionnaire, which measured two domains, medication adherence and lifestyle modification. Both domain-specific scores and the total treatment adherence score were calculated.

Statistical Analysis

Data were analyzed using SPSS version 16 (SPSS Inc., Chicago, IL, USA). Descriptive statistics, including means, standard deviations, frequencies, and percentages, were used to summarize the data. Between-group and within-group comparisons were performed using the chi-square test, independent-samples *t* test, and paired-samples *t* test, as appropriate. The normality of continuous variables was assessed by examining skewness and kurtosis. Variables with skewness and kurtosis values within the range of -2 to $+2$ were considered to have an approximately normal distribution. Effect sizes (Cohen's *d*) were calculated to estimate the magnitude of between-group and within-group intervention effects. A two-sided *P* value of less than 0.05 was considered statistically significant.

Result

Participants ranged in age from 32 to 83 years. The duration of heart failure ranged from 1 to 7 years and

left ventricular ejection fraction (LVEF) ranged from 15% to 45%. Overall, most participants were male (56%), married (83%), had a high school diploma as their highest educational qualification (54%), and resided in urban areas (88%). In addition, most participants lived with their families (90%). Based on self-reported income, 53% considered their income to be sufficient. No statistically significant differences were observed between the intervention and control groups with respect to demographic or clinical characteristics, indicating baseline comparability ($p > 0.05$). The demographic and clinical characteristics of the participants are presented in Table 2. Among the family caregivers,

most were female (64%), married (76%), had an educational level above a high school diploma (46%), and were the patient's children (44%).

The age of the family caregivers ranged from 20 to 73 years. Their demographic characteristics are presented in Table 3. An independent-samples t-test showed no statistically significant differences between the intervention and control groups in mean medication adherence, lifestyle modification, or total treatment adherence scores before the intervention. Following the intervention, however, mean scores for medication adherence, lifestyle modification, and total treatment adherence were significantly higher in the intervention group than in the control group.

Table 1. Structure of the Educational-Behavioral Intervention Program for Heart Failure Patients and Family Caregivers

Dimension	Number of Sessions	Content	Participants	Delivery Method	Provider	Session Duration
Motivation	1 session	Feedback of study findings to patients and family caregivers; creating shared awareness of program goals; clarification of roles, responsibilities, and expectations; awareness of current condition and potential complications of heart failure	Heart failure patients and family caregivers	Lecture	Nurse	
Preparation	4 weekly sessions	Nature of heart failure, risk factors, causes, and complications	Patients and caregivers	Lecture, educational booklet, WhatsApp group	Nurse	30–45 minutes
		Dietary adherence, smoking cessation, avoidance of alcohol and substance use (opium), and lifestyle modification	Patients and caregivers	Lecture, educational booklet, WhatsApp group	Nurse	
		Infection control, physical activity, exercise, stress management, self-monitoring of edema and daily weight measurement	Patients and caregivers	Lecture, educational booklet, WhatsApp group	Nurse	
		Medications in heart failure, mechanism of action, adherence, warning signs, and pulse monitoring	Patients and caregivers	Lecture	Cardiologist & Nurse	
Follow-up visits	2 monthly sessions	Assessment of patient problems, evaluation of outcomes of previous actions, feedback and guidance	Patients and caregivers	Feedback	Cardiologist & Nurse	
Engagement	Ongoing	Implementation, continuation, and adjustment of the care plan	Patients and caregivers	Feedback	Nurse	
Evaluation	Ongoing	Evaluation of educational objectives	Patients and caregivers	Q&A	Nurse	
	Final	Final assessment of intervention outcomes	Patients and caregivers	Treatment adherence questionnaire	Nurse	

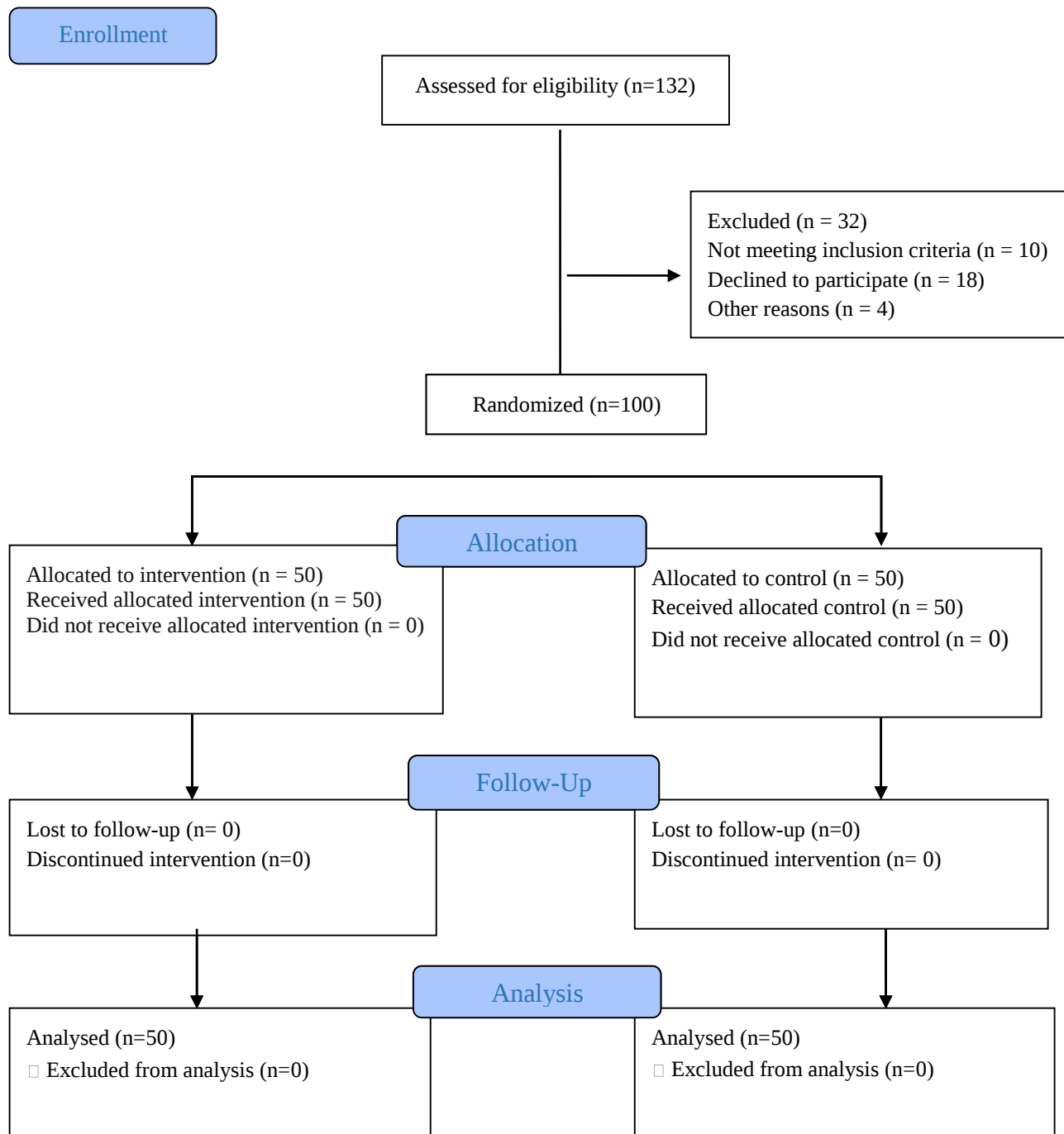


Figure 1. CONSORT flowchart of participant flow through the study.

Table 2. Demographic and Clinical Characteristics of Participants in the Heart Failure Study Groups

Variable	Category	Control Group n (%)	Intervention Group n (%)	χ^2 / t	<i>p</i>
Sex	Female	21 (42%)	23 (46%)	0.162	0.687
	Male	29 (58%)	27 (54%)		
Marital status	Single	9 (18%)	8 (16%)	0.071	0.790
	Married	41 (82%)	42 (84%)		
Education level	Below diploma	15 (30%)	16 (32%)	2.366	0.306
	Diploma	30 (60%)	24 (48%)		
	Higher than diploma	5 (10%)	10 (20%)		
Living status	With family	46 (92%)	44 (88%)	0.444	0.505
	Alone	4 (8%)	6 (12%)		
Residence	Urban	43 (86%)	45 (90%)	0.379	0.538
	Rural	7 (14%)	5 (10%)		
Income adequacy	Sufficient	26 (52%)	27 (54%)	0.040	0.841
	Insufficient	24 (48%)	23 (46%)		
Age (years)	—	57.20 (11.57)	56.98 (13.07)	- 0.089	0.929
LVEF (%)	—	29.20 (8.22)	28.10 (9.99)	- 0.601	0.549
Duration of disease (years)	—	1.82 (1.11)	2.04 (1.33)	0.891	0.375

Note. Values are presented as mean (standard deviation) or number (percentage). χ^2 = Chi-square test; t = Independent samples t-test; LVEF = left ventricular ejection fraction.

Table 3. Demographic Characteristics of Family Caregivers of Patients with Heart Failure in the Intervention Group

Variable	Category	n (%)
Sex	Female	32 (64%)
	Male	18 (36%)
Marital status	Single	12 (24%)
	Married	38 (76%)
Education level	Below diploma	6 (12%)
	Diploma	21 (42%)
	Higher than diploma	23 (46%)
Relationship to patient	Spouse	20 (40%)
	Child	22 (44%)
	Other relatives	8 (16%)
Age (years)	—	42.04 (11.00) (range: 20–73)

Note. Values are presented as number (percentage) or mean (standard deviation). Range is reported in parentheses for age.

Within-group analysis using the paired-samples *t* test showed no significant changes in medication adherence, lifestyle modification, or total treatment adherence scores in the control group after the intervention. In contrast, participants in the intervention group demonstrated significant improvements in medication adherence, lifestyle modification, and overall treatment adherence following the educational program based on the partnership care model compared with their baseline scores. Effect size analysis indicated that the intervention had a large effect on medication adherence, lifestyle modification, and overall treatment adherence ($d > 0.8$) [Table 4].

Table 4. Comparison of treatment adherence scores (medication adherence, lifestyle modification, and total adherence) in intervention and control groups before and after the educational program based on the partnership care model

Outcome	Group	Pre-intervention M (SD)	Post-intervention M (SD)	Mean Change (SD)	Within-group <i>p</i>	Between-group (Pre) <i>t</i> (<i>p</i>)	Between-group (Post) <i>t</i> (<i>p</i>)	Cohen's <i>d</i> (Post)	Change <i>t</i> (<i>p</i>)	Cohen's <i>d</i> (Change)
Medication adherence	Control	21.66 (2.35)	21.78 (2.19)	0.12 (1.18)	0.479	-0.625 (.534)	3.860 (<0.001)	0.77	4.680 (<0.001)	0.93
	Intervention	21.96 (2.44)	23.26 (1.58)	1.30 (1.32)	<0.001	—	—	—	—	—
Lifestyle modification	Control	65.80 (7.53)	65.76 (6.26)	-0.04 (3.30)	0.932	-1.539 (0.127)	9.724 (<0.001)	1.94	13.441 (<0.001)	2.68
	Intervention	63.52 (7.27)	76.52 (4.68)	13.00 (6.01)	<0.001	—	—	—	—	—
Total treatment adherence	Control	88.28 (8.41)	87.54 (7.18)	-0.74 (3.18)	0.106	-1.528 (0.130)	9.658 (<0.001)	1.93	14.726 (<0.001)	2.94
	Intervention	85.68 (8.60)	99.78 (5.35)	14.10 (6.37)	<0.001	—	—	—	—	—

Note. SD, standard deviation; *t*, independent-samples *t* test for between-group comparisons; within-group comparisons were performed using a paired-samples *t* test; *d*, Cohen's effect size.

Discussion

The present study examined the effect of an educational program based on the partnership care model on treatment adherence among patients with heart failure. The findings demonstrated that the intervention improved treatment adherence in the intervention group. These results suggest that educational interventions delivered within a structured, collaborative framework, together with ongoing follow-up, can positively influence treatment-related behaviors in patients with heart failure.

The observed effectiveness of the partnership care model is likely attributable to the synergistic effects of several complementary components. First, structured education tailored to patients' individual needs may enhance their understanding of heart failure, treatment goals, and the importance of adhering to recommended therapeutic regimens. Second, actively involving patients and their family caregivers in the educational process and shared decision-making may strengthen their sense of responsibility and promote sustained support for implementing treatment recommendations. These findings are consistent with previous studies demonstrating that family-centered educational interventions improve adherence-related behaviors and self-care among patients with heart failure [23,36]. Third, follow-up sessions provide opportunities to reinforce learning, address patients' concerns, identify barriers to treatment adherence, and offer individualized feedback, thereby facilitating the maintenance of adherence over time [23,37]. In addition, greater patient participation in the care process may enhance self-efficacy, which can increase motivation to adhere to treatment recommendations [38]. Collectively, these components may explain the beneficial effects observed in the present study rather than education alone.

The findings are consistent with those reported by Mohammadzadeh et al. (2022), who found that an educational intervention based on the partnership care model improved self-efficacy related to self-care behaviors among patients with heart failure [38]. This consistency suggests that, beyond

improving treatment adherence, the partnership care model may also promote treatment-related and self-care behaviors by enhancing patients' self-efficacy. The present findings are also broadly consistent with those of Zakeri et al. (2020), who reported that implementing the continuous care model improved medication adherence among patients with myocardial infarction. However, the difference between the intervention and control groups in adherence to the medication regimen was not statistically significant [39]. Differences in disease characteristics, adherence assessment tools, intervention design, and study populations may explain the discrepancy between their findings and those of the present study. Nevertheless, both studies support the value of structured education and follow-up in promoting treatment adherence, although the magnitude of the intervention effect may vary across different clinical settings.

Our findings also agree with those of Dessie et al. (2021), who demonstrated that a self-care education program based on social cognitive theory improved adherence to self-care behaviors among patients with heart failure [22]. Although the theoretical framework of that intervention differed from the partnership care model, both studies highlight the importance of structured education, repeated educational sessions, and regular follow-up in improving treatment adherence and self-care behaviors. It should be noted, however, that an imbalance between the study groups with respect to certain demographic and clinical characteristics in the study by Desy et al. may have influenced the interpretation of their findings.

The present results are further supported by the study conducted by Bahramnejad et al. (2021), which showed that a participatory educational intervention improved adherence to therapeutic recommendations, including dietary modifications, medication use, and physical activity, among patients undergoing open-heart surgery [40]. Despite differences in patient populations and outcome measures, both studies emphasize the importance of engaging patients and their caregivers throughout the educational process. These findings suggest that collaborative educational approaches may represent

an effective strategy for improving treatment adherence across different groups of patients with cardiovascular disease. Active involvement of both patients and family caregivers may have been a common factor contributing to the positive outcomes observed in both studies.

Najafi et al. (2020) also reported findings consistent with those of the present study. They demonstrated that a self-management-based discharge program incorporating face-to-face education and telephone follow-up improved treatment adherence among patients with heart failure [37]. The consistency between these findings highlights the importance of maintaining educational support after hospital discharge. It suggests that educational interventions are more effective when they extend beyond hospitalization and continue throughout follow-up care.

Similarly, Kobraei et al. (2022) reported that a five-session face-to-face educational program improved both treatment adherence and health literacy among patients with heart failure [41]. Their findings further support the results of the present study. However, unlike our findings, treatment adherence decreased significantly in the control group of their study, whereas no significant change was observed in the control group in the present study. This discrepancy may reflect differences in routine care, participant characteristics, and the content of the educational interventions.

The findings of the present study are also generally consistent with those reported by Fallahinia et al. (2018). They found that education delivered with the participation of family caregivers resulted in greater improvements in adherence to dietary recommendations, medication regimens, and physical activity than individual education alone. However, no significant difference was observed in health-protective behaviors [42]. These findings suggest that the different dimensions of treatment adherence may not respond equally to educational interventions and that variations in measurement instruments, sample size, and intervention characteristics may contribute to these differences. Clements et al. (2023) also reported findings that support the present results. They demonstrated that a

caregiver-focused educational intervention significantly improved heart failure self-care and reduced hospital readmissions, highlighting the important role of family engagement in supporting long-term disease management and adherence-related behaviors [36]. These findings suggest that structured education combined with the active involvement of family caregivers can strengthen patients' engagement in self-care and adherence to treatment recommendations, which is consistent with the principles of the partnership care model adopted in the present study.

Borhani et al. (2012) also demonstrated that the partnership care model improved all dimensions of quality of life among patients with heart failure [43]. Although quality of life was the primary outcome in their study rather than treatment adherence, their findings further support the positive contribution of the partnership care model to improving outcomes among patients with heart failure.

Overall, comparison of the present findings with previous research suggests that educational interventions are most effective when they combine active patient and family participation, structured education, and continuous follow-up, regardless of the underlying theoretical framework. The differences observed across studies are likely attributable to variations in disease characteristics, study populations, outcome measures, intervention intensity and duration, follow-up period, and the quality of routine care provided to control groups. These findings indicate that the effectiveness of educational interventions depends not only on the intervention itself but also on how it is implemented and the clinical context in which it is delivered. The improvement in treatment adherence observed in the present study was therefore likely the result of the combined effects of structured education, active patient and family involvement, and ongoing follow-up, which together facilitated positive changes in treatment-related behaviors.

This study has several limitations that should be considered when interpreting the findings. First, treatment adherence was assessed using a researcher-developed questionnaire. Although its face validity, content validity, and internal

consistency were established before use, its construct validity was not evaluated using exploratory or confirmatory factor analysis. In addition, test–retest reliability was not assessed using the intraclass correlation coefficient (ICC). Furthermore, the cutoff value used to define desirable treatment adherence was based on a percentage of the maximum possible score and requires further validation in future studies. Second, treatment adherence was measured using self-reported data, which may have introduced response bias and social desirability bias. Third, study outcomes were assessed only at the end of the intervention, and the absence of long-term follow-up precluded evaluation of the durability of the intervention effects. Finally, the intervention was delivered by the research team without the involvement of a multidisciplinary team, such as dietitians, psychologists, and pharmacists, which may have influenced its effectiveness across some dimensions of treatment adherence.

Accordingly, future studies should conduct a comprehensive psychometric evaluation of this instrument, assess the long-term effectiveness of the intervention through extended follow-up, and undertake multicenter studies with larger sample sizes and multidisciplinary teams to enhance the generalizability of the findings.

Conclusion

The findings of the present study demonstrated that an educational program based on the partnership care model significantly improved treatment adherence, including medication adherence and lifestyle modification, among patients with heart failure. These findings suggest that this educational approach appears to enhance treatment adherence by promoting active engagement of patients, family caregivers, and healthcare providers throughout the care process. Given its practical, feasible, and collaborative nature, this model may represent a useful approach for incorporating structured educational interventions into routine care for patients with heart failure. Further studies with longer follow-up periods are needed to determine whether these improvements are sustained over time

and to evaluate the effects of the intervention on other clinical outcomes.

Ethics Consideration

This study was approved by the Institutional Ethics Committee of the School of Nursing and Midwifery and the School of Rehabilitation, Tehran University of Medical Sciences (Approval No. IR.TUMS.FNM.REC.1398.019). The trial was prospectively registered with the Iranian Registry of Clinical Trials (IRCT) (Registration No. IRCT20200910048678N3). Written informed consent was obtained from all participants before enrollment.

Acknowledgements

The authors would like to sincerely thank all participants of this study, including patients and their family caregivers, for their valuable cooperation and time. The authors also appreciate the support provided by the staff of the participating clinic, which facilitated the data collection process. This study was derived from a PhD dissertation approved by the School of Nursing and Midwifery, Tehran University of Medical Sciences, Tehran, Iran.

Conflict of Interest

Some of the authors are affiliated with the journal Preventive Care in Nursing and Midwifery (PCNM) as members of the Editorial Board and the journal team.

To ensure transparency and impartiality, this manuscript was processed through the journal's standard peer-review workflow, independent of the involved editors.

The final editorial decision was made solely by the Editorial Board, without the participation of the affiliated authors in the review or acceptance process.

All other authors declare no conflicts of interest.

Funding

This study was supported by Tehran University of Medical Sciences (TUMS), Tehran, Iran (Grant No. [45651]).

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Artificial Intelligence Utilization

The authors declare that ChatGPT and Consensus were used solely to assist with the initial translation of the manuscript, language editing, and improving readability. All scientific content, study design, data analysis, interpretation of the findings, and final approval of the manuscript were performed independently by the authors, who take full responsibility for the accuracy, integrity, and originality of the work.

Data Availability Statement

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

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