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Effect of an IDEAL discharge program incorporating the teach-back technique on lifestyle behaviors among patients with coronary artery disease: A randomized clinical trial

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Abstract

Background: Sustaining lifestyle modifications after discharge remains a major challenge in coronary artery disease (CAD) care because routine discharge planning often fails to support long-term self-management. Although the IDEAL (Include, Discuss, Educate, Assess, Listen) program improves transitional care, its specific effect on lifestyle behaviors among patients with CAD in cardiac care units (CCU) remains underexplored. This study evaluated the effect of an IDEAL Discharge Program incorporating the teach-back technique on the lifestyles of these patients.

Methods: In this single-blind randomized trial, 60 patients with CAD (Kashan, Iran, 2024) were allocated either to an intervention group that received the IDEAL Discharge Program incorporating the teach-back technique through daily 30-minute bedside sessions and four post-discharge calls or to a control group that received routine care and non-educational calls. Lifestyle behaviors were assessed at baseline and at 1 and 2 months after discharge using the Standard Lifestyle Questionnaire. Data were analyzed using repeated-measures ANOVA and t-tests.

Results: The groups were comparable at baseline ($P>0.05$). At baseline and at 1 and 2 months post-intervention, the total lifestyle scores in the intervention group were 238.03±30.57, 256.43±32.32, and 275.43±29.87, respectively. Scores in the control group increased transiently before declining below baseline. Repeated-measures ANOVA revealed significant effects of time, group, and time×group (All $P<0.001$), and post-hoc tests confirmed significant within-group improvements at 1 and 2 months (Both $P<0.001$). At 2 months, total scores in the intervention group were significantly higher than those in the control group ($P<0.001$), although the Psychological Health, Avoidance of Drugs, and Accident Prevention dimensions showed no significant between-group differences.

Conclusion: The IDEAL Discharge Program incorporating the teach-back technique significantly improved overall lifestyle behaviors in patients with CAD and provides a practical framework for supporting post-discharge self-management in cardiac care settings.

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Highlights

What is current knowledge?

- Effective discharge planning and lifestyle modification may help reduce hospital readmissions and improve self-management among patients with coronary artery disease (CAD).
- The IDEAL (Include, Discuss, Educate, Assess, Listen) framework is a structured approach to improving the discharge transition, but its application among patients with CAD in cardiac care settings remains insufficiently studied.
- Teach-back and family-centered education have been reported to improve patient understanding and support self-management after hospital discharge.

What is new here?

- This randomized clinical trial evaluated the effect of the IDEAL discharge program incorporating the teach-back technique on lifestyle behaviors among patients with CAD admitted to a cardiac care unit.
- The intervention-initiated discharge planning within the first two hours of admission and continued after discharge through four telephone follow-up calls.
- The intervention was associated with significantly improved lifestyle scores, with improvements maintained through the two-month follow-up, suggesting a practical approach to supporting post-discharge self-management in cardiac care settings.

Introduction

Cardiovascular diseases, particularly coronary artery disease (CAD), constitute a major public health challenge worldwide and in developing countries such as Iran (1,2). Globally, ischemic heart disease remains the leading cause of death, accounting for approximately 9 million deaths annually (3). In Iran, CAD is the primary cause of cardiovascular mortality, and its burden continues to increase because of rapid lifestyle transitions and the high prevalence of underlying risk factors, such as hypertension and dyslipidemia (4,5). Because modifiable lifestyle behaviors are major determinants of prognosis and hospital readmission, effective post-discharge self-care and lifestyle modification are essential for this patient population (6,7).

Lifestyle encompasses learned social behaviors related to physical activity, nutrition, sleep, weight management, and coping with stress (6). The determinants of health are categorized as heredity (16%), healthcare (10%), environment (21%), and lifestyle behaviors (51%) (8). Cardiovascular disease remains a major global health burden, to which behavioral, metabolic, environmental, and social risk factors contribute substantially worldwide (3).

Discharge planning is a continuous process that is essential for facilitating lifestyle modification from admission through the post-discharge period. Nurses play a central role in reducing readmissions; however, short hospital stays, heavy workloads, and staffing shortages can limit adequate discharge preparation. Although no universal model exists, current discharge frameworks can be adapted to the resources and capabilities of each healthcare setting (3,9). The Agency for Healthcare Research and Quality (AHRQ) developed the IDEAL discharge

program to prevent readmission and relapse through patient and family engagement. The IDEAL acronym represents five core components: Inclusion (Involving patients/families in care), Discussion (Preventing home complications), Education (Tailoring information to comprehension levels), Assessment (Evaluating understanding), and Listening (Addressing concerns) (10). This model conceptualizes discharge as a continuous process beginning at admission, thereby preventing the overload associated with last-minute education. It comprehensively assesses care needs across settings and establishes a supportive, preventive, and educational structure with interdisciplinary coordination to ensure timely follow-up (11). Integrating the teach-back technique is strongly recommended to ensure that the "Education" and "Assessment" components of the IDEAL model are implemented effectively. Teach-back is a health-literacy communication method in which patients explain the information provided in their own words, enabling nurses to verify comprehension immediately and correct misconceptions in real time (12). In the context of CAD, which requires complex self-management regimens, teach-back has been shown to significantly improve health literacy, self-efficacy, and clinical outcomes, thereby reducing readmission rates (9,13).

Previous studies have reported mixed findings regarding the implementation of this model in cardiac patients. Rezaeifar et al. (10) demonstrated that the model improves treatment engagement and medication adherence in patients with congestive heart failure. Kaya and Dal Yılmaz (14) confirmed its positive effects on self-care behaviors among patients who underwent coronary artery bypass grafting (CABG). Tah et al. (2019) demonstrated that implementing the IDEAL discharge process for stroke patients resulted in a clinically meaningful reduction in 30-day readmission rates (From 20.6% to 6.1%) and substantial cost savings, although the reduction did not reach statistical significance in their pilot study (15). In contrast, Callihan (16) reported that the intervention had no significant effect on health-seeking behaviors. Furthermore, Rusmawati et al. (17) indicated that the program has not yet achieved full effectiveness among patients with heart failure in Indonesia, suggesting the need for further contextual refinement. Although the IDEAL model improves transitional care, its educational components depend heavily on patients' baseline health literacy. Studies evaluating the teach-back technique in cardiac populations have demonstrated its effectiveness in improving self-management and medication adherence (9,13). However, most studies have evaluated the IDEAL framework and the teach-back technique independently or have focused on narrow clinical outcomes, such as medication adherence or readmission rates for a single disease. Although a few studies have incorporated teach-back into general discharge planning, the specific synergistic integration of the structured IDEAL framework with the teach-back technique to address comprehensive lifestyle behaviors in patients with CAD has not previously been investigated.

A review of the literature indicates that many current discharge programs lack the necessary comprehensiveness. Discharge planning is the critical transitional bridge between acute hospital care and long-term, home-based lifestyle modification. Research demonstrates that structured discharge interventions that include targeted lifestyle counseling significantly improve the adoption of healthy behaviors and self-care practices among cardiac patients (18,19). An optimal discharge program should therefore integrate family-centered education, feedback mechanisms, needs-based assessments, and self-management strategies (10). Although previous studies have examined the effects of the IDEAL Discharge model on variables such as self-care, treatment adherence, and health-seeking behaviors in certain cardiac populations (e.g., heart failure), with mixed results, no study has specifically investigated its application to the lifestyles of patients with coronary artery disease (CAD). Lifestyle modification is a major priority for these patients because it can help prevent recurrent myocardial infarction and hospital readmission (20,21); therefore, addressing this research gap is essential. Given the absence of a comprehensive discharge program integrating both the IDEAL framework and the teach-back technique for patients with CAD admitted to the Cardiac Care Unit (CCU), the high prevalence of this condition, and the limited related research in Iran, the present study examined the effect of the IDEAL Discharge Program incorporating the teach-back technique on the lifestyles of these patients.

Methods

This single-blind clinical trial, in which the statistician and data analyst were blinded to group allocation, was conducted over a one-month period from early to late December 2024 in the Cardiac Care Units (CCUs) of Shahid Beheshti Educational Hospital in Kashan, Iran.

The sample size was calculated based on a type I error rate of 0.05 and statistical power of 90%. The calculation used the mean difference in total lifestyle scores reported in a relevant previous study by Arman et al. (2025), which evaluated a family-supported educational intervention in post-MI patients using the same Standard Lifestyle Questionnaire (22). In that study, the mean difference in total lifestyle scores between the intervention and control groups at the two-month follow-up was 28.5 points, with standard deviations of 32.5 and 30.2, respectively. Using these parameters and the formula for comparing two independent means, the minimum required sample size was calculated as 26 participants per group. After accounting for a potential 15% dropout rate, the final sample size was set at 30 participants per group, for a total of 60 participants.

Participants were recruited through convenience sampling according to the following inclusion criteria: a confirmed diagnosis of coronary artery disease (CAD), admission to the Cardiac Care Unit (CCU), transition out of the acute phase of the disease with no active pain as determined by the attending cardiologist, the presence of a primary caregiver, full consciousness, and willingness to participate in the study.

The exclusion criteria were re-entry into the acute phase or the development of complications during the study, unwillingness to continue participating, transfer to another hospital ward, or death.

After eligibility screening, patients were allocated equally to the intervention and control groups through block randomization (Block sizes 4 and 8) at a 1:1 ratio. An independent biostatistician generated the allocation sequence using an online random number generator. Allocation concealment was maintained using sequentially numbered, opaque, sealed envelopes prepared by a research assistant who was blinded to the study and was not involved in recruitment or data collection. To minimize selection bias, the envelopes were stored in a locked cabinet accessible only to the research assistant. The primary researcher (RT) opened each envelope only after participant enrollment, informed consent, and baseline data collection had been completed; the researcher had no prior access to the allocation sequence or knowledge of group assignments. All enrollment, consent, and allocation procedures were performed exclusively by the primary researcher (RT). Although a 15% dropout rate was anticipated, all 60 participants completed the study, resulting in a 100% retention rate (Figure 1). The study was conducted and reported in accordance with the CONSORT 2010 (Consolidated Standards of Reporting Trials) guideline. A completed CONSORT checklist has been provided, and the participant flow diagram is presented in Figure 1.

Instruments

Data were collected using two instruments. a) Demographic and Clinical Information Form: This form included age, sex, marital status, employment status, educational level, number of children, residential area, underlying diseases (Comorbidities), and left ventricular ejection fraction (LVEF). b) Standard Lifestyle Questionnaire: This questionnaire, originally developed and validated in Iran by Lali et al. (23), was initially designed for a general population (School teachers) but has since been widely used in Iranian studies of diverse adult populations because of its comprehensive nature. For example, it has been used specifically to evaluate lifestyle interventions in patients with hypertension (24,25) and to assess lifestyle behaviors in patients with coronary artery disease (26). To ensure its suitability for CCU patients with CAD, the face and content validity of the questionnaire were rigorously reassessed before data collection. A panel of 11 experts, comprising 10 critical care nursing faculty members and one cardiologist, reviewed all 70 items. Content validity was assessed quantitatively using the Content Validity Ratio (CVR) and Content Validity Index (CVI), both of which yielded acceptable values and confirmed the essentiality and relevance of the items. The panel also evaluated the clarity and comprehensibility of the items for patients with different levels of health literacy. Based on their feedback, minor phrasing adjustments were made to improve comprehension among

cardiac patients without altering the core meaning or scoring structure of the subscales. The instrument measures 10 subscales: physical health (8 items), physical activity (7 items), weight control (7 items), disease prevention (7 items), psychological health (7 items), spiritual health (6 items), social health (7 items), avoidance of drugs and narcotics (6 items), accident prevention (8 items), and environmental health (7 items). Questionnaire scores are interpreted as follows: total scores from 70 to 163 indicate poor lifestyle status, scores from 164 to 237 indicate moderate status, and scores from 238 to 350 indicate very good (Excellent) status. The validity of the questionnaire was confirmed in the original study by Lali et al. (23), and its reliability was established with a Cronbach's alpha coefficient of 0.85. In the present study, the high internal consistency (Cronbach's alpha = 0.90) further supports the reliability and practical applicability of the instrument in this specific clinical population.

Procedure

Following ethical approval and the issuance of an official introduction letter from the Vice-Chancellor for Research at Kashan University of Medical Sciences, the necessary administrative permissions were obtained from hospital management and the CCU head nurses. The researcher then visited the ward, explained the study objectives, and obtained written informed consent from all eligible patients.

To ensure transparency and enable accurate interpretation of the relative effect of the IDEAL program, the routine care protocol for the control group was strictly defined to reflect the hospital's actual standard of care without artificially withholding education. Upon admission and throughout hospitalization, patients in the control group received standard medical and nursing care according to hospital protocols. This care included routine medical rounds during which the attending physician provided standard, non-structured explanations of the diagnosis, medications, and basic post-discharge care (e.g., general dietary restrictions and rest). At discharge, patients received the hospital's standard generic written discharge summary and routine verbal instructions. This routine care did not include a structured daily educational curriculum, tailored lifestyle pamphlets, a formal needs assessment, or the teach-back technique.

Written educational materials and pamphlets on coronary artery disease (Angina and myocardial infarction) were developed for the intervention group. The content covered disease pathophysiology, etiology, risk factors, symptoms, complications, preventive measures, nutrition, physical activity, stress management, medication adherence, cessation of unhealthy habits, and lifestyle modification. The average duration of hospitalization was between 5 to 7 days. The number of educational sessions was tailored to each patient's length of stay to ensure that all core topics were systematically addressed before discharge. Typically, patients received 4 to 5 daily sessions, with the final session on the day of discharge serving as a comprehensive review and readiness assessment rather than as a separate additional session. The content of each session was systematically structured: the first session addressed disease pathophysiology, etiology, and symptom recognition; the second covered risk factors and preventive measures; the third addressed nutrition, weight control, and physical activity; the fourth focused on stress management and psychological well-being; and the final session on the day of discharge emphasized medication adherence, cessation of unhealthy habits, and recognition of warning signs requiring readmission. The content was initially developed through a comprehensive review of the scientific literature (10,11,14,15), and its content validity was confirmed by a panel of nursing faculty members and a cardiologist.

The IDEAL Discharge Program, which focused on lifestyle education, was implemented by the primary researcher (An experienced critical care nurse) in three phases: upon admission (Within the first two hours), during hospitalization (Daily sessions), and at discharge. The intervention began after the patient had transitioned out of the acute phase (Defined as being pain-free, as confirmed by the attending physician). During the initial encounter, the primary caregiver was identified, and comprehensive information about the study objectives and discharge phases was provided. The educational sessions were subsequently conducted according to the five core components of the IDEAL model: Inclusion of the patient and family, Discussion of home-based challenges, Education tailored to the patient's health literacy, Assessment of the patient's comprehension, and Listening to the patient's concerns. Individual educational sessions were conducted at the patient's bedside for 30 minutes each day between 16:00 and 17:00, a period selected because it was relatively quiet and did not coincide with medication administration. During these sessions, the patient was placed in a semi-Fowler's position, and the researcher and caregiver sat comfortably beside the bed. Education was delivered step by step using a feedback-oriented approach, specifically the "teach-back" technique. The patient and caregiver were asked to restate the instructions in their own words to confirm accurate comprehension of the information provided. The physician's daily orders were also clearly communicated, and emerging concerns were promptly addressed.

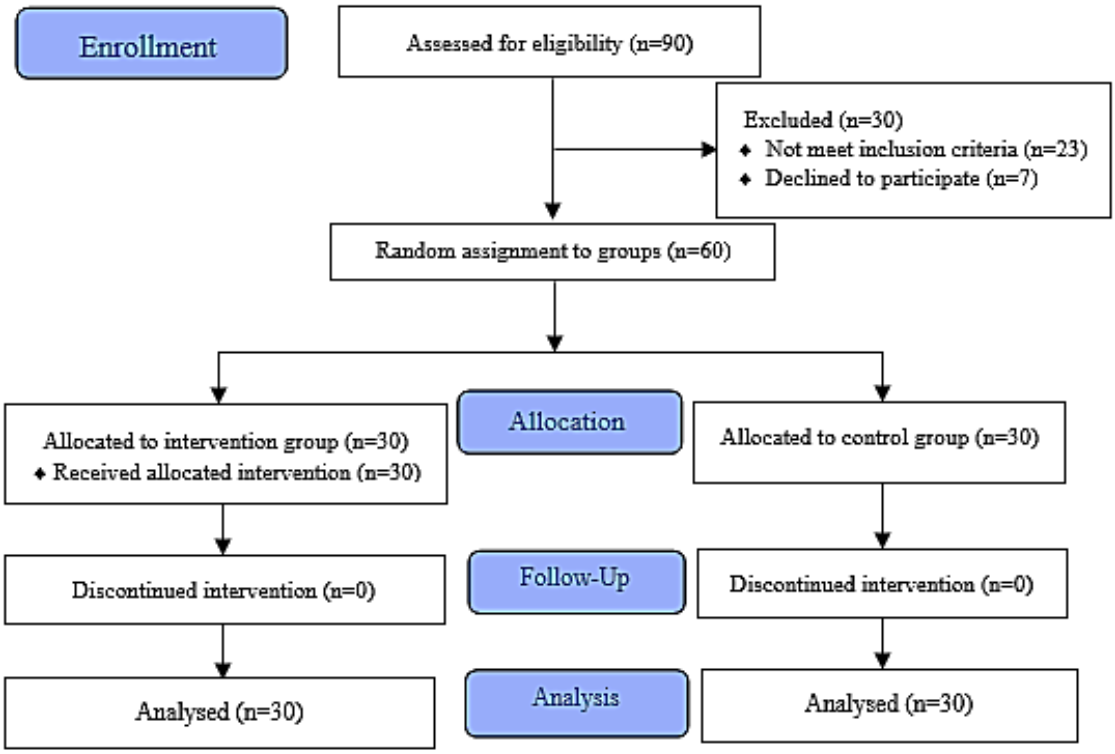

Figure 1. Flow diagram of the study

To monitor intervention fidelity and ensure that the intervention was delivered as intended, an independent senior nursing educator observed 20% of randomly selected educational sessions using a standardized fidelity checklist. The researchers developed the checklist based on the five core components of the IDEAL model and teach-back principles, and the same expert panel confirmed its content and face validity (Content Validity Index [CVI] = 0.92, Content Validity Ratio [CVR] = 0.85). The observer confirmed a high protocol-adherence rate (96.5%), indicating that the intervention was delivered as intended. On the day of discharge, the comprehension of both the patient and caregiver was evaluated using a question-and-answer format. Post-discharge lifestyle instructions were reviewed, the researcher's contact number was provided for follow-up questions, and the educational pamphlet was given to them.

Four structured follow-up telephone calls were made to each participant in the intervention group at 2 weeks, 4 weeks (1 month), 6 weeks, and 8 weeks (2 months) after discharge. The calls at 4 weeks and 8 weeks included formal administration of the lifestyle questionnaire, whereas the calls at 2 weeks and 6 weeks were supportive reinforcement calls intended to encourage adherence to the lifestyle modifications discussed during hospitalization. Each call lasted approximately 15 to 20 minutes and followed a standardized protocol that included (1) assessing the patient's current physical and emotional status; (2) reviewing adherence to prescribed medications, dietary recommendations, and physical activity plans; (3) addressing emerging questions or concerns; (4) reinforcing key educational content through the teach-back technique; and (5) documenting reported complications, hospital readmissions, or changes in health status. The same standardized protocol was applied consistently to all participants in the intervention group to ensure uniform follow-up care.

To ensure methodological equivalence in contact and attention between the groups, participants in the control group received telephone follow-up calls on the same schedule as the intervention group (At 2, 4, 6, and 8 weeks after discharge). However, the content of the calls differed substantially. To prevent contamination of the control group, a research assistant who was blinded to the specific educational details of the intervention conducted the calls. Their primary purpose was to collect data using the lifestyle questionnaire. To ensure that the control group was not neglected and to encourage adherence to standard care, the research assistant politely reminded patients to follow the routine discharge instructions previously provided by their healthcare team (e.g., taking prescribed medications and following general dietary advice). These calls were strictly limited to general reminders about standard care; no new structured educational content, tailored lifestyle counseling, or teach-back reinforcement was provided. A strict protocol was also enforced: if a participant asked a specific medical, nutritional, or lifestyle-related question, the research assistant politely acknowledged the concern and explicitly advised the patient to consult the attending physician or primary care provider.

Statistical analysis

Data were analyzed using SPSS version 21. Normality and homogeneity of variance were assessed using the Shapiro-Wilk test (With Q-Q plots) and Levene's test, respectively. Between-group comparisons of quantitative variables were performed using the independent samples t-test. Lifestyle scores over time (Baseline, one month, and two months) were analyzed using repeated-measures ANOVA. Mauchly's test indicated a violation of sphericity ($W = 0.674$, $\chi^2(2) = 10.24$, $P = 0.006$); therefore, the Greenhouse-Geisser correction was applied ($\varepsilon = 0.78$) with adjusted degrees of freedom (1.56, 90.48). Residual diagnostics confirmed no significant violations of normality or homogeneity. A sensitivity analysis using ANCOVA with age, sex, and LVEF as covariates confirmed that the time × group interaction remained significant ($P < 0.001$). Although three patients were rehospitalized during follow-up, all remained in the study, completed all assessments, and were analyzed according to the intention-to-treat principle. No deaths or missing data were recorded. A p-value < 0.05 was considered statistically significant.

Results

Most participants in both groups were male. The mean age was 56.47 ± 10.23 years in the intervention group and 57.13 ± 11.05 years in the control group. Most participants were male (53.3% in the intervention group and 66.7% in the control group), married (83.3% and 86.7%, respectively), and had a diploma-level education (73.3% and 56.7%, respectively). Chi-square tests showed no statistically significant differences between the groups in sex distribution ($P = 0.29$), marital status ($P = 0.92$), employment status ($P = 0.31$), educational level ($P = 0.18$), number of children ($P = 0.87$), residential area ($P = 0.54$), underlying comorbidities ($P = 0.27$), or left ventricular ejection fraction (LVEF) ($P = 0.93$). In addition, independent samples t-tests showed no significant difference in mean age between the groups ($P = 0.81$) (Table 1).

Table 1. Demographic and clinical characteristics of the intervention and control groups

Variable		Intervention group (n = 30) N (%)	Control group (n = 30) N (%)	P-Value
Sex	Female	14 (46.7)	10 (33.3)	0.29 *
	Male	16 (53.3)	20 (66.7)	
Education	Under Diploma	2 (6.7)	7 (23.3)	0.18 *
	Diploma	22 (73.3)	17 (56.7)	
	University	6 (20.0)	6 (20.0)	
Employment Status	Employed	10 (33.3)	5 (16.7)	0.31*
	Unemployed	12 (40.0)	16 (53.3)	
	Retired	8 (26.7)	9 (30.0)	
Marital Status	Single	4 (13.3)	3 (10.0)	0.92 **
	Married	25 (83.3)	26 (86.7)	
	Other (Widowed/Divorced)	1 (3.3)	1 (3.3)	
Number of Children	None	2 (6.7)	3 (10.0)	0.87 *
	1-2	10 (33.3)	9 (30.0)	
	3-4	14 (46.7)	13 (43.3)	
	> 4	4 (13.3)	5 (16.7)	
Residence	Urban	25 (83.3)	23 (76.7)	0.54 *
	Rural	5 (16.7)	7 (23.3)	
Underlying Disease	Hypertension	12 (40.0)	10 (33.3)	0.27 *
	Diabetes Mellitus	6 (20.0)	4 (13.3)	
	Other	4 (13.3)	4 (13.3)	
	None	8 (26.7)	12 (40.0)	
Ejection Fraction (EF)	Normal (≥ 55%)	17 (56.7)	18 (60.0)	0.93 *
	Mild Decrease (45-54%)	7 (23.3)	6 (20.0)	
	Moderate Decrease (30-44%)	4 (13.3)	4 (13.3)	
	Severe Decrease (< 30%)	2 (6.7)	2 (6.7)	
Age (Years)	Mean±SD	56.47±10.23	57.13±11.05	0.81 ***

* Chi-Square Test, ** Fisher's Exact Test, *** Independent T-Test

Regarding the clinical classification of lifestyle scores at baseline, 53.3% of the intervention group and 60.0% of the control group had a "moderate" lifestyle, whereas 46.7% and 40.0%, respectively, had a "very good" lifestyle. No participant was classified as having a "poor" lifestyle. At two months after discharge, the proportion of participants with a "very good" lifestyle increased substantially to 86.7% in the intervention group but decreased to 33.3% in the control group, in which the majority (66.7%) reverted to a "moderate" lifestyle.

Repeated-measures ANOVA revealed significant main effects of time (Degrees of freedom [df] = 1.56, 90.48; F = 45.32, P < 0.001) and group (df = 1, 58; F = 28.14, P < 0.001), as well as a significant time × group interaction (df = 1.56, 90.48; F = 38.67, P < 0.001), for the total lifestyle score. Among the individual dimensions, Disease prevention showed the greatest improvement in the intervention group (Increasing from 26.47 ± 3.32 to 30.07 ± 2.93, with the largest partial η^2 = 0.41), whereas psychological health (Partial η^2 = 0.15) and Avoidance of drugs and narcotics (Partial η^2 = 0.12) showed the smallest changes. Although all dimensions improved significantly over time (P < 0.001 for all time × group interactions), the significant interactions indicated that the trajectories of change differed between the groups. In the specific between-group comparisons at two months after discharge (T3), the total lifestyle score and seven individual dimensions differed significantly between the groups (All P < 0.001). However, three dimensions-Psychological Health (P = 0.12), Avoidance of Drugs and Narcotics (P = 0.26), and Accident Prevention (P = 0.18)-did not differ significantly between the groups despite significant within-group improvements in the intervention group.

In the intervention group, the total lifestyle score and most dimensions increased significantly from baseline to one month and from baseline to two months after discharge (All P < 0.001, Bonferroni-adjusted), except Spiritual Health, which improved significantly only at two months. In the control group, the total lifestyle score fluctuated over time. It initially increased slightly from 236.56 ± 32.90 at baseline (T1) to 246.57 ± 32.95 at one month after discharge (T2); however, this difference was not statistically significant after Bonferroni adjustment (P = 0.032, adjusted α = 0.016). The score subsequently decreased to 231.07 ± 30.56 at two months after discharge (T3). Complete pairwise comparisons for the control group showed that the score at T3 was not significantly lower than that at T2 (P = 0.018, which did not meet the adjusted α of 0.016), and the difference between baseline (T1) and two months (T3) was not statistically significant (P = 0.45). Several individual dimensions in the control group showed the same pattern of slight initial improvement followed by decline.

The mean total lifestyle score in the intervention group was 238.03 ± 30.57 before the intervention, increased to 256.43 ± 32.32 one month after discharge, and further increased to 275.43 ± 29.87 two months after discharge. In the control group, the corresponding scores were 236.56 ± 32.90, 246.57 ± 32.95, and 231.07 ± 30.56, respectively. The effect size of the time × group interaction for the total lifestyle score was large (Partial η^2 = 0.38, 95% CI [0.24, 0.50]). Bonferroni post-hoc comparisons showed statistically significant differences in the intervention group between baseline and one month after discharge (P < 0.001, Cohen's d = 0.58, 95% CI [0.31, 0.85]) and between baseline and two months after discharge (P < 0.001, Cohen's d = 1.22, 95% CI [0.91, 1.53]). Independent samples t-tests showed no significant between-group differences at baseline (P = 0.76, Cohen's d = 0.08, 95% CI [-0.43, 0.59]) or one month after discharge (P = 0.24, Cohen's d = 0.30, 95% CI [-0.21, 0.81]); however, a statistically significant between-group difference with a large effect size was observed two months after discharge (P < 0.001, Cohen's d = 1.40, 95% CI [0.84, 1.97]) (Table 2).

Table 2. Comparison of mean lifestyle scores and its dimensions between the intervention and control groups over time (n = 30 per group)

Variable	Group	Before (T1)	One-month post-discharge (T2)	Two months post-discharge (T3)	Time (P-Value) [a]	Group (P-Value) [b]	Time× Group (P-Value) [c]	Partial η^2 (Time × Group)	Between-group Cohen's d at T3 (95% CI)
		Mean±SD	Mean±SD	Mean±SD					
Physical Health	Intervention	23.53±5.17	26.90±3.91[a]	29.30±4.05[a,b]	< 0.001	< 0.001	< 0.001	0.35	1.30 (0.75, 1.86)
	Control	24.17±4.50	26.50±5.31	23.60±4.68[b]					
	Between-group P	0.61	0.74	< 0.001					
Exercise	Intervention	20.37±6.32	22.43±6.26[a]	25.20±6.01[a,b]	< 0.001	< 0.001	< 0.001	0.38	1.41 (0.84, 1.97)
	Control	18.53±6.52	20.93±7.52	17.63±4.67[b]					
	Between-group P	0.27	0.40	< 0.001					
Weight Control	Intervention	23.17±4.28	26.67±3.91[a]	28.40±3.20[a,b]	< 0.001	< 0.001	< 0.001	0.28	0.99 (0.46, 1.53)
	Control	23.97±5.12	26.47±4.04	24.57±4.43[b]					
	Between-group P	0.51	0.84	< 0.001					
Disease Prevention	Intervention	26.47±3.32	29.03±2.97[a]	30.07±2.93[a,b]	< 0.001	< 0.001	< 0.001	0.41	1.27 (0.71, 1.82)
	Control	26.43±3.46	26.83±3.47	26.13±3.29[b]					
	Between-group P	0.97	0.01	< 0.001					
Psychological Health	Intervention	23.53±6.60	24.83±6.46[a]	26.83±6.46[a,b]	< 0.001	< 0.001	< 0.001	0.15	0.40 (-0.11, 0.92)
	Control	23.23±5.76	24.40±5.51	24.40±5.51[b]					
	Between-group P	0.85	0.78	0.12					
Spiritual Health	Intervention	23.77±5.55	23.87±5.42	25.90±3.67[a,b]	< 0.001	< 0.001	< 0.001	0.32	1.25 (0.70, 1.80)
	Control	22.27±5.52	22.57±4.29	20.70±4.59[b]					
	Between-group P	0.29	0.30	< 0.001					
Social Health	Intervention	25.37±5.86	27.93±5.13[a]	29.60±3.45[a,b]	< 0.001	< 0.001	< 0.001	0.34	1.24 (0.69, 1.79)
	Control	25.33±6.01	25.77±4.71	23.77±5.69[b]					
	Between-group P	0.98	0.09	< 0.001					
Avoidance of Drugs and Narcotics	Intervention	25.17±4.99	25.43±6.07	26.40±4.68[a,b]	< 0.001	< 0.001	< 0.001	0.12	0.29 (-0.22, 0.80)
	Control	24.30±7.67	25.03±4.65	24.93±5.34[b]					
	Between-group P	0.60	0.77	0.26					
Accident Prevention	Intervention	21.03±8.95	22.33±8.92	25.00±9.57[a,b]	< 0.001	< 0.001	< 0.001	0.18	0.35 (-0.16, 0.86)
	Control	23.43±9.37	22.90±10.18	21.64±9.47[b]					
	Between-group P	0.31	0.82	0.18					
Environmental Health	Intervention	25.63±3.79	27.00±3.46[a]	28.73±3.68[a,b]	< 0.001	< 0.001	< 0.001	0.33	1.26 (0.71, 1.81)
	Control	24.90±4.06	25.17±4.35	23.70±4.27[b]					
	Between-group P	0.47	0.07	< 0.001					
Total Lifestyle Score	Intervention	238.03±30.57	256.43±32.32[a]	275.43±29.87[a,b]	< 0.001	< 0.001	< 0.001	0.38	1.40 (0.84, 1.97)
	Control	236.56±32.90	246.57±32.95	231.07±30.56[b]					
	Between-group P	0.76	0.24	< 0.001					

Note: Data are presented as Mean ± SD. Between-group P-values were calculated using independent t-tests. Repeated-measures ANOVA P-values were Greenhouse-Geisser adjusted (ε=0.78; df: Time/Time×Group=1.56, 90.48; Group=1, 58). Post-hoc pairwise comparisons (T1 vs. T2, T1 vs. T3, T2 vs. T3) were performed, and p-values were adjusted using the Bonferroni correction (Adjusted α = 0.016). Superscripts indicate significant differences after this adjustment: [a] P < 0.016 vs. T1; [b] P < 0.016 vs. T2. Effect sizes are reported as partial η^2 (Time×Group interaction) and Cohen's d with 95% CI (between-group at T3).

Discussion

The IDEAL Discharge Program incorporating the teach-back technique produced significant and sustained improvements in overall lifestyle behaviors among patients with coronary artery disease (CAD) during the two-month follow-up, in contrast to the transient improvement followed by decline observed with routine care. This divergence in the trajectories of the two groups reveals a critical limitation of standard cardiac care: hospitalization temporarily increases awareness of self-care, but patients may rapidly return to pre-admission behaviors without a structured transitional framework. This finding is consistent with Hansen et al. (27) and Naylor et al. (28), who emphasized that education delivered only at discharge does not sustain change and that transitional care must provide continuous support. Because lifestyle behaviors account for 51% of health determinants in CAD (8), this sustained divergence is clinically important (3,29).

Rather than attributing effectiveness to the IDEAL model as a single, indivisible package, it is useful to consider how its components may have facilitated behavioral change. The sustained improvement in the intervention group may be partly explained by the combined use of teach-back, caregiver engagement, and structured post-discharge reinforcement. Because this study evaluated a bundled intervention, the independent effect of each component cannot be isolated. However, the teach-back method may have transformed the passive receipt of information into active cognitive processing (13), a mechanism supported by Mohammadi et al. (26), Oh et al. (9), and Rezaeifar et al. (10) in cardiac and heart failure populations. The primary caregiver may also have served as an external source of support, maintaining behavioral feedback after discharge. This interpretation is consistent with recent evidence highlighting the complex role of psychosocial support in recovery after myocardial infarction (30) and the direct contribution of family caregivers to patients' self-care behaviors (31). Collectively, these findings suggest that educating patients in isolation, without incorporating a source of support in the home environment, may not effectively bridge the transition from hospital to home.

The temporal structure of the intervention-initiating discharge planning at admission and distributing education across daily sessions-represents an important change in practice. Routine discharge education is often compromised by patient fatigue and cognitive overload, resulting in superficial information transfer, as documented by Trivedi et al. (32). By distributing education over time, the IDEAL model reduced this burden and enabled iterative reinforcement, consistent with the findings of Arman et al. (22) and Ranjbar et al. (33). Structured post-discharge telephone follow-up extended this support during periods of particular vulnerability, a practice supported by recent nationwide analyses emphasizing the need to reduce readmission risk after discharge following cardiac surgery (34). The control group's initial improvement followed by decline reinforces the conclusion that even a brief hospitalization produces only a fragile, temporary educational effect that requires continued reinforcement.

In addition to physical measures, the intervention produced significant within-group improvements in psychological, social, and spiritual dimensions, suggesting that lifestyle modification should not be limited to isolated targets. The "Listen" and "Include" components may have increased patients' sense of agency and reduced illness-related uncertainty (15), consistent with the findings of Hosseini et al. (35) and Eghbali et al. (36) regarding reduced anxiety and improved self-efficacy. Addressing psychosocial well-being may also support emotional coping, as recent evidence indicates that psychosocial factors play an important role in medication adherence and self-care behaviors among cardiac patients, particularly in the presence of socioeconomic challenges (37). Similarly, collaborative discharge instructions increase perceived readiness for discharge (11,38), which is a prerequisite for adopting new health behaviors (39). Effective programs should therefore address patients' needs comprehensively.

Despite these promising findings, the study has several limitations. First, the two-month follow-up was relatively short, and the long-term durability of the effects remains unconfirmed. Second, the single-center design and modest sample size may limit generalizability. Third, self-reported lifestyle outcomes are susceptible to recall and social desirability biases. Fourth, the educational nature of the intervention precluded blinding of participants and providers, potentially introducing performance bias, although allocation concealment was strictly maintained. Fifth, because the study evaluated a bundled intervention, the independent contributions of specific components (e.g., the teach-back technique versus telephone reinforcement) cannot be determined. Future multicenter randomized trials should therefore include larger samples, longer follow-up periods, blinded assessments, objective endpoints, and attention-matched controls.

Conclusion

The IDEAL Discharge Program, initiated at admission and sustained through structured post-discharge follow-up, was associated with significant improvements in lifestyle scores during the two-month follow-up among patients with coronary artery disease (CAD) in the Cardiac Care Unit (CCU). The integration of the teach-back technique and active caregiver engagement into this multicomponent program may help translate health education into short-term within-group behavioral improvements across physical, psychological, social, and spiritual dimensions. Given the substantial burden of cardiovascular disease, implementing this continuous, structured transitional care model in cardiac settings may be a practical approach to supporting post-discharge self-management and lifestyle modification. However, future multicenter randomized trials with larger samples, longer follow-up periods, and attention-matched control groups are required to confirm the long-term sustainability of these behavioral changes and their effects on definitive clinical outcomes, such as hospital readmission rates.

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Ethical Statement

The study was approved by the Ethics and Research Council of Kashan University of Medical Sciences (Ethics Code: IR.KAUMS.NUHEPM.REC.1403.072) and was registered in the Iranian Registry of Clinical Trials (Registration Number: IRCT20250216064744N1). Before data collection, the researchers introduced themselves and thoroughly explained the study objectives and procedures to hospital officials and all participants. Written informed consent was obtained from all participants. Strict ethical principles were followed throughout the study, with particular attention to confidentiality, data anonymity, and the secure handling of personal information. After the study, the findings were disseminated to key stakeholders, including the participating patients and the nursing community. In accordance with ethical principles, the control group received supplementary education after the study was completed.

Conflicts of Interest

The authors declare no competing interests.

Author Contributions

R.T: Conceptualization, Methodology, Visualization, Data curation. E.Gh: Conceptualization, Methodology, Writing - Review and Editing. A.Y: Formal analysis. F.K and Z.R: Writing - Review and Editing. N.MA: Conceptualization, Methodology, Investigation, Resources, Project administration, Supervision, Writing - Review and Editing.

Data Availability Statement

The datasets generated and/or analyzed during the current study are not publicly available because of patient privacy and ethical restrictions concerning personal health information; however, they are available from the corresponding author upon reasonable request.

Use of Artificial Intelligence

The authors declare that no artificial intelligence (AI) tools or large language models were used in the study design, data collection, data analysis, interpretation of the results, or generation of the scientific content of this manuscript.

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