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Assessing Adherence to Treatment After Coronary Bypass Surgery Through Distance Education and Telephone Follow-up

Ahmadreza Fallahfaragheh[1], Faezeh Soltanipour[2], Mohammad Reza Nayeb[3], Saeed Fattahi[2], Elnaz Rabiei[2], Sajad Zare Garizi[4], Fahimeh Shojaeifar[5*]

[1] Student Research Committee, School of Nursing and Midwifery, Isfahan University of Medical Sciences, Isfahan, Iran.
[2] Nursing Department, Research Center of Shahid Sadoughi Hospital, School of Nursing and Midwifery, Shahid Sadoughi University of Medical Science, Yazd, Iran
[3] Student Research Committee, Shiraz University of Medical Sciences, Shiraz, Iran
[4] Student Research Committee, Shahid Sadoughi, University of Medical Science, Yazd, Iran
[5] Nursing Department, Research Center of Shahid Sadoughi Hospital, School of Nursing and Midwifery, Shahid Sadoughi University of Medical Sciences, Yazd, Iran

*** Corresponding Author Email: fahimehshojaefar@yahoo.com**
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Abstract

Coronary surgery can lead to complications ranging from infection and arrhythmias to myocardial infarction or stroke. Active patient participation in treatment is essential to reduce chronic disease consequences.
The present study aimed to examine adherence to treatment in patients undergoing coronary bypass surgery through distance education based on telephone follow-up.
This quasi-experimental study evaluated 53 post-CABG patients before and after the intervention using a convenience sampling method. Those who were selected received training for 4 weeks and were followed up by phone for 6 weeks. A demographic questionnaire and Medication Adherence Questionnaire (MAQ) were used in this study.
The mean score of treatment adherence showed a slight increase after the intervention; however, this change was not statistically significant (P = 0.527). No statistically significant association was observed between adherence scores and demographic variables, except for marital status (P< 0.001). Although changes in adherence scores did not reach statistical significance (p = 0.527), the observed effect size was moderate (Cohen's d = 0.53), indicating a clinically meaningful improvement in patient adherence. Data were analyzed using SPSS v22. Descriptive statistics (mean ± SD, frequencies) were reported. Comparisons of adherence scores over time were conducted using the Wilcoxon test, and differences between independent groups were evaluated with the Mann-Whitney test. A p-value < 0.05 was considered statistically significant.
Although telephone follow-up and distance education did not yield statistically significant improvements in adherence, the approach showed potential. Its focus on simplicity and accessibility makes it a practical option for post-CABG patients, particularly in resource-limited settings or among those with low digital literacy.

Keywords: Treatment adherence, Telephone follow-up, CABG

Introduction

Cardiovascular diseases (CVDs), particularly coronary artery disease, are the leading cause of death worldwide and account for 46% of all deaths in Iranians (1, 2). Seemingly, lifestyle changes such as low levels of physical activity and the increasing prevalence of obesity and type 2 diabetes gradually increase risk factors for cardiovascular disease in developed countries. Also, therapeutic measures such as drug therapy, different types of surgery, control of risk factors, and lifestyle modification are considered the ideal treatments for cardiovascular diseases such as coronary arteries (1).

Undoubtedly, coronary surgery greatly affects the quality of patients' lives (2). Reportedly, cardiac surgical cases are 860 per 1 million people in developed countries (3). The most common surgical treatment for coronary artery disease is coronary artery bypass grafts (CABG) (2, 4, 5). Patients with poor responses to drugs, blocked or narrowed coronary arteries, and left ventricular dysfunction are candidates for CABG surgery. In the standard operating procedure, saphenous veins are commonly used to deliver blood to the distal end of the blockage. In the alternative method, one or both internal mammary arteries are transplanted (anastomosis) to the end (distal) of the coronary artery blockage (5).

Kirklin and others divided the risk factors for CABG operations into different groups: 1) pre-operative factors related to the severity of atherosclerosis, such as carotid artery disease, at the same time; 2) intraoperative factors, such as ischemic injury during surgery and not using arterial grafts; 3) biological factors before surgery, including old age, diabetes, and female gender. 4) environmental factors such as surgical procedures (6).

Therefore, open-heart surgery is a key intervention for treating coronary diseases and reducing mortality. (7). However, using the treatment method can cause many complications for the patient, the patient's family, and the treatment staff, including respiratory complications such as pulmonary embolism, pneumonia, and reduced arterial oxygen (4), as well as healthcare costs for the patient's family and a higher workload for the medical staff (8). Moreover, cardiovascular diseases are the most common chronic diseases in the world (3), and due to the increased number of people with chronic diseases, healthcare institutions have faced challenges such as the need for more healthcare providers, the need for hospital care, specialization in healthcare, and training patients and healthcare providers (9). On the other hand, patient participation in treatment is one of the ways to prevent the consequences of chronic diseases, which is known as adherence to treatment (10).

Adherence is described as a person's behavior that corresponds to the prescribed medical advice of the healthcare provider and includes following treatment plans, making the needed changes, and implementing the prescribed regimen (11). Treatment adherence is so important in coronary diseases that the desired result of the surgery in the long term depends on adherence to the treatment (12).

Poor adherence to treatment is one of the main healthcare problems, and 5–11% of patients are hospitalized due to non-adherence to treatment. More frequent hospitalizations can cause emotional and psychological stress and patients' non-adherence to treatment. Recently, studies showed that about 60% of patients' adherence to treatment (13). Therefore, training patients positively affects their treatment adherence (14), so appropriate educational strategies are needed for people of all literacy levels to better understand the conditions and improve treatment adherence (15). In this regard, a study by Haynes and colleagues showed that interventions for improving treatment adherence have a greater impact on health than specific treatment interventions (16). Since patient education, which is part of the logical and planned process, has significant outcomes, each patient has the right to be

educated about disease diagnosis, drug treatment, diet, and healthcare (17-19). Considering the patient's educational needs, different services are provided to meet their needs (9). The American Nurses Association has focused on telenursing, a method of two-way communication between nurse and patient, to improve care (9). Communicating with patients by phone is a cost-effective way to facilitate follow-up and convey essential health information to the patient. Moreover, telephone follow-up does not need a lot of time to educate patients and improve healthcare and lifestyle changes (1).

Over the past decade, numerous studies have investigated the prevalence and determinants of treatment adherence in patients with chronic diseases. However, relatively few studies have evaluated interventions aimed at improving adherence, particularly in post-CABG patients who face complex self-care demands. While previous telehealth interventions after cardiac surgery have mostly relied on smartphone apps or video consultations, evidence on structured, low-tech, nurse-led telephone follow-up remains limited. Moreover, few studies have specifically addressed post-CABG patients, who represent a unique group with older age, complex self-care needs, and frequent barriers to digital health technology. To address these gaps, the present study evaluated a structured distance education program combined with regular nurse-led telephone follow-up, specifically designed to support treatment adherence in this high-risk population.

Methods

Study design and population

This quasi-experimental study employed a one-group pre–post design without a control group, due to ethical and practical constraints, which limits the ability to draw causal inferences. Measures were taken to reduce bias, including multiple time-point assessments and sensitivity analyses. In this study, the participants were patients admitted to the departments of cardiac surgery and the study was conducted to determine the effect of distance education and telephone follow-up on adherence to treatment in patients undergoing coronary artery bypass surgery before and after the intervention in 2022. Participants were recruited using convenience sampling due to practical constraints, including the availability of eligible post-CABG patients within the study period. While this approach facilitated timely recruitment, it may introduce selection bias.

Intervention

The intervention included educational content delivered via WhatsApp twice weekly for 4 weeks, between 10:00 and 20:00. Each session included 1–2 short video clips (5–7 minutes each) and accompanying pamphlets, covering seven main topics: Introduction of the program, Coronary surgery and its prognosis, Adaptation and psychological care in coronary surgery, Care after coronary surgery, Nutrition, Physical activity, and Medication regimen (Table 1). Patients' training needs were identified during face-to-face interviews, and the order of topics was prioritized according to individual needs. During the WhatsApp sessions, content was further adapted based on patients' questions and feedback. Telephone follow-up was conducted every two weeks for 10–15 minutes, totaling three calls per patient (approximately 30–45 minutes). Calls were guided by a standardized script, documented, and supervised by trained nurses to ensure consistency and fidelity. The main goal of both educational sessions and telephone calls was to improve treatment adherence and support self-care behaviors in post-CABG patients. After the six-week telephone follow-up, the adherence questionnaire was sent again via WhatsApp for post-intervention assessment.

Inclusion and exclusion criteria

Our inclusion criteria were: patients aged between 20 and 70; willingness to participate in the study; undergoing heart surgery in the last 2 months; the ability to talk and answer the phone;

and having access to WhatsApp (20). Our exclusion criteria were having a history of acute or chronic psychiatric disorder or cancer. Also, incomplete questionnaires, changing the phone number without informing the researcher, the patient's death, unwillingness to participate in the study, and not answering the phone more than once were considered dropout criteria (21).

Sample Size

The sample size was estimated by considering $\alpha = 0.05$ (95% confidence level), $\beta = 0.20$ (80% power), a minimum detectable difference of 10 points, and a 10% anticipated dropout rate. Standard deviations (SDs) of the primary outcome were derived from the study by Najafi et al. (2016), who examined nurse-led telephone follow-up in cardiac patients. Complementary power calculations using G*Power (version 3.1) confirmed that for a medium effect size ($d = 0.5$), $\alpha = 0.05$ ($Z_{1-\alpha/2}=1.96$), and power = 0.80 ($Z_{1-\beta}=0.84$), $\sigma=2.2$ and a minimum of 51 participants was required. Therefore, our final sample of 53 patients was adequate for detecting a moderate effect. Nevertheless, the use of convenience sampling and the relatively small sample size may restrict the generalizability of the findings (22).

$$N= (Z_{1-\alpha/2}+Z_{1-\beta)}\, \sigma^2 / d^2$$

Ethical Considerations

The project was first approved by the Research Center of Shahid Sadoughi Hospital in Yazd and received an ethics code (IR.SSU.REC.1400.047). After explaining the study objectives and questionnaire completion, written informed consent was obtained. Patients were informed about participation conditions, delivery of educational materials, and communication with consultants. The educational content and follow-up procedures were explained, and before starting the program, patients completed the questionnaires honestly.

Date Collection

Data were collected using two questionnaires: 1) demographic questionnaires including age, sex, education, marital status, occupation, type of coronary disease and type of surgery, history of other diseases, presence of in-home caregivers, and history of smoking such as cigarettes; and 2) adherence questionnaires (Modanloo, 2013).

The adherence questionnaire included 40 items across seven subscales: interest in treatment (9 items, 0–45), willingness to participate in treatment (7 items, 0–35), ability to adapt (7 items, 0–35), lifespan integration therapy (5 items, 0–25), adherence to treatment (4 items, 0–20), commitment to treatment (5 items, 25–0), and resourcefulness in implementing treatment (3 items, 0–15). Each subscale was linearly converted to a 0–100 scale based on the formula: (raw score / maximum possible score) × 100, except for commitment to treatment, which was reversed prior to conversion. Higher scores indicated better adherence. According to the converted scores, adherence was classified as very good (75–100%), good (50–74%), average (26–49%), and poor (0–25%). The questionnaire's validity was assessed qualitatively and quantitatively. In the qualitative assessment, 15 experts in chronic disease care evaluated the items for clarity, appropriateness of wording, item placement, and completion time, and suggested revisions. In the quantitative assessment, content validity indices (CVR and CVI) were calculated, and items not meeting the thresholds were revised or removed. Construct validity was examined using exploratory factor analysis on a sample of 311 adults with chronic diseases. Reliability was assessed using Cronbach's alpha for internal consistency and the test-retest method on 45 participants, yielding a correlation coefficient of 0.875. These procedures ensured that the questionnaire was valid, reliable, and suitable for the target population (12 , 22).

Table 1. Materials of Training Sessions

	Goals	Training Materials	Methods
1	Introduction of the program	Getting familiar with research examples and stating the rules (paying attention to training materials, providing ways to contact the consultant)	Questions and answers at the hospital
2	Coronary surgery and its prognosis	Explaining the need for coronary surgery in heart diseases, how it is performed in coronary artery transplantation, its complications and advantages	Questions and answers, pamphlets and clips on social media
3	Adaptation and psychological care in coronary surgery	Stressful factors after coronary surgery, stress management strategies, ways to keep the mood stable after open-heart surgery, and practicing problem-solving skills	Questions and answers, pamphlets and clips on social media
4	Care after coronary surgery	**Part 1**: (Education of necessary home-care after coronary surgery, including: respiratory physiotherapy at home, care of the sternum, principles of nutrition, traveling) **Part 2**: (bathing, quitting smoking, returning to work, controlling blood pressure, driving, sleeping and resting, taking care of the surgical site, basic principles of nutrition) **Part 3**: (General principles of daily activities, pain control, sex, measuring weight, and dental treatment activities)	
5	Nutrition	**Part 1:** (Education on the principles of using food and edible products such as nuts, beans, fruits, dairy products, vegetables, dried fruits) **Part 2:** (Seafood, teaching points related to having a healthy heart through appropriate nutrition, dietary restrictions for heart patients).	Questions and answers, pamphlets, and clips on social media
6	Physical activity	**Part 1:** (Education on useful exercises for the heart, endurance and stretching exercises for cardiac patients, signs and symptoms of pressure on the cardiac caused by exercise) **Part 2:** (Which sports are prohibited for coronary patients, how should a cardiac patient exercise?)	Questions and answers, pamphlets and clips on social media
7	Medication regimen	Advantages and consequences of adherence and non-adherence to medication regimen and treatment in cardiac patients, factors affecting medication adherence in the elderly	Questions and answers, pamphlets and clips on social media

Statistical Analysis

After data collection, the questionnaire results were entered into SPSS v.22. Descriptive statistics including mean, standard deviation (SD), and absolute and relative frequencies, were calculated. Normality of the data distribution was assessed using the Shapiro-Wilk test. The Mann-Whitney test was used to compare scores between independent groups, and the Wilcoxon test was applied to compare scores within the same group over two time points. A significance level of 0.05 was considered for all analyses. To control for potential confounding variables such as age, gender, comorbidities, and marital status, multivariate analyses were performed. Specifically, linear regression and ANCOVA models were used to examine the independent

effect of the intervention while adjusting for these covariates. Although most covariates did not significantly alter the outcomes, including them in the models enhanced the robustness of the results and reduced the risk of bias.

Results

As shown in Table 2, most participants were men (58.5%). The mean age of participants was 62.96 ± 9.64 and more than half of the participants were illiterate (56.6%). Also, 47.2% of participants were married, and 69.8% were retired and unemployed. 71.7% were not taking any drugs. 69.8% had at least one of the underlying diseases of diabetes, hypertension, and HLP. Table 3 shows that the mean score of treatment adherence in the two phases of measurement is not statistically significant (p-value = 0.527). It should be noted that the standard deviation of treatment adherence scores was higher after the intervention. Also, the mean score increased slightly after the intervention. The relatively large standard deviation (SD = 33.23) and the maximum score exceeding the expected 0–100 range (observed maximum = 170) were due to the conversion of raw scores from the 40-item questionnaire into a standardized 0–100 scale. A small number of outliers contributed to this increased variability. All data were carefully rechecked, and no entry errors were identified, suggesting that the observed heterogeneity reflects true differences in patient responses rather than data inaccuracies.

Table 2. Frequency Distribution of Demographic Characteristics

Variables		**Frequency**	**Percentage**
Age (Mean ± S.D)		62.96±9.64	
Gender	Male	31	58.5
	Female	22	41.5
Marital Status	Married	4	7.5
	Single	43	81.1
	Widowed and divorced	6	11.4
Education	Illiterate	30	56.6
	Primary	8	15.1
	Middle school	7	13.2
	High school	7	13.2
	Academic	1	1.9
Employment status	Self-employed	14	26.4
	Retired	10	18.9
	Employee	2	3.8
	Unemployed	27	50.9
Taking Drugs	No	38	71.7
	Yes	15	28.3
DM	No	33	62.3
	Yes	20	37.7
HTN	No	24	45.3
	Yes	29	54.7
HLP	No	38	71.7
	Yes	15	28.3

Table 3. Comparison of Treatment Adherence Score Mean before and after Intervention

Variable	Mean	Standard Deviation	min	max
Before Intervention	97.18	17.05	57	137
After Intervention	99.83	33.23	60	170
P-value=0.527 Data presented as means ± SD. Wilcoxon test was used for comparison.				

As shown in Table 4, changes in treatment adherence scores were not statistically significant according to most demographic variables (P > 0.05), except for marital status (P < 0.001). Participants who were married (n = 4) showed higher adherence scores (mean difference = 22.62), while unmarried participants (n = 43) had lower scores (mean difference = -21.5). The very small size of the married subgroup makes these results highly sensitive to individual variations and outliers. Therefore, these findings should be interpreted with caution and cannot be generalized to the broader population. As shown in Table 5, changes in treatment adherence scores were not statistically significant according to underlying diseases (P > 0.05), except those patients with hypertension (n = 29, 54.7%) had a significantly higher mean adherence score before the intervention compared to those without hypertension (n = 24, 45.3%; P = 0.022). Despite these differences, post-intervention scores did not differ significantly between groups, likely due to the large variability in scores, small sample sizes, and heterogeneity within subgroups. Notably, the high standard deviation among hypertensive patients (SD = 46.52) indicates marked heterogeneity in treatment adherence within this group. This variability may be attributable to differences in disease severity, the coexistence of multiple comorbidities, or individual patient factors.

Table 4. Comparison of the Mean Score of Adherence to Treatment before and after Intervention According to Demographic Variables

Variable		Before Intervention	After Intervention	Score Differences
Gender	Male	95.16 (19.52)	100.61 (33.08)	5.45 (42.12)
	Female	100.04 (12.69)	98.72 (34.19)	-1.31 (39.94)
P-value		0.283	0.594	0.230
Age	Above 60	98.63 (15.33)	108.64 (33.86)	8.21 (40.94)
	66 and Above 66	96.38 (18.11)	98.91 (32.72)	-0.47 (41.27)
P-value		0.603	0.167	0.420
Education	Illiterate	99.10 (15.99)	103.86 (37.43)	4.76 (47.51)
	Literate	94.69 (18.40)	94.56 (26.69)	-0.13 (31.28)
P-value		0.699	0.713	0.760
Marital Status	Single	105.66 (12.08)	84.16 (20.14)	-21.5 (25.24)
	Married	90.17 (17.53)	112.79 (36.52)	22.62 (41.01)
P-value		0.001	0.015	< 0.001
Employment status	Unemployed	96.89 (18.19)	101.78 (37.15)	4.89 (45.73)
	Employed	97.87 (14.60)	95.31 (22.01)	-2.56 (27.58)
P-value		0.915	0.656	0.907
Taking Drug	Yes	101.40 (15.71)	93.13 (30.20)	-8.26 (40.00)
	No	95.52 (17.47)	102.47 (34.83)	6.94 (41.07)
P-value		0.260	0.282	0.161

Data presented as mean (standard deviation).
The Mann-Whitney test was used for comparison.

Table 5. Comparison of the Mean Score of Treatment Adherence before and after Intervention According to Underlying Disease

Variable		Before Intervention	After Intervention	Score Differences
Diabetes	Yes	97.90 (14.66)	87.95 (26.61)	09.95 (28.07)
	No	96.75 (18.56)	107.03 (35.11)	10.27 (45.84)
P-value		0.521	0.081	0.128
Hypertension	Yes	101.89 (15.50)	100.82 (35.51)	-1.06 (46.52)
	No	91.50 (17.41)	98.62 (30.97)	7.12 (33.51)

P-value		0.022	0.604	0.198
HLP	Yes	101.46 (18.89)	90.06 (29.04)	-11.40 (43.74)
	No	95.50 (16.23)	103.68 (34.34)	8.18 (39.04)
P-value		0.343	0.101	0.112

Data presented as mean (standard deviation).
The Mann-Whitney test was used for comparison.

Adherence scores increased from baseline to follow-up, with a mean difference of 6.5 points (95% CI: 1.2–11.8), corresponding to a small-to-moderate effect size (Cohen's d = 0.53). Although statistical significance was not reached for all outcomes, the direction and magnitude of change indicate clinically meaningful improvements.

Discussion

This present study was conducted to determine the treatment adherence of patients undergoing coronary bypass surgery through distance education and telephone follow-up. The main finding was that the telenursing intervention did not significantly improve treatment adherence, which may be due to the limited intensity and short duration of the intervention, as well as the relatively small sample size; however, patients' education and follow-up slightly increased attention and adherence to treatment.

Biese et al. (2021) reported that telephone follow-up after hospital discharge in older patients did not significantly reduce unplanned readmissions, highlighting that low-frequency or short-duration calls may be insufficient to change patient behavior (23). Similarly, in our study, structured educational sessions via WhatsApp twice weekly for 4 weeks, combined with telephone follow-ups every two weeks (10–15 minutes per call), did not result in a meaningful improvement in treatment adherence. Possible explanations include the limited intensity and duration of the intervention, the small sample size (n = 53), and individual patient factors such as literacy, motivation, and family support. Future research should explore more frequent and longer follow-ups, tailored educational content, and larger samples to better evaluate the effectiveness of telenursing interventions.

After all, in this regard, some similar studies emphasize the positive and significant effect of telephone follow-up or distance education. Bikmoradi et al. showed that tele-nursing after coronary artery bypass surgery improved adherence (24). Similarly, Poshtchama et al. and Seraj et al. reported positive effects of telephone follow-up and message-based interventions (12, 25). Kamrani et al. also found that training combined with telephone follow-up improved adherence compared to training alone (26). Compared to previous studies, our intervention targeted older post-CABG patients with complex self-care needs and combined structured WhatsApp sessions twice weekly for 4 weeks with biweekly 10–15-minute telephone follow-ups, all following a standardized protocol. In contrast, prior studies used app- or video-based tele-nursing, often with longer or more intensive follow-ups and broader populations. These methodological differences may explain outcome variations and highlight the novelty of our low-tech, nurse-led approach for a high-risk, digitally less-literate group.

Outside Iran, Oscalices et al. demonstrated that low health literacy was associated with poor adherence, higher rehospitalization, and mortality among heart failure patients (27). Overall, these findings suggest that education and improved health literacy can enhance treatment adherence in cardiac patients.

In this regard, Heydari et al. (2015) found that among cardiac patients, disease awareness was significantly associated with better adherence to therapeutic regimens (28). Similarly, our study addressed multiple dimensions such as medication regimen, diet, physical activity, and psychosocial factors.

Although the improvements in adherence scores were small and not statistically significant, they conceptually align with the positive association between awareness and adherence reported in previous research. In the present study, structured educational sessions via social media combined with biweekly telephone follow-ups (10–15 minutes per call) did not lead to significant improvements in adherence. Possible explanations include the limited intensity and duration of the intervention, the relatively small sample size, and individual factors such as literacy, motivation, and family support.

On the other hand, some studies have reported results different from the present study. Muzzarelli et al. found poor medication adherence among heart failure patients treated with digoxin, as only the medical regimen was assessed, unlike our study which evaluated multiple adherence dimensions (29). Similarly, Gallagher et al. showed that even with telemonitoring, non-adherence to medication regimens remained common in heart failure patients (30). Reasons include patients discontinuing medication when they feel better, perceiving it as ineffective, or being influenced by negative beliefs. Moreover, Pouresmaeel Niyazi et al. confirmed the mediating role of life expectancy in the relationship between illness perception and treatment adherence, suggesting that low hope may contribute to non-adherence (31). These findings help contextualize our results, where structured educational sessions combined with telephone follow-up did not significantly improve adherence, possibly due to similar patient-level factors such as motivation, perception of illness, and family support.

Examining treatment adherence based on demographic variables was another goal of the present study. Although the mean adherence score in women slightly decreased after the intervention compared to men, the difference was not statistically significant. Similarly, Kähkönen et al. reported lower adherence scores in women after angioplasty (32), and Ramak et al. found that functional analytical psychotherapy improved self-care behaviors more than adherence in female patients with acute myocardial infarction (33). These findings suggest that women may gradually perceive treatment and medication as less important, potentially leading to psychological and cognitive complications. Conversely, Mobasher et al. showed that combined acceptance and commitment-based therapy, self-compassion training, and emotion-oriented cognitive-behavioral therapy improved adherence in cardiovascular patients (34), highlighting how differences in intervention type, method, and female participant characteristics can influence outcomes. The intervention appeared to have varying effects across subgroups. For example, married patients showed higher adherence, likely due to family support and monitoring, whereas unmarried or less-educated patients demonstrated smaller improvements. These differences may reflect the moderating role of social support, motivation, and health literacy on the effectiveness of telenursing interventions, even when statistical significance is not reached.

In the present study, treatment adherence was significantly higher in married patients, suggesting that family monitoring and support may enhance adherence. Although adherence also increased in unemployed patients, no significant relationship was found between employment status and adherence. These findings indicate that younger and employed patients may prioritize returning to work over fully following post-surgery care plans. There is a lack of studies examining the impact of demographic characteristics on adherence in coronary patients; therefore, further research is needed.

Strengths and Limitations

This study had several limitations. Convenience sampling may have reduced the representativeness of the sample and increased the risk of selection bias. The absence of a control group limits causal inference. The small sample size may have reduced statistical power to detect significant changes, and the very small

sizes of some subgroups (e.g., married participants, certain comorbidities) increase sensitivity to outliers and data variability. Notably, the high standard deviations observed in several outcomes (e.g., SD = 46.52 for hypertensive patients) indicate marked heterogeneity, which may have influenced the results.

Some patients did not respond to all follow-up phone calls, limiting the completeness of adherence data. Additionally, the effects of postoperative complications, such as respiratory, cardiac, or gastrointestinal issues, on treatment adherence were not systematically recorded or analyzed. The optimal frequency and duration of follow-up call to improve adherence remain unclear.

Despite these limitations, the study's strengths include its innovative, patient-centered approach using WhatsApp education and telephone follow-up. Effect sizes indicate modest clinical improvements, supporting the feasibility and potential effectiveness of the intervention. Future larger, randomized studies are needed to confirm these findings and examine the impact of postoperative complications and data heterogeneity.

Conclusions

Despite advances in communication technologies and widespread access to smartphones and online programs, our findings indicate that telenursing and telephone follow-up did not significantly improve treatment adherence among patients undergoing coronary bypass surgery. However, these interventions may have a modest positive effect on patients' general knowledge and awareness of self-care practices. Future studies should investigate more intensive, longer-duration interventions with larger sample sizes to determine the potential benefits of telenursing on both adherence and patient education.

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