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Impact of behavioral health education interventions on knowledge, adherence to treatment, and quality of life of patients with heart failure: A randomized controlled trial

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Abstract: ***Introduction:*** Heart failure (HF) is a common chronic disease with high morbidity and mortality rates. Besides HF treatments aimed to improve patients' quality of life and health status, health education interventions for behavioral changes ensuring their adherence to treatment are very important. Therefore, this study aimed to evaluate the effect of behavioral health education interventions on knowledge, treatment adherence, and quality of life of patients with HF. ***Methods:*** This was a randomized controlled trial. A total of 330 patients were selected and randomly distributed into intervention and control groups (n = 165 per group). Data were collected at the time points before the intervention and three months after the intervention using the Dutch Heart Failure Knowledge Scale (DHFKS), Revised Heart Failure Compliance Scale (RHFCS), and quality of life (EQ-5D-5L v2.1, Vietnamese version). ***Results:*** There were no significant differences between the two groups in HF knowledge or quality of life at baseline. After three months of health education intervention, intervention group significant increase to 1.68 times (95%CI: 1.05 – 2.69; p=0.03) in overall HF knowledge; 1.91 times (95%CI: 1.25 – 2.92; p=0.003) in general HF knowledge and 1.59 times (95%CI: 1.03 – 2.45; p=0.038) in behavior of exercise when compare to control group. However, the quality of life did not change significantly after the intervention. ***Conclusions:*** Although the health education intervention had no impact on the quality of life of patients with HF, it was effective in improving their HF knowledge and treatment adherence.

Keywords: Health education interventions, Heart failure knowledge, Treatment adherence, Quality of life

1. INTRODUCTION

Heart failure (HF), is a condition in which the heart cannot pump enough blood and oxygen to the organs [1]. It is a common chronic cardiovascular disease with high morbidity and mortality [2]. Nearly 6.5 million people in Europe, 5 million in the United State, and 2.4 million in Japan suffered from HF. Each year, approximately 1 million new cases are diagnosed worldwide [3]. In Vietnam, approximately 1.8 million people suffered from HF [4]. Patients with HF may suffer from negative impacts on health and daily life. HF can reduce health-related quality of life (QoL) and increase healthcare costs [5,6]. HF

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imposes a significant financial burden on patients, society, and the healthcare system.

HF patients were required long-term treatment targeted to relieve symptoms and improve health conditions and the quality of life of patients. Besides advancements in medication treatment, adherence to non-medication treatment is important for achieving the most effective treatment. Adherence to medication and non-medication treatment reduced the risk of death in patients with HF and readmission rates [7]. However, previous studies in Vietnam showed the limitation of adherence to treatment among patients with HF. In 2015, a study at the Heart Institute of Ho Chi Minh City showed that only 32% of the patients were compliant with drug treatment [8]. The adherence rate was 37% in studies at Dong Thap General Hospital [9] and 54.5% at C Hospital [10], in which the adherence with non-medication treatments is worse than medication treatments. Noncompliance to both medication and non-medication treatment is an important issue in patients with HF, which can lead to worsening the condition and possibly early hospitalization [11].

Health literacy is fundamental to proactive treatment and disease prevention. Lack of knowledge is also a problem of patients with HF in Vietnam. The adequate overall knowledge rate was found as 17.2% in the study of Xoan VT[12] and 27.3% in Ha TT[13]. Lack of knowledge may be a barrier to adherence to treatment in patients with HF.

Health education is the potential intervention to improve adherence to HF treatment among patients. Health education helps patients change unhealthy behaviors into health-promoting ones. Health education methods are both direct and indirect. Each method has its own advantages and disadvantages, but the effect of health education on treatment outcomes and patient compliance and knowledge has increased. The effectiveness of health education has been proven through studies on patients' adherence behavior [14], [15]. Many studies recognized effect of health education on adherence to treatment and quality of life among patients with HF. A study conducted in 2008 by Wu JR et.al showed that health education helps patients understand their disease, its symptoms, and the proper use of drugs, thereby improving their adherence to treatment [16]. Ruppar's study showed that health education in patients with HF was effective and significantly reduced readmissions and mortality [7]. Habibzadeh showed that the Pender health education model impacted the QoL of patients with HF ($p<0.05$) [15]. According to Abbasi, the educational program significantly improved the QoL of patients with HF [17]. In another study, Abbasi observed an improvement in the total QoL score in the intervention group after education health (p 0.001) and found that self-management education could be considered a suitable strategy to improve the QoL of people with HF [14].

In the scope of evidence in Vietnam, no research has evaluated the effect of health education on adherence to treatment of patients with HF. In light of the above situation, we conducted this study to evaluate the effectiveness of direct health education methods on knowledge, treatment adherence, and quality of life among patients with HF in Nhan Dan Gia Dinh Hospital. The study hypothesis is the health education intervention for behavioral change is effective in improving the rate of treatment adherence in patients receiving the intervention compared with the group of patients without intervention.

2. MATERIALS AND METHOD

2.1. Study setting and design

This study design was a randomized controlled trial conducted among 330 patients being treated from November 2021 to June 2022 at Nhan Dan Gia Dinh Hospital, which is a level 1 general hospital in Ho Chi Minh City, Vietnam. The trial was conducted as parallel with 1:1 allocation ratio.

2.2. Intervention method

Study applied the direct health education program using motivational interviewing for intervention. The method of motivational health education involves a continuous exchange of information, emotions, and skills between the communicator or health educator and individuals or groups of information recipients. In this method, health educators would directly contact participants receiving health education. The advantage of the direct method is that broadcasters can hear and immediately respond to listeners' opinions and questions. Thus, messages can be adjusted to help recipients receive the correct information they want to convey. Particularly, new recipients could be attracted and a stronger impact of information on their awareness, attitude, and behavior can be ensured.

2.3. Sample size, recruitment and randomization

Sample size

Minimum sample size was estimated based on compare two independent rate fomular, in which, independent rate is adherence to treatment after three months intervention, the main outcome of study.

$$n = \frac{\left[Z_{1-\alpha/2}\sqrt{2p(1-p)} + Z_{1-\beta}\sqrt{p_1(1-p_1)+p_2(1-p_2)}\right]^2}{(p_2-p_1)^2}$$

In which, Z is the Z-score of normal distribution, α is type I error (α=0.05), β is type II error (β=0.1), p, p_1, p_2 is adherence to HF treatment rate in total, intervention, and control group, respectively.

According to the findings of Cuong HV in Heart Institutes of Ho Chi Minh City, the pre-intervent rate of adherence to medication was 32%[8], and the expected outcome after the health education intervention was 50% for the intervention group and unchanged in the control group. The minimum sample size for the study was 310 patients with HF.

Participants, selection criteria, and recruitment

Participants in the study were outpatients with HF identified based on an electronic medical record system. They are generally diagnosed based on guide of Vietnam Ministry of Health (No. 1857/QĐ-BYT signed at July 05,2022. Patients diagnosed at least one month before who were aged 18 years and had a permanent address in Ho Chi Minh City were included. On the day before treatment schedules, we called to remind each patient to go to routine treatment. Patients were conveniently selected when they visited for routine treatment. After finishing the routine treatment, eligible patients were provided the information, and invited to participate. Patients who disagreed to

participate or had difficulty in understanding or responding were excluded. Patients agreed to participate by signing the consent form and then were interviewed.

Randomization and blinding

All patients in the study sample will be divided into two groups using block randomization to ensure a balance between the intervention group (A) and the control group (B). Blocks of 2, 4, and 6 are utilized. Study participants will be randomly assigned to these blocks, and the order of the blocks will also be arranged randomly using the software available at https://play36.shinyapps.io/Block_Randomization/1. The results of the random allocation generated by the software will be printed out and stored in individual envelopes, numbered 1 to 330. Each envelope contains the allocation order into the two groups for all patients, along with each patient's identification code. The study was single blinding, in which the patient did not know the group that they belong to.

2.4. Intervention program and distribution

Intervention group: Only the patients in the intervention group received an health education about HF self-care and management. The health education session lasted for approximately 20–30 min. A health education plan was developed for each patient based on the results of Knowledge and Adherence assessments of HF before the intervention. The collaborator ticked the hands of knowledge about HF and treatment outcomes that patients still had before the health education [18]. A Guiding Notebook for Self-management of Heart failure consisting of HF health information and a diary were provided to all patients. The purpose of the diary was to reinforce the content of health education. The contents of the logs were not reviewed or analyzed during the intervention. Phone call was used for reminder and appointment of follow-up visits; evaluating and reinforcing the content of medical education about knowledge and adherence to the treatment of HF. Interventions were performed by 30 healthcare professionals who underwent the training before.

In summarize, patients in the intervention group recieved intervention as below:

- Personal health education with trained collaborators

- Treatment compliance monitoring log

- The patients were reminded of each follow-up visit on 5–7 days within 3 consecutive months after the start of the intervention (three calls).

Control group: After examination and guidance by the doctor following a normal follow-up examination (instructing patients to take prescription drugs, follow up on time, and perform laboratory tests at the follow-up examination, if any). A Guiding Notebook for Self-management of Heart failure was provided with no more instructions were provided. A call was made to the participants to schedule an appointment for the survey 5–7 days before each follow-up visit for 3 consecutive months from the first interview (three calls). Each call takes 3–5 minutes.

2.5. Data collection

Study instrument

Research was conducted with a pre-prepared set of questions. The data collection toolkit consisted of four parts: general characteristics, knowledge of HF, treatment adherence, and the QoL index.

Background and pathological characteristics included age, sex, marital status, education level, economic status, degree of HF, and comorbidities.

To measure participants' knowledge about HF, we used The Dutch Heart Failure Knowledge Scale (DHFKS) developed by Van der Wal (2005), which consists of 15 3-choice questions and is divided into three groups: general information about HF (4 sentences); the assessment of diet, water restriction, and actions to evaluate treatment of HF (6 questions); and the assessment of symptoms and symptom development (5 sentences). Adequate HF knowledge for the overall scale or each domain was defined as correct answer ≥2/3 number of questions (correct ≥10 questions for overall scale, ≥3 questions for HF in general, ≥4 for HF treatment, and ≥4 for HF symptom/symptom recognition) [19]. The DHFKS underwent a back-translation method and was adapted for the Vietnamese context in a previous study. The Vietnamese version is acceptable reliability with Cronbach's alpha of 0.72.[20]

The RHFCS questionnaire to measure treatment adherence consists of six questions measured on a Likert scale from 0 to 4. Patients were asked to estimate their adherence over the past week to medication, dietary salt restriction, fluid restriction, and regular exercise for three months for daily weighing and regular health checkups. Patients were assessed as compliant when they selected the answer "always" or "mostly" and non-compliant when they answered "never" or "rarely." Patients were recorded as "compliant" if they had at least four of the six recommendations. The internal consistency of the original version of the tool was tested using Cronbach's alpha, which was 0.68 [21]. In the Vietnam context, the scale shows Cronbach's alpha was 0.77 and moderately correlated to HF patients' mental health (r=0.29).[10]

The QoL was assessed by the EQ-5D-5L questionnaire consisted of a descriptive system and a visual analogue scale (VAS). The descriptive system includes five questions on walking, self-care, daily activities, pain or discomfort, and anxiety or melancholy. The descriptive system score were lookup from a utility value table, and this score generally ranged from less than 0 to 1, with higher scores indicating higher health utility (<0 is worse than dead, 0 is equivalent to death, and 1 is full health). The QoL index from -0.5115 to 1.0 was assessed based on the Vietnam Quality of Life Scale study [22]. The EQ-5D-5L questionnaire was first used in Vietnam in 2012 (for HIV patients) with Cronbach alpha 0.85. Among patients with HF, a previous study in 108 Military Central Hospital 2022 was used EQ-5D-5L to assess the quality of life.[23]

Data collection

Based on the list of patients visiting the hospital, the interviewer selected patients then performed the following stages of the RCT.

Stage 1: Pre-intervention assessment

Stage 2: Implementation of health education interventions.

Stage 3: Post-intervention assessment

Data were collected through face-to-face interview using a structured questionnaire.

Interview were conducted by 20 study staff who are health care professional. All study staff underwent training for patient recruitment, inviting and convincing patients to consent, and interviewing. Before starting the major study, the pilot study on ten patients was conducted. The pilot result showed the appropriateness of the study protocol, the face validity of the questionnaire, and the interview skills of the study staff.

2.6. Data analysis

The data were analyzed using the STATA v16. Age and BMI were described as median and interquartile range (IQR) and test the difference of baseline between group by Mann-whitney test. Gender, ethnicity, education level, living with relatives, using health insurance, overweight/obesity, NYHA class, Comorbidities, Overweight/Obesity were described as frequencies and percentages and test the difference of baseline between group by Fisher's exact test. The HF knowledge, adherence to treatment were described as frequency and percentage and test the difference of baseline between group by fisher's exact test. Quality of life score were describeb by mean and standard deviation and test the difference of baseline between group by T-student test.

Pre-post intervention difference within group were tested by $\chi 2$ McNemar for knowledge and adherence rate, and by Paired T-test for quality of life score. Effect of intervention were estimated by multivariable regression model with controling baseline, age and comorbidities (age and comorbidities showed difference between group in baseline). Poisson regression model with risk ratio (RR) and 95% confidence interval (95% CI) was used for estimated effect on knowledge and adherence; and using Linear regression model to estimated difference in difference and 95% CI for quality of life. The p-value of less than 0.05 was considered statistically significant.

3. RESULTS

We approached 370 HF patients during the study period. In which, 330 patients agreed to participated in our study. The response rate was 89,8%.

3.1. Patients' characteristics

As a results of randomization, almost general characteristics have not difference between groups; only age and commerbidities showed the difference. The median age of the patients in the intervention and control groups was 64 and 62 years old, respectively. The difference in the median age between the two groups was related and statistically significant (p=0.032). The least one comorbidity prevalence in control group was higher than intervention group (p=0.015). (Table 1).

Table 1. General characteristics of patients with heart failure

	Intervention group (n=165)	Control group (n=165)	p
General Characteristics			
Age, *Median (IQR)*	64 (56 – 72)	62 (53 – 68)	0.032#
Age group, *n (%)*			
<50 years old	23 (13.9)	25 (15.2)	
50-59 years old	35 (21.2)	46 (27.9)	0.310*
≥60 years old	107 (64.9)	94 (57.0)	
Gender (male)	80 (48.5%)	86 (52.1%)	0.582*
Ethnicity (Kinh), *n (%)*	162 (98.2)	161 (97.6)	1.000*
Education level, *n (%)*			
Below primary school	21 (12.7)	14 (8.5)	0.670*
Secondary school	39 (23.6)	42 (25.5)	
High school	79 (47.9)	82 (49.7)	
Higher than high school	26 (15.8)	27 (16.4)	
Using health insurance (yes), *n (%)*	164 (99.4)	164 (99.4)	1.000*
Living with relatives (yes), *n (%)*	159 (96.4)	158 (95.8)	1.000*
NYHA classification of heart failure, *n (%)*			
Class I	92 (55.8)	97 (58.8)	0.357*
Class II	38 (23.0)	43 (26.1)	
Class III, IV	35 (21.2)	25 (15.1)	
Comorbidities (least one), *n (%)*	145 (87.9)	158 (95.8)	0.015*
BMI, *Median (IQR)*	23.3 (21.2 – 25.9)	23.5 (21.6 – 25.4)	0.476#
Overweight/Obesity (BMI≥25 kg/m^2), *n (%)*	57 (35.4)	49 (29.7)	0.289
Adequate HF knowledge, n (%)			
HF general knowledge	41 (24.9)	31 (18.8)	0.230*
HF treatment	7 (4.2)	14 (8.5)	0.175*
HF symptoms/symptom recognition	11 (6.7)	16 (9.7)	0.422*
Overall HF knowledge	7 (4.2)	9 (5.5)	0.799*

	Intervention group (n=165)	Control group (n=165)	p
Adherence to heart failure treatment, n (%)			
Taking medication as prescribed	148 (89.7)	81 (49.1)	<0.001*
Reduced sodium intake	67 (40.6)	73 (44.2)	0.578*
Restricted fluid intake	19 (11.5)	23 (13.9)	0.621*
Exercise	28 (17.0)	64 (38.8)	<0.001*
Daily weighing	30 (18.2)	44 (26.7)	0.086*
Follow-up appointment keeping	155 (93.9)	152 (92.1)	0.666*
Overall adherence	29 (17.6)	40 (24.2)	0.176*
Quality of life according to EQ-5D-5L			
Descriptive system score, *Mean* ± *SD*	0.89 ± 0.18	0.85 ± 0.26	0.211[&]
VAS score, *Mean* ± *SD*	67.1 ± 11.9	72.2 ± 12.1	<0.001[&]

** Fisher's exact test;[#] Mann-Whitney U test; [&]T-student test; HF: Heart failure; IQR: Interquartile range; n (%): Frequency (percentage); NYHA: the New York Heart Association; BMI: Body mass index*

3.2. Patient's knowledge of heart failure

Of the 330 patients included in the study, 165 were in the intervention group and 165 were in the control group. At baseline, 4.2% of the patients in the intervention group had sufficient knowledge about HF, and 9.7% of the patients in the control group had sufficient knowledge about HF, but there was no relationship between the two groups (p > 0.05) (Table 1).

After three months of intervention (increasing with baseline time), 32.7% of patients had sufficient knowledge about HF in the intervention group, and 20.6% of patients had sufficient knowledge about HF in the control group. Furthermore in multivariable analysis, the percentage of patients with adequate overall knowledge of HF in the intervention group increased by 1.68 times (95%CI: 1.05 – 2.69) to the control group (p = 0.030), and increased by 1.91 times (95%CI: 1.25 – 2.92) for HF knowledge in general (p=0.038) (Table 2).

3.3. Adherence with medication and non-medication treatment

At the start of the study, there was no difference between the intervention and control groups in the number of patients adherence to treatment. However, when each specific behavior was analyzed, there was a difference in the behaviors of "Taking medication as prescribed " and "Exercise" with p<0.05 (Table 3).

However, after control all confused potential in multivarible model, study not found effect on overall compliance after three months of intervention. The intervention only reached effect on behaviour of "Exercise" with an increasing 1.59 times (95%CI: 1.03 – 2.45) of compliant in intervention group.

Table 2. Knowledge of heart failure at pre-post intervention

Adequate HF knowledge	Intervention group (n=165)	Control group (n=165)	RR (CI 95%)	p[@]
HF general knowledge				
Pre-intervention, *n (%)*	41 (24.9)	31 (18.8)	1.91 (1.25 – 2.92)	0.003
Post-intervention, *n (%)*	75 (45.5)	39 (23.6)		
p[$]	<0.001	0.182		
HF treatment				
Pre-intervention, *n (%)*	7 (4.2)	14 (8.5)	0.97 (0.64 – 1.48)	0.905
Post-intervention, *n (%)*	56 (33.9)	55 (33.3)		
p[$]	<0.001	<0.001		
HF symptoms/symptom recognition				
Pre-intervention, *n (%)*	11 (6.7)	16 (9.7)	1.09 (0.75 – 1.61)	0.644
Post-intervention, *n (%)*	65 (39.4)	63 (38.2)		
p[$]	<0.001	<0.001		
Overall HF knowledge				
Pre-intervention, *n (%)*	7 (4.2)	9 (5.5)	1.68 (1.05 – 2.69)	0.030
Post-intervention, *n (%)*	54 (32.7)	34 (20.6)		
p[$]	<0.001	<0.001		

[$]χ2 McNemar test; [@]Multivariable Poisson regression; HF: Heart failure; n (%): Frequency (percentage); RR (95% CI): Risk ratio (95% confidence interval)

Table 3. Adherence to heart failure treatment at pre-post intervention

Adherence to heart failure treatment	Intervention group (n=165)	Control group (n=165)	RR (CI 95%)	p[@]
Taking medication as prescribed				
Pre-intervention, *n (%)*	148 (89.7)	81 (49.1)	1.07 (0.81 – 1.43)	0.630
Post-intervention, *n (%)*	147 (89.1)	140 (84.9)		
p[$]	0.847	<0.001		
Reduced sodium intake				
Pre-intervention, *n (%)*	67 (40.6)	73 (44.2)	0.91 (0.67 – 1.24)	0.546
Post-intervention, *n (%)*	99 (60.0)	110 (66.7)		
p[$]	<0.001	<0.001		
Restricted fluid intake				
Pre-intervention, *n (%)*	19 (11.5)	23 (13.9)	1.02 (0.70 – 1.49)	0.917
Post-intervention, *n (%)*	61 (37.0)	69 (41.8)		
p[$]	<0.001	<0.001		
Exercise				
Pre-intervention, *n (%)*	28 (17.0)	64 (38.8)	1.59 (1.03 – 2.45)	0.038
Post-intervention, *n (%)*	60 (36.4)	51 (30.9)		
p[$]	<0.001	0.102		
Daily weighing				
Pre-intervention, *n (%)*	30 (18.2)	44 (26.7)	1.04 (0.71 – 1.52)	0.851
Post-intervention, *n (%)*	61 (37.0)	71 (43.0)		
p[$]	<0.001	<0.001		
Follow-up appointment keeping				
Pre-intervention, *n (%)*	155 (93.9)	152 (92.1)	1.07 (0.83 – 1.38)	0.581
Post-intervention, *n (%)*	159 (96.4)	144 (87.3)		
p[$]	0.248	0.103		
Overall compliance				
Pre-intervention, *n (%)*	29 (17.6)	40 (24.2)	1.09 (0.78 – 1.53)	0.595
Post-intervention, *n (%)*	86 (52.1)	85 (51.5)		
p[$]	<0.001	<0.001		

[$]χ2 McNemar test; [@]Multivariable Poisson regression; n (%): Frequency (percentage); RR (95% CI): Risk ratio (95% confidence interval)

3.4. Quality of life

The QoL score was measured according to the EQ-5D-5L V2.1 scale. At baseline before the intervention, the mean descriptive system score in the intervention group was 0.89 and that in the control group was 0.86, and insignificant change after intervention. VAS score was significant improved after intervention in both groups (p<0.001). After three months, intervention did not found effect of intervention on descriptive system and VAS score (p=0.389 and p=0.770, respectively) (Table 4).

Table 4. Quality of life of patients with heart failure at pre-post intervention

Quality of life according to EQ-5D-5L	Intervention group (n=165)	Control group (n=165)	Difference in difference (95% CI)	p[@]
Descriptive system score				
Pre-intervention, *Mean ± SD*	0.89 ± 0.18	0.85 ± 0.26	-0.018 (-0.058 – 0.023)	0.389
Post-intervention, *Mean ± SD*	0.89 ± 0.18	0.90 ± 0.18		
p[$]	1.000	0.094		
VAS score				
Pre-intervention, *Mean ± SD*	67.1 ± 11.9	72.2 ± 12.1	-0.28 (-2.15 – 1.60)	0.770
Post-intervention, *Mean ± SD*	74.5 ± 11.0	77.8 ± 10.4		
p[$]	<0.001	<0.001		

[$]Paired T-test; [@]Multivarible linear regression; SD: Standard deviation; VAS: Visual Analogue Scale

4. DISCUSSION

We found that before the intervention, the proportion of patients with sufficient knowledge about HF in the intervention group was 4.2% and that in the control group was 9.7%. This indicates that the percentage of patients with knowledge about HF remained low. Further, the study showed no relationship between the two groups in HF knowledge ($p > 0.05$). After the health education intervention, the proportion of patients with sufficient knowledge about HF increased significantly. Further, there was a relationship between the control and the intervention groups after three months of intervention. Tawalbeh's study showed a change in the mean score of knowledge between the tests before and after the health education intervention, and a relationship between the tests of knowledge before and after the intervention in the experimental group compared with the control group ($p<0.001$) [24]. Our study also found a statistically significant difference in the effect of health education on the behavioral change and knowledge of patients with HF, with an increase in the proportion of patients with HF who had sufficient knowledge about HF after three months compared to the time before the health education intervention (Table 2). This result was similar to the results of Pham Thi Hong Nhung, who showed that the average score of HF knowledge after the health education intervention increased compared to the time before the intervention, and this difference was also statistically significant ($p<0.001$) [25]. Vu Van Thanh's study also showed similar results when the total score of HF knowledge after the health education intervention was higher than the time before the educational intervention and was statistically significant ($p<0.001$) [26]. The above ratio showed that health education interventions were effective and had a direct impact on patients' knowledge and perception on HF,

helped them have a better view of HF, and made them take measures to spread this knowledge to other patients being treated for HF.

The percentage of patients with drug adherence and no medication use among the patients with HF before the intervention was assessed. Patients with treatment adherence in the control group (24.4%) had a higher adherence rate than those in the intervention group (17.6%). Patients adhered to drug therapy in the intervention group had higher rates than patients who adhered to non-drug treatment in both groups (Table 2). After 3 months of intervention, the rate of adherence to medication and no medication in patients with HF was higher than that before the intervention; specifically, in the intervention group, the overall rate of adherence to treatment was 52.1%, and in the control group, it was 51.5% (Table 2). Also, the rate of adherence to non-drug therapy in patients with HF increased significantly compared to the condition before the intervention. Thus, health education interventions for patients with HF impacts drug adherence and non-medication outcomes. This finding is consistent with that of Tinoco's study, which showed that health education interventions were more effective than usual care in improving adherence ($p<0.001$) [27]. In a study by Ali Navidian, the results of a health education session showed differences in attitudes of the two groups ($p<0.0001$) toward treatment adherence and self-care behaviors [28]. Further, before the intervention, the treatment adherence rate of the intervention group was 0.73 times higher than that of the control group. This difference was not statistically significant ($p>0.05$; 95% CI:0.47–1.11). This result was similar after three months of intervention; despite an increase in the rate of adherence compared to the time before the intervention, there was no relationship between the rate of adherence in the intervention and the treatment control groups ($p > 0.05$). In Tawalbeh's study, the change in adherence to treatment and self-care of patients with HF between the intervention and the control groups was statistically significant before and after the intervention [24]. In a study by Wu et al., after three months of intervention, patients' adherence to medication was significantly better than that of patients in the control group [29].

In this study, the mean QoL score of patients with HF in the intervention group was 0.89 before intervention and that in the control group was 0.86. After 3 months of intervention, the QoL scores of patients with HF in the intervention and control groups showed changes of 0.89 and 0.90, respectively (Table 4). There was no increase in the QoL score in the intervention group; however, in the control group, the patients' QoL score changed. Habibzadeh's study also showed that the mean QoL score between groups increased significantly after a health education intervention [15].

Further, we did not find an association between QoL scores in patients with HF in the intervention and control groups at the time of intervention or three months after the intervention ($p > 0.05$) (Table 4). This was also found in Abbasi's study, which showed no statistically significant difference between the groups in terms of QoL [17]. A study by Hwang did not show any difference in the QoL of patients between groups before and after the intervention, either [30]. These findings suggest that although the health education program improved patients' adherence, it did not significantly impact their QoL. This may be due to poor adherence to nonpharmacological therapies, which may limit the overall effectiveness of the intervention.

Although this research achieved specific objectives, its limitations need to be overcome. First, three months of follow-up might not be enough to change the quality of life. Short-term of follow-up might lead to ineffective results of intervention on quality of life in our study. Second, intervention was performed by 30 healthcare professionals. Heterogeneity among theseprofessional may affect study results. To mitigate this impact, we trained these professionals before intervention. Third, besides the advantages of the direct health education method for research, it has some limitations. Since the method is one-way, the recipients are very likely to misunderstand the information because they only watch and listen in one direction without being able to return to the previous information. Finally, the study focuses on outpatients at a single center, suggesting the findings might not be universally applicable to other patient demographics with different characteristics compared to our study population.

Conclusion

In summary, this study showed that direct health education measures to change adherence behavior in patients with HF are effective in changing the awareness of patients with HF, adding their knowledge, and improving their ability to take care of themselves. Further, this study showed an association between

HF education and knowledge, medication adherence, and non-medication in patients with HF. Although health education interventions have no impact on the QoL of patients with HF, they are effective in improving their HF knowledge and treatment adherence. Therefore, the results of this study are appropriate only for future large-scale studies. However, it contributes to building health education models to educate patients, supplement knowledge about HF, and improve the QoL of patients with HF.

LIST OF ABBREVIATIONS

HF: Heart Failure

DHFKS: Dutch Heart Failure Knowledge Scale

RHFCS: Revised Heart Failure Compliance Scale

EQ-5D-5L: European Quality of Life 5 Dimension 5 Level

QoL: Quality of Life

VAS: Visual Analogue Scale

IQR: Interquartile range

RR: Risk Ratio

CI: Confidence interval

ETHICAL STATEMENT

The study was approved by the ethics committee of Ho Chi Minh City University of Medicine and Pharmacy (No. 980/HDDD-DHYD, signed on December 29, 2020) and Nhan Dan Gia Dinh Hospital (approval number 11/NDGD-HDDD, signed on January 29, 2021). This study was voluntary; only patients who agreed to participate were included in the study. The study only involved interviews; there was no medical intervention; the data was used purely for research purposes and not for any other purpose. The collected data were encrypted and kept confidential for study participants. The patients were interviewed, consulted, given health education as well as missing knowledge about HF and the treatment regimen.

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For the study, we only collected data on patients, met them face-to-face, and interviewed them using a set of prepared questionnaires. Based on the information in the questionnaire, participants could skip any questions if they felt uncomfortable. All data were collected for research purposes only and were completely confidential. The data of the study participants were not used for any other purposes.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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AUTHORS' CONTRIBUTION

All authors made a significant contribution included:

CVH: Ideas, methodology, project administration, data collection, data analysis, result interpretation, writing, response to reviews.

TND: Methodology, data analysis, result interpretation, writing, response to reviews.

DNN: Ideas, methodology, result interpretation, supervision.

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