Medicine®

OPEN

Association between the nurse-led program with mental health status, quality of life, and heart failure rehospitalization in chronic heart failure patients

Yuzhu Mo, RN[a], Mingzi Chu, RN[b], Wenxiong Hu, MD[a], Haiyan Wang, RN[b,*]

Abstract

The nurse-led program is associated with a short-term improvement of mental health status (MHS) and quality of life (QOL) in patients with chronic heart failure (CHF). Nonetheless, the long-term effect of this program is undetermined. The aims of the current study were to evaluate the 1-year effects of the nurse-led program on MHS, QOL, and heart failure (HF) rehospitalization among patients with CHF.

CHF patients in the control group received standard care, and patients in the treatment group received standard care plus telehealth intervention including inquiring patients' medical condition, providing feedbacks, counseling and providing positive and emotional talk with the patients. At the third, sixth, and twelfth month's follow-up, patients were called by registered nurses to assess the Mental Health Inventory-5 (MHI-5) and Kansas City Cardiomyopathy Questionnaire (KCCQ) scores. HF rehospitalization was also assessed.

A total of 300 patients were included and 46% (n = 138) of the patients were in the treatment group. There were no significant between-group differences in the MHI-5 and KCCQ scores at baseline. In the control group, the MHI-5 score was gradually decreased with follow-up and the score was significantly lower than that in the treatment group since the third month's follow-up (63.5 ± 10.6 vs 73.6 ± 10.3). Compared with the treatment group, KCCQ score was lower in the control group from the third month's follow-up (64.3 ± 10.6 vs 73.5 ± 12.3) until the end of the twelfth months' follow-up (45.3 ± 11.2 vs 60.8 ± 11.1). During 12 months' follow-up, the proportion of patients who experienced HF rehospitalization was lower in the treatment group (19.6% vs 24.1%). After adjusting for covariates, the utilization of the nurse-led program, and increase of MHI-5 and KCCQ scores were associated with reduced risk of HF rehospitalization.

The nurse-led program is beneficial for the improvement of MHS and QOL for CHF patients, which might contribute to the reduction of HF rehospitalization.

Abbreviations: CHF = chronic heart failure, CI = confidence interval, eGFR = estimated glomerular filtration rate, KCCQ = Kansans City Cardiomyopathy Questionnaire, LVEF = left ventricular ejection fraction, MHI-5 = mental health inventory-5, MHS = mental health status, NYHA = New York Heart Association, OR = odds ratio, QOL = quality of life, RAS = Renin–angiotensin system.

Keywords: chronic heart failure, mental health status, quality of life, rehospitalization

[a] Department of Nursing, Hainan Western Central Hospital, Hainan, [b] Department of Nursing, the Ninth People's Hospital, Shanghai Jiaotong University, School of Medicine, Shanghai, China.

* Correspondence: Haiyan Wang, Department of Nursing, the Ninth People's Hospital, Shanghai Jiaotong University, School of Medicine, Shanghai 201000, China (e-mail: ss.its@163.com).

1. Introduction

Chronic heart failure (CHF) is a leading cause of morbidity and mortality around the world.[1–4] Epidemiological studies have reported that a substantial proportion of CHF patients have depression, which significantly influences their quality of life (QOL), mental health status (MHS), medication adherence, and clinical outcomes.[5–7] Unfortunately, prior studies have demonstrated that antidepressant therapy did not improve the survival rate of CHF patients with depression.[8–10] Interestingly and importantly, nonpharmacological strategies have been applied to evaluate their effects on QOL and MHS in CHF populations.[11–14] Among these strategies, the nurse-led program has been shown to improve QOL and MHS in these populations for a short period. Specifically, in our prior study,[14] registered nurses called CHF patients after discharge inquiring their clinical condition, medication adherence, daily sodium consumption, and physical activity. Based on these evaluations, guidance on selfcare management and persuasive statement regarding medical management were provided. Nonmedical chitchat including positive and emotional talk were implemented. Through this strategy, we observed that the QOL and MHS of CHF patients were significantly improved after

6 months' follow-up.[14] Other studies also have demonstrated that the nurse-led program was beneficial for lowering the risks of HF rehospitalization and unplanned admission.[15–17]

Although studies have demonstrated the short-term benefits of the nurse-led program for CHF patients, whether these benefits were sustainable is undetermined. This issue is clinically relevant since the QOL and MHS is deteriorated with long-term follow-up and CHF progress. If the nurse-led program had long-term favorable effects on QOL and MHS, the nurse-led program might be a paradigm-shift for CHF management in the future. Taken together, the aims of the current study were to evaluate the 1-year effect of the nurse-led program on QOL and MHS in patients with CHF; and we additionally assessed whether the utilization of the nurse-led program was associated with a reduction of HF rehospitalization. We believed that findings from the current study would provide solid evidence to further support the implementation of the nurse-led program for the management of CHF populations in daily clinical practice.

2. Methods

2.1. Study participants

The current study was approved by the Clinical Research Ethic Committee of Hainan Western Central Hospital. The information and protocol of the study was provided to individual patient before written informed consent was obtained. The current study was conducted since September of 2019. The included criteria were as follows: acute exacerbation of CHF during index hospitalization, New York Heart Association (NYHA) class II to IV, left ventricular ejection fraction (LVEF) $\leq 40\%$ as assessed by transthoracic echocardiography, and participants were hemodynamically stable at discharge. The excluded criteria were as follows: patients were discharged with hospice status, terminal illness with life expectancy < 6 months, advanced stage of malignant disease, significant mental illness such as dementia which impaired their capabilities to provide consent or to finish questionnaire for QOL and MHS assessment. Before discharge, CHF patients were asked about their willingness to join the current study, and those who agreed to join the nurse-led program were assigned to the treatment group, while those who did not agree to join the nurse-led program were assigned to the control group. Baseline characteristics, laboratory data, and guideline-directed medication use were obtained from electronic medical record by 2 independent investigators. Study flowchart was presented in the Figure 1.

2.2. Nurse-led program

The day before discharge, the Mental Health Inventory-5 (MHI-5) was used to assess baseline MHS, and the Kansans City Cardiomyopathy Questionnaire (KCCQ) was used to assess baseline QOL in both the treatment and control groups by registered nurses. All the procedures were supervised by board-certified psychiatrists and cardiologists, respectively. The performances by registered nurses have been validated in our prior study.[14] Participants in the control group received standard care (e.g., explanation of disease's condition, the importance of adherence to prescribed medications and low sodium diet, and monitoring body weight daily). In the treatment group, participants received standard care plus telehealth intervention. Specifically, registered nurses called participants in the first (October to November of 2019), second (November to December of 2019), and sixth (March to April of 2020) months after discharge. During the telephone call, patients were asked about their clinical condition, current medication therapy, and daily sodium consumption and physical activity. Thereafter, patients
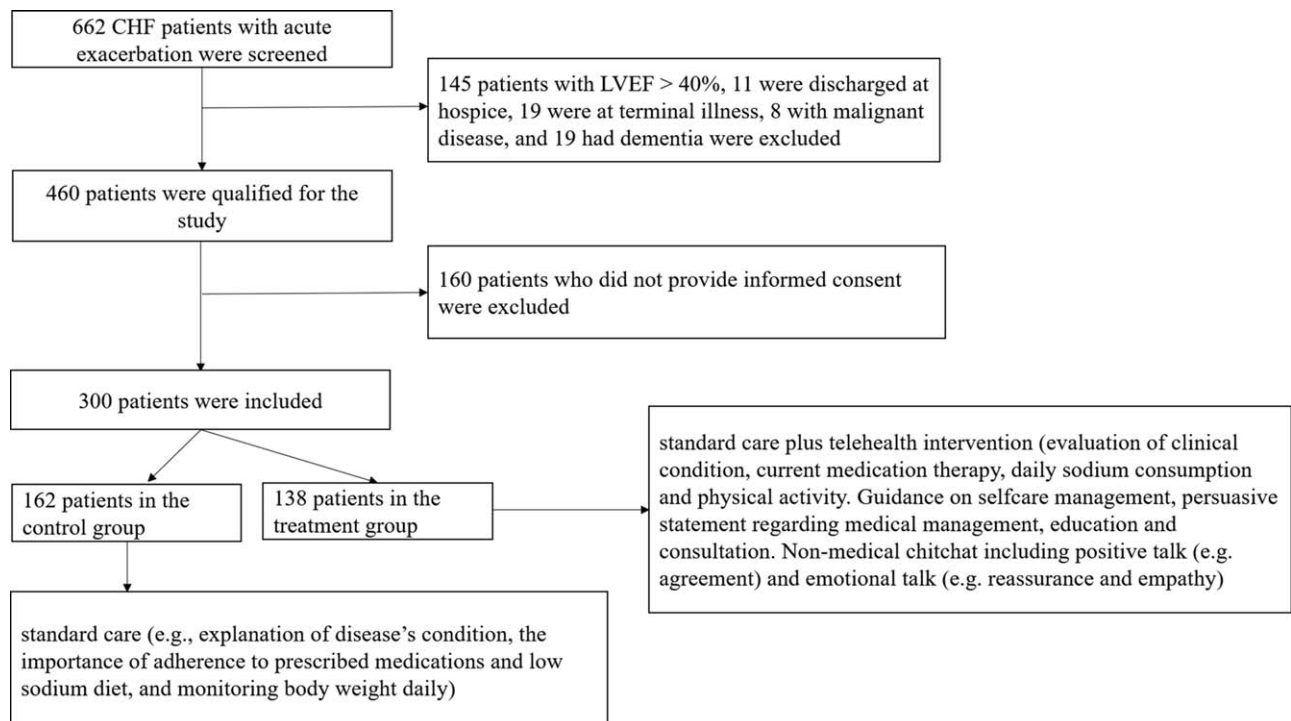

Figure 1. Study flowchart.

were provided guidance on selfcare management, persuasive statement regarding medical management, educating and counseling patients. Finally, nurses would have nonmedical chitchat including positive talk (e.g., agreement) and emotional talk (e.g., reassurance and empathy) with patients. The follow-up was conducted at the third (December of 2019 to January of 2020), sixth (March to April of 2020), and twelfth (September of 2020) months after discharge, and participants were called by registered nurses to reassess MHI-5 and KCCQ score. At the end of follow-up, serum level of N-terminal pro brain natriuretic peptide (NT-proBNP) and NYHA classification were reassessed and the event of HF rehospitalization was collected.

2.3. Statistical analysis

Continuous variables with a normal distribution were presented as mean and standard deviation, otherwise were presented as median (interquartile range). Categorical variables were presented as number and percentage. Continuous variables were assessed by Student t test if normal distribution, otherwise were assessed by Mann–Whitney U test. Categorical variables were assessed by the χ^2 test. To assess the relationship between MHI-5 and KCCQ scores with the use of the nurse-led program, linear regression analysis was performed. Beta coefficient (β) and 95% confidence interval (CI) was reported. Logistic regression analyses were conducted to evaluate the factors associated with HF rehospitalization, with adjusting for covariates. In the univariate regression analysis, factors with a P value $< .1$ were entered into the multivariable regression analyses. Odds ratio and 95% CI were reported. All analyses were performed using SPSS 23.0 and a 2-sided P value $< .05$ was considered as statistical significance.

3. Results

3.1. Baseline characteristics

A total of 300 participants were included in the current analyses, and 46% (n=138) of the participants were assigned in the treatment group. Comparisons of baseline characteristics were presented in Table 1. Compared with the control group, participants in the treatment group were more likely to have educational attainment ≥ high-school degree (57.9% vs 48.8%) and to be in a married status (93.5% vs 87.0%), but less likely to

Comparisons of baseline characteristics.

Variables	Control group (n = 162)	Treatment group (n = 138)
Age (yr)	53.8 ± 12.2	52.3 ± 10.4
Male, n (%)	110 (67.9)	92 (66.7)
Education ≥ high school, n (%)	79 (48.8)	80 (57.9)[*]
Married status, n (%)	141 (87.0)	129 (93.5)[*]
Smoking, n (%)	67 (41.4)	58 (42.0)
Hypertension, n (%)	88 (54.3)	77 (55.8)
Diabetes mellitus, n (%)	57 (35.2)	41 (29.7)[*]
Dyslipidemia, n (%)	72 (44.4)	60 (43.7)
Coronary heart disease, n (%)	94 (58.0)	77 (55.8)
Dilated cardiomyopathy, n (%)	31 (19.1)	29 (21.0)
Valvular heart disease, n (%)	37 (22.8)	32 (23.2)
Systolic blood pressure, mm Hg	130 ± 12	131 ± 11
Diastolic blood pressure, mm Hg	78 ± 10	79 ± 10
Heart rate, beat per minute	92 ± 15	93 ± 16
Fasting blood glucose, (mmol/L)	6.1 ± 1.1	6.1 ± 1.0
Total cholesterol (mmol/L)	5.2 ± 0.9	5.1 ± 1.0
Creatinine (umol/L)	72.6 ± 15.7	73.0 ± 15.2
eGFR (mL/min/1.73m^2)	69.7 ± 14.4	70.1 ± 15.7
Left ventricular ejection fraction, (%)	34 ± 5	34 ± 4

eGFR = estimated glomerular filtration rate.
[*] $P < .05$ versus the control group.

have diabetes mellitus (29.7% vs 35.2%). Notably, there were no differences in the etiologies of CHF, and the indicators of CHF severity at baseline, including serum NT-proBNP level, LVEF, and proportion of individuals with NYHA class III to IV, were similar between these 2 groups.

3.2. Trends in MHI-5 and KCCQ score during 12 months follow-up

Trends in MHI-5 and KCCQ scores during 12 months follow-up were presented in Figure 2. There were no significant differences in the MHI-5 and KCCQ scores at baseline between these 2 groups. In the control group, MHI-5 score was gradually decreased with follow-up and the score was significantly lower than that in the treatment group since the third month's follow-up (63.5 ± 10.6 vs 73.6 ± 10.3, Panel A). Importantly, in the treatment group, MHI-5 score was increased in the first 3 months
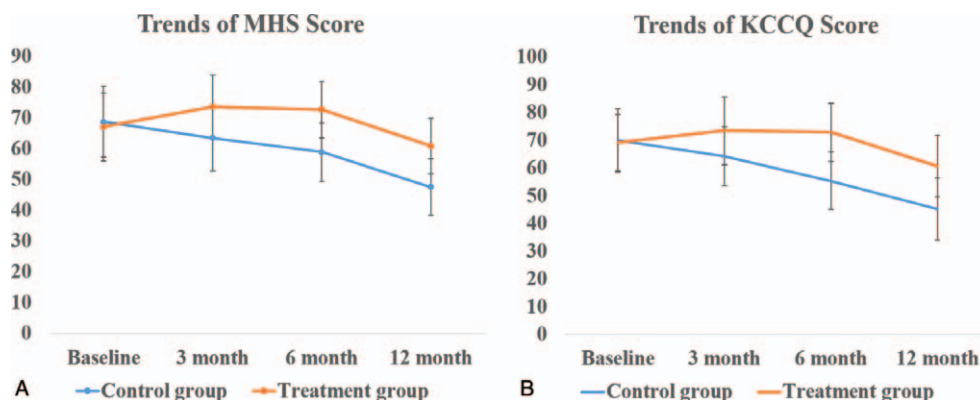

Figure 2. Trends of MHI-5 and KCCQ scores. A, Comparisons of MHI-5 score between the control and treatment group over time. B, Comparisons of KCCQ score between the control and treatment group over time. KCCQ = Kansans City Cardiomyopathy Questionnaire, MHI-5 = mental health inventory-5.

and then extended to the sixth month. Thereafter, MHI-5 score was gradually decreased throughout the follow-up. Compared with the treatment group, KCCQ score was significantly lower in the control group from the third month's follow-up (64.3 ± 10.6 vs 73.5 ± 12.3) till the end of the twelfth months' follow-up (45.3 ± 11.2 vs 60.8 ± 11.1, Panel B). Similarly, in the treatment group, KCCQ score was increased in the first 6 month and then was gradually decreased.

3.3. Comparisons of NT-proBNP, NYHA classification, HF rehospitalization, and medication use

As shown in Table 2, there were no between-group differences in serum NT-proBNP level at baseline. After 12 months' follow-up, median NT-proBNP level was lower in the treatment group and the magnitude of the change from baseline to 12 months follow-up was greater in the treatment group than that in the control group. The proportion of patients with NYHA class III to IV was higher in the control versus treatment group at the end of the follow-up (43.2% vs 35.5%). In addition, during 12 months' follow-up, the proportion of patients who experienced HF rehospitalization was lower in the treatment group (19.6% vs 24.1%). Furthermore, although there was no difference in the guideline-directed medication use at discharge, the use of renin–angiotensin-system (RAS) inhibitor and betablocker at the end of follow-up was higher in the treatment group.

3.4. Factors associated with HF rehospitalization

As presented in Table 3, in the univariate regression analysis, age, female gender, education attainment, married status, diabetes mellitus, eGFR, NT-proBNP, LVEF, NYHA classification, the nurse-led program, MHI-5, and KCCQ scores were significantly associated with HF rehospitalization. After adjusting for covariates, increase of age, serum NT-proBNP level and NYHA

classification and decrease of LVEF were associated with increased risk of HF rehospitalization; while the utilization of the nurse-led program, increase of MHI-5 and KCCQ scores were associated with a reduced risk of HF rehospitalization.

Table 2

Comparisons of NT-proBNP, NYHA classification, HF rehospitalisation, and medication use.

Variables	Control group (n = 162)	Treatment group (n = 138)
NT-proBNP (pg/mL)[*]		
At baseline	836 (427–1420)	844 (436–1473)
At 12 mo	420 (187–933)	306 (129–820)[†]
Change	382 (296–552)	427 (300–583)[†]
NYHA classification III–IV, n (%)		
At baseline	84 (51.9)	71 (51.4)
At 12 mo	70 (43.2)	49 (35.5)[†]
HF rehospitalization, n (%)	39 (24.1)	27 (19.6)[†]
Medication		
At discharge		
RASi, n (%)	132 (81.5)	111 (80.4)
Betablocker, n (%)	124 (76.5)	103 (74.6)
MRA, n (%)	49 (30.2)	41 (29.7)
Diuretic, n (%)	95 (58.6)	80 (58.0)
Digoxin, n (%)	22 (13.6)	20 (14.5)
At 12 mo		
RAS inhibitor, n (%)	96 (59.3)	93 (67.9)[†]
Betablocker, n (%)	90 (55.6)	87 (63.0)[†]
MRA, n (%)	25 (15.4)	20 (14.5)
Diuretic, n (%)	77 (47.5)	67 (48.6)
Digoxin, n (%)	15 (9.3)	12 (8.7)

HF = heart failure, MRA = mineralocorticoid receptor antagonist, NT-proBNP = N-terminal pro-B type natriuretic peptide, NYHA = New York Heart Association, RAS = renin–angiotensin system.
[*] Presented as median (interquartile rage).
[†] $P < .05$ versus control group.

Table 3

Factors associated with HF rehospitalization.

	Univariate regression		Multivariate regression	
Factors	OR (95% CI)	P value	OR (95% CI)	P value
Age (every 10 yr increase)	1.43 (1.18–2.01)	.009	1.19 (1.03–1.66)	.039
Female versus male	1.35 (1.10–1.80)	.017	1.12 (0.98–1.52)	.053
Education ≥ high school (yes vs no)	0.80 (0.68–0.92)	.031	0.94 (0.83–1.09)	.087
Married status (yes vs no)	0.72 (0.64–0.90)	0.025	0.89 (0.78–1.01)	.052
Smoking (yes vs no)	1.08 (0.92–1.17)	.116	NA	
Hypertension (yes vs no)	1.06 (0.90–1.22)	.304	NA	
Diabetes mellitus (yes vs no)	1.27 (1.11–1.67)	.015	1.10 (0.98–1.26)	.063
Dyslipidemia (yes vs no)	1.02 (0.90–1.09)	.217	NA	
Coronary heart disease (yes vs no)	1.18 (0.95–1.43)	.086	1.09 (0.90–1.21)	.117
Dilated cardiomyopathy (yes vs no)	1.07 (0.87–1.21)	.601	NA	
Valvular heart disease (yes vs no)	1.04 (0.89–1.16)	.236	NA	
SBP (every 10 mm Hg increase)	1.06 (0.90–1.21)	.129	NA	
DBP (every 10 mm Hg increase)	1.01 (0.83–1.05)	.732	NA	
HR (every 10 beats per/m increase)	1.14 (0.98–1.25)	.057	1.03 (0.91–1.17)	.105
eGFR (every 10 mL/min/1.73m² reduce)	1.24 (1.10–1.63)	.016	1.14 (0.96–1.32)	.061
NT-proBNP (every 50 pg/mL increase)	1.44 (1.21–2.09)	< .001	1.21 (1.10–1.73)	.009
LVEF (every 5% decrease)	1.55 (1.32–2.18)	< .001	1.29 (1.18–1.62)	.015
NYHA (class III–IV vs class II)	1.38 (1.16–1.92)	< .001	1.20 (1.07–1.53)	.029
Nurse-led program (yes vs no)	0.83 (0.71–0.94)	< .001	0.90 (0.82–0.98)	.040
MHI-5 (every 5 scores increase)	0.81 (0.73–0.90)	< .001	0.87 (0.80–0.96)	.038
KCCQ (every 5 scores increase)	0.79 (0.70–0.86)	< .001	0.84 (0.76–0.91)	.042

CI = confidence interval, DBP = diastolic blood pressure, eGFR = estimated glomerular filtration rate, HR = heart rate, KCCQ = Kansans City Cardiomyopathy Questionnaire, LVEF = left ventricular ejection faction, MHI-5 = mental health inventory-5, NT-proBNP = N terminal pro-B natriuretic peptide, NYHA = New York Heart Association, OR = odds ratio, SBP = systolic blood pressure.

Table 4

Association between the nurse-led program with MHI-5 and KCCQ scores.

Unadjusted		Adjusted	
β (95% confidence interval)	P value	β (95% confidence interval)	P value
MHI-5 score			
1.38 (1.22–1.96)	<.001	1.17 (1.05–1.65)	.033
KCCQ			
1.41 (1.30–2.02)	<.001	1.22 (1.13–1.78)	.019

Adjusted for age, gender, educational attainment, married status, diabetes mellitus, LVEF, and NYHA classification.
KCCQ = Kansans City Cardiomyopathy Questionnaire, LVEF = left ventricular ejection fraction, MHI-5 = mental health inventory-5.

3.5. Association between nurse-led program with MHI-5 and KCCQ scores

The association between the nurse-led program with MHI-5 and KCCQ scores was shown in Table 4. After adjusting for potential covariates, the utilization of the nurse-led program was significantly associated with increased MHI-5 (β 1.17 and 95% CI 1.05–1.65) and KCCQ (β 1.22 and 95% CI 1.13–1.78) scores, respectively.

4. Discussion

To our knowledge, the current study should be the first few prospective cohort studies in China in evaluating the efficacy of the nurse-led program on MHS, QOL, and HF rehospitalization for CHF patients in a long-term period. There are 2 important findings of the current study. First, in CHF patients with acute exacerbation, the nurse-led program was beneficial for the improvement of MHS and QOL for a long-term follow-up. Second, compared with the control group, participants in the nurse-led program had lower risk of HF rehospitalization, and after adjusting for potential covariates, the nurse-led program was independently associated with lower odds of HF rehospitalization. Consistent to prior reports,[14–17] findings from the current study support the utilization of the nurse-led program for the management of CHF patients. Further randomized clinical trials are needed to confirm the current findings.

With the advancement of medication and device therapy, the prognosis of HF patients with LVEF < 40% has been improved in the past 2 decades,[2,18,19] resulting in the increased prevalence of CHF.[3,20–22] It is noted that a substantial proportion of CHF patients have impairment of MHS and QOL.[23,24] In addition, the risk of HF rehospitalization remains high, leading to substantial health and economic loss.[25,26] Several strategies have been used to assess their effects on improvement of MHS and QOL for CHF populations. Among these strategies, the nurse-led program seems to be a promising and feasible approach. Indeed, for instance, Scott et al[27] reported that compared with the control group, patients who had received the nurse-led program had better MHS as suggested by a higher MHI-5 score after 6 months' follow-up. Thompson et al[15] also reported that the nurse-led program was associated with a lower risk of HF rehospitalization. Our preliminary study showed that compared with the control group, patients who have received the nurse-led program had higher MHS and QOL scores after 6 months follow-up.[14] In addition, after adjusting for covariates, the nurse-led program was associated with better MHS and QOL. The current study confirms and extends prior studies by demonstrating that compared with the control group, patients in the treatment group had better MHS and QOL after 12 months' follow-up. The underling mechanisms are likely multifactorial.

First, through close follow-up at discharge, patients were more likely to adhere to guideline-directed medication therapy.[28,29] Indeed, in the current study, at the end of the follow-up, patients in the treatment group had higher rate of using betablocker and RAS inhibitor than the control group. Second, prior studies have shown that positive communication and interaction between healthcare worker and patients was associated with a better improvement of MHS.[30,31] In the current study, patients in the treatment group received the nurse-led program at the first, second, and sixth month's follow-up, which might be beneficial for the improvement of MHS. Third, patients with better MHS were more likely to comply to healthy lifestyle including low sodium diet and regular physical activity, which in turn results in a better QOL as reflected in the KCCQ score.[32,33] Indeed, in the current study, patients in the treatment group had lower serum NT-proBNP level and lower NYHA classification at the end of the follow-up, supporting this hypothesis.

Extending from our prior study,[14] the current study showed that at the end of the follow-up, patients who received the nurse-led program had lower risk of HF rehospitalization. Considering the high rate of HF rehospitalization at discharge, results of the current study have important clinical implication.[23,34–36] First, reduction of HF rehospitalization is beneficial for the reduction of the health expenditure and burden for both the patients and the healthcare facilities.[36] In addition, prior studies have demonstrated that patients with lower rate of HF rehospitalization had better prognosis than those with recurrent HF rehospitalization.[34,35] Indeed, HF rehospitalization per se might reflect the poor management and unstable status of HF. Third, HF rehospitalization might cause worsening MHS and QOL, which in turn results in accelerated progress of HF.[23,37,38]

There are some limitations of the current study. First, this was not a randomized clinical trial and findings from the current study did not allow us to draw causal relationship. Second, although we have evaluated HF rehospitalization; however, we did not capture the hard outcome in terms of mortality. Future studies are needed to evaluate whether the nurse-led program was beneficial for the improvement of prognosis. Third, we have increased study sample size and prolonged follow-up duration; however, longer-term follow-up is needed. In addition, whether this finding can be generalized to other population groups is needed to examine.

5. Conclusion

In conclusion, the current study suggests that in CHF patients, the nurse-led program is beneficial for the improvement of MHS and QOL, which might contribute to the reduction of HF rehospitalization. Further randomized clinical trials are needed to confirm the current study.

Author contributions

Conceptualization: Yuzhu Mo.
Data curation: Yuzhu Mo, Mingzi Chu, Wenxiong Hu, Haiyan Wang.
Formal analysis: Yuzhu Mo, Wenxiong Hu, Haiyan Wang.
Methodology: Mingzi Chu, Wenxiong Hu.
Resources: Haiyan Wang.
Software: Mingzi Chu.
Supervision: Mingzi Chu, Wenxiong Hu.
Validation: Mingzi Chu, Wenxiong Hu.
Writing – original draft: Haiyan Wang.
Writing – review & editing: Yuzhu Mo.

References

[1] Truby LK, Rogers JG. Advanced heart failure: epidemiology, diagnosis, and therapeutic approaches. JACC Heart Fail 2020;8:523–36.

[2] Tromp J, Ferreira JP, Janwanishstaporn S, et al. Heart failure around the world. Eur J Heart Fail 2019;21:1187–96.

[3] Buckley LF, Shah AM. Recent advances in the treatment of chronic heart failure. F1000Research 2019;8:F1000 Faculty Rev-2134.

[4] Cai A, Zhang J, Wang R, et al. Joint effects of obstructive sleep apnea and resistant hypertension on chronic heart failure: a cross-sectional study. Int J Cardiol 2018;257:125–30.

[5] Gnanasekaran G. Epidemiology of depression in heart failure. Heart Fail Clin 2011;7:1–0.

[6] Newhouse A, Jiang W. Heart failure and depression. Heart Fail Clin 2014;10:295–304.

[7] Bordoni B, Marelli F, Morabito B, et al. Depression and anxiety in patients with chronic heart failure. Future Cardiol 2018;14:115–9.

[8] O'Connor CM, Jiang W, Kuchibhatla M, et al. Safety and efficacy of sertraline for depression in patients with heart failure: results of the SADHART-CHF (Sertraline Against Depression and Heart Disease in Chronic Heart Failure) trial. J Am Coll Cardiol 2010;56:692–9.

[9] Jeyanantham K, Kotecha D, Thanki D, et al. Effects of cognitive behavioural therapy for depression in heart failure patients: a systematic review and meta-analysis. Heart Fail Rev 2017;22:731–41.

[10] Rajeswaran T, Plymen CM, Doherty AM. The effect of antidepressant medications in the management of heart failure on outcomes: mortality, cardiovascular function and depression—a systematic review. Int J Psychiatry Clin Pract 2018;22:164–9.

[11] Zhang Y, Lv X, Jiang W, et al. Effectiveness of a telephone-delivered psycho-behavioural intervention on depression in elderly with chronic heart failure: rationale and design of a randomized controlled trial. BMC Psychiatry 2019;19:161.

[12] Das A, Roy B, Schwarzer G, et al. Comparison of treatment options for depression in heart failure: a network meta-analysis. J Psychiatr Res 2019;108:7–23.

[13] Abdelbasset WK, Alqahtani BA. A randomized controlled trial on the impact of moderate-intensity continuous aerobic exercise on the depression status of middle-aged patients with congestive heart failure. Medicine (Baltimore) 2019;98:e15344.

[14] Mo Y, Wang H, Huang G, et al. Effectiveness of nurse-led program on mental health status and quality of life in patients with chronic heart failure. Medicine (Baltimore) 2020;99:e21746.

[15] Thompson DR, Roebuck A, Stewart S. Effects of a nurse-led, clinic and home-based intervention on recurrent hospital use in chronic heart failure. Eur J Heart Fail 2005;7:377–84.

[16] Luo ZC, Zhai L, Dai X. Does a Nurse-Led Program of Support and Lifestyle Management for patients with coronary artery disease significantly improve psychological outcomes among the patients?: A meta-analysis. Medicine 2018;97:e12171.

[17] Hebert PL, Sisk JE, Wang JJ, et al. Cost-effectiveness of nurse-led disease management for heart failure in an ethnically diverse urban community. Ann Intern Med 2008;149:540–8.

[18] Bhatt AS, Abraham WT, Lindenfeld J, et al. Treatment of HF in an era of multiple therapies: statement from the HF collaboratory. JACC Heart Fail 2021;9:1–2.

[19] Wilcox JE, Fang JC, Margulies KB, et al. Heart failure with recovered left ventricular ejection fraction: JACC Scientific Expert Panel. J Am Coll Cardiol 2020;76:719–34.

[20] Pandey A, Vaduganathan M, Arora S, et al. Temporal trends in prevalence & prognostic implications of comorbidities among patients with acute decompensated heart failure: the ARIC study community surveillance. Circulation 2020;142:230–43.

[21] Li L, Liu R, Jiang C, et al. Assessing the evidence-practice gap for heart failure in China: the Heart Failure Registry of Patient Outcomes (HERO) study design and baseline characteristics. Eur J Heart Fail 2020;22:646–60.

[22] Bayes-Genis A, Liu PP, Lanfear DE, et al. Omics phenotyping in heart failure: the next frontier. Eur Heart J 2020;41:3477–84.

[23] Allen LA, Gheorghiade M, Reid KJ, et al. Identifying patients hospitalized with heart failure at risk for unfavorable future quality of life. Circ Cardiovasc Qual Outcomes 2011;4:389–98.

[24] Warraich HJ, Kitzman DW, Whellan DJ, et al. Physical function, frailty, cognition, depression, and quality of life in hospitalized adults ≥60 years with acute decompensated heart failure with preserved versus reduced ejection fraction. Circ Heart Fail 2018;11:e005254.

[25] Li J, Wu Y, Zhang D, et al. Associations between heart failure and risk of dementia: a PRISMA-compliant meta-analysis. Medicine 2020;99:e18492.

[26] Li XQ. Effects of high-quality nursing care on psychological outcomes in patients with chronic heart failure. Medicine 2019;98:e17351.

[27] Scott LD, Setter-Kline K, Britton AS. The effects of nursing interventions to enhance mental health and quality of life among individuals with heart failure. Appl Nurs Res 2004;17:248–56.

[28] Diamant MJ, Virani SA, MacKenzie WJ, et al. Medical therapy doses at hospital discharge in patients with existing and de novo heart failure. ESC Heart Fail 2019;6:774–83.

[29] Ahn MS, Yoo BS, Yoon J, et al. Guideline-directed therapy at discharge in patients with heart failure and atrial fibrillation. Heart 2020;106:292–8.

[30] Loeppke R, Boldrighini J, Bowe J, et al. Interaction of health care worker health and safety and patient health and safety in the US health care system: recommendations from the 2016 summit. J Occup Environ Med 2017;59:803–13.

[31] Hessels A, Flynn L, Cimiotti JP, et al. Impact of heath information technology on the quality of patient care. Online J Nurs Inform 2015;19.

[32] Abraham WT, Psotka MA, Fiuzat M, et al. Standardized definitions for evaluation of heart failure therapies: scientific expert panel from the heart failure collaboratory and academic research Consortium. Eur J Heart Fail 2020;22:2175–86.

[33] Truby LK, O'Connor C, Fiuzat M, et al. Sex differences in quality of life and clinical outcomes in patients with advanced heart failure: insights from the PAL-HF trial. Circ Heart Fail 2020;13:e006134.

[34] Gheorghiade M, Vaduganathan M, Fonarow GC, et al. Rehospitalization for heart failure: problems and perspectives. J Am Coll Cardiol 2013;61:391–403.

[35] Tromp J, Bamadhaj S, Cleland JGF, et al. Post-discharge prognosis of patients admitted to hospital for heart failure by world region, and national level of income and income disparity (REPORT-HF): a cohort study. Lancet Glob Health 2020;8:e411–22.

[36] Upadhyay S, Stephenson AL, Smith DG. Readmission rates and their impact on hospital financial performance: a study of Washington hospitals. Inquiry 2019;56:46958019860386.

[37] Tung YC, Chou SH, Liu KL, et al. Worse prognosis in heart failure patients with 30-day readmission. Acta Cardiol Sin 2016;32:698–707.

[38] Cai G, Guo K, Zhang D, et al. The efficacy of baroreflex activation therapy for heart failure: a meta-analysis of randomized controlled trials. Medicine 2020;99:e22951.