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Original Article

Factors influencing readmission among Thais with heart failure

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Abstract

Hospital readmissions for heart failure are a major clinical problem and associated financial burden. However, readmission rate in heart failure remains high. This study aimed to test a model explaining the factors influencing readmission in people with heart failure. In total, 204 patients with heart failure were recruited at four regional hospitals in Thailand. All research instruments used showed acceptable validity and reliability. The data were analyzed using version 8.72 of Linear Structural Relationship. The results showed that the hypothetical model matched the empirical data. The severity of symptoms was the factor that had the most impact on readmission and had a direct positive effect on readmission, followed by quality of life and depression. An intervention study to prevent readmission in heart failure patients should be developed and tested as well. It should incorporate the promotion of social support and quality of life to reduce readmission in heart failure patients.

Keywords: heart failure patients, readmission, Thais

1. Introduction

Heart failure (HF) is a rising healthcare burden and one of the leading causes of death, hospitalizations, and readmission (Au *et al.*, 2012; Ziaeian & Fonarow, 2016). Additionally, heart failure results in a marked decrease in health-related quality of life. The prognosis of patients with heart failure is still poor even though medical treatment is in advance (Volz *et al.*, 2011). In the United States, more than 6.2 million individuals have heart failure and over 960,000 are diagnosed annually (Virani *et al.*, 2020). In Thailand, heart failure is leading cause of death and hospitalization, 17,118 Thai people die of HF a year (The Heart Association of Thailand [HAT], 2019; Health data center, 2018). Hospital readmissions for heart failure are a major clinical problem and associated financial burden (Gheorghiade *et al.*, 2013; Ryan *et al.*, 2013). Additionally, readmission to the hospital is a drain on the health care system and recognized as a maker of decreasing quality of care and a significant contributor to rising health care cost (Coffey *et al.*, 2012; Sadiq *et al.*, 2020). There are multiple definitions of readmission. First, it has been defined as a hospitalization for any reason within 30 days of discharge after the hospitalization (Ryan *et al.*, 2013). Wideqvist *et al.* (2021) defined the term of readmission as a repeated hospitalization within 1, 3, 6, or 12 months of discharge. In addition, readmission is defined as all-cause of admission to acute care hospital within 30 days of discharge from the hospital (Usinowicz *et al.*, 2020). Thus, in this study readmission define as heart failure patients repeated hospitalization for all-cause within 12 months of discharge from the index hospitalization.

In Thailand, readmission has been documented as an indications of quality of care in heart failure patients (Jenghua & Jedsadayanmata, 2011). Some research has been conducted on readmission in heart failure. One study examined rates and predictors of early readmission (defined as readmission within 30 days after discharge) among Thai heart failure patients by reviewing of electronic medical data base. That study found that heart failure patient's early readmission rate was 14.1% and length of stay in hospital more than 5 days, history of diabetes mellitus, history of renal failure, and digoxin were factors associated with readmission with heart failure. The most common cause of readmission was angina pectoris and chronic renal failure (Jenghua, & Jedsadayanmata, 2011). In addition, a review of annual 1-year medical records of patients with acute decompensated heart failure within 1 year found that HF patients accounted for 51% of one-year readmissions and comorbidity, systolic blood pressure, and heart rate

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variability were important factors associated with a one-year readmission with heart failure. (Lertpongpakpoom, Phonphet, &Suwanno, 2019). Several interventions have been conducted to reduce readmission rate among heart failure, such as information provision, motivation, and self-monitoring skill program, self-care promoting program, dietary control, eating behavior, food intake, and sodium restriction intent (Kongpibarn, Ua-Kit, & Tantikosom, 2017; Mahaviriyotai, Wattanakitkrileart, & Poungkaew, 2021; Terdsudthirona poom, 2015). However, readmission rate in heart failure remains high. Thus, the study explores the factors influencing readmission in Thai heart failure patient information that is needed before developing interventions to reduce readmission.

1.2 Literature reviews

As the largest group of health professionals, nurses are both positive and negative contributors to the quality of health care. Nurses have an intimate understanding of patients' needs, and their ongoing interactions with patients and their families uniquely position them to positively impact their hospital experiences and subsequent outcomes (Duffy, 2009, p. 6). Quality of care is a model designed to foster an understanding of the relationship between quality health care and care (Duffy, 2009, p. 35). A quality care model is threefold (Duffy, 2009). The first is the structure, which refers to the context or condition of care. These factors include institutional resources, provider credentials and patient characteristics. The second element is the process, which refers to what is done for the patient, including the technical and interpersonal aspects of care. The third element is outcomes, and that is the impact of the health care process. Thus, this study focused on the patient characteristics because we aimed to manipulate the factors related to the patients before developing a process to improve the outcome.

Social support correlates significantly with quality of life and is related to readmission that is, a high level of social support is related to a high quality of life resulting in decreased readmission in heart failure patients (Bennett *et al.*, 2011; Volz *et al.*, 2011). Depression is negatively related to quality of life and is linked to readmission (Faller *et al.*, 2010; Ryan, Bierle, &Vuckovic, 2019). Depression also has a negative impact on quality of life and is associated with readmission in patients with heart failure (O'Loughlin *et al.*, 2010). Heart failure patient with high symptom severity reported lower quality of life and higher frequency of readmission (Giamouzis *et al.*, 2011; Ryan *et al.*, 2019). Comorbidity was most often associated with readmission in patients with heart failure (Coffey *et al.*, 2012; Davis *et al.*, 2017). Comorbidity precipitates early readmission in patients suffering from heart failure (Gheorghiade *et al.*, 2013; Sadiq *et al.*, 2020). Heart failure is an unpredictable exacerbation and the progression of the symptom which leads to poor quality of life and is associated with the frequency of readmission (O'Loughlin *et al.*, 2010; Whitaker-Brown *et al.*, 2017). So, the research hypotheses of this study is as follows: 1) Social support has a negative direct effect on readmission, a positive direct effect on quality of life, and a negative direct effect on depression. 2) Depression has a positive direct effect on readmission, and a negative direct effect on quality of life. 3) Symptom severity has a positive direct effect on readmission, a positive direct effect on depression, and a negative direct effect on quality of life. 4) Comorbidity had a positive direct effect on readmission, a positive direct effect on depression, a negative direct effect on symptom severity, and a negative direct effect on quality of life. 5) Quality of life has a negative direct effect on readmission.

2. Materials and Methods

2.1 Study design

A cross-sectional and descriptive approach was used to explore the theoretical relationship between potential factors of interest and readmission among people with heart failure in Thailand.

2.2 Sample and setting

Participants were recruited from all parts of Thailand, including the North, South, Central and Northeastern regions. An optimum sample size was required for the rejection of the null assumption that R is zero. In this case, was estimated by the number of predictors, alpha level, desired output and effect size or a specific level of R^2 (Hair *et al.*, 2006; Polit & Beck, 2004). An appropriate ratio of 15 to 20 respondents for each variable was recommended (Hair *et al.*, 2010). However, Hair *et al.* (2006) recommended for a sound basis for estimate sample size is 200. Thus, a sample size of 204 in this study met statistical power for the path analysis. The participants were recently readmitted in hospital at an in-patient cardiology department, with the following subject inclusion criteria: 1) recent readmission in hospital in the in-patient cardiology department in hospitals in Thailand; 2) age $\geq$ 20 years; 3) no cognitive impairment and no disease complications (based on current medical record).

2.3 Instruments

Readmission was defined as repeated hospitalization within 12 months of discharge from the hospitalization index and based on medical records (Polsook & Aungsuroch, 2021). Comorbidity refers to the presence of one or more other conditions associated with heart failure and based on medical record (Polsook & Aungsuroch, 2021).

Symptom severity was based on the definition of heart failure patients having the limitations/symptoms in regard to normal breathing and varying degrees in shortness of breath and/or angina pain by The Criteria Committee of the New York Heart Association (1994).

Multidimensional Scale of Perceived Social Support (MESSI) was used to measure social support (Zimet *et al.*, 1988). Participants were asked to respond to the 12-item scale, with the response to each item ranging from 1 (very strongly disagree) to 7 (very strongly agree) with a score ranging from 12 to 84. A higher MESSI score (over 61) indicates higher social support. In this study, the Cronbach's alpha coefficient was 0.81.

Cardiac Depression Scale (CDS) used to measure depression (Hare & Davis, 1996). The CDS is a 26-item self-rating scale used specifically for medical cardiac patients in Australia. Participants were asked to respond to each item from 1 (disagree strongly) to 7 (agree strongly) with a score ranging from 26 to 182. The higher score (over 90) represents

depression (Kiropoulos *et al.*, 2012). The Cronbach's alpha coefficient for this study was 0.91.

Quality of life used the Quality of life Index-Cardiac version IV, the Thai version translated by Saengsiri (2003). The instrument is composed of 70 items scored on a Likert scale ranging from 0 to 5 with a final score ranging from 0 to 30. Higher scores (over 20) indicate high quality of life. In the study, the Cronbach's alpha coefficient was 0.94.

2.4 Data collection

The researchers and research assistants collected data. The investigator trained and tested the research assistants to ensure their understanding of the use of the questionnaires. The researcher and research assistants presented the benefits/risks of the intervention and the protection of human rights in nontechnical terms, to obtain approval from the patients to participate in the study. The study was explained to participants, and they were provided assurance that their identity would be protected at all times. Participants were entitled to withdraw from the study at any time and their removal would not affect their treatment and that it would take 30–45 minutes to complete all the questionnaires. Completed surveys were stored in a locked cabinet and on a password-protected computer at the researcher's office. Only researchers could access the data.

2.5 Statistical analysis

IBM SPSS 22 was used to analyze data and provide descriptive statistics. Version 8.72 of Linear Structural Relationship (LISREL) was employed for the path analysis. The statistical assumptions were examined, including normality of distribution, linearity of relationships, homoscedasticity, and multicollinearity. The Pearson Product Moment correlations were used to test bivariate relationships between pairs of variables and to evaluate multicollinearity between independent variables. Multiple regression analyses were used to compute a variance inflation factor and tolerance to examine multicollinearity among the major variables. To evaluate the overall model adequacy index and the hypothetical model, we used the statistical criteria from Hair *et al.* (2010): 1) The model is considered in a good fit if χ^2 is not significant (p-value >.05), and χ^2 /df is less than 2; 2)The value of Root Mean Square Error of Approximation (RMSEA) less than .05, and Standardized Root Mean Square Residual (SRMR) should be less than .05 to be considered a good fit model; 3) GFI ≥ .95 and AGFI ≥ .90 were also used for examining a goodness of fit statistics. An alpha level p-value of .05 was set as the accepted level of significance for this study.

2.6 Ethical issues

Ethics approval for this study was obtained from the review committees of the facilities located at Hatyai Hospital (85), Faculty of Medicine Ramathibodi Hospital, Mahidol University (2558/716), Faculty of Medicine, Chiang Mai University (2558-03518), Faculty of Medicine, Chulalongkorn University (074/59), and Khon Kaen University (00001189) (Polsook & Aungsuroch, 2021).

3. Results and Discussion

3.1 Characteristics of sample and the study variables

A total of 204 participants who were heart failure patients were included in this analysis. The findings revealed that most of the participants' age was ≥ 61 years old (64.2%). They were predominantly female (50.5%) and married (65.2 %). For type of health care coverage, most of the participants were under the Universal Coverage Scheme (52.5%). For symptom severity, New York Heart Association used to categorize symptom severity of participants. The participants had class I (10.8 %), class II (41.7%), class III (39.2%), and class IV (8.3%). Most of the participants had one comorbidity (41.7%) follow by no comorbidity (25.0%), two comorbidities (20.1%), and three comorbidities (13.2%). Regarding readmission, most of the participants had 1-2 readmission within 12 months after discharge from hospital (70.6%) (Table 1). The details regarding characteristics of each variable are presented in Table 2.

Table 1. Demographic and clinical characteristics of patients with heart failure (N=204)

Characteristics	Number (N)	Percent (%)
Age		
20-40	14	6.9
41-60	59	28.9
≥ 61	131	64.2
Gender		
Male	101	49.5
Female	103	50.5
Marital status		
Single	16	7.8
Married	133	65.2
Widowed	47	23.0
Divorced	8	4.0
Type of health care coverage		
Universal Coverage Scheme (the 30- Baht Scheme)	107	52.5
Social security	19	9.3
Pay by themselves	1	0.5
Government coverage	77	37.7
New York Heart Association		
Class 1	22	10.8
Class 2	85	41.7
Class 3	80	39.2
Class 4	17	8.3
Comorbidities		
No comorbidity	51	25.0
One comorbidity	85	41.7
Two comorbidities	41	20.1
Three comorbidities	27	13.2
Readmission (within 12 months of discharge from hospital)		
1-2 times	144	70.6
3-4 times	42	20.5
5-6 times	12	5.9
7-8 times	1	0.5
9-10 times	5	2.5

Table 2. The characteristics of study variables (N=204)

Variables	Possible range	Actual range	Mean	SD	Skewness (Z value)	Kurtosis (Z value)	Interpretation
Readmission	1-5	1-5	1.47	0.83	-1.27 (.17)	2.47 (.34)	1-2 times
Quality of life	0-30	6-30	23.30	3.94	-1.51 (.17)	3.86 (.34)	High
Social support	12-84	22-120	61.79	14.81	-.24 (.17)	.37 (.34)	High
Depression	26-182	29-161	93.60	26.3	-.11 (.17)	-.47 (.34)	Mild to moderate
Comorbidity	1-5	1-4	2.22	0.97	.44 (.17)	-.74 (.34)	One comorbidity
Symptom severity	1-4	1-4	2.45	0.80	0.01 (.17)	-.44 (.34)	Class II

SD= Standard deviation

3.2 The relationships between variables

The results showed that social support had a low negative correlation with readmission (r = - .16) and quality of life had a moderate negative correlation with readmission (r = - .30), and depression and symptom severity had no correlation with readmission (r= .09 and r= .08). Comorbidity had low positive correlation with readmission (r= .12). Social support had a moderate positive relationship with quality of life (r = .37) and social support had low negative correlation with depression (r= -.16). Symptom severity and comorbidity had no correlation with social support (r= -.04, and r= -.08). Depression had moderate positive correlation with symptom severity (r = .36) and no correlation with comorbidity (r = .05). Depression had moderate negative correlation with quality of life (r= -.46). Symptom severity had no correlation with comorbidity (r = - .04) and moderate negative correlation with quality of life (r =-.30). Comorbidity had no correlation with quality of life (r = - .04) (Table 3).

3.3 Model testing

In the hypothesized model, the exogenous variables were social support and comorbidities, while the endogenous variables were symptom severity, depression, quality of life, and readmission. The study findings revealed that the hypothesized model fits the empirical data and could explain 10% (R^2 = .10) of the variance of readmission by social support, comorbidity, symptom severity, depression, and quality of life (Chi-square = 0.35, df = 1, p =0 .56, Chi-square/df = 0.35, GIF = 1.00, RMSEA = 0.00, SRMR = 0.01, AGFI = 0.99). Thirty-two percent (R^2 = 0.32) of the variance in the QOL was explained by the social support, comorbidity, symptom severity, and depression; 15% (R^2 =0.15) of the variance in depression was explained by social support, comorbidity, and symptom severity; and non-coefficient of determination (R^2 =0.0) of the variance in symptom severity was explained by comorbidity are shown in Table 4.

A summary of the model testing is as follows (Table 5): 1) Social support had a negative direct effect (-.02, p < .05) on readmission, had a positive direct effect (.01, p < .05) on quality of life, and a negatively direct (-.26, p < .05) on depression. 2) Depression had a positive direct effect (.00, p < .05) on readmission, and a negative direct effect (-.05, p < .05) on quality of life. 3) Symptom severity had a positive direct effect (.08, p < .05) on readmission, a positive direct effect (11.97, p < .05) on depression, and a negative direct effect (-.62, p < .05) on quality of life. 4) Comorbidity had a positive direct effect (.08, p < .05) on readmission, a positive direct effect (1.13, p < .05) on depression, a negative direct effect (-.03, p < .05) on symptom severity, a negative direct effect (-.06, p < .05) on quality of life. 5) Quality of life had a negative direct effect (-.01, p < .05) on readmission (Figure 1).

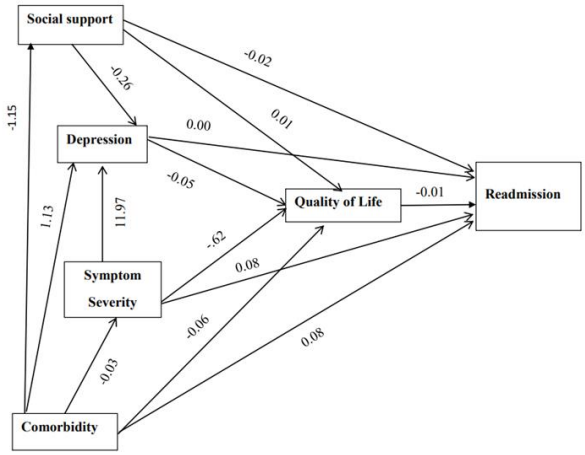

Figure 1. The model of readmission among heart failure

3.4 Discussion

This study was based on a quality care model by Duffy (2009). The hypothesized model fits the empirical data and could explain 10% (R^2 = .10) of the variance of readmission by social support, comorbidity, symptom severity, depression, and quality of life. There is a possibility that a quality care model has three components but this study focused on the patient characteristics only because we aimed to manipulate the factors related to the patients. Moreover, the extended family is common in Thailand, and it is possible that family members are a very good social support for patients with heart failure. So, the variance of readmission is quite low (Polsook, Aungsuroch, & Thanasilp, 2016). Based on this model, this study found the following:

Table 3. Pearson's relationships among readmission, social support, depression, symptom severity, comorbidity, and quality of life

	Readmission	Social support	Depression	Symptom severity	Comorbidity	Quality of life
Readmission	1.000					
Social support	-.30**	1.000				
Depression	.09	-.16*	1.000			
Symptom severity	.08	-.04	.36**	1.000		
Comorbidity	.12	-.08	.05	-.04	1.000	
Quality of life	-.16*	.37**	-.46**	-.30**	-.04	1.000

* p <0.05, ** p <0.01

Table 5. Summary the total, direct, and indirect effects of influencing variables on affected variables

Dependent variables	Influencing variables	TE	IE	DE
Readmission	Social support		0.00	-0.02
	Comorbidity		0.00	0.08
	Symptom severity	0.08	0.01	
	Depression	0.00	0.00	
	Quality of life	-0.01		
Quality of life	Social support		0.01	0.10
	Comorbidity		-0.03	-0.06
	Symptom severity	-1.42	-0.62	
	Depression	-0.05		
Depression	Social support			-0.26
	Comorbidity		-0.37	1.13
	Symptom severity	11.97		
Symptom severity	Comorbidity			-0.03

TE= Total effect, IE= Indirect effect, DE= Direct effect

Table 4. The proportion of the variance in the dependent variable that is predictable from the independent variables.

Variables	Influencing variables	R^2
Readmission	Social support Comorbidity Symptom severity Depression Quality of life	0.10
Quality of life	Social support Comorbidity Symptom severity Depression	0.32
Depression	Social support Comorbidity Symptom severity	0.15
Symptom severity	Comorbidity	0.00

R^2 = The coefficient of determination

Participants as a whole had social support at a moderate level ($\bar{X}$=61.8; S.D. = 14.8), were married (65.2%), had a high level of quality of life ($\bar{X}$=23; S.D. = 3.9), and were readmitted 1-2 times within 12-months ($\bar{X}$=1.4; S.D. = 0.8). As Thai people generally have an extended family, and most of the participants lived with family members, it is possible that family members participated in care and supported these patients (Polsook, Aungsuroch, & Thanasilp, 2013, 2016). This finding is supported by Volz *et al.* (2011) who found that among heart failure patients who had higher social support related to decrease readmission. Similarly, Al-Omar *et al.* (2018) and Betihavas *et al.* (2012) found that among heart failure patients, living alone or lacking social support were predictors of readmission. Moreover, Kim, Kim, & Kwon (2021) and Bennett *et al.* (2011) indicated that increasing social support significantly improved quality of life and was linked to a decreased readmission in heart failure patients. Additionally, social support is related to improving quality of life, and reinforcing and increasing social support has been suggested to develop an effective intervention in order to improve quality of life (Chung, Mosor, Lennie, & Frazier, 2013). Similarly, Gallagher *et al.* (2016) and Barutcu and Mert (2013) found that high level of social support, especially from a family related to quality of life and reflected in decreases readmission in hospital.

In this study, all participants had mild to moderate depressive symptom. The result is supported a previous study by Lum *et al.* (2016), which found that depressive symptom results in decreased health status in heart failure patients and was related to a high rate of readmission. Additionally, depression is a common condition in heart failure and has been shown to influence readmission (Kim *et al.*, 2021; Shimizu, Suzuki, Okumura, &Yamada, 2013). Moreover, we found that depression had a moderate relationship with quality of life. It is possible that heart failure patients had depression, it's linked to lower quality of life. This result supports previous study by Nesbitt *et al.* (2014) which indicated that depressive symptom were associated with lower quality of life. Furthermore, depression is negatively related to quality of life and linked to readmission (Faller *et al.*, 2010; Ryan *et al.*, 2019). Similarly, Patel *et al.* (2020) found that depression also has a negative impact on quality of life and associated with readmission in heart failure patients.

For symptom severity, most participants had mild to moderate severity of symptom. So, the readmission rate was low. This is supported previously studies, low severity of symptoms related to decreased readmission. Heart failure with low symptom severity reported higher quality of life and lower frequency of readmission (Faller *et al.*, 2010). Additionally, symptom severity had a moderate relationship with depression. It is possible that participants who had high level of symptom severity who had to increased depression. This is support previous study by Graven, Martorella, Gordon, Grant Keltner, & Higgins (2017) who found that heart failure patients who has more symptom severity most likely suffered from depression. Furthermore, in this study, symptom severity had a moderate relationship with quality of life. Symptom severity such as physical symptoms and limitations in daily activities due to heart failure affect quality of life (Kim et al, 2021;). Similarly, Adebayo, Olunuga, Durodola, & Ogah (2018) found that heart failure patient who had higher symptom severity had low of quality of life.

Another variable is comorbidity, the current study found that nearly half of the participants had one comorbidity. A possible explain that most of participant's age more than 60 years, so they had a diagnosis with comorbidity before diagnosis with heart failure such as diabetes mellitus and hypertension. This result support by Reeves *et al.* (2015) and Wideqvist *et al.* (2021) indicated that comorbidity associated with readmission in heart failure patients. Similarly, Akkineni *et al.* (2020) demonstrated that comorbidity had the greatest association with early readmission. In addition, we found that the participants had mild to moderated depression, high level of quality of life, and only one comorbidity (Coffey *et al.* 2012; Gheorghiade *et al.*, 2013). It is possible to explain that heart failure patients who had low comorbidity result in lower symptom severity and linked to high quality of life that affect low readmission. This result supports previous study by Lawson *et al.* (2018) found that comorbidity associated symptom severity and lower symptom severity such as shortness of breath and chest pain; related to high quality of life in heart failure patients while heart failure patients who had physical symptom—shortness of breath and physical condition had a negative impact on quality of life (Ryan *et al.*, 2019).

Regarding quality of life, the results show that most of the participants had a high level of quality of life and readmission 1-2 times within 12 months. It is possible to explain that among heart failure patients a high quality of life in associated with decreased readmission in hospital. This results supported previously study by Adebayo *et al.* (2018) was found that the goals of care in heart failure patients are to decrease symptoms and prevent readmission, and improve survival. Thus, heart failure patients who have high quality of life linked to decrease readmission. Additionally, Nieminen *et al.* (2015) found that heart failure patients with a high quality of life had decrease readmission. Heart failure patients who had good physical and emotional experiences had a better quality of life and linked to lower frequency of readmission (Kim *et al.*, 2021; Ryan *et al.*, 2019).

There are several limitations in this study. The data were based on self-reports, which could have caused overestimated or underestimated values. The instruments to measure these variables were used only one time in the Thai context. Testing of psychometric properties within the Thai context is needed gauge the reliability of the instruments. The vast majority of the present study sample was married and in Thailand had extended family. It is possible that family member participated in care, and when compared to Western countries had a nuclear family, Thai culture are more likely to support in these patients. A large sample size is needed to determine the variation of variables in the future research.

4. Conclusions

The present study was conducted to test the effects of social support, comorbidity, symptom severity, depression, and quality of life on readmission. The finding shows that social support and quality of life have a negative effect readmission, and comorbidity, symptom severity, and depression have a positive effect on readmission. No prior studies have examined the relationships between social support and quality of life on readmission in heart failure patients. So, this study has contributed to the field by explaining the influence of each variable in the model on readmission in heart failure patients in the Thai context. Thus, this study has identification of factors that impact readmission among heart failure patients. It provides significant information to nurses and health care team for screening depression and enhance social support program for caring for patients with heart failure. The information should be use to developed strategies to control the severity of symptom and comorbidity to prevent readmission.

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