

EVALUATION OF A HEALTH SERVICE SYSTEM FOR HEART FAILURE MANAGEMENT IN THAILAND

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Received: May 18, 2018; Revised: June 15, 2018; Accepted: June 15, 2018

Abstract

Health service systems worldwide face challenges to improve the functional health of patients with heart failure. A heart failure management policy has recently been launched in Thailand. This study aimed to evaluate the effectiveness of this policy focusing on the functional capacity of these patients, and to identify the multilevel factors influencing their functional capacity. A cross-sectional design using a multilevel approach was used. Questionnaires and a six-minute walk test were performed with 413 patients with heart failure at 13 cardiac outpatient clinics from tertiary hospitals located in the Bangkok metropolitan area and the central part of Thailand. Descriptive statistics and multilevel linear regression were used to analyze the data. The results revealed that the mean six-minute walk distance (269.2 ± 126.6 m) of the participants indicated a low level of functional capacity. Sex, age, severity of co-morbidity ($p < 0.001$), self-care, and adequacy of income ($p < 0.05$) significantly influenced the functional capacity. Participants receiving heart failure management provided by cardiologists and cardiac nurses undergoing a 4-month cardiovascular course performed a longer walk distance than those receiving care from cardiologists and general nurses ($p < 0.05$). To maximize the functional capacity of patients with heart failure, their diversity and the integration of a specialized care team are vital for effective HF management at all cardiac clinics

Keywords: Heart failure, functional capacity, six-minute walk test, health service system

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Introduction

Heart failure (HF) is a progressive clinical syndrome that affects 38 million people globally (Braunwald, 2015). Recent research from several western countries has reported HF prevalence at approximately 1-2% of the population (Páren *et al.*, 2014; Heidenreich *et al.*, 2013). In the USA and Europe, the 1-year mortality rate was 9% (Dokainish *et al.*, 2017). Among developing countries in Asia, including Thailand, the HF prevalence rates range from 1-3% of the population (Reyes *et al.*, 2016) and reported as between 3.4-6.7% of all hospitalized patients (Rajadurai, 2017). The 1-year mortality rates are also high in Southeast Asia patients with HF at 15% (Dokainish *et al.*, 2017). The adaptation of a service system for heart failure management may help to reduce the burden of HF in Asian countries.

The service system for heart failure management in western countries is based on the American Heart Association (Yancy *et al.*, 2017) and the European Society of Cardiology guidelines (Ponikowski *et al.*, 2016). This system includes a multidisciplinary care team (MTD) and implementation of heart failure management guidelines which emphasize personalized holistic care; evidence has shown that it significantly reduces morbidity, mortality (Davidson *et al.*, 2015; Driscoll *et al.*, 2013; Ponikowski *et al.*, 2016), and improves the quality of life and the functional status of patients with HF (Crissinger *et al.*, 2015; Verma *et al.*, 2017). Currently, there are 2 models of care in cardiac outpatient clinics, cardiologist-led or clinical nurse specialist (CNS)-led clinics (Lambrinou *et al.*, 2013; Urvashi, 2018). As is evident, the roles of the CNS contribute to improve the health outcomes of cardiac patients as they focus on therapeutics, education, monitoring, follow-up, and self-care management support for these patients and their families (Bekelman *et al.*, 2013; Chouinard *et al.*, 2013).

Although shown to be effective from evidence which is drawn from major HF patients' backgrounds in western countries, the ability to implement heart failure management guidelines may vary from country to country. In 2013, the Ministry of Public Health in

Thailand (2016) implemented a policy to improve the service system for patients with HF in ambulatory care by establishing more cardiac clinics using an MTD led by a cardiologist and using chronic heart failure management programs (CHF-MPs) in all tertiary hospitals. The goal of this policy is focused on patient-centered care and team management to improve the quality of care and promote the desired health outcomes, especially the functional capacity of the HF patients. To date no evaluation of the impact of the Thai policies on the clinical outcomes in HF patients.

Reduced functional capacity is a common consequence of HF and one of the crucial clinical outcomes that reflects the quality of HF management (Davidson *et al.*, 2015). Nowadays, the six-minute walk test (6-MWT) is a validation tool that has been widely used to assess the functional capacity of HF patients (Pollentier *et al.*, 2010; Hwang *et al.*, 2016). From previous western studies, there were significant multilevel factors, including the service system and patient characteristics, that could affect the functional capacity of HF patients. In relation to the service system, the model of care using an MTD, especially a cardiologist and cardiac nurse as CNS, and the utilization of the standard guidelines in CHF-MPs play an important role in improving the health outcomes of HF patients (Driscoll *et al.*, 2013; Davidson *et al.*, 2015). With respect to patients' characteristics, previous studies revealed that HF patients who were female (Pollentier *et al.*, 2010), older adults (Pepera *et al.*, 2015), had a lower socioeconomic status (Dokainish *et al.*, 2015; Verma *et al.*, 2017) and had a greater severity of co-morbidities and were more likely to have poor functional capacity (Fry *et al.*, 2016). As Andersen (1995) asserted, the optimal functioning of patients relies heavily on the integration of the care needs and health service under different conditions and with the varying contexts of individual patients. However, there is still a lack of information integration of various factors in both levels to show what important factors contribute to enhancement of the functional capacity of HF patients.

The purposes of this study were to evaluate the effectiveness of the HF management policy implementation by assessing the patients' functional capacity and identifying the influential factors, including service system factors; the model of care and level of implementation of CHF-MPs and the patients' factors comprising sex, age, adequacy of income (referred to as adequacy of income for cost of living), severity of co-morbidity, and self-care, on their functional capacity. The results could be used as an informational base for further improvement of the service system which may lead to an enhancement of the functional capacity in patients with HF in developing countries, especially in Thailand.

Materials and Method

Study Design and Sample

This multilevel study was a cross-sectional design. According to the multilevel research criteria, the study size of the service settings were 12.2 hospitals, which was calculated with the desired sample size of the HF patients being at least 30 cases in each hospital, based on the desired intra-class correlation (ICC) of 0.15 (Snijders and Bosker, 2012) with the effect size of 0.71, which was calculated based on a previous HF study (Shao *et al.*, 2013), with a power analysis of 0.8 and a significance level of 0.05 (Gou, 2005). In anticipation of sample dropouts, an oversampling of 10% was included. Overall, the calculated sample size of the service setting consisted of 13 hospitals with 429 patients, comprising 33 patients per hospital.

For a sampling procedure in the service settings, the probability proportional to size method was used. The inclusion criteria for the research settings were public hospitals at tertiary care which had a cardiac clinic and the gaining of permission to collect data from each hospital director. Purposive sampling was used to recruit a head or senior nurse working in a cardiac clinic (1 nurse per clinic) to provide information about the health service related to HF management in each setting. In relation to HF patients, they were selected with simple

random sampling based on the following inclusion criteria: (a) had a heart failure diagnosis according to the international guidelines (Yancy *et al.*, 2017); (b) were 18 years or older; (c) had attended a cardiac clinic for at least 6 months; (d) had the ability to walk without assistance; and (e) could understand and communicate in Thai. The exclusion criteria were as follows: (a) had had unstable angina or myocardial infarction during the previous month; (b) had a resting heart rate of >120 beats per minute, systolic blood pressure of >180 mmHg, diastolic blood pressure of >100 mmHg; and (c) had been diagnosed with dementia.

Data Collection

The data collection was performed during routine visits in ambulatory cardiac clinics. After getting permission from nurses in each designated setting, we interviewed them and gathered data for capturing the health service factors by using: 1) the Personal Information and Structure of Heart Failure Service Delivery (PIQSHF) questionnaire which was developed by the researchers; the content validity index (CVI) was 0.94, and it consisted of questions about the model of care which was divided into 2 models: the service run by cardiologists and a GN (model of care 1) and the service run by cardiologists and a cardiac nurse (model of care 2); and 2) the HF Instrument Score (HF-IS) questionnaire, developed by Driscoll and colleagues, including questions on 27 interventions related to CHF-MPs. Each intervention is categorized according to "the level of evidence and each of which is assigned an arbitrary weighted score (a score of 10 for interventions with levels A, B, and C Class I evidence and a score of 1 for level C Class IIb evidence)" (Driscoll *et al.*, 2011). The HF-IS is used for assessing the level of the implementation of heart failure management programs in cardiac clinics that are classified into 2 categories: high-quality (scores 190 or more) and low-quality level (scores <190).

In relation to HF patients, we contacted the nurses at the cardiac clinics to invite all patients for voluntary participation, then explained all the information to the eligible patients and obtained their consents. The data

gathering methods included interviews, data retrieval, and clinical assessment. The interviews were conducted by using a questionnaire consisting of: 1) the Personal Information Questionnaire (PIQ) developed by the researchers and the CVI was 1, including sex, age, adequacy of income, education, living condition, severity of co-morbidity, and New York Heart Association (NYHA) - functional class, and 2) the European Heart Failure Self-Care Behavior Scale 9-item version (EHFScBS-9) (Jaarsma *et al.*, 2009), which was used to evaluate their self-care behaviors. The EHFScBS-9 was used with permission and translated from English into Thai based on a recommendation of Brislin (1970). In this study, the back-translation process included translating the English version of the EHFScBS-9 to Thai by 2 independent translators who were bilingual (in English and Thai), and then the Thai version was back-translated to English by another 2 translators. The translation process was repeated until the maximum equivalence between the 2 versions was reached to ensure accuracy of the descriptions

and meanings. The total reverse standardized score ranging from 0 to 100 was computed, with higher scores indicating better self-care. The data contained in the medical records were retrieved to measure the severity of co-morbidity using Charlson's Co-morbidity Index (CCI) (Charlson *et al.*, 1987). The possible total scores ranged from 0 to 36 points, with a high score on the CCI indicating a more severe comorbid disease.

For the health outcome, the 6-MWT record was used to evaluate the functional capacity, according to the standard guidelines of the American Thoracic Society (2002). The patients were instructed to walk as far and fast as possible for 6 min. They were allowed to stop and rest during the test, but were instructed to resume walking as soon as they felt they were able to do so. Standardized verbal encouragement was provided after 2 and 4 mins. In addition, before and after performing the 6-MWT, blood pressure, pulse rate, respiratory rate, and modified Borg's scale were gathered to ensure a patient's safety.

Table 1. The patient and health service characteristics (N = 413)

Variables	All		The six-minute walk distance (m)				p-value	
			>= 300		< 300			
			N = 179		N = 237			
Patient factors								
Sex, n (%)								
Male	237	(57.4%)	132	(75.0%)	105	(44.3%)	0.000	***
Female	176	(42.6%)	44	(25.0%)	132	(55.7%)		
Age, n (%)								
< 60 years	189	(45.8%)	117	(66.5%)	72	(30.4%)	0.000	***
>= 60 years	224	(54.2%)	59	(33.5%)	165	(69.6%)		
Adequacy of Income, n (%)								
Adequate	298	(72.2%)	137	(77.8%)	161	(67.9%)	0.000	***
Inadequate	115	(27.8%)	39	(22.2%)	76	(32.1%)		
Severity of co-morbidity								
Mean (SD)	2.6	(3.06)	1.9	(2.70)	3.1	(3.16)	0.000	***
95% CI	(2.41,	2.81)	(1.68,	2.18)	(2.83,	3.39)		
Self-care								
Mean (SD)	52.529	(25.067)	55.540	(24.889)	50.293	(25.017)	0.003	**
95% CI	(50.10,	54.95)	(51.84,	59.24)	(47.09,	53.49)		
Service system factors								
Model of care, n (%)								
Model of care 1:	314	(76.0)	106	(33.8)	208	(66.2)	0.002	**
Cardiologist and GN								
Model of care 2:	99	(24.0)	71	(71.7)	28	(28.3)		
Cardiologist and cardiac nurse								
Score of CHF-MPs								
Mean (SD)	140.0	(27.07)	148.6	(31.19)	133.6	(21.50)	0.001	**
95% CI	(137.36,	142.59)	(143.92,	153.20)	(130.85,	136.35)		

p-value < 0.01 * p-value < 0.001

At the end of testing, the total distance that the patients walked in 6 min was measured in meters by the researcher. The longer the distance they could walk, the better their functional capacity. A 6-MWD <300 m was considered having a poor functional capacity (Pollentier *et al.*, 2010; Pepera *et al.*, 2015).

Ethical Considerations

This study was approved by the committee for the protection of human subjects, Siriraj Institutional Review Board (SI-IRB) (ID: 663/2014), as well as the ethics committees of all of selected hospitals. The informed consents were gathered from nurses and patients prior to data collection. The personal information of all of them was maintained confidentially.

Data Analysis

This study used SPSS/FW version 18.0 © and STATA version 13.1© for data analysis. The data processing began with the management of the data set, data entry, data cleaning, and missing data. Descriptive statistics were used to describe the participants' backgrounds, clinical, self-care, functional capacities and health service characteristics. Multilevel linear regression was conducted to determine the influence of the patient and service system level factors on the functional capacity with statistical significance at the interval of 95%. The ICC was calculated from the dependent variable of functional capacity, which was equal to 0.25, that met the assumption to analyze the data by using multilevel analysis at the value of at least 0.1 (Guo, 2005).

Results and Discussion

Patient Characteristics

A total of 413 participants completed the study. More than half of the participants were male (57.3%). The mean of age was 60.85 ± 0.704 , and 72.2% had adequate income. The participants' mean score of self-care was 52.53 ± 25.067 . The average severity of co-morbidity score was 3.61 ± 2.06 (Table 1).

In addition, the majority of the participants (90.8%) had at least 1 comorbid condition. The most common were hypertension, diabetes mellitus, and myocardial infarction, accounting for 68.0%, 40.7%, and 30.0%, respectively. In addition, the participants had their level of severity of the disease in the NYHA- functional class I, II, III equal to 44.6%, 32.9%, and 22.5%, respectively.

Health Service Characteristics

This study presented a model of care in real- world practice for patients with HF seeking services at cardiac clinics in Thailand. There were 2 models of care revealed. Most of the designated settings (76.9%) allocated cardiologists and GNs (model of care 1) as the main healthcare providers, while 23.1% involved collaboration between cardiologists and cardiac nurses as major care providers (model of care 2) (Table 1). For the qualification of the cardiac nurses, all of them had obtained a 4-month specialty program in cardiovascular nursing. With respect to qualification of the GNs, 90% graduated with a bachelor's degree in nursing science and did not further their studies for specialization. Moreover, in relation to implementation of the CHF- MPs, all of the designated settings did not reach a high-quality level (median = 134; actual range = 104-188). Out of 27 standard interventions, only nine (33.3%) interventions were applied in all 13 cardiac clinics and were mainly educational themes such as patient and career education concerning diet and medication. Three interventions in the levels of evidence A, B, and C Class I were accessible to fewer than 50% of patients with HF. Furthermore, none of them fully implemented interventions in levels of evidence A, B, and C Class I. However, when considering clinics with higher HF- IS scores (median = 187, actual range = 184-188), it was found that all of them were clinics providing services using model of care 2. On the other hand, the clinics with low HF- IS scores were clinics providing services using model of care 1 (median = 125, actual range = 104-146). When considering the types of model of care, it could be seen that the provision of

HF management in model of care 2 comprised exclusive interventions in all aspects (100%) including assessment of fluid status, giving specific health education (disease process, diet, exercise, medications, and self-management strategies), as well as 24-h telephone monitoring. On the contrary, the services provided in model of care 1 revealed that only some participants received HF interventions, for example, assessment of fluid status (50%) and 24-h telephone monitoring (20%).

Functional Capacity of Participants

The mean score of a 6-MWD of the participants was 269.22 ± 126.56 m, which indicated poor performance. However, the participants who received services in model of care 2 had a high mean score of 6-MWD at 361.49 ± 129.09 m which indicated a good level of functional capacity, whereas those receiving services in model of care 1 performed at a poor level of functional capacity (240.14 ± 111.02 m) (Table 2). Among the 413 participants, 70.5% walked without a break during the test. There were 34.6% of the participants who reported symptoms, such as dyspnea (22.8%), leg pain (8.7%), and dizziness (4.6%). However, these participants later had their symptoms resolved and returned to their baseline conditions within a few minutes with no adverse events.

The Multilevel Factors (Service System and Patient Factors) Influencing Functional Capacity

Table 3 displays the results of the multilevel linear regression analysis. The first

step, the null model was supported with statistical significance ($p < 0.001$) of a clustering effect with intra-class correlation of 0.25 on the 6-MWD of the participant; therefore, multilevel analysis was appropriate. For model A, the random intercept model with additive effects in the patient level showed that the whole patient-level factors could significantly predict the 6-MWD. The researchers added the set of 2 service system-level factors, model of care (model B) and level of implementation of CHF-MPs, into each of the models. It was found that both variables were able to enter the model when such variables were analyzed one by one. However, when both variables were simultaneously entered, it could not be seen that both of the service system factors could predict the 6-MWD at the significance level 0.05. The last step, the cross-level interaction was used to test and the results showed that the service system-level factor, model of care, had no effect on the relationships among the whole patient-level factors and the 6-MWD ($p > 0.05$).

Therefore, model B was selected as the best model because it presented the quality of the fixed-effect model with the lowest values of Akaike information criterion (AIC) and log-likelihood and the quality of the random effect model had the values of standard error higher than zero. A good fit with scatter plots (Figure 1) suggested that the analysis significantly predicted the 6-MWD of the best model by 2-level factors: included were all selected patient-level variables, i.e., sex (male compared with female) ($B = 56.02$, $p < 0.01$), age (younger than 60 years compared

Table 2. The six-minute walk distance (6-MWD) of the 413 participants

The 6-MWD (Meters)	Total participants (N = 413)		Model of care 1 (N = 314)		Model of care 2 (N = 99)	
	Mean (SD)		Mean (SD)		Mean (SD)	
	269.22 (126.56)		240.14 (111.02)		361.49 (129.09)	
	n	%	n	%	n	%
< 300.00	234	56.7	206	65.6	28	28.3
300.00 - 374.99	100	24.2	68	21.7	32	32.3
375.00 - 449.99	44	10.6	33	10.5	11	11.1
>= 450.00	35	8.5	7	2.2	28	28.3

Model of care 1: Participants received services from cardiologist and general nurse (GN).

Model of care 2: Participants received services from cardiologist and cardiac nurse.

with 60 years or older) ($B = 68.85, p < 0.001$), adequacy of income (adequate compared with inadequate) ($B = 24.66, p < 0.05$), severity of co-morbidity ($B = -12.70, p < 0.001$), and self-care ($B = 0.53, p < 0.05$), as well as the model of care variable in the service system level (model of care 2 compared to model of care 1) ($B = 75.24, p < 0.05$). For the level of implementation of CHF- MPs, although it cannot enter into the best model, the result from the Spearman correlation between it and the type of model of care is 0.747 ($p < 0.001$). It means that the clinics using model of

care 2 had higher scores of CHF- MPs implementation than those using model of care 1.

Overall, the equation of the best model was as follows:

$$\hat{y} \text{ (6-MWD)} = 174.84 + (56.02 * \text{sex} = \text{male}) + (68.85 * \text{age} = \text{younger than 60}) + (24.66 * \text{adequacy of income} = \text{adequate}) + (-12.53 * \text{severity of co-morbidity}) + (0.53 * \text{self-care}) + (75.52 * \text{model of care} = \text{model of care 2})$$

Table 3. Multilevel linear modeling of factors influencing functional capacity

Variables	Null model ^a			Model A ^b			Model B ^c		
	Coef		SE	Coef		SE	Coef		SE
	(95% CI)			(95% CI)			(95% CI)		
Fixed effect									
Constants	268.02	***	18.27	180.26	***	21.29	174.84	***	17.55
	(232.22, 303.83)			(138.52, 221.99)			(140.45, 209.24)		
Patient level									
Sex (Ref = Female)									
Male				55.94	***	9.34	56.02	***	9.32
				(37.63, 74.25)			(37.75, 74.29)		
Age (Ref. >= 60 year)									
0 < 60 years				70.99	***	9.81	68.85	***	9.81
				(51.76, 90.23)			(49.62, 88.09)		
Income (Ref. = Inadequate)									
Adequate				24.80	*	10.42	24.66	*	10.38
				(4.37, 45.22)			(4.31, 45.01)		
Severity of co-morbidity				-12.53	***	2.32	-12.70	***	2.31
				(-17.07, -7.99)			(-17.23, -8.18)		
Self-care				0.73	**	0.24	0.53	*	0.23
				(0.26, 1.21)			(0.08, 0.98)		
Health service level									
Model of care (Ref = Model of care 1 ^d)									
Model of care 2 ^e							75.24	*	34.83
							(6.98, 143.49)		
Random effect									
ST. DEV (Model of care)							50.65		27.00
							(17.82, 143.97)		
ST. DEV (Constant)	62.94		13.50	45.11		10.02	22.41		7.93
	(41.34, 95.82)			(29.19, 69.71)			(11.20, 44.84)		
ST. DEV (Residual)	109.33		3.87	89.76		3.17	89.80		3.18
	(102.01, 117.17)			(83.75, 96.20)			(83.78, 96.25)		
ICC	0.2489			0.2016			0.2756		
Log likelihood	-2540.68			-2457.63			-2452.85		
AIC	5087.35			4931.26			4925.70		
BIC	5099.42			4963.44			4965.93		

a Null model: Exclude explanatory variables.

b Model A (Patient level model): Include patient level variables.

c Model B (Mixed model: random slope: include both patient and service system level variables in random slope model.

d Model of care 1: Provided care by cardiologist and general nurse (GN).

e Model of care 2: Provided care by cardiologist and cardiac nurse.

*p-value < 0.05 **p-value < 0.01 *** p-value < 0.001

To clarify the equation of the best model, the following contextual analysis is included to explain the findings. For example, a male patient with HF aged 55 years, who had adequate income, a score of severity of co-morbidity equal to 4, and score of self-care equal to 40; when this patient received services according to model of care 1, he or she would have a 6-MWD equal to 295.45 m. However, if receiving the model of care 2, this person would have a 6-MWD equal to 370.97 m.

Discussion

The Functional Capacity of Participants was at a Low Level

The functional capacity indicated by the 6-MWD of the participants was at a low level and lower than most recent studies in western countries (La Rovere *et al.*, 2015; Pepera *et al.*, 2015) and some developing countries in Asia like China (Gu *et al.*, 2016). However, the result of the present study was rather similar to the study conducted by Lee *et al.* (2007) which has reported that more than half of Asian patients with HF (55.7%) were able to walk less than 310 m and previous studies carried out in Europe have reported a lower mean score of the 6-MWD (232 m) (60-386 m)

(Ingle *et al.*, 2014) and 305±123 m (Pepera *et al.*, 2015). Besides this, it could be explained by both the patient and service system factors affecting the functional capacity of the participants. Regarding the health service characteristics, they seem to be a greater influence as elaborated by the best model.

In relation to the patient factors, this study supported recent research that female (Pepera *et al.*, 2015) and older participants had poorer functional capacity (Batalli *et al.*, 2017). This study had a higher proportion of participants who were female than many previous studies (Ingle *et al.*, 2014; Hwang *et al.*, 2017). Age was an important demographic that could affect functional capacity among Thai patients with HF in the future due to the average age of participants in the current study being lower when compared to developed countries (Pepera *et al.*, 2015; Rajadurai *et al.*, 2017; Tran *et al.*, 2017). Income was negatively related to functional capacity, supported by the recent studies that socio-economic status affects patients' accessibility to health care services and their ability to recognize the need for specialized care or willingness to seek medical advice (Diaz-Toro *et al.*, 2015; Verma *et al.*, 2017). Overall, this study indicated that the participants who had an adequate income had a higher mean self-care score (69.02) when compared with those who had an inadequate income (47.33).

Furthermore, this study found that the greater the severity of co-morbidities the participants suffered, the poorer their functional capacity. This concurs with a previous study (Murad *et al.*, 2015) that HF patients with multiple chronic conditions had increased functional impairments, including lower activities of daily living and walk distance. Moreover, a greater severity of co-morbidities in combination with HF could create difficulties in recognizing and managing multiple symptoms leading to poorer health outcomes (Fry *et al.*, 2016). With respect to self-care, the findings indicated that the participants with poor self-care had poor functional capacity. For example, regular exercise as part of self-care was noted to be lower than expected and

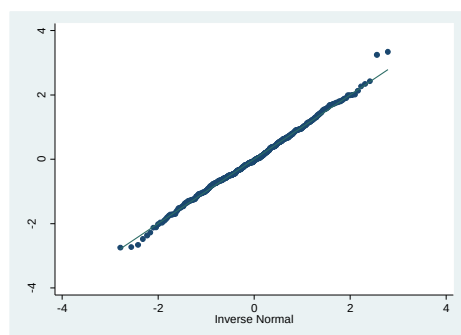


Figure 1. Scatter plot for a goodness of fit test. The best model was tested for goodness of fit with the scatter plots, and the results showed that most observation residuals were in the same line of standardized residuals

required to be improved. While the majority of participants (77.5%) had NYHA functional class I and II (mild to moderate symptoms of HF), only 27.6% of them performed an exercise. This was congruent with a previous study that HF patients were afraid that more exercise would worsen their condition (Murad *et al.*, 2015). This finding was consistent with a study of Albert *et al.* (2015) who suggested that HF patients needed to build confidence in their capabilities to enable them to achieve the benefits of exercise.

Cardiac Trained Nurse is Crucial in the HF Care Team to Improve Functional Capacity

This study found that the participants' functional capacity would increase when they received HF services in model of care 2, in which cardiac nurses were involved. The highlight from this study found that the qualifications of cardiac nurses were unlike those in international studies that supported the effective functions of an advanced practice nurse at a master level as CNS (Glogowska *et al.*, 2015; Boyde *et al.*, 2017). These cardiac nurses underwent a short training program (a 4-month course) in cardiovascular nursing. Historically, the Thailand Nursing and Midwifery Council initiated various 4-month training programs for nurses, focusing on advanced health assessment, management of co-morbidities and complications, lifestyle modification, and care coordination (Langer *et al.*, 2015). With the demands for specialized nurses to serve Thai patients around the country, these programs aim to enhance nursing competencies to improve health outcomes of specific groups of chronic illness patients, such as diabetes and hypertension, stroke, and cardiac patients.

As is obvious, cardiac trained nurses were seen to be significant in the HF care team to improve functional capacity. Firstly, formal training could promote the nurses' ability and expertise required in providing care to patients with HF in particular. Similarly, the existing literature has addressed the need for preparation of the HF specialist nurse (Jokiniemi *et al.*, 2015). Secondly, in this study cardiac nurses were health professionals

who played a significant role to encourage implementation of necessary interventions, including delivering physical assessment, education, and health monitoring tailored to the patients, while facilitating better liaison among all clinicians. These specific roles of cardiac nurses were supported by a previous study (Rasmusson *et al.*, 2015) that they could lead to the improvement of the participants' functional capacity. Thirdly, the findings revealed that more than half of the participants who accessed model of care 2 had a higher self-care score than those receiving services with model of care 1. These might reflect that cardiac nurses used their well-rounded knowledge to enable participants to develop their self-care and improve functional capacity (Smith *et al.*, 2014) and better manage chronic illness in cardiovascular patients (Padilha *et al.*, 2017). In the present study, the participants and/or caregivers receiving care from clinics led by cardiologists and cardiac nurses were able to monitor the signs and symptoms that indicated deterioration from the outset. Some patients adjusted the dosage or used diuretics in accordance with the changes in their body weight, so they were able to continue living normally at home. These findings were consistent with studies in western countries that HF provision requires cardiac nurses to provide self-care education interventions (Langer *et al.*, 2015) and act as care coordinators (Glogowska *et al.*, 2015) to ensure better health outcomes.

Implications

Implications for Nursing Practice

The 6-MWT should be routinely performed with patients with HF to identify their functional capacity. Nurses along with the health care team should use the standard HF interventions to promote self-management ability, especially the regular exercise. Moreover, they need to pay greater attention to important characteristics of individuals, including age, income, severity of co-morbidity, and self-care that could influence the HF patient's functional capacity.

Implications for Nursing and Health Policy

To ensure the effectiveness of a HF service system, appropriate allocation of the cardiac specialist care team, including cardiologist and cardiac nurse, should be implemented to provide better healthcare services to patients with HF at both heart and heart failure clinics. In addition, policy makers should ensure that nurses working in cardiac settings undertake formal cardiac training courses to enable them to foster the use of chronic heart failure management programs in clinical settings.

Implications for Future Research

Further research should be undertaken to determine the effectiveness of this HF service system by evaluating other health outcomes such as morbidity, mortality rate, and quality of life.

Limitations

This study has some limitations. First, there were no data related to the level of functional capacity of patients with HF in these settings to compare with their capacity prior to the HF policy being launched. Second, the participants were obtained in Thailand's central region where access to health care resources might differ from other regions or rural areas.

Conclusions

The study opens a new perspective for health service research highlighting the evaluation of HF service systems in Thailand and provides the suggestion that these special cardiac training programs might assist nurses to provide better care to maximize the functional capacity of patients with HF. It may be one of the solutions for designing services system for HF patients at ambulatory clinics in developing countries which suffer from limited specialized human resources and budget. To promote health outcomes, policy makers need to evaluate how policy is put into

action, while nurses working in cardiac settings need to undertake formal cardiac training to enable them to foster the use of CHF- MPs in clinical settings. In addition, health care providers should consider the diversities of patients' characteristics when planning for HF management.

Acknowledgements

This study was supported by the National Research Council of Thailand (Research Grant in 2015), Faculty of Nursing, and Faculty of Graduate Studies, Mahidol University.

References

- Albert, N.M., Forney, J., Slifcak, E., and Sorrell, J. (2015). Understanding physical activity and exercise behaviors in patients with heart failure. *Heart Lung*, 44(1):2-8.
- American Thoracic Society. (2002). ATS statement: Guidelines for the six – minute walk test. *Am. J. Resp. Crit. Care*, 166(1):111-117.
- Andersen, R.M. (1995). Revisiting the behavioral model and access to medical care: does it matter? *J. Health Soc. Behav.*, 36(1):1-10.
- Batalli, A., Ibrahim, P., Bytyci, I., Ahmeti, A., Haliti, E., Elezi, S., Michael Y., Henein, M. Y., and Bajraktare, G. (2017). Different determinants of exercise capacity in HFrEF compared to HFpEF. *J. Cardiovasc. Ultras.*, 15(12):1-9.
- Bekelman, D. B., Plomondon, M. E., Sullivan, M. D., Nelson, K., Hattler, B., McBryde, C., Lehmann, K.G., Potfay, J., Heidenreich, P., and Rumsfeld, J.S. (2013). Patient- centered disease management (PCDM) for heart failure: Study protocol for a randomized controlled trial. *BMC Cardiovasc. Disor.*, 13(49):2-6.
- Boyde, M., Peters, R., Hwang, R., Korczyk, D., Ha, T., and New, N. (2017). The self-care educational intervention for patients with heart failure: A study protocol. *J. Cardiovasc. Nurs.*, 32(2):165-170.
- Braunwald, E. (2015). The war against heart failure: The Lancet lecture. *Lancet*, 385:812-824.
- Brislin, R.W. (1970). Back-translation for cross-cultural research. *J. Cross Cult. Psychol.*, 1:185-216.
- Charlson, M.E., Pompei, P., Ales, K.L., and MacKenzie, C. R. (1987). A new method of classifying prognostic comorbidity in longitudinal studies: Development and validation. *J. Chron. Dis.*, 40(5):373-383.
- Chouinard, M.C., Hudon, C., Dubois, M.F., Roberge, P., Loignon, C., Tchouaket, É., Fortin, M., Couture, É.M., and Sasseville, M. (2013). Case management and self-management support for frequent users

- with chronic disease in primary care: a pragmatic randomized controlled trial. *BMC Health Serv. Res.*, 13(1):13-49.
- Crissinger, M. E., Marchionda, K. M., and Dunlap, M. (2015). Adherence to clinical guidelines in heart failure (HF) outpatients: Impact of an interprofessional HF team on evidence- based medication use. *J. Interprof. Care*, 29(5):483-487.
- Davidson, P. M., Newton, P. J., Tankumpuan, T., Paull, G., and Dennison- Himmelfarb, C. (2015) . Multidisciplinary management of chronic heart failure: Principles and future trends. *Clin. Ther.*, 37(10):2225-2233.
- Diaz-Toro, F., Verdejo. H. E., and Castro, P. F. (2015). Socioeconomic inequities in heart failure. *Heart Fail. Clin.*, 11(4):507-513.
- Dokainish, H., Teo, K., Zhu, J., Roy, A., AlHabib, K. F., ElSayed, A., Palileo- Villanueva, L., Lopez-Jaramillo, P., Karaye, K., Yusoff, K., Orlandini, A., Sliwa, K., Mondo, C., Lanas, F., Prabhakaran, D., Badr, A., Elmaghawry, M., Damasceno, A., Belley-Cote, E., Tibazarwa, K., Belley-Cote, E., Balasubramanian, K., Islam, S., Yacoub, M. H., Huffman, M. D., Harkness, K., Grinvalds, A., McKelvie, R., Bangdiwala, S. I., and Yusuf, S. (2017). Global mortality variations in patients with heart failure: results from the International Congestive Heart Failure (INTER- CHF) prospective cohort study. *Lancet Glob. Health*, 5:e665-672.
- Dokainish, H., Teo, K., Zhu, J., Roy, A., Al-Habib, K., ElSayed, A., Palileo, L., Jaramillo, P. L., Karaye, K., Yusoff, K., Orlandini, A., Sliwa, K., Mondo, C., Lanas, F., Dorairaj, P., Huffman, M., Badr, A., Elmaghawry, M., Damasceno, A., Belley-Cote, E., Harkness, K., Grinvalds, A., McKelvie, R., and Yusuf, S. (2015). Heart failure in low-and middle-income countries: Background, rationale, and design of the INTERnational Congestive Heart Failure Study (INTER- CHF). *Am. Heart J.*, 170(4):627-634.
- Driscoll, A., Tonkin, A., Stewart, A., Thompson, D. R., Worrall-Carter, L., Riegel, B., Hare, D. L., Davidson, P. M., and Stewart, S. (2011) . Development of an evidence-based scoring system (HF- IS) to assess the quality of heart failure programs for patients postdischarge from hospital. *J. Clin. Nurs.*, 20:3,011-3,019.
- Driscoll, A., Tonkin, A., Stewart, A., Worrall-Carter, L., Thompson, D. R., Riegel, B., Hare, D. L., Davidson, P. M., Mulvany, C., and Stewart, S. (2013) . Complexity of management and health outcomes in a prospective cohort study of 573 heart failure patients in Australia: Does more equal less? *J. Clin. Nurs.*, 22:1629-1638.
- Fry, M., McLachlan, S., Purdy, S., Sanders, T., Kadam, U. T., and Chew- Graham, C. A. (2016) . The implications of living with heart failure; the impact on everyday life, family support, co- morbidities and access to healthcare: a secondary qualitative analysis. *BMC Fam. Pract.*, 17(139):1-8.
- Glogowska, M., Simmonds, R., McLachlan, S., Cramer, H., Sanders, T., Johnson, R., Kadam, U. T., Lasserson, D. S., and Purdy, S. (2015). Managing patients with heart failure: A qualitative study of multidisciplinary teams with specialist heart failure nurses. *Ann. Fam. Med.*, 3(5):466-471.
- Gu, M., Ma, Y., Zhou, T., and Xia, Y. (2016). Evaluation of a community health service center- based intervention program for managing chronic heart failure. *Balk. Med. J.*, 33(1):45-51.
- Guo, S. (2005). Analyzing grouped data with hierarchical linear modeling. *Child. Youth Serv. Rev.*, 27:637-652.
- Heidenreich, P. A., Albert, N. M., Allen, L. A., Bluemke, D. A., Butler, J., Fonarow, G. C., Ikonomidis, J. S., Khavjou, O., Konstam, M. A., Maddox, T. M., Nichol, G., Pham, M., Piña, I. L., and Trogon, J. G. (2013). Forecasting the impact of heart failure in the United States: a policy statement from the American Heart Association. *Circ- Heart Fail.*, 6:606-619.
- Hwang, R., Bruning, J., Morris, N. R., Mandrusiak, A., and Russell, T. (2017). Home-based telerehabilitation is not inferior to a centre-based program in patients with chronic heart failure: a randomised trial. *J. Physiother.*, 63:101-107.
- Hwang, R., Morris, N. R., Mandrusiak, A., Mudge, A., Suna, J., Adsett, J., and Russell, T. (2016). Timed up and go test: a reliable and valid test in patients with chronic heart failure. *J. Card. Fail.*, 22(8):646-650.
- Ingle, L., Cleland, J. G., and Clark, A. L. (2014). The relation between repeated 6- minute walk test performance and outcome in patients with chronic heart failure. *Ann. Phys. Rehabil. Med.*, 57(4):244-253.
- Jaarsma, T., Arestedt, K., Martensson, J., Dracup, K., and Strömberg, A. (2009). The European Heart Failure Self-care Behaviour scale revised into a nine-item scale (EHFScB-9): a reliable and valid international instrument. *Eur. J. Heart Fail.*, 11(1):99-105.
- Jokiniemi, K., Haatainen, K., Meretoja, R., and Pietila, A. M. (2015). The future of the clinical nurse specialist role in Finland. *J. Nurs. Scholarship*, 47(1):78-86.
- Lambrinou, E., Kalogirou, F., Lamnisosa, D., and Sourtzi, P. (2013) . Effectiveness of heart failure management programmes with nurse-led discharge planning in reducing readmissions: A systematic review and meta- analysis. *Int. J. Nurs. Stud.*, 49:610-624.
- Langer, A., Meleis, M., Knaut, F. M., Atun, R., Aran, M., Arreola-Ornelas, H., Bhutta, Z. A., Binagwaho, A., Bonita, R., Caglia, J. M., Claeson, M., Davies, J., Donnay, F. A., Gausman, J. M., Glickman, C., Kearns, A. D., Kendall, T., Lozano, R., Seboni, N., Sen, G., Sindhu, S., Temin, M., and Frenk, J. (2015). Women and health: The key for sustainable development. *Lancet*, 386:1165-1210.
- La Rovere, M. T., Maestri, R., Caporotondi, A., Corbellini, D., Guazzotti, G., Pinna, G. D., and Febo, O. (2015). Pre-discharge evaluation in heart failure-additive predictive value of the 6-minute walking test to clinical scores. *Circulation*, 79(8):1756-1763.
- Lee, R., Chan, Y. H., Wong, J., Lau, D., and Ng, K. (2007). The 6-minute walk test predicts clinical outcome in Asian patients with chronic congestive heart failure

- on contemporary medical therapy: a study of the multiracial population in Singapore. *Int. J. Cardiol.*, 119(2):168-175.
- Ministry of Public Health, Thailand. (2016). Service Plan 2017- 2022 Assembly. Available at: www.phdb.moph.go.th/phdb/site/index.php?&p=4&type= 3&t= 3&id= 24&n_id= 29296&sec= 2. Accessed date: 2 May 2017.
- Murad, K., David, C.G., Morgan, T.M., Burke, G., Bartz, T.M., and Kizer, J. (2015). Burden of comorbidities and functional and cognitive impairments in elderly patients at the initial diagnosis of heart failure and their impact on total mortality: The cardiovascular health study. *JACC-Heart Fail.*, 3(7):542-550.
- Padilha, J.M., Sousa, P.A., and Pereira, F.M. (2017). Nursing clinical practice changes to improve self-management in chronic obstructive pulmonary disease. *Int. Nurs. Rev.*, 65(1):122-130.
- Påren, P., Schaufelberger, M., Björck, L., Lappas, G., Fu, M., and Rosengren, A. (2014). Trends in prevalence from 1990 – 2007 of patients hospitalized with heart failure in Sweden. *Eur. J. Heart Fail.*, 16:737-742.
- Pepera, G., Ingle, L., and Sandercock, G.R.H. (2015). Predictors of the 6-minute walk test in patients with chronic heart failure. *Br. J. Cardiac Nurs.*, 10(9):454-549.
- Pollentier, B., Irons, S.L., Benedetto, C.M., DiBenedetto, A.M., Loton, D., Seyler, R.D., Tych, M., and Newton, R.A. (2010). Examination of the six minute walk test to determine functional capacity in people with chronic heart failure: a systematic review. *Cardiopulm. Phys. Ther. J.*, 21(1):1-21.
- Ponikowski, P., Voors, A.A., Anker, S.D., Bueno, H., Cleland, J.G.F., Coats, A.J.S., Falk, V., González-Juanatey, J.R., Harjola, V.P., Jessup, E.A.J.M., Linde, C., Nihoyannopoulos, P., Parissis, J.T., Pieske, B., Riley, J.P., Rosano, G.M.C., Ruilope, L.M., Ruschitzka, F., Rutten, F.H., and van der Meer, P. (2016). 2016 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure. *Eur. Heart J.*, 37(27):2129-2200.
- Rajadurai, M., Tse, M.F., Wang, C.H., Yang, N.J., Zhou, J., and Sim, D. (2017). Understanding the epidemiology of heart failure to improve management practices: an Asia-Pacific perspective. *J. Card. Fail.*, 23(4):327-339.
- Rasmusson, K., Flattery, M., and Baas, L.S. (2015). American Association of Heart Failure Nurses position paper on educating patients with heart failure. *Heart Lung*, 44(2):173-177.
- Reyes, E.B., Ha, J.W., Firdaus, I., Ghazi, A.M., Phrommintikul, A., Sim, D., Vu, Q.N., Siu, C.W., Yin, W.H., and Cowie, M.R. (2016). Heart failure across Asia: same healthcare burden but differences in organization of care. *Int. J. Cardiol.*, 223:163-167.
- Shao, J.H., Chang, A.M., Edwards, H., Shyu, Y-I. L., and Chen, S-H. (2013). A randomized controlled trial of self-management programme improves health-related outcomes of older people with heart failure. *J. Adv. Nurs.*, 69(11):2458-2469.
- Smith, C.E., Piamjariyakul, U., Wick, J.A., Spertus, J.A., Russell, C., Dalton, K.M., Elyachar, A., Vacek, J.L., Reeder, K.M., Nazir, N., and Ellerbeck, E.F. (2014). Multidisciplinary group clinic appointments: the Self-management and Care of Heart Failure (SMAC-HF) trial. *Circ-Heart Fail.*, 7(6):888-894.
- Snijders, T.A. and Bosker, R.J. (2012). *Multilevel Analysis: an Introduction to Basic and Advanced Multilevel Modeling*. SAGE Publications Ltd., Thousand Oaks, CA, USA, 368p.
- Tran, D.N., Njuguna, B., Mercer, T., Manji, I., Fischer, L., Lieberman, M., and Pastakia, S.D. (2017). Ensuring patient-centered access to cardiovascular disease medicines in low-income and middle-income countries through health-system strengthening. *Cardiol. Clin.*, 35(1):125-134.
- Urvashi. (2018). Heart failure specialist nurse “need of time” for developing countries: an old concept but new initiative - A review article. *Journal of Indian College of Cardiology*, 8:11-13.
- Verma, A.K., Schulte, P.J., Bittner, V., Keteyian, S.J., Fleg, J.L., Piña, I.L., Swank, A.M., Fitz-Gerald, M., Ellis, S.J., Kraus, W.E., Whellan, D.J., O'Connor, C.M., and Mentz, R.J. (2017). Socioeconomic and partner status in chronic heart failure: Relationship to exercise capacity, quality of life, and clinical outcomes. *Am. Heart J.*, 183:54-61.
- Yancy, C.W., Jessup, M., Bozkurt, B., Butler, J., Casey, D.E., Colvin, M.M., Drazner, M.H., Filippatos, G.S., Fonarow, G.C., Givertz, M.M., Hollenberg, S.M., Lindenfeld, J., Masoudi, F.A., McBride, P.E., Peterson, P.N., Stevenson, L.W., and Westlake, C. (2017). 2017 ACC/AHA/HFSA focused update of the 2013 ACCF/ AHA Guideline for the Management of Heart Failure. *J. Am. Coll. Cardiol.*, 70(6):776-803.