

Cost-Utility Analysis of Specialized Multidisciplinary Care Versus Standard Care in the Management of Patients with Reduced Ejection Fraction Heart Failure in Thailand

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Objective: To compare the cost-utility of specialized multidisciplinary care (MC) and standard care (SC) of patients with reduced ejection fraction heart failure (HFrEF).

Materials and Methods: The present study was a retrospective analytical cohort study on societal perspective in the 12-month follow-up of patients in the tertiary hospitals in Thailand. Conventional care was offered to the patients in the SC group by the hospitals, and the MC group received additional care in the specialized care of the multidisciplinary heart failure clinic. The authors collected data pertaining to resource utilization from the hospital medical records. The unit cost was based on the Thai Health Technology Assessment's standard cost list. Quality-adjusted life years (QALYs) were the health outcome of the study.

Results: The total cost per patient in MC group was \$835.24 versus \$933.10 in the SC group. SC and MC QALYs were 0.72 and 0.78, respectively. MC is an outstanding alternative to save cost of \$97.86 annually per patient. Patients in the MC group used fewer resources because the complication and hospitalization rates were lower.

Conclusion: MC appeared to be a cost-saving approach compared with ambulatory care delivery from SC to patients with HFrEF.

Keywords: Cost-utility analysis; Reduced ejection fraction heart failure; Heart failure clinic; Multidisciplinary care

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Heart failure (HF) is a group of clinical symptoms from changes in the structure and functions of the heart that cause systolic function loss in the heart. This results in its inability to pump sufficient blood to feed the organs and tissues as required by the body. It also leads to symptoms of fluid congestion in the circulatory system, followed by difficulty in

breathing, swelling, depression, fatigue, and anxiety. These symptoms can affect a patient's life in terms of poor performing the normal routine activity. Besides, it causes recurrent hospitalizations and decreases survival and quality of life^(1,2). Prognosis remains poor in patients with HF with an annual mortality rate of 26.7%.

The lower function of the left ventricular myocardium is the most common etiology of HF⁽³⁾. Based on the report of admissions in government hospitals in Thailand categorized from the group of cardiovascular diseases, it was found that, there were 216,131 patients with HF in 2019, accounting for 329.68 patients per 100,000 populations. Thailand ranked tenth for hospitalization and has shown a higher tendency of increase in the number of patients with HF annually⁽⁴⁾.

Treatment for patients with HF symptoms is complicated and difficult to perform because patients need to adjust their lifestyles. The guideline for care

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of patients with HF recommends the use of many drug types to slow disease progression, prevent hospitalization, and reduce the mortality rate. This patient group has comorbidities, such as diabetes, high blood pressure, and kidney disease, which require the use of multiple medications, prescribed by physicians from various branches. Thus, the patients receive drugs that are difficult to monitor for compliance and drug interactions. Moreover, most patients are older adults, who may have other problems from nutrition care, and physical therapy. Therefore, patients with HF should receive multidisciplinary care (MC) so they can receive the most efficient care⁽⁵⁾. Disease management in specialized multidisciplinary clinics has reflected the improve outcomes of patients with HF having different health conditions^(6,7).

Studies in Thailand have reported the efficiency of HF clinics in enhancing the patients' quality of life, improving heart function, and reducing hospitalization rates. Such clinics have helped reduce the progression of HF and saved cost in patient care and burdens on hospitals in the care of patients⁽⁸⁻¹⁰⁾. However, whether balance against the intervention cost and subsequent costs of future health care will be associated with management care still remains unclear. Therefore, the present study aimed to determine cost-utility of the specialized multidisciplinary HF clinic in patients with reduced ejection fraction HF (HFrEF) compared with the standard care (SC) for the management of patients with HF in Thailand.

Materials and Methods

The present study was an economic evaluation research on the cost-utility analysis compared the specialized MC and the SC of patients with HF within 12-month period based on the societal perspective. This retrospective analytical cohort study was conducted where the outcomes of health and costs were obtained from a retrospective cohort study on patients with HF at Chonburi Hospital. Chonburi Hospital is a tertiary hospital that serves as a referral center to most hospitals in the eastern Thailand. The calculation of quality-adjusted life years (QALYs) from each treatment group's utility values was performed using Microsoft Excel 2013 and Stata version 13. Chonburi Hospital's Ethical Committees approved the present study protocol (date of approval: April 28, 2021; number: 151/63/T/q). The principles of the Declaration of Helsinki were adhered to while conducting the present study.

Patients and intervention

Patients with HFrEF were identified and included in the present study. The inclusion criteria were age 18 years or older, HFrEF with EF at 40% or lower, and treated under SC and specialized MC. The exclusion criteria were unclear treatment history, failure to follow-up after a year of HFrEF diagnosis, and pregnancy. Forty-six patients that received MC were included in the study. The MC group data were retrospectively collected between 2017 and 2020, whereas the SC group data were retrospectively obtained between 2009 and 2017 because the hospital had established the HF clinic in 2017. Three hundred thirty-nine patients with SC were classified in the control group after propensity score matching with the MC group. The characteristics of patients with HFrEF based on age, gender, and comorbidity were matched from one to many with 0.01-caliper replacement to eliminate the confounding effects.

Patients in the SC group received the hospital-offered usual/conventional care including on-appointment hospital visit or with-sickness visit, physician consultations, drug prescription, routine laboratory tests, and diagnosis and medication review. The additional practices of the MC group included receiving the treatment following clinical practice guideline and service plan in cardiology and nephrology⁽¹¹⁾. The Healthcare Accreditation Institute of Thailand (HA) assured quality standards of the service. Specific educational needs assessment in patients, identification of drug-related problems, and comprehensive and achievable patient plan were development together with the patients themselves and the multidisciplinary team. Moreover, the multidisciplinary team, including the physician, nurse, physical therapist, psychologist, health educator, pharmacist, and nutritionist, conducted the review and monitoring of patients from time to time. Together, the multidisciplinary team collaborated in terms of organizing patients, testing at point of care, providing counseling to patients, and providing reinforcing information to patients. The visit/ appointment schedule were given to patients by the physicians with the prescription of laboratory tests. Moreover, they participated in the consensus strategies implementation to manage drug-related problems in medication change, withdrawal, or substitution areas.

Data collection

Data were collected from MC and SC groups on the 12-month utilization of healthcare resources.

Table 1. Baseline characteristics of the patients in the MC and SC groups

Demographic data	MC (n=46)	SC (n=339)	p-value
Age (year); mean±SD	58.39±14.77	56.76±15.35	0.50
Sex (female); n (%)	47.83	48.08	0.97
Comorbidities; n (%)			
Hypertension	52.17	42.48	0.21
Atrial fibrillation	15.22	15.34	0.98
Ischemic heart disease	19.57	15.93	0.53
Stroke	4.35	2.65	0.52
Dyslipidemia	21.74	12.98	0.11
COPD	2.17	2.06	0.96
Asthma	0.00	1.18	0.46
Chronic kidney disease	10.87	9.73	0.81
Benign prostatic hyperplasia	0.00	0.59	0.60
Diabetes	30.43	25.96	0.52
Cirrhosis	0.00	0.59	0.60
Valvular heart disease	17.39	42.00	0.34

MC=multidisciplinary care; SC=standard care; COPD=chronic obstructive pulmonary disease; SD=standard deviation

The researchers collected data on direct medical costs, including costs of healthcare personnel, laboratory tests, drugs, number of hospital visits, accident and emergency department visits, and inpatient and outpatient care. Moreover, the direct non-medical costs were collected from the costs of transportation of both the patient and their relatives. Resource utilization data were collected through the review of medical records. The unit cost from the volumes of these resources was derived from the list of standard costs by the health technology assessment in Thailand and website of Drug and Medical Supply Information Center^(12,13). All costs were presented in U.S. dollars (USD), where the Consumer Price Index of year 2021 was adopted in adjustment. The cost was converted from Thai baht to USD using the exchange rate: 31.03 Baht to 1 USD. The estimation of utility score was made based on the Minnesota Living with Heart Failure Questionnaire when patient received

treatment for one year. The Minnesota Living with Heart Failure Questionnaire was recommended for collecting utility values in HF patients. The quality of life was converted to utility score as described⁽¹⁴⁾ and multiplied by the 12-month time period.

Statistical analysis

Stata, version 13 (StataCorp LP, College Station, TX, USA) was applied to perform the statistical analysis. Data were summarized in the form of means, standard deviation, percentage, range, and mean differences. Student's t-tests were used for two-sample comparisons. Chi-square test or Fisher's exact test was used for comparisons of proportions. A priori significance level of p-value less than 0.05 was employed. The outcomes of cost-effectiveness were shown in the form of the incremental cost-effectiveness ratios (ICERs) for costs per QALY obtained estimation.

Results

Table 1 presents the summary of characteristics of 46 patients from the MC group and 339 patients from the SC group. The mean ages were 58.39 years in the MC group and 56.76 years in the SC group. Hypertension was the most common comorbidity of both groups. The groups did not show statistical difference in their demographic data. Patients in both groups received 12-month treatments. Table 2 presents the costs per MC versus SC patient per annum by mean and range. The MC group had lower total cost than the SC group at \$835.24 versus \$933.10. The SC group showed higher hospitalization costs compared with the MC group. Table 3 presents the one-year results on cost-effectiveness. In comparison with the SC group (0.72), the MC group (0.78) showed better QALYs. Thus, MC was the outstanding strategy with 97.86 USD of estimated cost-saving per patient per year. It saved the hospitalization cost, which was the major component for cost reduction at \$147.18 saving, followed by laboratory costs at \$81.16 saving.

Table 2. Costs per patient per year

Cost per patient per year	MC (\$); mean (range)	SC (\$); mean (range)
Drug	312.37 (29.27 to 2,620.22)	304.85 (6.23 to 2,477.37)
Laboratory	176.76 (18.32 to 765.89)	257.92 (6.27 to 1,157.69)
Outpatient services	143.98 (20.24 to 485.76)	78.31 (14.99 to 239.84)
Hospitalization	26.51 (0 to 745.5)	173.69 (0 to 3,205.65)
Patient and relative transportations	147.26 (20.44 to 490.56)	112.70 (20.44 to 347.48)
Total cost per patient	835.24 (204.84 to 2,964.18)	933.10 (543.45 to 6,739.33)

MC=multidisciplinary care; SC=standard care

Table 3. Total costs, QALYs, and ICER per patient per year at 12-month follow-up period

Group	Total cost (\$)	Difference cost (\$)	QALYs	Difference QALYs	ICER
SC	933.10	-	0.72	-	-
MC	835.24	- 97.86	0.78	0.06	Dominant

MC=multidisciplinary care; SC=standard care; QALYs=quality-adjusted life years; ICER=incremental cost-effectiveness ratio

Discussion

Cost-utility analysis was performed to compare the HF_{rEF} patients in the MC and the SC groups within a 12-month period. MC showed lower cost of an incremental benefit compared with SC; thus, MC was considered the dominant strategy. Therefore, the MC program could result in a 1-year cost-saving at 97.86 USD per patient.

MC groups received treatment with close patient follow-up to help reduce the burden of symptoms of HF. Therefore, this group of patients had better life quality with a lower hospitalization rate. This also led to lower a laboratory cost and hospitalization cost in the MC group compared with the SC group. The present study results were conformed to the previous study results, which stated that MC helped lower the hospitalization rates from HF symptoms^(6,15). Therefore, MC in patients with HF was considered the integral development of HF patient care that facilitated reduction in hospitalization and laboratory costs. Because patients presenting with acute decompensated HF required a follow-up laboratory test, patient care enabled cost savings. Moreover, it promoted better patients' quality of life, which conformed to the previous study^(16,17).

Patients in the MC group used more drugs such as angiotensin-converting-enzyme inhibitor/angiotensin receptor blocker, beta-blocker, and mineralocorticoid receptor antagonist, to control HF symptoms. This is evident from the higher drug costs in accordance with the previous studies^(8,10). Besides, care of patients with HF by specialized multidisciplinary clinics caused more patients in the MC group to visit physicians than those in the SC group. Because the closer follow-up by physicians required more frequent appointment, the MC group had a higher cost of transportation than the SC group. Moreover, MC used more personnel, such as physicians, nurses, physical therapists, pharmacists, psychologists, nutritionists, and health educators, in patient care at home than SC; consequently, the cost of patient care for outpatient clinics was higher than that in SC. However, considering all costs, it was found that MC had a lower total cost because of lower

hospitalization rates and cost of inpatient treatment. The laboratory costs were also lower than those in SC.

The limitations of the present study were the incomplete recorded data and uncontrolled factors as this was a retrospective study. The researchers had not settled the adverse effects, and dose titration was at the cardiologists' discretion. Moreover, additional costs from out-of-pocket external hospitalization for patients were excluded among the total costs.

HF is the main economic burden in term of health owing to the high medication costs from hospitalization and device use. Specialized multidisciplinary clinics help improve patients' access to treatment and better outcomes with cost-saving for patient care.

Conclusion

The present study findings provide the implications toward the improvement of patients with HF_{rEF} in multidisciplinary clinics in Thailand. The present study finding may also suggest outcome improvement policies for patients with HF_{rEF} to lower the complication risks and save costs in the healthcare system.

What is already known on this topic?

Treatment for patients with HF symptoms is complicated and difficult to perform since patients need to adjust their lifestyles. Patients with HF should receive MC in order for them to receive the most efficient care. Disease management of specialized multidisciplinary clinics has reflected the improvement outcomes of patients with HF in a number of health conditions

What this study adds?

Specialized MC in the management of patients with HF_{rEF} shows lower cost and incremental benefit compared to standard treatment. It may also suggest the outcome improvement policies for the patients with HF_{rEF} to lower the complication risks and save costs in the healthcare system.

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Conflicts of interest

No potential conflict of interest relevant to this

article was reported.

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