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Original article

Economic benefits of medication reconciliation performed by pharmacists in Heart Failure Clinic

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Background: Patients with heart failure (HF) are commonly prescribed medications from multiple healthcare providers, sometimes duplicated. This leads to costly excessive, unused, or expired medications.
Objectives: To evaluate the economic benefits of medication reconciliation (MR) performed by pharmacists on medication saving cost in HF patients and to propose a MR model in ambulatory setting.
Methods: This is a cross-sectional study conducted at the Heart Failure Clinic in November 2018. Patients were asked to bring all tablets of their current medications from each provider and over the counter. The MR was performed by pharmacists to obtain complete patients' medication history which was then reconciled with any new prescriptions. Pharmacists completed the prescriptions by filling in the amount of each drug up to next appointment by taking patients' remaining tablets into account. Medication saving cost was considered if patients' own drugs were continued and was calculated based on patients' remaining tablets and hospital drug price.
Results: A total of 99 patients with 111 patient-visits were consecutively included. The total saving cost from MR was 176,011.8 Thai baht (THB) in 93 patient-visits (84.0%) with a median monthly saving cost of 508.8 (IQR: 143.8 – 2,379.5) THB. The median of money saved on essential and non-essential drugs were 302.5 (IQR: 62.0 – 542.3) THB and 0 (IQR: 0 – 1,644.0) THB, respectively ($P = 0.351$).
Conclusion: MR performed by pharmacists substantially saved medication cost in HF clinic patients with an extrapolation of 2,112,142 THB annually.

Keywords: Medication reconciliation, heart failure, ambulatory setting, cost saving.

Heart Failure (HF) is a heart condition with a five-year mortality rate of approximate 40.0% after being hospitalized with HF.[1] According to the American Heart Association, the incidence of HF is 10 per 1,000 persons at the age of 65 years or older and increases with advancing age.[1] In 2009, the estimated direct and indirect expenditures on HF management in the United States were $37.2 billion.[1] One study showed that mean monthly medication cost of HF outpatients was $438 per patient and increased with the number of comorbidities.[2] In relation to an annual hospitalization rate of 30.0 – 40.0% and comorbidities are quite common in patients with HF;[3] therefore, they tend to visit multiple healthcare settings. During transition of care across settings, medication reconciliation (MR) is needed in order to prevent medication discrepancies and to communicate medication information.

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MR is a process of obtaining a complete list of patient's medication history, comparing and reconciling with newly prescribed orders at every transition of care to prevent medication errors that may lead to adverse drug events and poor clinical outcomes.[4] Studies have shown that MR performed by pharmacist improves medication safety by significantly reducing medication errors, diminishes drug related emergency department visits and prevents unnecessary costs.[5 - 8] Karnon J, *et al.* [9] demonstrated that pharmacist-led MR was a cost-effective intervention to prevent medication errors during hospitalization. However, most studies were conducted in inpatient settings including admission, ward transition and discharge. Limited number of studies evaluated the impact of MR on clinical and financial outcomes in an ambulatory setting.[10, 11]

To our knowledge, there are no published studies that demonstrate a direct economic benefit of MR in ambulatory settings of HF care in Thailand. Moreover, optimal practice of MR process in ambulatory care is not widely standardized and requires further discussion among healthcare providers and organizations.[10] The aims of this study were to evaluate the impact of MR performed by pharmacists on medication cost saving in heart failure clinic and to propose a MR model in ambulatory setting.

Materials and methods

Study design and patients

This was a single center, cross-sectional, non-blinded study conducted at King Chulalongkorn Memorial Hospital. This study consecutively enrolled patients who were followed up at the heart failure clinic from 1–30 November 2018. Patients' characteristics, comorbidities, medical treatment regimen and patient's health care scheme were reviewed from hospital electronic database and heart failure clinic form. The study has been approved by the Institutional Review Board of the Faculty of Medicine, Chulalongkorn University No. 237/62.

Medication reconciliation

Patients were asked to bring all tablets of their medications to the clinic. MR was performed by HF pharmacists before and after the patients were seen by the cardiologists (referred as pre-MD MR and post-MD MR, respectively) as shown in Figure 1. During the pre-MD MR, pharmacists performed comprehensive medication review from hospital electronic database, HF clinic form and patients' own medications to make complete and accurate list of patients' medication history and documented patients' remaining tablets of each drug. Furthermore, the pharmacists also assessed on medication adherence, identified drug related problems (DRPs) and collaborated with cardiologists and nurses to resolve DRPs.

During the post-MD MR, after patients had been examined by cardiologists and medications had been prescribed, pharmacists reconciled new prescriptions with patients' medication history and completed the prescriptions by filling in the amount of each drug up to next appointment by taking patients' remaining tablets into account. The pharmacists also provided patient counseling if any drug regimens were changed, resolved DRPs and provided them with written summarized medication information in order to communicate with other healthcare providers (Figure 1). Because of the difference in drug formulary between hospitals, medication with multiple brand names, which contained the same active ingredient (the same generic name) and has identical strength and formulation, was considered pharmaceutically equivalent and interchangeable. In these cases, the patients would be counselled to continue their own drugs until finish then followed by the new brands.

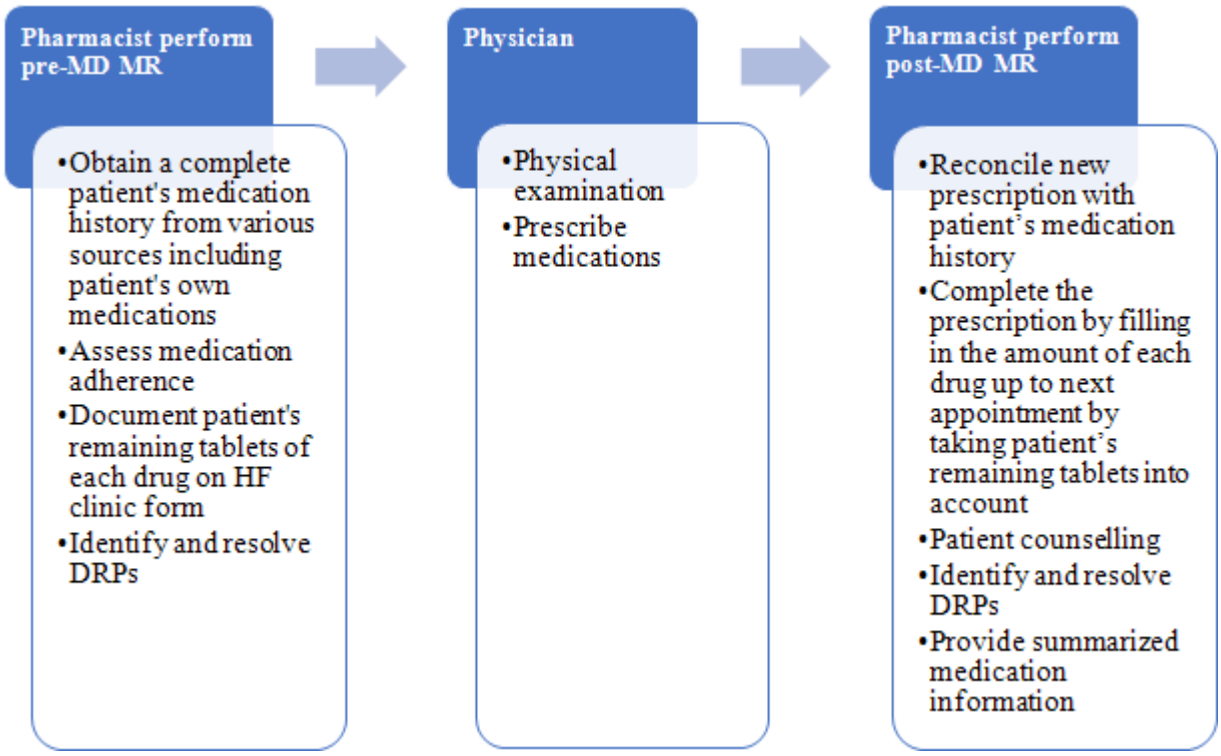
Medication cost saving

Medication cost saving was considered if patients' own drugs were continued and the number of tablets prescribed were saved based on patients' remaining tablets. In contrast, cost saving was disregarded if the patients did not bring their own medications or medications list and the number of remaining tablets to the clinic. Cost saving was calculated based on hospital drug prices as follows:

Cost saving of each drug = (Total amount intended to prescribe – Total amount exactly prescribed*) x drug price

*Total amount exactly prescribed = Total amount intended to prescribe – Patient's remaining tablets

Medication was classified based on Thailand National List of Essential Medicines 2018,[12] which categorized medication list as non-essential and essential drugs, and patient's health care scheme i.e., universal health coverage (UHC) scheme, civil servant medical benefit scheme (CSMBS), social health insurance, The Thai Red Cross Society insurance, state enterprise officer and payment.



DRPs = Drug related problems, HF = Heart Failure, MR = Medication reconciliation.

Figure 1. Process of MR performed by pharmacist.

Statistical analysis

The continuous data are presented as mean ± standard deviation (SD) or median and interquartile range (IQR; 25th and 75th percentile) as appropriate. The categorical data are presented as number and percentage. Comparison between non-essential and essential drug cost saving was performed by Students *t* - test or Wilcoxon signed ranks test as appropriate using $P < 0.05$ as a statistical significance. All data were analyzed using Microsoft Excel 2016 and IBM SPSS Statistics for Windows (Version 22.0, IBM Corp., Armonk, NY).

Results

A total of 99 patients, 11 (11.0%) patients were first visit patients and 46 (46.0%) patients visited at least 2 ambulatory care settings, with 111 patient-visits were consecutively enrolled.

The pre-MD MR and post-MD MR were performed in 109 (98.0%) patient-visits. Two patients were omitted from post-MD MR; one was transferred to the emergency room and the other did not receive any prescription. The patient characteristics and health care scheme are presented in Table 1. The mean age of the patients was 57.6 ± 15.9 years. Seventy-three patients (74.0%) were male. Based on the European Society of Cardiology definition,[3] there were 70.0%, 13.0% and 17.0% of patients categorized as HF with reduced (left ventricular ejection fraction (LVEF) less than 40.0%), mid-range (LVEF 40.0 – 49.0%) and preserved (LVEF greater than or equal to 50.0%) ejection fraction, respectively. The mean LVEF was 34.2 ± 15.8%. Regarding health care scheme, 36.0% used UHC scheme; 28.0% used CSMBS; 15.0% used social health insurance; 3.0% used The Thai Red Cross Society insurance; 1.0% used state enterprise officer and 17.0% were cash payment.

There were 93 patient-visits (84.0%) which MR resulted in total cost saving of 176,011.8 THB. The median cost saving was 508.8 (IQR: 143.8 – 2,379.5) THB. When classified by Thailand National List of Essential Medicines, there were 120,468.5 THB and 55,543.3 THB saving cost of non-essential drugs and essential drugs, respectively. The median of money saved on non-essential and essential drugs were 0 (IQR: 0 – 1,644.0) THB and 302.5 (IQR: 62.0 – 542.3) THB, respectively ($P = 0.351$). The weekly medication cost saving is shown in Figure 2. The average weekly saving cost was 44,003 THB.

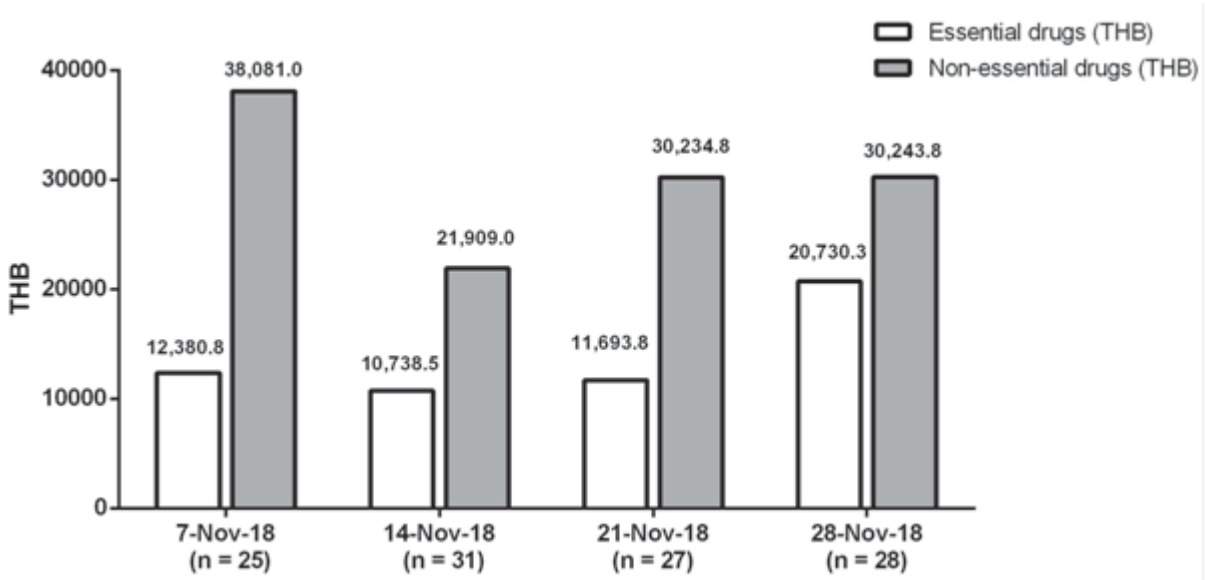
Figure 3 shows saving cost classified by patients' health care scheme. Total saving cost was 95,047 THB in CSMBS, 54,608.8 THB in UHC scheme, 11,497.8 THB in payment, 7,725.8 THB in social health insurance, 4,011.3 THB in The Thai Red Cross Society and 3,121.3 THB in state enterprise officer. The cost saving of non-essential drugs was more pronounced than the essential ones in all schemes; however, the significant difference between saving cost of non-essential and essential drugs was observed only in CSMBS [median (IQR); 882.5 (0 – 2,936.3) THB vs 318.8 (64.4 – 531.2) THB; $P = 0.007$].

The saving cost of each drug is demonstrated in Figure 4. Regarding the value, the leading drugs that we saved cost were Sacubitril/Valsartan 68,544 THB, Ivabradine 15,877.5 THB and non-vitamin K antagonist oral anticoagulants (NOACs) 14,900 THB.

Table 1. Patient characteristics and health care scheme.

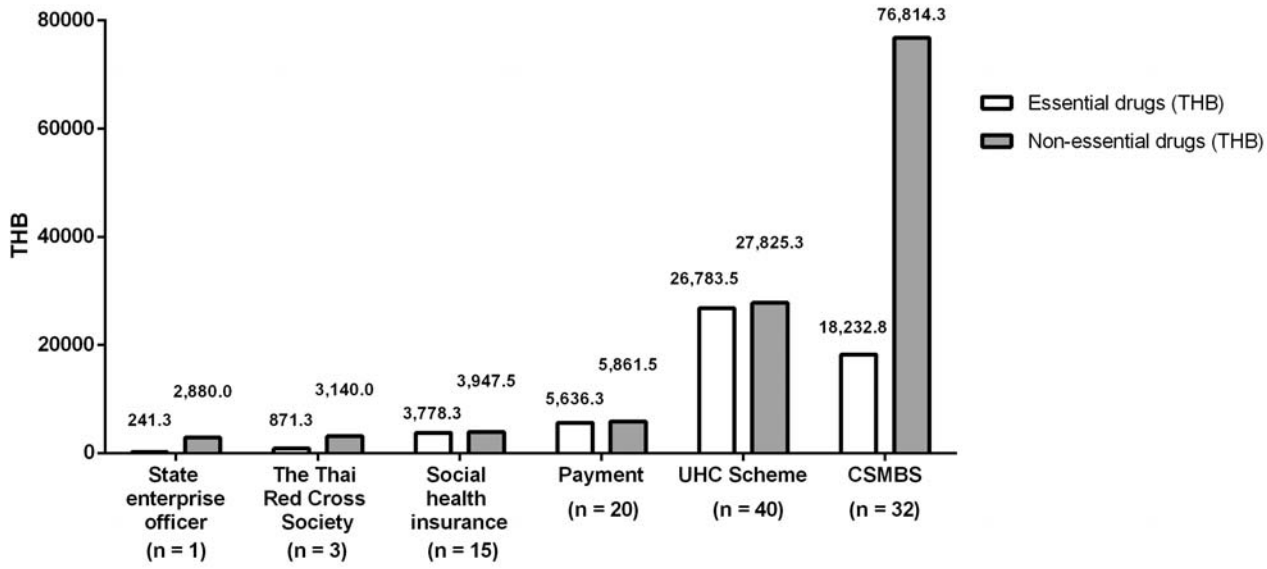
Patient characteristics	**n = 99 (%)**
Age (years) (mean ± SD)	57.6 ± 15.9
Male	73 (74.0)
LVEF (%) (mean ± SD)	34.2 ± 15.8
LVEF < 40.0 %	69 (70.0)
LVEF 40.0 – 49.0 %	13 (13.0)
LVEF ≥ 50.0 %	17 (17.0)
NYHA functional class	
I	16 (16.0)
II	66 (67.0)
III	17 (17.0)
IV	0 (0.0)
Cause of HF	
Ischemic	41 (41.0)
Non-ischemic	57 (58.0)
Unknown	1 (1.0)
Comorbidity	
Hypertension	10 (10.0)
Diabetes	33 (33.0)
Atrial fibrillation/flutter	31 (31.0)
Chronic kidney disease	17 (17.0)
COPD/asthma	5 (5.0)
Dyslipidemia	23 (23.0)
Gout	15 (15.0)
Pulmonary hypertension	8 (8.0)
History of stroke or TIA	13 (13.0)
Anemia	6 (6.0)
Health care scheme	
UHC scheme	35 (36.0)
CSMBS	28 (28.0)
Social health insurance	15 (15.0)
Thai Red Cross Society insurance	3 (3.0)
State enterprise officer	1 (1.0)
Payment	17 (17.0)

COPD = chronic obstructive pulmonary disease, CSMBS = civil servant medical benefit scheme, HF = heart failure, LVEF = left ventricular ejection fraction, NYHA = New York Heart Association, TIA = transient ischemic attack, UHC = universal health coverage.



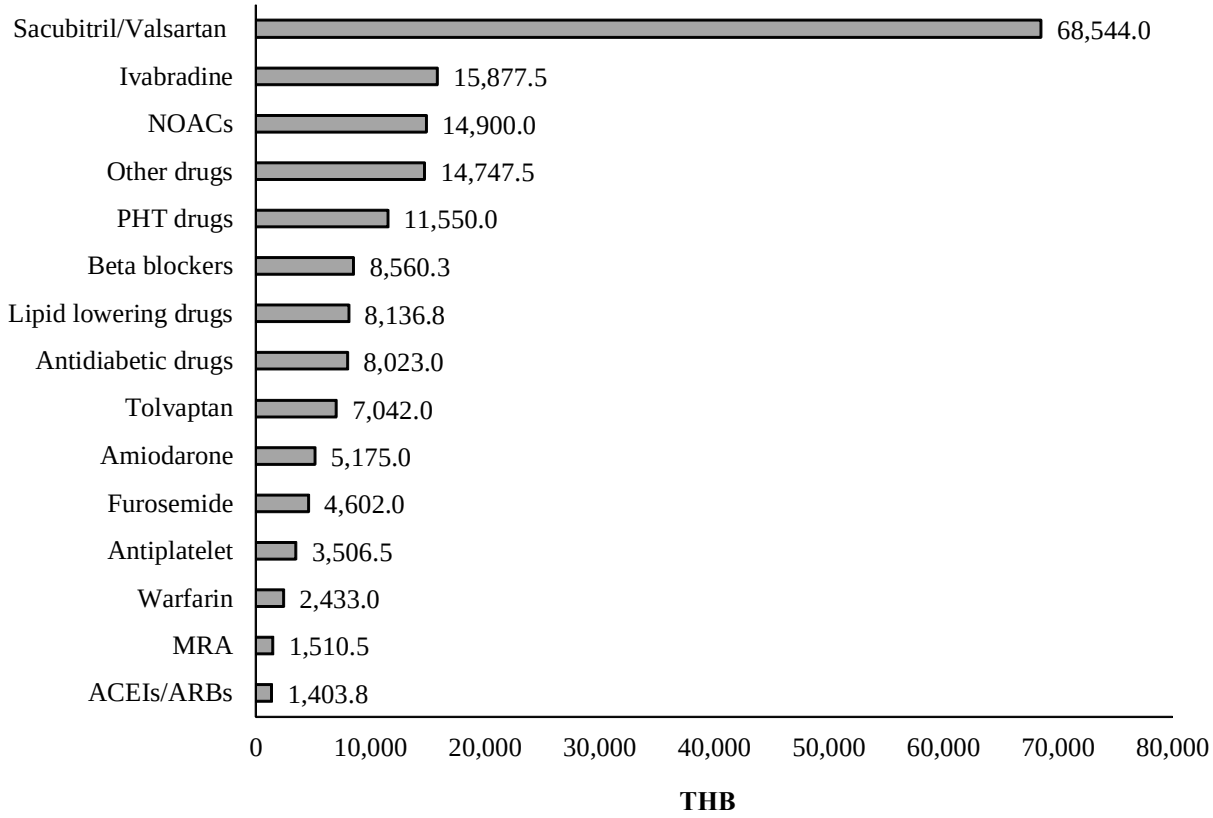
THB = Thai Baht

Figure 2. Weekly medication saving cost.



CSMBS = civil servant medical benefit scheme, THB = Thai Baht, UHC= universal health coverage

Figure 3. Medication saving cost of different care schemes.



ACEIs = angiotensin converting enzyme inhibitors, ARBs = angiotensin receptor blockers, MRA = mineralocorticoid receptor antagonist, NOACs = non-vitamin K antagonist oral anticoagulants, PHT = pulmonary hypertension, THB = Thai Baht

Figure 4. Saving cost of each drug.

Discussion

This study shows that MR performed by pharmacists substantially saved patients' medication cost in HF clinic. In present study, comorbidities were common in patients with HF. Most common ones were diabetes (33.0%), atrial fibrillation/flutter (31.0%), dyslipidemia (23.0%) and chronic kidney diseases (17.0%). Patients with HF especially individuals with comorbidities are more likely to visit and receive medications from multiple specialty clinics such as endocrine, nephrology or cardiovascular thoracic surgery clinic. Without an effective communication between health care providers and patients or among providers across settings, this may lead to unnecessary drug problems: unused or expired medications and excessive drug costs. For example, patients who were referred from other hospitals and received different trade name drugs which theirs packaging are completely different from ours, may dispose of their own drugs and start taking the newly prescribed ones or they may take both products without realizing that they are the same. Moreover, patients' unexpired medications that were temporarily omitted during hospital admission could be reconciled with the newly prescribed orders at ambulatory setting and restarted if appropriate in order to reduce medication waste and save cost.

Numerous studies showed that MR conducted by pharmacists improved patient medication safety, avoided cost related medication errors and was evaluated as a cost effective intervention in prevention of medication errors during hospitalization.[5, 6, 9, 13 - 15] However, implementing MR performed by pharmacists in ambulatory settings is limited by time constraint, lack of resources and standardized process of MR in practice.[10] In our clinic, which comprises of multidisciplinary teams including cardiologists, nurses, pharmacists and dietician, pharmacists are responsible for performing pre-MD and post-MD MR. Our study showed that MR conducted by pharmacists in HF clinic saved medication cost up to 176,011.8 THB per month and might be extrapolated to 2,112,142

THB annually. One study showed similar results that appropriately patients' own medications management during MR at hospital discharge could have saved annual cost of □15,000.[16]

New medications for HF with promising outcomes have been introduced, including Sacubitril/Valsartan and Ivabradine;[3, 17] however, these drugs are costly and are not listed in the Thailand National List of Essential Medicines.[12] Similarly, the newer medicines for managing common comorbidities in patients with HF such as NOACs[18] are costly and are not listed as essential drugs. However, we managed to saved cost of these 3 costly drugs including Sacubitril/Valsartan, Ivabradine and NOACs up to 99,321.5 THB per month.

In terms of payers, MR saved monthly cost to the payers ranged from 3,121.3 THB to 95,047 THB which maximum saving cost was evidenced in CSMBS. Non-essential drugs saving cost was more prominent in all schemes; however, non-essential drugs are not generally covered by all health care scheme. These would be patients' financial responsibility. Therefore, saving non-essential drugs costs would decrease burden on patients. Consequently, MR performed by pharmacists is financial benefit to hospital payers including the government, social security fund, insurers and patients.

However, there are limitations in this study that could be addressed in future research. First, applicability of our findings to non-pharmacist involvement MR model may be limited. Second, this study lacks a control group; therefore, the significance of financial benefit of this intervention cannot be drawn. Finally, our study was designed to focus only the impact of MR on direct cost saving by tablet counting. The indirect saving cost including cost avoidance from prevention of medication errors related hospital admission or emergency department visit requires further studies. Therefore, a full economic evaluation such as cost-effectiveness analysis of MR performed by pharmacists in ambulatory settings is needed.

Conclusion

MR performed by pharmacists in a HF clinic setting saved annual medication cost more than 2 million THB. The saving cost of non-essential drugs was more pronounced than the essential ones. The financial benefits were reported in all health care scheme. This should be informative to health policymakers and healthcare providers in facilitating broader implementation of MR model into ambulatory settings.

Conflict of interest

The authors declare no conflict of interest.

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