Annals of Pharmacotherapy
1–8

DOI: 10.1177/1060028019882685
journals.sagepub.com/home/aop
SAGE

Impact of Pharmacist Involvement in Heart Failure Transition of Care

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Abstract

Background: Heart failure (HF) transition of care (TOC) programs may improve continuity of care and coordination and decrease hospital readmissions. **Objective:** This study evaluated the impact of pharmacy-led HF TOC on HF readmission rate. **Methods:** This was a single-center, pre-post quasi-experimental study. Pharmacy TOC comprised admission and discharge medication reconciliations and patient education. Patients were included if they had a primary HF diagnosis. Patients were excluded if they were admitted for a non-HF diagnosis, admitted for <24 hours, had a stage IV cancer or dementia diagnosis, or were transferred to hospice care. The primary outcome was HF 30-day readmission rate. **Results:** A total of 663 patients were included in the study: 330 in the control group and 333 in the intervention group. The average age for both groups was 67 ± 16 years; 48.1% were female; 56.9% were African American; and 51.4% of patients had an ejection fraction ≤40%. In the control group, 57 (17.3%) patients had a HF 30-day readmission compared with 35 (10.5%) patients in the intervention group. After adjusting for age, the intervention group continued to show a difference in readmission (odds ratio = 0.578; 95% CI = 0.367-0.911; $P = 0.018$). The most common interventions were medication addition (11%), dose titration (7.5%), medication discontinuation (6.6%), and duplication avoidance (2.7%). **Conclusion and Relevance:** Pharmacy-led HF TOC, as a component of a targeted hospital-based initiative, significantly decreased HF 30-day readmission rate. Results from this study warrant further research to explore which interventions in TOC are most effective.

Keywords

heart failure, medication reconciliation, patient readmission, transitions of care, patient education

Introduction

Heart failure (HF) affects approximately 6.2 million adults in the United States.[1] It is projected that the prevalence of HF will increase to more than 8 million adults by 2030 and the total cost of HF will more than double to approximately $69.7 billion.[2] In 2011, HF was reported to be the leading cause of 30-day readmissions among Medicare patients. Consequently, the Centers for Medicare and Medicaid Services (CMS) announced a rule that reduced reimbursement by up to 3% to medical institutions with excessive risk-standardized readmission rates for HF within 30 days following hospital discharge.[3] As a result, medical institutions have implemented transition of care (TOC) programs to ensure that HF patients receive optimal treatment in the hospital and continue to adhere to therapy after discharge.

TOC is defined as a set of "actions designed to ensure the coordination and continuity of health care, as patients transfer between different locations or different levels of care within the same location."[4(p556)] Furthermore, the Joint Commission National Patient Safety Goals recommend that medication reconciliation be performed during all levels of TOC to reduce negative patient outcomes associated with medication discrepancies.[5] Medication reconciliation is defined as a process of comparing patient's medication orders to all the medications that the patient has been taking to avoid medication errors such as omission, duplications, dosing errors, and interactions.[6]

There have been several studies that assessed the impact of pharmacist-led TOC programs. One TOC program at a

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390-bed community teaching hospital involving a pharmacist, resident, student, and HF nurse navigator performed admission medication review, discharge medication review, and discharge counseling. This program demonstrated a 2% and 0.9% absolute reduction in HF 30-day and all-cause readmissions, respectively, increased patient satisfaction, and improved CMS HF core measures compliance rate.[7] Additionally, a study by Eggink et al[8] showed that the involvement of a clinical pharmacist in discharge services significantly reduced the risk of medication discrepancies and prescriptions errors among patients with HF. The most common discrepancy was patients restarting a discontinued medication at home, and the most common error was prescription of an incorrect dose. Finally, a systematic review of randomized trials demonstrated that patients who received pharmacist-directed TOC had reduced rates of all-cause hospitalization (odds ratio [OR] = 0.71; 95% CI: 0.54-0.94) and HF-related hospitalization (OR = 0.69; 95% CI: 0.51-0.94).[9]

In the fiscal year of 2016, 46% of the 30-day hospital readmissions at Ascension were because of HF. In comparison, the national median HF 30-day readmission rate for the same fiscal year was 21.4%.[10] Locally within the Detroit metropolitan area, HF 30-day readmission rate ranges between 21.1% and 23.4%.[11] Accordingly, Ascension launched the Heart Failure Medication Management Goal initiative in October 2016 to work toward the goal of reducing 30-day readmissions for HF patients. At Ascension St John Hospital, a pharmacy-led HF TOC program was implemented in June 2017 to help achieve this goal. This program, which involves pharmacists, residents, and students, focuses on the provision of patient education prior to discharge and completion of medication reconciliation for patients with HF on admission and before discharge. The purpose of this project is to evaluate the impact of pharmacy-led discharge counseling and medication reconciliation on the HF readmission rate.

Methods

This was a single-center, retrospective quasi-experimental study using a pre-post design to evaluate the impact of a pharmacy-led TOC program in reducing HF 30-day hospital readmissions. The study was conducted at Ascension St John Hospital, a 772-bed community teaching hospital in Detroit, Michigan.

Patients were included if they were admitted to cardiac medical floors with a primary or new diagnosis of HF between March 1, 2016, and August 31, 2018. The HF TOC program at Ascension St John Hospital was implemented in June 2017. Patients who were admitted from March 1, 2016, through November 30, 2016, comprised the control study group. Patients admitted from March 1, 2018, through August 31, 2018, who met the inclusion criteria served as the intervention study group. This study period was selected as it corresponded to the time when the HF TOC program was fully implemented, with a standardized monitoring, intervention, and documentation process in place. For patients with multiple index admissions within the study period, only the first index admission was included. Patients were excluded if they were admitted for a non–HF-related diagnosis, admitted for 24 hours or less, had a stage IV cancer diagnosis, were transferred to hospice care on discharge, or had a dementia diagnosis, including Alzheimer's disease, Lewy body dementia, frontotemporal dementia, or mixed dementia. Patients who met the inclusion criteria in the control study group were excluded from the intervention study group. The study was approved by the investigational review board.

The primary outcome of this study was to compare the effect of pharmacy led-TOC on the HF 30-day hospital readmission rate. Secondary outcomes were to evaluate time to HF 30-day hospital readmission, number and nature of pharmacy interventions, and Joint Commission HF quality measure compliance rate, specifically looking at β-blocker use in HF patients with reduced ejection fraction with a left-ventricular ejection fraction (LVEF) ≤40%. Data collected from patients' medical records included demographic information, discharge disposition, hospital length of stay, 30-day hospital readmissions, and pharmacy interventions.

Program Description

The HF TOC program focused on HF patients admitted to the cardiac medical floors. The program involved pharmacists, postgraduate year 1 residents, professional years 3 and 4 pharmacy students, and paid interns. All pharmacy students and interns received a 2-day training followed by supervised training on the patient care unit under the direction of HF TOC clinical pharmacists. Patients were primarily managed by cardiologists and their nurse practitioners. All admitted patients with a primary or new diagnosis of HF were identified using Sentri7, a real-time clinical surveillance system used for patient monitoring and documentation of pharmacy interventions. Three main interventions were attempted for all identified patients. This included (1) admission medication reconciliation, which was completed on admission through patient interview, and review of the patient's refill record and outside medical records, if available; (2) discharge medication reconciliation, where medication discrepancies were addressed and discussed with physicians prior to the provision of patient discharge instructions; and (3) patient or caregiver counseling with a focus on HF medications through verbal and written education materials. Materials were from the Heart Failure Society of America (https://www.hfsa.org/patient/patient-tools/educational-modules) and an internally developed

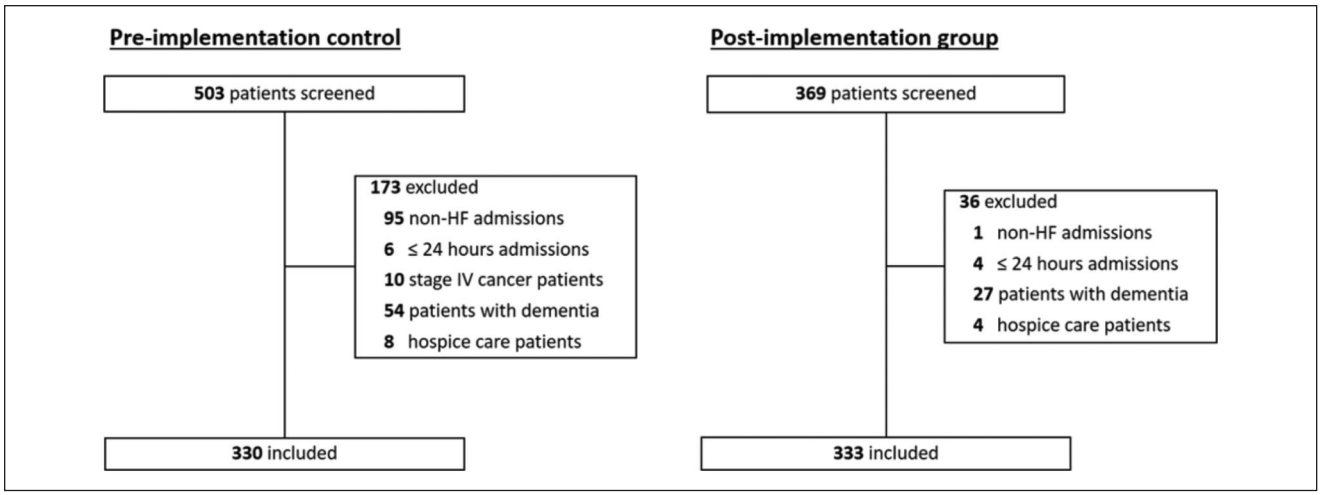

Figure 1. Screening flow diagram: During the study period, a total of 872 patients were screened; 173 (34.3%) patients were excluded in the control group based on the exclusion criteria, leaving 330 patients for the analysis. For the intervention group, 36 (9.8%) patients were excluded, leaving 333 patients for analysis.
Abbreviations: HF, heart failure; IV, intravenous.

education handout (Appendix 1, available online). A HF nurse navigator provided patients with more detailed lifestyle education than that provided by the pharmacy team, which included education on fluid and sodium restriction, exercise, and weight monitoring. Patients were also provided with a personalized medication calendar and a pill box prior to discharge and offered the first fill service, which provided up to 30-day supply of medications delivered to the bedside prior to hospital discharge. Pharmacist services were provided Monday through Sunday from 7:00 AM to 3:30 PM. Patients discharged after the regular hours would follow the institution standard discharge process without a clinical pharmacist involvement.

Statistical Analysis

Sample size was calculated using institutional data from July 2017 to June 2018, which showed a 20% HF-related readmission at 30 days. It was estimated that a sample size of 329 patients per group would provide 80% power to demonstrate an 8% absolute rate reduction in the rate of HF 30-day readmission in the intervention group with an α error rate of 0.05. Descriptive statistics were used to characterize the study group. Continuous variables were described as means $\pm$ SDs. Categorical variables were described as frequency distributions. Differences between the control and intervention groups were assessed using the χ^2 test and Student *t*-test. The log-rank test was used to analyze time to HF 30-day readmission. Multivariable analysis was performed using logistic regression. Variables were considered for inclusion into the model if there was a difference between study groups and there was an association with HF-related 30-day readmission ($P < 0.1$). All data was analyzed using SPSS version 25.0, and a P value of 0.05 or less was considered to indicate statistical significance.

Results

A total of 872 patients were screened for study inclusion, with 330 being included in the control group and 333 in the intervention group (Figure 1). Descriptive baseline characteristics of the groups are presented in Table 1. The mean ages of the patients in the control and intervention groups were 66 $\pm$ 16.6 and 68.6 $\pm$ 14.9 years, respectively. More than 50% of patients in both cohorts had a LVEF on admission of 40% or less. Baseline characteristics between the 2 groups were similar, with the exception of age, cerebrovascular disease, and length of stay. Patients in the control group had a higher average length of stay (5.6 $\pm$ 3.8 vs 4.9 $\pm$ 3.3 days, $P = 0.008$). Inpatient medications such as furosemide infusion, inotrope infusion, metolazone, and vasodilator infusion, which were indicators of HF severity, were similar between the 2 groups.

Patients' transitions of care characteristics are presented in Table 2. The most common primary admitting diagnosis was HF. Most patients (94%) were admitted from home. Evaluation of discharge medications indicated statistically significant difference between the groups in terms of angiotensin II receptor blockers, β-blockers, diuretics, and hydralazine and nitrate, with more patients in the intervention group discharged with these medications. More patients in the intervention group were discharged home, whereas more patients in the control group were discharged to rehabilitation facilities, transferred to different institutions, or

Table 1. Baseline Demographics.[a]

	Control (n = 330)	Intervention (n = 333)	*P* Value
Mean age, years	66.0 ± 16.6	68.6 ± 14.9	0.032
Female	159 (48.2)	160 (48.0)	1.000
Race			
White	138 (41.8)	127 (38.1)	0.131
Black	180 (51.5)	197 (59.2)	
Other	4 (1.2)	7 (2.1)	
Declined to specify	8 (2.4)	2 (0.6)	
Comorbidities			
Atrial fibrillation	143 (43.3)	149 (44.7)	0.714
Diabetes mellitus	148 (44.8)	166 (49.8)	0.197
Coronary artery disease	181 (54.8)	172 (51.7)	0.409
Chronic obstructive pulmonary disease	137 (41.5)	145 (43.5)	0.597
Hypertension	297 (90.0)	301 (90.4)	0.866
Cerebrovascular accident	29 (8.8)	48 (14.4)	0.024
Chronic kidney disease	153 (46.4)	154 (46.2)	0.976
End-stage renal disease	13 (3.9)	9 (2.7)	0.374
Average length of stay, days	5.6 ± 3.8	4.9 ± 3.3	0.008
Left-ventricular ejection fraction on admission			
≥50%	115 (34.8)	123 (36.9)	0.151
41%-49%	36 (10.9)	39 (11.7)	
≤40%	172 (52.1)	169 (50.8)	
Unknown	7 (2.1)	2 (0.6)	
Inpatient medications			
Furosemide infusion	32 (9.7)	22 (6.6)	0.146
Inotrope infusion (dobutamine, milrinone)	60 (18.2)	50 (15)	0.273
Metolazone	46 (13.9)	32 (9.6)	0.084
Vasodilator infusion (nitroglycerin, sodium nitroprusside)	45 (13.6)	49 (14.7)	0.691

[a]Values are mean ± SD or n (%).

left against medical advice ($P = 0.038$). A total of 93 (28.2%) patients in the control group utilized the first fill service compared with 185 (55.6%) patients in the intervention group. The types of insurance coverage between the 2 groups were similar.

A total of 57 (17.3%) patients in the control group had a HF readmission within 30 days postdischarge compared with 35 (10.5%) patients in the intervention group ($P = 0.002$). Multivariate logistic regression analysis controlling for age showed a difference in HF 30-day readmission rate (OR = 0.578; 95% CI: 0.367-0.911; $P = 0.018$). Adjusting for age and length of stay did not change the estimate for the intervention (OR = 0.596; 95% CI: 0.377-0.941; $P = 0.026$). Other differences in baseline characteristics (ie, β-blocker, Cerebrovascular accident) did not influence the estimate of the intervention. The number needed to treat to prevent 1 HF 30-day readmission was 15. Additionally, time to HF 30-day readmission was shorter in the control group (Figure 2). The average time to HF 30-day readmission for all included patients was 12.9 ± 8 days.

In the intervention group, medication reconciliations on admission and at discharge were completed for 87% and 56% patients, respectively; 99% of patients received education on discharge medications prior to their discharge. The pharmacy team communicated a total of 106 discharge interventions to patients' physicians. Some of the most common interventions included the addition of medication, 11% (n = 37); dose titration, 7.5% (n = 25); treatment discontinuation, 6.6% (n = 22); and duplication avoidance, 2.7% (n = 9). The rate of β-blocker therapy (ie, bisoprolol, carvedilol, sustained-release metoprolol succinate) prescribed for HF patients with LVEF of <40% was higher in the intervention group, although not statistically significant (88% vs 93%; $P = 0.212$).

Discussion

The present study aimed to evaluate the impact of pharmacy-led medication reconciliation and discharge counseling on HF readmission rate. We found that the pharmacy-led

Table 2. Transitions of Care Characteristics.[a]

	Control (n = 330)	Intervention (n = 333)	*P* Value
Primary admitting diagnosis			
Heart failure	242 (73.3)	268 (80.5)	0.092
Atrial fibrillation	17 (5.2)	17 (5.1)	
Acute coronary syndrome	9 (2.7)	2 (0.6)	
Chronic obstructive pulmonary disease	8 (2.4)	13 (3.9)	
Other	54 (16.4)	33 (9.9)	
Admitted from			
Home	313 (94.8)	314 (94.3)	0.003
Nursing home	5 (1.5)	17 (5.1)	
Rehab facility	11 (3.3)	2 (0.6)	
Other	1 (0.3)	0 (0)	
Insurance coverage			
Private	155 (47.0)	178 (53.5)	0.095
Government	175 (53.0)	155 (46.5)	
Discharge medications			
Angiotensin-converting enzyme inhibitor	111 (33.6)	97 (29.1)	0.211
Angiotensin receptor blocker	41 (12.4)	77 (23.1)	<0.001
Angiotensin receptor-neprilysin inhibitor	14 (4.2)	24 (7.2)	0.101
Aldosterone antagonist	72 (21.8)	72(21.6)	0.951
β-Blocker (bisoprolol, carvedilol, metoprolol succinate)	273 (82.7)	297 (89.2)	0.017
Diuretics	261 (79.1)	295 (88.6)	0.001
Hydralazine and nitrate	37 (11.2)	64 (19.2)	0.004
I_f channel inhibitor	1 (0.3)	1 (0.3)	0.995
First fill	93 (28.2)	185 (55.6)	<0.001
Discharge disposition			
Home	253 (76.7)	276 (82.9)	0.038
Nursing home	18 (5.5)	19 (5.7)	
Rehab facility	45 (13.6)	35 (10.5)	
Transfer	3 (0.9)	2 (0.6)	
Left against medical advice	9 (2.7)	0 (0)	
Expired	2 (0.6)	1 (0.3)	

[a]Values are mean ± SD or n (%).

HF TOC program was associated with a significant reduction in HF 30-day readmission rate. This was accomplished without adding an additional pharmacist to our staffing model, which increases the applicability of our findings. At our institution, the pharmacy-led TOC program was added to a decentralized pharmacist assignment without a reduction in scope of patient workload or clinical services, which included pharmacokinetic assessments, anticoagulation management, medication optimization services, and order reviews and verifications. These additional patient care responsibilities within the HF TOC program were feasible through the incorporation of trained pharmacist extenders, which included pharmacy residents, student pharmacists, and pharmacy interns.

Although the overall TOC program improved patient outcomes, we were unable to determine which specific components were driving patient outcomes (ie, admission medication reconciliation, patient education, or discharge interventions such as addition of medication and dose titration). The significantly increased first fill rate in the intervention group, providing patients with improved access to medications postdischarge, could have also led to the improved patient outcome observed in our study. This is especially true for patients with their preadmission medications adjusted during their admissions. Nonetheless, the outcomes of this study have important patient care and financial implications to the health system.

The results seen in our study concur with previously published research. Although the components of TOC vary within each study, results have consistently demonstrated that pharmacist involvement in the management of patients with HF reduces the rate of HF hospitalization.[7,12-14] A randomized controlled trial with 134 patients conducted at the Duke University Medical Center looked at the effect of clinical pharmacist involvement in the HF management team.[12] Patients in the intervention arm received clinical pharmacist

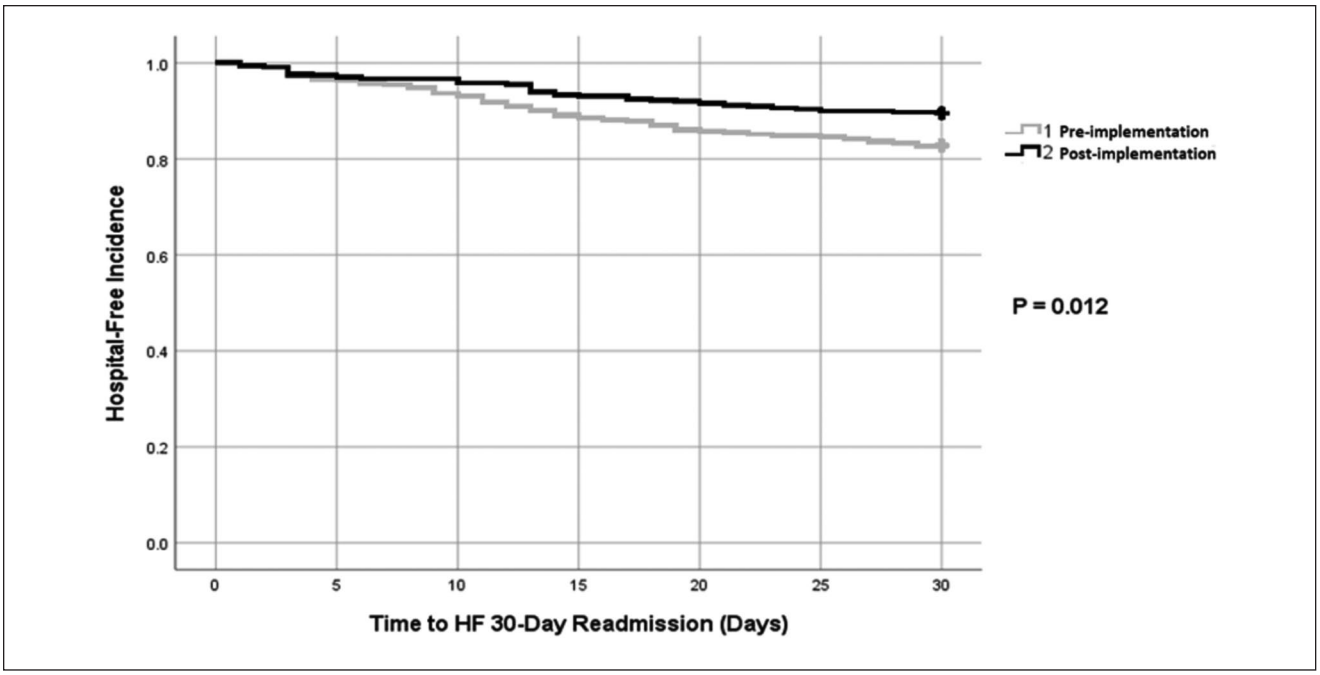

Figure 2. Time to heart failure (HF) 30-day readmission: Kaplan-Meier curve illustrating time to HF 30-day readmission. The *P* value is shown for the log-rank test.

evaluation, which included medication evaluation, therapeutic recommendations to physicians, patient education, and follow-up. The study found that the composite of all-cause mortality and HF events (emergency department visits or HF hospitalizations) was significantly lower in the intervention group (OR = 0.22; 95% CI: 0.06-0.63; $P = 0.05$).

Another randomized controlled trial with 34 patients looked at the impact of pharmacist interventions on HF hospital readmissions.[13] The intervention group received routine care and preparation for discharge consisting of physician discharge instructions and a nurse review of treatment plans, nutrition, and medications. In addition, a pharmacist would review patients' medications, make therapeutic recommendations to physicians, and provide patients with adherence aids. The study reported a significant reduction in HF readmissions in the intervention group (23.5% vs 58.8%; $P < 0.05$).

The observed reduction in HF 30-day readmission rate in our study may have occurred for several reasons. Pharmacy interventions completed at different stages throughout the patient's admission enabled early recognition of potential barriers to adherence. In the Pharmacist Intervention for Low Literary in Cardiovascular Disease (PILL-CVD) study, which evaluated the role of pharmacists in TOC, medication reconciliation was identified as the most important intervention to improve care transitions.[15] The high completion rate of admission medication reconciliation in our study allowed our pharmacists to establish a relationship with the patient at the time of admission, which helped provide individualized patient education and facilitate discharge planning at discharge time. Our program can still improve the proportion of patients who receive discharge medication reconciliation. We attributed the discharge medication reconciliation rate in our study to the number of pharmacist hours provided by our HF TOC program.

Another potential explanation for our observed reduction in HF 30-day readmission rate was the higher rates of guideline-directed medical treatment for HF with angiotensin II receptor blockers, angiotensin receptor-neprilysin inhibitors, β-blockers, and hydralazine and nitrate combination therapy prescribed to patients on discharge in the intervention group. With at least half of our patients admitted with a LVEF of 40% or less, the optimization of these HF medical therapies may significantly benefit these patients in slowing progression of left-ventricular dysfunction and reducing HF hospitalization.

Strengths of our study include a large sample size, which was powered to detect a difference in outcome between the 2 cohorts. Our study design also represents a real-world analysis of pharmacist impact on HF 30-day readmission rate within a heterogeneous patient population setting. Pharmacy students and interns' involvement within the TOC team ensures that a continuous service was provided to our HF patients, even during weekends, although limited by the pharmacy service hours. With this study being completed within a community teaching facility, other hospitals with a similar setting will be able to adopt and apply a study design similar to this study.

Study Limitations

First, given the retrospective nature of the study design and different time periods between the 2 cohorts, our results are susceptible to confounding factors that could not be controlled for. Whereas the roles of the providers, nurses, and clinical pharmacists remained relatively stable throughout the study period, better understanding of HF and advances in medical management of HF that occurred over time were confounders that we could not account for. However, our results agree with previous research. Next, the impact of other ongoing TOC initiatives at the health system on HF 30-day readmission rate could not be captured through our study. In addition to a HF nurse navigator providing patients with comprehensive lifestyle education, part of the goals laid out within our institution initiative included ensuring patient access to medications. Apart from the first fill service provided by our HF TOC program, patient assistance programs such as drug repository programs, Dispensary of Hope, and foundations for copays were developed to help mitigate costs for low-income patients who were unable to afford their medications. The pharmacy provided referrals to case management and social workers as needed to address any financial constraints, access, and other barriers to ensure a smooth discharge planning, although this was not a formal part of the HF TOC program. This may have contributed to the significant reduction in HF 30-day readmission rate seen in our study. Furthermore, data on readmissions to other institutions and adherence to medications could not be collected. However, it is likely that this limitation would affect both control and intervention groups in a similar fashion.

Conclusion and Relevance

Pharmacy-led HF TOC, as a component of a targeted hospital-based initiative, which comprised admission and discharge medication reconciliations and patient education, significantly decreased HF 30-day readmission rate. Hospitals should consider instituting a pharmacy-led TOC if their readmission rates are high for HF patients. This allows pharmacists to participate in hospital-based medication reconciliation and provide tailored patient education to improve transitions of care and reduce HF 30-day readmissions. The encouraging results from this study warrant further trials to explore which interventions in TOC are most effective, thereby improving cost-effectiveness of different models of pharmacist involvement in HF TOC.

Acknowledgments

The authors thank Michael S. Palmer, PharmD, and Suzanna M. Szpunar, PhD, MPH, for their involvement in data retrieval and analysis, respectively. The authors also appreciate Marina Merzlyakova, PharmD, and Evelynne E. Smith, PharmD Candidate, Class of 2022, for their contributions in study data collection.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

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Supplemental Material

Supplemental material for this article is available online.

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