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A multidisciplinary transition of care approach to reduce 30-day readmissions in heart failure patients

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ABSTRACT

Background: While advancements in pharmacologic and device therapies have improved survival, one in five adults with heart failure (HF) patients is readmitted within 30 days of discharge. Thus, the epidemic of HF is largely one of increasing hospitalizations.

Objective: To determine if a comprehensive HF program reduces 30-day readmission rate.

Methods: A convenience sample of adults with Medicare and HF (N = 1617) admitted to a large academic medical center were identified. Patients received HF education by a specialized registered nurse while inpatient and were seen by a pharmacist prior to discharge. Post-discharge, patients were called by a pharmacist within 72 h, followed by an ambulatory care manager for 90 days, and scheduled for a multidisciplinary clinic visit with a nurse practitioner within 7 days of hospitalization. High risk patients were referred to a community health worker (CHW). Clinic services included phlebotomy, education, point-of-care ultrasound, intravenous diuretic administration, and referrals to appropriate services. Data were analyzed descriptively.

Results: The 30-day readmission rate was 18.39 % (N = 930) during the intervention period compared to 22.71 % (N = 617) at baseline, resulting in a 4.32 % reduction, *p* value 0.0325. Approximately 40 percent of the patient cohort was over age 85. Pharmacy was able to contact greater than 86 % of patients post discharge. Only half of patients were agreeable to ambulatory care management. Less than half (42 %) of eligible patients were seen in the post-discharge clinic. The CHW supported approximately 146 patients in a 9-month period.

Conclusions: A real-world comprehensive multidisciplinary team approach to the management of HF patients can reduce 30-day hospital readmissions.

Introduction

Heart failure (HF) affects 6.7 million people in the United States annually and has significant financial implications for the healthcare system.¹ Survival rates have improved in the last decade due to remarkable advances in pharmacologic and device therapy. Specifically, pharmacologic agents, including beta-blockers, angiotensin receptor/neprilysin inhibitors, mineralocorticoid receptor antagonists, and sodium-glucose cotransporter inhibitors in patients with HF with reduced left ventricular function was associated with an estimated 73 %

relative reduction in mortality over a 2-year period.² Implantable cardioverter defibrillator device therapy reduced all-cause mortality by 25.3 % when compared to patients who did not receive an device therapy.³ Considering these advances, the epidemic of HF has largely become one of increasing hospitalizations. The national average 30-day readmission rate for HF was 21.8 percent in 2015 for patients over 65 years of age with Medicare.⁴

Congestive HF is a complex clinical syndrome that results from any structural or functional impairment of ventricular filling or ejection of blood.⁵ Patients with HF often present to the hospital with symptoms

Abbreviations: HF, Heart failure; NP, Nurse practitioner; CHW, Community health worker; ACM, ambulatory care manager; POCUS, point of care ultrasound.

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such as shortness of breath, fatigue, lower extremity swelling, cough, weight gain, and difficulty lying flat. Symptoms are typically indicative of fluid accumulation in the body caused by activation of neural hormonal systems which cause vasoconstriction, hypertrophy, and hypervolemia.⁶ The causative factors contributing to HF readmissions are numerous, some of which include inadequate understanding of disease processes, non-adherence to prescribed dietary and medication regimens,⁷ poor social support, persistent congestion,⁸ and lack of timely follow up.⁹

Managing this patient population poses significant challenges due to disease complexity, multiple comorbidities, socioeconomic status, language barriers, and advanced age. In addition, many patients with HF are prescribed many medications. Guideline-directed therapy for HF with reduced ejection fraction typically involves four medications,² however, with additional diagnoses, patients are often taking many more medications. Complexity of care can be overwhelming and confusing for patients. Care challenges are significant because managing multiple medications increases the risk of errors, such as missed doses, incorrect administration, or harmful drug interactions. Cognitive decline further complicates adherence to complex medication regimens, potentially leading to poor disease management, worsening symptoms, and increased hospitalizations. Addressing care complexities is critical to improving patient outcomes and quality of life.

Heart failure primarily impacts older adults, and Medicare provides coverage for a significant portion of patients with this condition. As Medicare transitions towards bundled payments, healthcare institutions face increasing fiscal pressure to manage high risk populations efficiently, improve patient outcomes, and simultaneously reduce overall cost of care. One response has been to develop programs and tools aimed at reducing readmission rates for HF. Several strategies have been shown to effectively reduce HF readmissions. First, optimization of guideline-directed medical therapy has been shown to lower mortality and hospitalizations.¹⁰ Second, remote monitoring of patients with nursing support during the post-discharge period has been established to improve outcomes and reduce readmissions.¹¹ Third, scheduling a post-discharge follow-up appointment for patients is correlated with decreased rates of readmission.^{12,13} During this post discharge visit, pharmacists complete a medication reconciliation, and patients are assessed by a nurse practitioner (NP) or other provider for volume overload. Persistent congestion is a risk factor for rehospitalization,⁸ and early identification of patients may allow for more prompt treatment, such as administering intravenous diuretic therapy. This project describes the integration and sustainability of a multidisciplinary HF team to reduce all cause 30-day readmission rates in Medicare fee-for-service patients with an admission for HF.

Methods

Aims and design

This single-center, evidence-based project aimed to assess whether the implementation of a comprehensive multidisciplinary program, Enhanced Heart Care, could reduce the 30-day readmission rate in Medicare patients diagnosed with HF.

Population sample and setting

Adults with HF (N = 930) were included in the Medicare cardiac care bundle, with a diagnosis code of HF. The average age of the patients in the cardiac bundle at the project's institution was 80.2 years of age with a standard deviation of 11.03; 39.1 percent of the cohort was 85 years of age or greater. In this sample, 52.8 % were female and 47.2 % were male. By race, more (57.8 %) were white, 20.3 % of the cohort were black, and 7.7 % were Hispanic. Patients who underwent a procedure such as percutaneous coronary intervention, pacemaker or defibrillator implant during initial admission were excluded. The setting for the

project was a large academic medical center in Los Angeles. Table 1 describes the patient population.

Intervention

Patients were evaluated while hospitalized and provided education about their HF diagnosis by a registered nurse or NP. Interpreter services were available by phone or video for non-English speaking patients. Pharmacists reviewed each patient's medication list to ensure guideline-directed medical therapy was implemented. Each patient was offered a one-time post-discharge clinic visit (in person or virtual) within 7 days of discharge from the hospital. The post-discharge appointment was made during the hospital episode. Patients were contacted by a transition-of-care pharmacist within 72 h of discharge. The pharmacy communicated updated medication regimens and provided education on the importance of medication adherence. Medication discrepancies or errors were escalated to the primary doctor, cardiologist, or Enhanced Heart Care NP.

An ambulatory case manager (ACM) called each patient within three days of discharge and reviewed symptoms and upcoming appointments and triaged patients with high-risk symptoms to the appropriate

Table 1
Baseline Characteristics.

	Baseline (N = 687)	Intervention (N = 930)	Total (N = 1617)	Chi-Squared p value
AGE GROUP				0.0011
18–44	0 (0.0 %)	9 (1.0 %)	9 (0.6 %)	
45–64	47 (6.8 %)	44 (4.7 %)	91 (5.6 %)	
65–84	333 (48.5 %)	513 (55.2 %)	846 (52.3 %)	
85+	307 (44.7 %)	364 (39.1 %)	671 (41.5 %)	
RACE				0.0107
American Indian or Alaska	1 (0.1 %)	2 (0.2 %)	3 (0.2 %)	
Asian	31 (4.5 %)	60 (6.5 %)	91 (5.6 %)	
Black or African American	139 (20.2 %)	189 (20.3 %)	328 (20.3 %)	
Hispanic	53 (7.7 %)	82 (8.8 %)	135 (8.3 %)	
Other	16 (2.3 %)	53 (5.7 %)	69 (4.3 %)	
Patient Declined	0 (0.0 %)	2 (0.2 %)	2 (0.1 %)	
Unknown	3 (0.4 %)	4 (0.4 %)	7 (0.4 %)	
White	444 (64.6 %)	538 (57.8 %)	982 (60.7 %)	
GENDER				0.6723
Female	370 (53.9 %)	491 (52.8 %)	861 (53.2 %)	
Male	317 (46.1 %)	439 (47.2 %)	756 (46.8 %)	
MARITAL STATUS				0.0535
Divorced	64 (9.3 %)	101 (10.9 %)	165 (10.2 %)	
Domestic Legally	5 (0.7 %)	3 (0.3 %)	8 (0.5 %)	
	7 (1.0 %)	8 (0.9 %)	15 (0.9 %)	
Married	227 (33.0 %)	334 (35.9 %)	561 (34.7 %)	
Signific	10 (1.5 %)	19 (2.0 %)	29 (1.8 %)	
Single	104 (15.1 %)	166 (17.8 %)	270 (16.7 %)	
Unknown	1 (0.1 %)	5 (0.5 %)	6 (0.4 %)	
Widowed	269 (39.2 %)	294 (31.6 %)	563 (34.8 %)	

provider or the Enhanced Heart Care program. If there were any unmet social needs, ACM would refer to social work or community health worker (CHW). The CHW joined the team a year and a half after program inception and assisted high-risk patients with social needs. Due to advanced age, many were readmitted secondary to cognitive decline, medication non-adherence, and self-neglect. The CHW offered services that included home visits, identification of in-home health services caregivers, enrollment of patients in low salt food delivery programs, set up of transportation to healthcare provider visits, and financial assistance with medical co-payments.

At the time of the clinic visit, each patient was evaluated again by a pharmacist for medication reconciliation. Patients were instructed to bring medication bottles to the clinic. The pharmacist reinforced the importance of compliance with the patient and answered any medication questions. The NP performed a comprehensive physical exam, optimized guideline directed medical therapy, and adjusted diuretic therapy as needed. One year into the program, the NP started to utilize point-of-care ultrasound (POCUS) to measure inferior vena cava diameter to assess for collapsibility. Intravenous diuretic therapy was administered in the post-discharge clinic if patients had evidence of persistent or worsened volume overload. Point-of-care ultrasound was also used to assess for pleural effusions. Referrals were made to the outpatient thoracentesis center for patients noted to be hypervolemic with moderate to large pleural effusions on POCUS. Many of these patients had some degree of renal failure and did not experience a reduction in pleural effusions with diuretic therapy alone.

Additionally, the NP coordinated any outstanding post-discharge needs, such as rechecking labs, restarting diuretics, and ordering electrocardiograms. The NP gave actionable instructions, refilled medications, ensured necessary studies or referrals were in place such as cardiac rehab, physical therapy, and gave clear points of contact for any questions. The NP also corresponded with the patient’s primary doctor or cardiologist and established follow-up with the primary cardiologist. NP conducted weekly multidisciplinary readmissions meetings, which included the program’s medical director, ACM, CHW, social worker and administrators to discuss high-risk patients, identify drivers for readmission, and implement interventions to support this population. [Table 2](#) describes these interventions.

Data collection and instruments

Data was collected from 4/1/2022 to 3/31/2024. Our team utilized Tableau, a visual analytics platform, to track admission and readmission data for patients with HF. Each patient’s reason for readmission was recorded. Measurement acquisition images from POCUS were uploaded into the Epic electronic health record using the image capture feature within the Haiku smartphone app.

Analysis

Readmission rates from 4/1/2022 to 3/31/24 were compared to 30-day readmission data from 1/1/2019 to 12/31/2019. Data pull was conducted retrospectively from Tableau dashboard. Demographic and clinical characteristics were analyzed using descriptive statistics. The degree of association of the two readmission rates was measured using a Chi-squared analysis. The alpha level was set at <0.05 for all tests. Data was analyzed using IBM SPSS Statistical Software.

Ethical considerations

IRB approval was obtained from XX Hospital, in Los Angeles and the requirement for individual informed consent was waived. All data were restricted to the institution’s electronic medical records system.

Table 2
Program Interventions.

Intervention	Description
Inpatient education and medication review	- Heart failure education by registered nurse or NP. - Pharmacy evaluation of guideline directed medical therapy.
Transition-of-care pharmacist phone call within 72 h of discharge	- Evaluation for medication discrepancy and non-compliance. - Assessment of guideline direct medical therapy. - Address medication access barrier, consider alternatives. - Offer patient assistance programs. - Evaluate for medication errors, adverse drug interactions, and dose adjustments. - Provide comprehensive medication education. - Communication with primary care and cardiologist.
Ambulatory case manager (ACM) phone call within three days of discharge	- Review symptoms and medical appointments. - Triage patients with high-risk symptoms to appropriate providers and the Enhanced Heart Care program. - Refer to social work or CHW.
One-time post-discharge clinic visit (in person or virtual) within 7 days of discharge	- Medication review by clinical pharmacist with education to reinforce medication compliance - Comprehensive physical exam by NP optimized guideline directed medical therapy, adjust diuretic therapy. - Assessment of inferior vena cava diameter and pleural effusions by POCUS. - Intravenous diuretic therapy. - Referral to procedure center for elective thoracentesis. - NP authorized medication refills and referrals to cardiac rehabilitation, physical therapy, and home health services. - Correspondence with the patients’ primary doctors or cardiologists
Community health worker post discharge follow up*	- Support high-risk patients with social needs. - Offered services including home visits, identification of in-home health services and caregivers, enrollment of patients in low salt food delivery programs, set up of transportation to healthcare provider visits, and financial assistance with medical co-payments.
Weekly multidisciplinary readmissions meetings	- Meetings included the program’s medical director, ACM, CHW, social worker and administrators. - Discuss high-risk patients, identify drivers for readmission, and implement interventions to support this population.

* A dedicated CHW joined the team a year and a half after program inception and supported approximately 146 patients in a 9-month period.

Results

The 30-day readmission rate for HF patients was 18.39 % (N = 930) during the intervention period 4/1/22–3/31/24 compared to 22.71 % (N = 687) baseline, resulting in a 4.32 % reduction with a p value 0.0325. [Table 3](#) displays the readmission results. Among the readmitted patients, 26.2 % were readmitted for cardiac reasons, 39.6 % for medical reasons, and 34.5 % for surgical reasons, including elective procedures. [Table 4](#) defines the reasons for readmission.

Many patients eligible for the EHC program were difficult to contact. Pharmacy was able to contact 86 % of patients post discharge. However, only half of patients were agreeable to ambulatory care management. Approximately 42 % of eligible patients were seen in the post-discharge

Table 3
Heart Failure Readmissions.

Heart Failure Readmissions			
Chi-squared $p = 0.0325$			
Time Period	30-Day Readmission		Total
	No	Yes	
Baseline	531	156	687
Intervention	77.29	22.71	930
	759	171	
Total	81.61	18.39	1617
	1290	327	

A logistic regression for only the above bundle of readmission on time period adjusted for age group, gender, race (white vs non) gives the adjusted Chi-squared test for difference of time periods with $p = 0.0240$, OR for intervention vs baseline 0.754 95 % CL (0.589,0.963).

Table 4
Reason for Readmission.

Reason for Readmission	n	%
Cardiac	84	26.17
Medical	127	39.56
Surgical	110	34.27
Total	321	100

clinic. Thirty-eight patients received IV diuretics in the clinic, while 13 patients were referred for elective thoracentesis. The CHW supported approximately 146 patients in a 9-month period.

Discussion

Survival rates for HF have shown significant improvement due to notable advancements in pharmaceutical and device therapies. However, a concurrent rise in recurrent hospitalizations has imposed a substantial financial burden on the healthcare system. Many healthcare systems have adapted to these evolving dynamics.^{14,15} The Enhanced Heart Care program was developed to address these challenges. This evidence-based practice implementation project utilized retrospective data from adults with HF (N = 1617) who were hospitalized before and after the introduction of a comprehensive program. The program followed a structured approach, implementing multiple interventions at critical stages throughout the continuum of care: during hospitalization, early post-discharge, and up to 90 days post-discharge. The entire team recognized that the intervention components were evidence-based, and each member was dedicated to implementing the actions with the goal of reducing the readmission rate.

Within our hospital, the program resulted in a statistically significant reduction in 30-day readmissions. This reduction was achieved by incorporating tailored strategies to address specific challenges as stated above. During hospitalization, patients were provided HF education. In the early post-discharge phase, interventions such as medication reconciliation by pharmacists shortly after discharge was most effective when patients had just returned home. Similar programs were able to identify an average on 2.1 medications errors during the patient’s first follow up visit.¹⁴ Furthermore, ACM proved particularly valuable for patients facing challenges in self-care due to a new diagnosis or a decline in functional status following a prolonged hospitalization. Additionally, ACM provided support for up to 90 days, ensuring ongoing oversight and addressing any emerging issues during that period.

In a similar study, a protocol driven post discharge clinic was able to achieve a reduction in 30 day readmission rates with multidisciplinary clinic visit post-discharge.¹⁴ This study was smaller with an intervention group of 169 patients, of whom only 114 were seen in post discharge setting and were included in the results. The study focused on a younger population with a mean age of 59 and included private insurance

although Medicare was the predominant insurance. Despite having an older population, we were able to achieve a similar reduction in HF readmissions by early identification of high-risk patients during hospitalization, education during hospitalization, and ongoing multidisciplinary support with phone calls and clinic visit after discharge.

During the post discharge visit, Enhanced Heart Care NPs also managed concomitant disease process due to the complex needs of this older population. Management required collaborative relationships with a broad range of clinical specialties, and it was essential to preserve primary care connections to address comorbidities and ensure non-cardiovascular preventive care was not overlooked. Approximately one-quarter of readmissions in our program were attributed to cardiac causes. Few HF programs integrate internists for primary care purposes. This underscored the importance of fostering strong relationships with external primary care providers.¹⁶

After the post discharge clinic visit, the NP shared a report summarizing the patient’s recent hospital stay and updates with the patient’s primary care physician and primary cardiologist, who may not have been involved in the hospitalization. Additionally, Enhanced Heart Care NPs were familiar with many multi-visit patients and were able to identify potential drivers for readmissions and address these issues while communicating with the patient’s providers. If patients were readmitted, NPs would communicate drivers to inpatient teams to ensure coordinated effort to address these factors. In this way, Enhanced Heart Care providers brought valuable longitudinal insights into the patient’s broader circumstances, such as socioeconomic factors and chronic health challenges which often underlie readmissions. This contrasted with the inpatient team’s narrower focus on the immediate reason for hospitalization. Developing a culture of seamless communication and teamwork between inpatient and outpatient providers enhanced care continuity, prevented gaps, and ultimately improved patient outcomes.

Older adults are more likely to be hospitalized due to co-morbidities and frailty. Our patients were of advanced age; approximately 40 percent of our patients were over 85 years old. All patients had Medicare insurance, and some had MediCal insurance as their secondary coverage. The STOP-HF-clinic¹⁵ conducted in Spain had a similar population group with a mean patient age of 82.3 and standard deviation of 8.3 years. The post discharge intervention observed all cause 30-day readmission rate of 13.9 % with a relative risk reduction of 47.5 %. The program interventions included a post discharge visit with a HF registered nurse and either an internist, geriatrician, or cardiologist. No other disciplines were present. However, unlike our program implementation, patients discharged from the cardiology ward and those with reduced left ventricular ejection fraction of <30 % were excluded. This suggests a patient population that was less acutely ill. Our programs were similar in terms of age but our population was inclusive of all wards including ICU and there was no exclusion criteria for low ejection fraction.

Maintaining program integrity over the 2-year period required significant resources and effort. Initially, two NPs, a pharmacist, and 2 registered nurses were required to support the program. Eventually, the program was sustained with one registered nurse and incorporated a CHW to further enhance care. Additionally, the NPs trained to utilize POCUS and ensured they were proficient in its use. Using POCUS for guidance, the NP confirmed fluid overload, administered intravenous therapy to 38 patients, and referred 13 patients for elective thoracentesis. Throughout the process, the team also familiarized itself with readmission data to continuously monitor and improve the program’s effectiveness.

There were several challenges in program implementation. The clinic saw less than half of patients eligible for a post-discharge clinic visit; ACM followed approximately half of patients eligible for the EHC program. The academic center’s pluralistic model included many private physicians who had varying degrees of familiarity and support of the program resulting in lower than anticipated clinic attendance. Other reasons for low clinic attendance included advanced age, poor mobility,

lack of self-care and family support, non-adherence with medical care, and unstable housing. Some patients, such as those with unstable housing, were difficult to contact. This potentially introduced bias into the results.

Limitations

This project has several limitations. The comparison group was 2 years prior to the program implementation. The before and after groups were separated by the COVID-19 pandemic. Post-pandemic, new constraints emerged regarding healthcare provider shortages that were not present pre-pandemic. We did not assess healthcare clinicians' expertise, years of service, changes in guideline-directed medical therapy, or other characteristics that may have differed between time periods. Additionally, advanced statistical methods were not applied to account for differences in patient characteristics between groups. Lastly, there was also an initiative by the institution that all medical network cardiac patients with Medicare fee-for-service be seen by a healthcare provider within seven days of discharge from the hospital. This simultaneous initiative may have confounded the results given similar intent of the network initiative.

Areas of improvement

Future prospective two-group studies should be conducted to more rigorously evaluate outcome achievements among patients, the healthcare system, and healthcare providers and clinicians. Additionally, meta-analyses with similar interventions aimed at reducing the 30-day readmission rate should be performed to validate results.

Conclusions

Medicare's current trajectory is unsustainable, prompting healthcare systems to implement initiatives aimed at improving efficiency and reducing preventable readmissions. The Enhanced Heart Care program was our health system's response to delivering efficient, high-quality care within the evolving framework of Medicare bundled payments. This evidenced-based project incorporated a multidisciplinary team, including advanced practice providers, pharmacists, case managers, CHWs, and specialized nurses, all working collaboratively to support patients during this vulnerable period. Although some hospital readmissions cannot be prevented, establishing programs that offer pharmacy conducted medication reconciliation, coordination of care with ACM, and a multidisciplinary appointment that can offer administration of intravenous diuretic therapy, and early referral for thoracentesis can improve patient outcomes. Real world evidence from this program supports the effectiveness of other multidisciplinary programs in reducing 30-day readmissions, emphasizing the critical role of coordinated care in enhancing patient outcomes.

CRedit authorship contribution statement

Christina L. Craigo: Writing – review & editing, Writing – original draft, Project administration, Methodology, Formal analysis, Data curation, Conceptualization. **Claire M. Dow:** Writing – review & editing, Writing – original draft, Project administration, Methodology, Formal analysis, Data curation, Conceptualization. **Yervant M. Malhasian:** Writing – review & editing, Validation, Methodology,

Conceptualization. **Margo B. Minissian:** Writing – review & editing, Visualization, Formal analysis. **Ronit Zadikany:** Writing – review & editing, Visualization, Conceptualization. **Raymond Zimmer:** Writing – review & editing, Visualization, Conceptualization.

Declaration of competing interest

The authors report no conflicts of interest. No relationship with industry.

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