

Preventing heart failure hospital readmissions: challenges and opportunities

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Abstract

Heart failure (HF) is a leading cause of hospitalization and readmission. As evidence-based treatments for the management of HF with reduced ejection fraction have evolved, the ability to reduce the HF readmission risk has improved. Clinical trials have shown measurable improvements in patient-centered outcomes through exercise, pharmacologic, and device therapies. In contrast, for HF with *preserved* ejection fraction, no medical therapy has been identified that improves survival, though aldosterone antagonists may reduce HF hospitalization risk. Thirty-day readmission rates have become a metric for hospital quality and financial penalties in the United States; however, reducing all preventable hospitalizations, improving health status, and prolonging survival should be the goal for HF patients. Nearly half of repeat hospitalizations for HF are secondary to noncardiovascular conditions. Careful attention to complicating comorbid conditions should be assessed before discharge for an acute decompensation. Optimizing the outpatient management of HF and providing careful transitions from the hospital to the outpatient setting are critical to minimizing readmission risk and improving patient-centered outcomes. ■ *Heart Metab.* 2017;74:17-23

Keywords: heart failure; prevention; process measures; quality of care; readmission

Introduction

In the United States, heart failure (HF) is the fourth leading cause of all hospitalizations and the leading cause of hospitalization among cardiovascular diagnoses.¹ According to Medicare, approximately one in four patients with a HF hospitalization will be readmitted at 30 days.² Readmissions are a target for researchers and policy makers, as they are perceived as a marker of poor care quality and a source of preventable health care utilization. With HF prevalence

projected to increase from 5.7 million to over 8 million American adults and costs ballooning from \$20.9 billion to \$53.1 billion between 2012 and 2030, reducing preventable hospitalizations for HF patients is a national priority.^{2,3}

Medicare uses hospital performance on 30-day HF mortality and readmissions as a quality metric and applies financial penalties to hospitals based on performance. Yet, strategies for effectively preventing or reducing readmissions are not agreed upon. Furthermore, the 30-day period of observation for readmis-

Abbreviations

CARE-HF: CArdiac REsynchronization-Heart Failure; **HF:** heart failure; **HF-ACTION:** Heart Failure: A Controlled Trial Investigating Outcomes of exercise traiNing; **HFrEF:** heart failure with reduced ejection fraction; **MADIT-CRT:** Multicenter Automatic Defibrillator Implantation Trial with Cardiac Resynchronization Therapy; **PARADIGM-HF:** Prospective comparison of ARNI with ACEI to Determine Impact on Global Mortality and morbidity in Heart Failure

sion after hospitalization is arbitrary and a multitude of factors external to the quality of inpatient care may influence a patient's readmission risk. Nevertheless, care systems must prioritize reducing all avoidable hospitalizations whether initial or repeated. This article will discuss strategies for preventing HF readmissions, highlighting both challenges and opportunities.

Heart failure hospitalizations

A hospital admission for HF portends a high risk for future morbidity and mortality. Among Medicare patients admitted for HF, 67% experienced a readmission and 36% died within 1 year. Readmission risk is highest on the third day following discharge. Not

until 38 days after discharge is the readmission risk cut in half.⁴ Whereas hospital length of stay and inpatient mortality have decreased in the United States, discharges to skilled nursing facilities have increased (*Figure 1*).⁵ This reflects a sizeable population of chronically ill HF patients unable to live independently and at high readmission risk. The quality of a skilled nursing facility is known to influence hospital readmission rates, as well as mortality.⁶

HF management protocols prioritize cardiovascular care; only 17% to 35% of HF discharges are readmitted with a repeat HF exacerbation; however, 47% to 62% are readmitted for noncardiovascular causes.^{7,8} The diversity of readmission etiologies emphasizes the importance of a comprehensive assessment to prevent complications from other comorbidities and to identify specific patient needs. With the implementation of financial incentives to reduce readmissions, Medicare has reported modest decreases in the average 30-day HF readmission rate (*Figure 2*).^{9,10} The corresponding fall in the readmission rate also correlated with an increase in "observational stays," which are not categorized as readmissions. The degree to which readmissions in HF patients are preventable is unclear. Less than a quarter of all 30-day readmissions were estimated as potentially avoidable based on chart review.¹¹

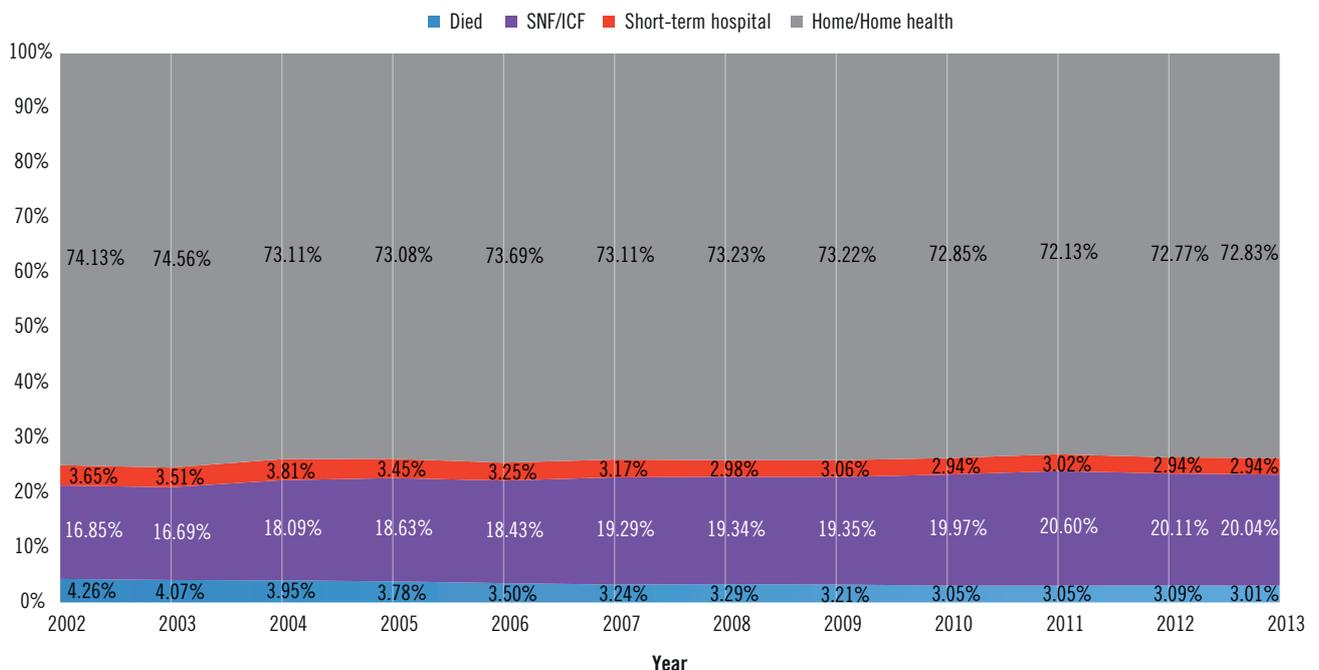


Fig. 1 Disposition at discharge for primary heart failure admissions in the United States. *Data estimated from the National Inpatient Sample.

Abbreviations: Home/Home health, discharged home or with home health care services; SNF/ICF, discharged to skilled nursing facility, intermediate care facility, or another type of facility; Short-term hospital, transfer; Died, inpatient death.

Medical therapy to reduce HFrEF readmissions

The management of HF with reduced ejection fraction (HFrEF) has evolved over recent decades with additional medical therapies and interventions that improve long-term survival. A strong foundation exists for the use of evidence-based medical therapies to improve outcomes and reduce the hospitalization burden for HFrEF patients (Table 1).¹² Therapies that reduce the hospitalization burden are expected to reduce readmissions as well.

The cornerstone of guideline-directed medical therapy for HFrEF includes the inhibition of the renin-angiotensin and cardiac β -adrenergic systems.^{13,14} Angiotensin-converting enzyme (ACE) inhibitor or angiotensin II receptor blocker (ARB) were found in clinical trials to improve mortality and reduce hospitalizations.^{15,16} β -Blockers are effective in reducing both mortality and readmissions.¹⁷⁻¹⁹ Of the performance measures recommended by the American College of Cardiology and the American Heart Association, only β -blockers and ACE inhibitors/ARB were significantly associated with reductions in mortality and readmissions.²⁰ The new angiotensin II receptor neprilysin inhibitor (ARNI) sacubitril-valsartan improved mortality and hospitalization risk beyond the benefits of ACE inhibition among symptomatic HFrEF patients in the large PARADIGM-HF trial (Prospective comparison of ARNI with ACEI to Determine Impact on Global Mor-

tality and morbidity in Heart Failure).²¹ Both American and European guidelines endorse the use of ARNIs in appropriately selected patients.^{13,14}

Additional medical therapies have been found to reduce hospitalization risk. Aldosterone inhibitors such as spironolactone and eplerenone have both been shown in clinical trials to reduce death and hospitalizations, with benefits seen within 30 days of therapy initiation.^{22,23} Observational data confirms that the addition of an aldosterone inhibitor reduces HF readmissions, but remains underutilized in clinical practice.²⁴ Among African Americans with HFrEF, the combination of hydralazine and isosorbide dinitrate was found to improve mortality and reduce hospitalizations on top of optimal medical therapy.²⁵ Optimization of guideline-directed medical therapy dosing and monitoring is also essential for improving outcomes, and better ensuring the efficacy of therapies demonstrated in trials translates into real-world clinical effectiveness.

HFrEF patients with elevated heart rates are observed to be at increased risk for adverse outcomes.²⁶ A new sodium-potassium inward channel (I_f , also called the funny current) blocker, ivabradine, was found to reduce hospitalizations for medically optimized HFrEF patients with a sinus rate greater than 70 beats per minute.²⁷ Although an older medication, there is fair evidence for recommending digoxin as an add-on therapy in symptomatic or at-risk patients. The Digitalis Investigators Group trial found a 6% absolute risk

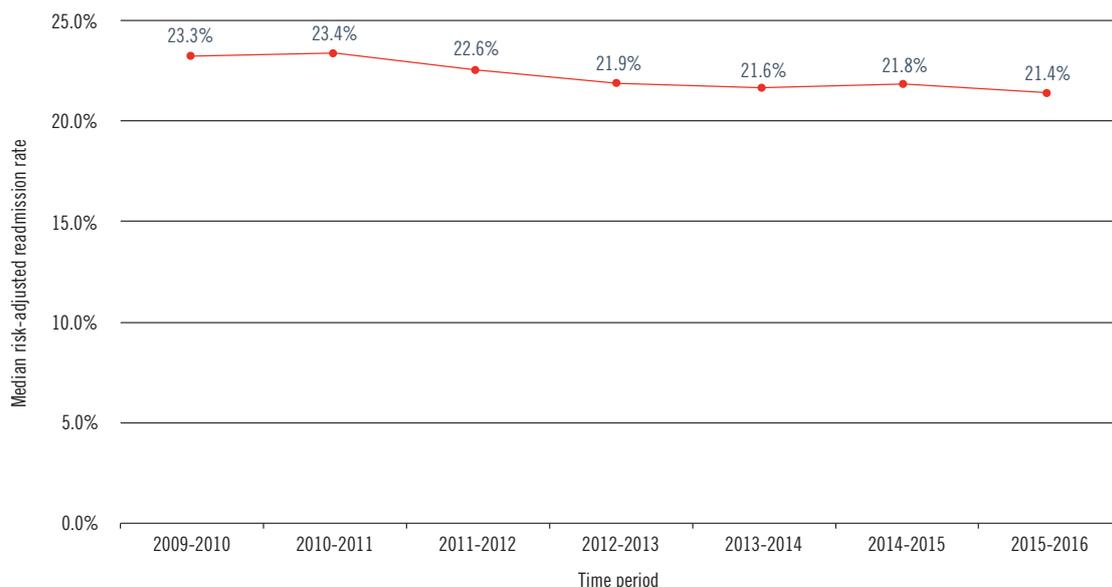


Fig. 2 Trends in the median hospital risk-standardized readmission rates for Medicare heart failure patients.

Based on data sourced from reference 10: Centers for Medicare and Medicaid Services. Hospital Quality Initiative: Outcome Measures. Chartbook 2013-2017 (2017). Available at <https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/HospitalQualityInits/OutcomeMeasures.html>. Accessed December 2017.

reduction in hospitalization with digoxin after an average of 37 months of follow-up.²⁸ Although β -blockers were not routinely used during the study period, more recent observational data suggest that digoxin may be effective in reducing readmissions.²⁹ With respect to diuretic therapy, torsemide has a higher bioavailability compared with furosemide. Small nonblinded trials suggest that patients discharged with torsemide have a lower readmission risk.³⁰

Nutritional supplementation with *n*-3 polyunsaturated fatty acids was found to provide a small mortality and hospitalization benefit after a median observation period of 3.9 years.³¹ Lifestyle interventions through exercise were evaluated in the HF-ACTION trial (Heart Failure: A Controlled Trial Investigating Outcomes of exercise training).³² The addition of a

regimented exercise program reduced HF hospitalizations and improved quality of life. Pooled findings from other monitored exercise trials facilitated Medicare's approval of cardiac rehabilitation in chronic HFrEF patients.³³

Whereas device therapies such as implantable cardioverter defibrillators (ICD) are indicated for the prevention of sudden cardiac death, cardiac resynchronization therapy (CRT) is useful for improving cardiac function and symptoms. In the trials CARE-HF (CArdiac RESynchronization-Heart Failure) and MADIT-CRT (Multicenter Automatic Defibrillator Implantation Trial with Cardiac Resynchronization Therapy), CRT markedly reduced HF hospitalization risk.^{34,35} When compared with ICD therapy alone, CRT therapy is associated with a lower risk of death and all-cause readmission.³⁶

The potential for new technologies to monitor congestion and prevent readmissions is a developing field. The CardioMEMS device (St. Jude Medical, Inc, St. Paul, Minnesota) is the first implantable pulmonary artery sensor that wirelessly transmits pulmonary artery hemodynamics to monitor cardiac pressures. Usage of the device reduced HF hospitalizations by 37% after 15 months among patients previously hospitalized for HF compared with usual care.³⁷ Both the fidelity of data and an advanced care team receiving the transmitted information resulted in improved fluid management and patient outcomes.

In patients with HF with preserved ejection fraction (HFpEF), no therapy has been shown to reduce mortality. However, there is some data to suggest that aldosterone antagonist therapy may reduce HF hospitalization risk in these patients. Implantable hemodynamic monitoring also has been demonstrated to reduce HF hospitalizations.³⁶

Hospital interventions to reduce readmissions

Transforming care delivery to provide more information and resources to discharged patients has also been associated with lower readmission rates. A review of interventions (such as patient education, discharge planning, medication reconciliation, scheduling follow-up before discharge, communication with outpatient providers, and follow-up telephone calls) implemented to reduce readmissions found that no single intervention alone reduced the 30-day readmission risk. Generally, more interventions are as-

	Trial
Exercise	
Cardiac rehabilitation	HF-ACTION
Drug	
ACE inhibitor	SOLVD
ARB	CHARM
ARNI	PARADIGM-HF
β -Blockers	CIBIS-II, MERIT-HF, COPERNICUS
Mineralocorticoid antagonist	RALES, EPHEsus-HF
Ivabradine	SHIFT
Digoxin	DIG
Hydralazine-isosorbide dinitrate	A-HeFT
n-3 PUFA	GISSI-HF
Devices	
CRT	CARE-HF, MADIT-CRT
CardioMEMS	CHAMPION

Table 1 Therapies shown to reduce heart failure hospitalization risk in clinical trials on heart failure with reduced ejection fraction.

Abbreviations: ACE, angiotensin-converting enzyme; ARB, angiotensin II receptor blocker; ARNI, angiotensin II receptor neprilysin inhibitor; n-3 PUFA, n-3 polyunsaturated fatty acids; CRT, cardiac resynchronization therapy

Trial names: A-HeFT, African-American Heart Failure Trial; CARE-HF, CArdiac RESynchronization - Heart Failure; CHAMPION, CardioMEMS Heart sensor Allows Monitoring of Pressure to Improve Outcomes in NYHA Class III heart failure patients; CHARM, Candesartan in Heart failure: Assessment of Reduction in Mortality and morbidity; CIBIS-II, Cardiac Insufficiency Bisoprolol Study II; COPERNICUS, Carvedilol Prospective Randomized Cumulative Survival; DIG, Digitalis Investigation Group; EPHEsus-HF, Eplerenone Post-Acute Myocardial Infarction Heart Failure Efficacy and Survival Study; GISSI-HF, Gruppo Italiano per lo Studio della Sopravvivenza nell'Infarto miocardico; HF-ACTION, Heart Failure: A Controlled Trial Investigating Outcomes of exercise training; MADIT-HF, Multicenter Automatic Defibrillator Implantation Trial with cardiac resynchronization therapy; MERIT-HF, METoprolol CR/XL Randomised Intervention Trial in congestive Heart Failure; PARADIGM-HF, Prospective comparison of ARNI with ACE-I to Determine Impact on Global Mortality and morbidity in Heart Failure trial; RALES, Randomized ALDactone Evaluation Study; SHIFT, Systolic Heart failure treatment with the I₁ inhibitor ivabradine Trial; SOLVD, Studies Of Left Ventricular Dysfunction.

sociated with greater success.³⁸ Most research in this realm has been observational, and further research is warranted in order to understand the effectiveness and costs of resource intensification.

Certain hospital characteristics have been associated with lower readmission risks. Higher nurse staffing ratios were associated with 41% lower odds of receiving Medicare penalties for excessive readmissions when controlling for case-mix and hospital characteristics.³⁹ Hospitals with a greater proportion of patients receiving follow-up care within 7 days of discharge have a lower risk of 30-day mortality and readmission, controlling for patient and hospital factors.⁴⁰ Appropriate follow-up after hospitalization remains integral to reducing repeat hospitalizations.

Peri-discharge interventions may improve clinical outcomes and reduce HF readmissions, as shown in small trials. A multidisciplinary, nurse-directed intervention including comprehensive education for patients and families, medication review, and intensive follow-up reduced readmissions by over half and improved quality of life scores.⁴¹ Another small randomized trial found formal education that used nurse-directed patient education and intermittent patient contact after discharge for 1 year reduced readmissions by 39%.⁴² A meta-analysis of interventions among older HF patients reported that comprehensive discharge planning with post-discharge support reduces readmissions and improved outcomes without increasing costs.⁴³ Publication bias remains a concern regarding the external validity of these interventions, especially for smaller studies. Overall, the literature suggests that more support and careful outpatient monitoring may reduce the readmission burden and improve patient quality of life.

Perspective on HF readmission reduction efforts

Whether the 30-day HF readmission is an appropriate metric of hospital care quality is debatable. Critics have argued that the 30-day readmission measure does not adjust for medical complexity, disability, and socioeconomic status. Models that risk adjust on the basis of characteristics during hospitalization perform poorly, with C-statistics well below acceptable discrimination standards.⁴⁴ Hospitals in lower socioeconomic regions are disadvantaged and more likely to receive Medicare penalties.⁴⁵⁻⁴⁷ Over half of the national variation in hospital readmission rates may

be explained by the county socioeconomic factors.⁴⁸ Financially penalizing hospitals that have limited resources is a perverse disincentive that may exacerbate disparities in the quality of care delivered.

Nearly half of HF patients are readmitted for non-cardiovascular conditions. The importance of a complete medical evaluation should be emphasized, as HF is only one of many comorbidities that may increase the readmission risk. A HF hospitalization should not only address the acute cardiovascular issues. Before discharge, outpatient challenges should be evaluated. Patients should have an assessment of their comorbid conditions, health literacy, cognitive impairment, mental health, financial barriers, functional status, and be provided early outpatient follow-up.⁴⁹ The potential impact that such multidimensional assessments and interventions may have on rehospitalization risk for HF patients requires further evaluation in clinical trials.

Conclusions

A number of medical and device therapies are known to improve HF outcomes in HF rEF patients and to reduce readmission risk. These therapies are frequently underutilized in eligible patients. Hospital strategies that increase support at discharge, improve communication, and provide close outpatient follow-up are associated with lower readmission risk. Whether the 30-day readmission rate is an appropriate quality metric for inpatient care is debatable. Evidence suggests that variations in hospital performance are mostly unexplained and may relate to patient and regional factors. Nevertheless, a hospitalization is a major life event that portends future adverse outcomes. All potentially avoidable hospitalizations should be prevented through careful outpatient HF management. Health system strategies that improve the quality of care and reduce the hospitalization burden are needed and require further research. ■

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Preventing heart failure hospital readmissions

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