

Protocol-Driven Allied Health Post-Discharge Transition Clinic to Reduce Hospital Readmissions in Heart Failure

Erin K. Donaho, RN, MS, ANP-C; Andrea C. Hall, PharmD; Jennifer A. Gass, PharmD; Macarthur A. Elayda, MD, PhD; Vei-Vei Lee, MS; Shreda Paire, MS, RN, FNP, ACHPN; Deborah E. Meyers, MD, FRACP, FACC

Background—Heart failure (HF) patients have high rates of hospitalization and rehospitalization.

Methods and Results—A protocol-driven clinic staffed by an allied health care team was designed for patients discharged from the hospital with a diagnosis of congestive HF. The clinic provided follow-up visits 1 week and 4 to 6 weeks after hospital discharge. One-hundred and fourteen patients were observed at least 1 time, and 80% of these patients completed the 2-visit protocol. Clinical evaluations were provided by a nurse practitioner specializing in HF and a clinical pharmacist; these evaluations included physical examination, laboratory evaluation, medical education and reconciliation, medication adjustment and titration, and care coordination. Referrals to home health and appropriate services were provided. At visit 1, 25% of patients were hypervolemic and 13% were hypovolemic. At visit 2, 20% were hypervolemic and 13% were hypovolemic. Medicine reconciliation errors were common, with an average of 2.1 and 0.8 errors per person recorded for visits 1 and 2, respectively. Clinic participants showed a 44.3% reduction in 30-day readmission rates, as compared to the hospital's average 30-day readmission rates.

Conclusions—Protocol-driven postdischarge transition care delivered by allied health staff addressed multiple transition issues and was associated with a dramatic reduction in readmission rates. (*J Am Heart Assoc.* 2015;4:e002296 doi: 10.1161/JAHA.115.002296)

Key Words: diuretics • drugs • heart failure • nursing • pharmacy • readmission • transition care

Heart failure (HF) is a chronic medical condition associated with significant morbidity, mortality, and costs. Approximately 6.5 million individuals in the United States have HF, and the cost to care for these patients is estimated to be \$39 billion annually.^{1,2} Most of this cost is incurred through recurrent hospitalizations; a recent report estimated that primary diagnoses of HF account for over 1 million hospitalizations annually, and secondary diagnoses of HF account for another 3 million hospitalizations annually.³

Readmission rates have become important surrogates for quality of hospital care for HF patients. They are receiving greater scrutiny by policy makers and payers who are increasingly relying on pay-for-performance measures to

determine compensation. Poor “handoff,” or transition of care, has been an additional problem for these complex patients and has been associated with adverse events and low satisfaction with care.⁴

Hospital readmissions for HF exacerbations are common, and many readmissions are known to be attributable to modifiable factors⁵ that can be addressed with high-quality postdischarge care; disease management approaches are currently endorsed in contemporary HF guidelines.^{6–13} However, despite the strength of these published studies, the first of which was published almost 2 decades ago, recent data show that 25% of hospitalized patients with HF are readmitted within 30 days of discharge and 50% are readmitted within 6 months.^{14–16} In addition, there are financial incentives for decreasing readmissions to the hospital. As of October 1, 2012, the Centers for Medicare and Medicaid Services can reduce payments by 1% to hospitals whose readmission rates for patients with certain conditions (eg, HF, acute myocardial infarction, and pneumonia) exceed a particular target.¹⁷

In a landmark study published in *JAMA* in 2010, Hernandez et al.¹⁸ performed an analysis including more than 30 000 Medicare patients cared for in 25 hospitals. The analysis showed that early physician follow-up (ie, within 7 days), which occurred for less than one third of patients, is

From the Seasons Hospice Care, Houston, TX (E.K.D.); Pharmacy Department, Memorial Hermann TMC, Houston, TX (A.C.H., J.A.G.); Texas Heart Institute, Houston, TX (M.A.E., V.-V.L., D.E.M.); Palliative Care Department, Kelsey Seybold Clinic, Houston, TX (S.P.).

Correspondence to: Deborah E. Meyers, MD, FRACP, FACC, 6770 Bertner Ave, Houston, TX 77030. E-mail: dmeyers@texasheart.org

Received June 9, 2015; accepted November 7, 2015.

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independently associated with lower rates of all-cause 30-day readmission.¹⁸ Substantial variations in the timing of follow-up and the fact that the health care was rarely provided by a cardiologist were noted. The majority of post-hospital follow-ups were performed by general medicine specialists, whereas only a small percentage of the follow-ups (7%) was provided by a cardiologist. In most cases, the physician responsible for patient follow-up was not the physician who delivered inpatient care. This finding likely reflects an increasing trend in which hospitalists only manage the care of HF patients in the hospital setting, without an expectation of any longitudinal care relationship after the patient has been discharged from the hospital. The transition from 1 caregiver to another is one of many points where a breakdown in communication can occur.¹⁹ The transition process can be complex and may involve many participants, including case managers, social workers, home health agencies, pharmacy services, and outpatient clinical providers (eg, primary care and specialist providers and ancillary services). Transitional care is increasingly being recognized as a critical component of high-quality care for patients hospitalized for HF. The importance of this topic prompted the American Heart Association (AHA) to publish a scientific statement stressing the need for quality transitional care interventions for these patients to address a variety of unmet needs.²⁰

In September 2010, the University of Texas Health Science Center in Houston and Memorial Hermann Hospital initiated a novel allied health service that was offered on a referral basis to all patients with a primary or secondary diagnosis of congestive HF (CHF). This clinic delivered specialized, protocol-driven care to patients at 1 and 4 to 6 weeks after an index hospital admission. Our hypothesis was that establishing such a clinic would reduce 30-day readmission rates to the hospital.

Methods

We analyzed the effect of a novel, multidisciplinary clinic for the first 169 patients who were observed between September 2010 and March 2012 by performing a retrospective chart review. This project was approved by the institutional review board at Memorial Hermann Hospital, and the requirement for individual informed consent was waived. The clinical service assessed was specifically designed to address the needs of HF patients discharged from the hospital. The postdischarge transitional care clinic was located in the Memorial Hermann Pharmacy Wellness Clinic, which is a facility-based clinic located close to the acute care hospital. Memorial Hermann Hospital is a large, tertiary care urban teaching hospital in Houston, Texas, with 650 inpatient beds for adults. The goal of the clinic was to

reduce 30-day all-cause readmissions and address transitional care problems by providing timely, protocol-driven postdischarge evaluation and management.

The multidisciplinary allied health clinic comprised a board-certified nurse practitioner and a board-certified doctor of pharmacy, both of whom worked in collaboration with referring providers. A board-certified HF cardiologist acted as the medical director for this new transitional care service. The detailed clinic protocols were developed with the multidisciplinary team and were based on approved American College of Cardiology/AHA guidelines. These protocols were approved by the hospital medical board.

Patients were eligible to be observed in the postdischarge clinic if they were recently admitted to the hospital with a diagnosis of HF. The protocol included planned follow-up within 1 week and between 4 and 6 weeks postdischarge. Initial visits were scheduled for 1 hour, and subsequent visits were scheduled for 40 minutes. One additional interim visit was allowed by protocol for patients deemed to be at high risk for readmission. Family members and caregivers were encouraged to be present and participate in the visits. Referral was voluntary by providers who agreed to the designated protocols. For a patient to be referred, the referring physician had to be acquainted with the policies, procedures, and protocols of this new service and had to sign a referral to the clinic.

Postdischarge clinic visits included the following: (1) a physical examination; (2) medication education and reconciliation; (3) medication up-titration per protocol; (4) individualized HF disease education emphasizing symptom recognition and reporting; (5) coordination of outpatient health care resources; and (6) a comprehensive discharge plan, including medication lists and assistance in establishing follow-up with home health care and other providers. The physical examination was performed by a nurse practitioner specializing in HF and focused on hemodynamic status (perfusion) and volume assessment (congestion). Volume assessment included taking orthostatic blood pressure measurements in the supine, sitting, and standing positions; performing a bedside evaluation of jugular venous pressures; and looking for any evidence of edema. Furthermore, patient weights recorded in the clinic were carefully compared to those recorded at discharge and by the patients themselves at home. Based on the examination findings, the clinical nurse practitioner made alterations to the treatment plan as necessary. The examination also included a point-of-care laboratory evaluation to detect electrolyte abnormalities and any deterioration in renal or hepatic function.

Patients were asked to bring all prescription and nonprescription medications to the clinic for review. The clinical pharmacist performed a detailed medication reconciliation to identify potential errors and/or nonadherence. Medication

regimen alterations were focused on titration of HF therapy to maintain euvoemia and maximize therapeutic medication targets, as well as correcting identified errors or addressing contraindicated therapy. Additionally, the patient’s overall health status was evaluated to address comorbid conditions. All patients left the clinic with an updated Med Action Plan (a patient-friendly printed list of medications and dosing instructions) in either full- or wallet-size formats.

Care coordination services included communications with the primary care provider, other specialist providers, and/or home health services. In coordination with the referring provider, the need for additional resources, such as physician specialists, advanced home health services, rehabilitation services, and palliative care or hospice services, was also evaluated.

Statistical Analysis

All statistical analyses were performed by using SAS software (Version 9.3; SAS Institute Inc., Cary, NC). Continuous variables are expressed as the mean±SD. The chi-square test was used to determine associations for categorical variables. *P* values <0.05 were considered statistically significant.

Results

Throughout the study period, 169 patients were referred to the clinic. The main referral sources were cardiologists, including those affiliated with a university and those in private practice. One hundred and fourteen were observed at least 1 time in the postdischarge setting. The remaining 55 referred patients (33%) were cancelled referrals; these patients were excluded from the study protocol. Ninety-one (80%) of the patients observed completed the 2-visit protocol. Over the course of 18 months, 44 patients (26% of the patients referred) had at least 1 rereferral because of rehospitalization. In total, 253 visits were recorded for the 114 patients served. The primary reasons for a cancelled referral were use of an alternative physician for follow-up (27%), inability to contact the patient (22%), and extended distance to clinic (11%). In a chi-square analysis, no baseline differences were found between the referred patients who were observed in the clinic and those who had a canceled referral. This signifies that there was no selection bias in the patient population analyzed.

Mean age of the patients observed was 59 years old (range, 17–87). These patients were ethnically diverse, with 63% identifying as African American. The majority of patients in this HF population had multiple comorbidities, including hypertension (86%), diabetes (56%), and advanced renal disease (41%; Table 1). The majority of patients (75%) had left ventricular (LV) systolic dysfunction, either with or without

Table 1. Baseline Characteristics of the Patients Referred to the Clinic

Characteristic	Seen (N=114)	Not Seen (N=55)	<i>P</i> Value
Age, mean (range)	59 (17–87)	59.9 (26–90)	
Sex (male)	55 (48%)	33 (61%)	0.12
Ethnicity			
Hispanic/other	10.5%	7.3%	
African American	65.8%	52.7%	
Caucasian	20.2%	34.5%	
Declined identification	3.5%	5.5%	
Insurance status			
Medicare	17.5%	23.6%	
Medicaid	63.2%	54.5%	
Private insurance	12.3%	12.7%	
Uninsured/self-pay	7.0%	9.2%	
Diabetes mellitus	64 (56%)	30 (55%)	0.85
Coronary artery disease	62 (54%)	28 (51%)	0.67
Hypertension	98 (86%)	38 (69%)	0.01
Dyslipidemia	67 (59%)	23 (42%)	0.04
OSA	27 (24%)	8 (15%)	0.17
COPD	26 (23%)	10 (18%)	0.49
Pulmonary hypertension	14 (12%)	6 (11%)	0.80
Advanced renal disease			
CRI (SCr >1.5, not ESRD)	37 (32%)	16 (29%)	0.66
ESRD	10 (9%)	3 (5%)	0.45
Body mass index >35	48 (42%)	17 (31%)	0.14
Atrial fibrillation	30 (26%)	14 (25%)	0.90
Tobacco use	24 (21%)	16 (31%)	0.33

COPD indicates chronic obstructive pulmonary disease; CRI, chronic renal insufficiency; ESRD, end-stage renal disease; OSA, obstructive sleep apnea; SCr, serum creatinine.

concomitant right-sided systolic dysfunction (Table 2). Overall mean ejection fraction for the patients with LV systolic dysfunction was 24% and for those without LV systolic dysfunction was 54%. Thirty-six percent of the patients had severe right ventricular (RV) dysfunction, further signifying the advanced nature of the heart disease in this population. Of the patients observed, 47 had defibrillators; 32% were implanted, and 8% were external. For this population, the predominate form of insurance was Medicare (66.7%), and most of the remaining patients were evenly divided between using Medicaid (14%) and private insurance (14%). Only a small subset of patients was classified as uninsured/self-pay (7.0%). Patients were not excluded from participation if they were non-English speakers, because translation services were available. Cognitive limitations were also not a contraindication for participation if family members could attend the clinic

Table 2. Heart Failure Characteristics of the Patients Who Visited the Clinic

Structural Classification of Heart Failure	N (114 Total)	EF (Mean %)	RVSP (Mean)
HFrEF	52	25.9±8.09	44.7±10.77
HFpEF	21	51.7±6.79	NR
Biventricular dysfunction	34	22.4±5.67	47.9±13.75
Isolated RV systolic dysfunction*	7	60±8.16	78.0±22.75

EF indicates ejection fraction; HFpEF, heart failure with preserved ejection fraction; HFrEF, heart failure with reduced ejection fraction; NR, normal range; RV, right ventricular; RVSP, right ventricular systolic pressure.

*RV dysfunction as described qualitatively on the echocardiogram.

with the patient. Furthermore, patients with end-stage renal disease (ESRD) were not excluded. We were concerned that patients who did not attend the clinic might actually be sicker than those who did attend the clinic. However, when we compared the 2 groups, the only significant differences we identified were greater numbers of patients with hypertension and dyslipidemia in the cohort that visited the clinic, as compared to the patients who did not attend the clinic (Table 1).

Symptom Class

Assessment of New York Heart Association (NYHA) functional classification on initial presentation to the clinic further confirmed the severity of illness in this population, with 83% of patients having NYHA functional class III symptoms or greater. Symptom class varied over the course of the 2 evaluations, as shown in Table 3.

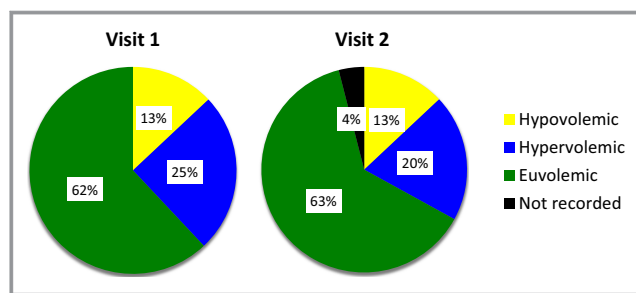
Volume Status

Although the patients were observed in a timely fashion after hospitalization, only 62% were euvoletic upon initial postdischarge evaluation (Figure 1); thus, medication adjustments were often required at the initial visit. Volume status between visits 1 and 2 appeared to be static when assessed solely on the percentages shown. However, further evaluation showed

Table 3. New York Heart Association (NYHA) Functional Classification Across Visits

NYHA Class	Visit 1 (N=114)	Visit 2 (N=87)*
II	19 (17%)	18 (20%)
III	89 (78%)	63 (69%)
IV	6 (5%)	6 (7%)

*NYHA classification data unavailable for 4 patients at visit 2.

**Figure 1.** Volume status at each clinic visit.

that volume shifts occurred frequently in this postdischarge population. Between visits 1 and 2, 46% of patients showed a change in volume status. Although volume data were missing for 4 patients at visit 2, we determined that only 43% of patients remained euvoletic during the evaluation period (visits 1 and 2) without diuretic adjustments, exemplifying the need for early and repeated monitoring after hospitalization.

Medication Errors

Medication reconciliation focused on identifying medication errors and/or patient nonadherence. Individual medication errors were classified as omission/commission, incorrect dosages, duplication of therapy, and nonprocurement. Non-compliance was determined based on an overall evaluation of the patient at each visit and indicated that the patient knowingly did not take a medication correctly (if procurement was not the major issue).

Across both visits, 297 individual medication errors were identified (Figure 2). The most frequent medication error was incorrect dosage, which accounted for 44% of the errors. Omission errors were also very frequent, accounting for 37% of the errors. Duplication of therapy and nonprocurement occurred less frequently and comprised 8% and 11% of the errors, respectively. Importantly, the vast majority of medication errors appeared to be related to the transition from hospital to home rather than self-aware nonadherence. The average number of medication reconciliation errors per person decreased from 2.1 at visit 1 to 0.8 at visit 2. Medication corrections for therapy unrelated to HF were frequently necessary, with an average of 0.95 medication corrections required per visit across visits 1 and 2. True noncompliance, meaning the patient knowingly did not follow the medication regimen, occurred for only 10% of patients and was similar between visits 1 and 2.

Medication Intervention

An average of 1.7 HF medications were altered per person during visit 1, whereas an average of 1.4 medications were altered during visit 2. The medication intervention required

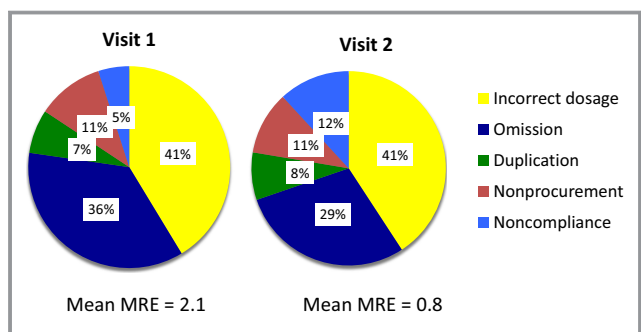


Figure 2. Medication reconciliation errors (MRE) at each clinic visit.

most frequently at the clinic visits was diuretic adjustments, which were made at 46% of the exams conducted during visits 1 and 2 (Table 4). Ninety-one percent of these changes involved oral diuretic adjustments alone, whereas the remaining 9% involved parenteral diuretic interventions. Parenteral therapy was delivered either in the clinic or in the home (by home health or palliative care house calls). Other frequently adjusted medications included angiotensin-converting enzyme (ACE) inhibitors, angiotensin II receptor blockers, and/or hydralazine, which were adjusted in 44% of visits. Beta-blocker therapy was altered in 33% of visits. Less-frequent medication interventions are noted in Table 4.

Care Coordination

Coordination of multidisciplinary follow-up care included an evaluation of the postdischarge plan and determination if additional resources were needed, with a focus on providers and ancillary services. The most frequent intervention was promoting the necessary physician follow-up, which occurred in 44% of visits. The nurse practitioner provided specialized

Table 4. Medication Titrations at Each Clinic Visit

Medication Category	Visit 1 (N=114)	Visit 2 (N=91)
Diuretic, PO/parenteral IV	51 (45%)/ 6 (5%)	34 (37%)/ 3 (3%)
ACE inhibitors/ARBs	33 (29%)	25 (27%)
Hydralazine	21 (18%)	11 (12%)
Beta blockers	48 (42%)	20 (22%)
Isordil	11 (10%)	9 (10%)
Digoxin	4 (3.5%)	2 (2%)
Potassium	12 (11%)	12 (13%)
Aldosterone antagonist	18 (16%)	13 (14%)
Average No. of HF medication changes per visit	1.7	1.4

ACE indicates angiotensin-converting enzyme; ARB, angiotensin II receptor blocker; HF, heart failure; IV, intravenous administration; PO, oral administration.

coordination of additional services. In 30% of visits, either initiation or expansion of home health services was necessary. Additionally, during 12% of visits, palliative care and/or hospice services were arranged for patients with severe and persistent end-of-life symptoms. We did not define strict criteria for making these referrals, but tended to refer patients who were the most socially isolated and who had the highest symptom burdens.

Handoff to Post-Hospital Health Care Providers

Communication with primary providers regarding transitional care interventions and care plans was critical. The referring provider routinely received full progress notes that included an assessment of the hemodynamic and volume status of the patient, newly identified transitional issues that required attention, medication reconciliation reports, and any additional referrals that were made. Additionally, communications were recorded in the electronic medical record (EMR) to provide continuity of care with other hospital-based providers. Furthermore, patients were provided copies of their progress notes for their physician and allied health providers who may not have had access to the EMR.

Readmission

In our cohort, 14 patients were readmitted at least once in the 30 days after discharge, which equates to a 12.3% all-cause readmission rate. Of the 14 patients who were readmitted to the hospital within 30 days, 8 (57.14%) were readmitted primarily because of CHF exacerbations, 3 (21.4%) were readmitted because of gastrointestinal bleeding, 1 (7.1%) was readmitted for management of chronic obstructive pulmonary disease (COPD), 1 (7.1%) was readmitted for hemoptysis, and 1 (7.1%) was readmitted because of pacemaker-related complications. In contrast to the readmission rate for our intervention group, the 30-day all-cause readmission rate for HF patients at Herman Memorial Hospital at the Texas Medical Center was 22.1% during the same time period (<https://data.medicare.gov/data/archives//hospital-compare>). Therefore, the clinic intervention resulted in a 44.3% reduction in 30-day readmission rates in this group of patients during the study period, as compared to the hospital average.

Cost

The direct cost for each visit was calculated to be \$110.00, which included 1.5 hours of health care practitioner time (50% nurse practitioner and 50% clinical pharmacist), point-of-care testing supplies, and a medical assistant and appointment scheduler. The cost estimate in this study was fairly low because the service was established within a clinic structure

that already existed. Indirect costs, such as facility fees, business overhead, and liability costs, were not included in this cost basis because these costs are highly variable between institutions and regions of the country.

Discussion

It is widely recognized that high-quality postdischarge care can reduce hospital admissions and improve quality of life; some studies have even shown a mortality benefit.^{21–23} We found that establishing a novel, protocol-driven allied health clinic that focused on the issues that HF patients encounter as they transition from hospital to home resulted in a 44.3% reduction in 30-day hospital readmissions in a sick cohort of patients. An especially important aspect of transition care is patient access to postdischarge services, and access to care very early after hospital discharge (ie, within 7 days) appears to be critical for reducing readmissions. In fact, the 7 day postdischarge visit is likely to be the single most powerful tool to prevent exacerbation of illness and readmission.^{18,24}

“Transitional care,” or specialized postdischarge interventions, involves 1 or more activities that facilitate the safe, smooth, and efficient transition from one care setting to the next.²⁰ Although the Hospital to Home (H2H) initiative has identified key strategies to address this problem, implementing these well-intended strategies takes time, resources, and coordination and has been difficult to achieve in practice.^{25,26} Because the majority of hospital patients are not “cured” after a hospital stay, but instead go on to suffer from a constellation of chronic diseases, it is essential to have effective transitional care that takes into account the broad needs of the patient and provides the support needed in a community setting.

Hospital discharges are often haphazard events. A properly coordinated discharge integrates nursing, social, pharmacologic, and “hand over” aspects of care. However, the pressure to discharge patients in the morning can undermine the considerable effort needed to coordinate a proper discharge. It was recently reported that of the 537 hospitals enrolled in the H2H quality improvement program, less than 25% arranged home nursing visits for patients upon discharge and less than half were using the 10 key practices identified to reduce admissions.²⁶

High-quality transitional care must include systematic communication between the hospital and postdischarge healthcare providers, patient-friendly medication reconciliation, verification that the patient has the ability to access medications after discharge, consideration of comorbidities, and education directed to patients and caregivers. Education is important and should include instructions that are easy to understand and a system to monitor for worsening signs and

symptoms of HF, such as changes in daily weights, worsening shortness of breath, and swelling. It is probably best if this process is started in the inpatient setting, and then teaching can be reviewed and reinforced at subsequent visits. Post-hospital care may be further complicated if the patient is elderly or has cognitive issues, poor health care literacy, transportation limitations, or limited access to follow-up care.³

For patients leaving the hospital with a primary or secondary diagnosis of CHF, arrangements for transitional care must be both routine and systematized. Otherwise, the care does not occur. There is increasing evidence that equal consideration should be given to both cardiac and noncardiac contributors to readmission because HF usually exists within a spectrum of other diseases.³ Often, it is the comorbidities that drive morbidity, mortality, and hospital readmission rates in HF patients.²⁷ There is also evidence that it is beneficial to receive follow-up care from a familiar provider.²⁸

Our goal for this project was to establish a routine and systematized avenue for patients to access high-quality, evidenced-based postdischarge care. We specifically designed the clinic in such a way that the referring physician did not need to be concerned about “losing their patient” and physicians could continue to be the primary point of contact for ongoing medical issues that arose. The transition care medical director, however, acted as a “back up” if the referring physician was unavailable and an urgent or semiurgent issue arose. We also specifically sought to include non-English-speaking patients; patients with ESRD and frail, elderly patients in an effort to evaluate a “real-world” population of sick patients. This helped overcome the significant reluctance of some physicians to refer patients to the new clinic.

In our study population of sick, symptomatic patients with multiple comorbidities, we found that by 1 week postdischarge, one third of the patients were already having issues with blood volume. The most common issue was volume overloaded (hypervolemia, 25%); however, a significant number of patients presented with diuretic-related volume contraction (hypovolemia, 13%). This can be especially hazardous for frail, elderly patients who are at increased risk for falling. Overall, 44.7% of the patients observed at visit 1 and 40.6% of patients observed at visit 2 required diuretic adjustment, making volume control an important target for early intervention as patients transition to the home setting.

As patients resume consumption of a more representative diet within the domestic environment, changes in salt and fluid intake can affect their volume status. Thus, volume management is critical during the early transition after hospitalization. It is clearly more difficult to control a patient’s diet in this setting, given that this depends on what is available in the community and easy to prepare in the home.

In total, 88 diuretic adjustments were made at visits 1 and 2 (adjustments made for 42.9% of the patients observed), indicating that maintenance of euolemia is an important target for early intervention as patients transition to the home setting. Given that additional diuretics adjustments were required at visit 2 (4–6 weeks after discharge), it appears that strategies are needed for long-term volume monitoring after hospital discharge of HF patients.

The complexity of managing HF pharmacology can be daunting for most patients. Patients who are treated according to modern guidelines require an average of 7 medications to manage HF, independent of the need for medications to treat other comorbidities.²⁹ Improvements in prescribing practices start with thoughtful medication reconciliation practices within the hospital.³⁰ In theory, this should be a straightforward process: At every transition of care, a systematic and comprehensive review should occur in order to maintain an accurate prescription record, and changes should be communicated to all caregivers involved. In practice, however, this has proven to be an enormously difficult undertaking. This process is complicated by: (1) the multiple practitioners involved; (2) multiple health care electronic records that cannot cross-communicate; (3) practitioners that do not (or cannot despite attempts) communicate with other caregivers that are treating the patient; (4) substitutions that occur in local pharmacies; (5) the complexity of insurance coverage for various medications; (6) the need for previous authorization, which can dramatically delay medication access; and (7) the burden of costs associated with medications and copays for patients taking multiple medications.

These issues can be overwhelming and can be further complicated by language, literacy, and financial issues.

In our study, even with extraordinarily focused efforts, discrepancies persisted. We found an average of 2.1 medication reconciliation errors per patient at visit 1. After dedicated individualized attention, we still found 0.8 medication reconciliation errors per patient at visit 2, which was, albeit, less than half of the frequency at the first visit. This underscores the fact that continual and ongoing pharmacological vigilance is warranted in populations with chronic disease. The observed persistence of medication reconciliation errors across the visits underscores the need for more-frequent medication monitoring. Furthermore, this observation supports the findings of previous studies that suggest that enhanced and longitudinal involvement of a clinical pharmacist may be critical in reducing these discrepancies.^{31,32} To address this need, programs could perhaps adopt a system of weekly medication reconciliation for a specified period of time after an index HF admission.

Our study also showed that not all medication errors represent patient “noncompliance or nonadherence,” as is

often asserted by frustrated clinicians. In fact, this was true for only a minority of cases. Other factors, such as medication duplication and difficulty with procurement, were more-frequent problems. There is strong evidence in support of assisting patients with this process early; primary nonadherence (ie, not filling discharge medications) by inpatients after an acute coronary event is associated with significantly increased mortality, and secondary nonadherence (ie, not following instructions or obtaining refills) has been shown to increase mortality, hospitalization rates, and costs.^{33–35} Medication reconciliation is an important goal that clearly needs concerted attention. This process should not be viewed merely as an “accreditation game,” but should be considered critical for patient safety.³⁶

Care coordination was important for this cohort.^{37,38} The nurse practitioner reviewed the patient’s HF diagnosis in the context of the comorbidities and made an assessment of the family situation in regard to social support. Care coordination was particularly important for the most fragile and elderly patients.^{11,21,39,40} Referrals were frequently made for cardiology, internal medicine, nephrology, wound care, and psychiatry, to name a few. For highly symptomatic patients, the nurse practitioner made referrals to home health care, palliative care, and hospice services, when appropriate. These decisions were based on the patient’s functional and symptomatic status and in recognition of the need for such services for patients who were nearing the end stages of life. Inclusion of patients who were identified as highly symptomatic and in the palliative care phase of HF was likely important. In a recent large study, Chun et al.⁴¹ identified a large upsurge in hospital readmissions in the last 30 to 60 days of life, with approximately 50% of HF readmissions occurring in this time frame. It is possible that appropriate identification and management of this end-stage HF population, through the provision of supportive and home-based palliative nursing services, may have contributed to the reduced hospitalization rates noted in our study.

In 2011, the single largest contributor to 30-day all-cause readmissions was HF, which accounted for 134 000 hospital readmissions totaling \$1.7 billion in costs. In 2009, the mean cost of a HF admission was \$13 000.⁴² There is a human cost to the HF readmission statistics, as well as clear societal and financial costs. When a patient leaves the hospital and then requires readmission because of a decline in his or her health, there is increased suffering and stress for the patient and the family of the patient. Furthermore, the risk of death increases progressively and independently with each subsequent HF or cardiovascular event.^{43,44} Each time a patient “bounces back” to the hospital for additional care, there is a significant increase in the risk of death. Recently, a detailed analysis of readmission data from 2228 hospitals showed that penalties accrued by 1636 hospitals were strongly related to excessive

HF readmission rates. The researchers concluded that initiatives to reduce admission rates should specifically target HF readmissions.⁴⁵ For hospitals that are operating on increasingly tight financial margins and are now subjected to penalties for excessive readmissions, the clear imperative is penalty avoidance. However, there may be an intrinsic conflict of interest for hospitals because readmissions represent increased volume that may contribute to the hospital's income stream. For society, the genuine question is how to provide access and effectively deliver high-quality care that alleviates suffering at an affordable cost.

We have demonstrated that an allied health care team consisting of a nurse practitioner specializing in HF and a clinical pharmacist can effectively deliver specialized postdischarge care by using protocols developed by a HF cardiologist. We showed that this care delivery model reduced 30-day all-cause hospital readmission rates, even exceeding the reduction rates shown for other postdischarge management programs, which have been up to 25%.⁹ This study shows that an allied health postdischarge clinic can provide a valuable service to patients and physicians that will not interfere with the physician-patient relationship. Furthermore, if such care were to be offered routinely and systematically, this model could offer a means to improve the random and haphazard discharge care that is currently the normative standard at most hospitals. This can all be accomplished in a cost-effective, patient-centered manner. The protocols developed in this study could also potentially be modified for home-based services in order to accommodate patients who are physically unable to attend the clinic.

Our study had some limitations. First, it was a single-center study. Also, we did not compare our readmission rates to a control group, but rather to the overall HF readmission rates derived from the same hospital during the same period of time; therefore, the patient groups compared may have differed. Furthermore, we were unable to collect clinical data on patients who were referred but subsequently did not attend the clinic visits; thus, we could not determine whether this group represented a different population than those in our study who did attend the clinic. Home-based interventions were not available to meet the needs of patients who did not attend the clinic because of homebound status or lack of transportation. Additionally, patients were observed on a referral basis, which could have biased the composition of the sample. The patient group that attended the clinic appeared to be motivated to the extent that they made the time to visit the clinic; therefore, data from our cohort may have underestimated medical noncompliance in the total HF population. Further study is warranted to determine whether implementation of this postdischarge care can improve quality of life or be further expanded to other populations known to be at high risk for readmission, such as those admitted for acute

coronary syndrome or pneumonia. Finally, we referred select high-risk patients to outpatient home palliative care, which may have affected our results as well. This aspect needs further study in order to assess the impact on readmission rates and overall quality of life for patients living with advanced or end-stage disease.

Conclusions

In this study, a specialized postdischarge clinic staffed by a clinical pharmacist and a nurse practitioner specializing in HF used protocols developed by a HF cardiologist, including clinic visits at 1 and 4 to 6 weeks postdischarge, to reduce readmission rates for HF patients. The resulting reduction in 30-day readmission rates observed for patients who received the protocol-driven transition care (44.3%) exceeded that reported for previous postdischarge management programs. Thus, by providing a systematized, protocol-driven strategy administered by highly skilled allied health professionals, we were able to address the needs of this population directly and respond to patients individually. Furthermore, by using this strategy, which focused on patient education, maintaining euvolemic status, and reducing medication nonadherence, we provided a service to physicians and their patients that did not interfere with their private physician-patient relationships. Additional care coordination was provided in the outpatient setting. This service, which was performed at a very low cost to the hospital, catered specifically to the postdischarge population; therefore, competition for appointments was never an issue, as it typically is in heavily scheduled primary care clinics or specialists' offices. Finally, this care provided a "relief valve" for patients who had not selected a primary caregiver or who had issues with access to care, giving patients more time to find appropriate primary care.

Sources of Funding

No funding was received to support this project. Clinic space and scheduling support was provided by the Memorial Hermann Hospital at the Texas Medical Center.

Disclosures

None.

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