Discharge Hospice Referral and Lower 30-Day All-Cause Readmission in Medicare Beneficiaries Hospitalized for Heart Failure

Raya E. Kheirbek, MD; Ross D. Fletcher, MD; Marie A. Bakitas, DNSc, CRNP; Gregg C. Fonarow, MD; Sridivya Parvataneni, MD; Donna Bearden, MD, MPH; Frank A. Bailey, MD; Charity J. Morgan, PhD; Steven Singh, MD; Marc R. Blackman, MD; Michael R. Zile, MD; Kanan Patel, MBBS, MPH; Momanna B. Ahmed, BGS; Rodney O. Tucker, MD; Cynthia J. Brown, MD, MSPH; Thomas E. Love, PhD; Wilbert S. Aronow, MD; Jeffrey M. Roseman, MD, PhD; Michael W. Rich, MD; Richard M. Allman, MD; Ali Ahmed, MD, MPH

Background—Heart failure (HF) is the leading cause for hospital readmission. Hospice care may help palliate HF symptoms but its association with 30-day all-cause readmission remains unknown.

Methods and Results—Of the 8032 Medicare beneficiaries hospitalized for HF in 106 Alabama hospitals (1998–2001), 182 (2%) received discharge hospice referrals. Of the 7850 patients not receiving hospice referrals, 1608 (20%) died within 6 months post discharge (the hospice-eligible group). Propensity scores for hospice referral were estimated for each of the 1790 (182+1608) patients and were used to match 179 hospice-referral patients with 179 hospice-eligible patients who were balanced on 28 baseline characteristics (mean age, 79 years; 58% women; 18% non-white). Overall, 22% (1742/8032) died in 6 months, of whom 8% (134/1742) received hospice referrals. Among the 358 matched patients, 30-day all-cause readmission occurred in 5% and 41% of hospice-referral and hospice-eligible patients, respectively (hazard ratio associated with hospice referral, 0.12; 95% confidence interval, 0.06–0.24). Hazard ratios (95% confidence intervals) for 30-day all-cause readmission associated with hospice referral among the 126 patients who died and 232 patients who survived 30-day post discharge were 0.03 (0.04–0.21) and 0.17 (0.08–0.36), respectively. Although 30-day mortality was higher in the hospice referral group (43% versus 27%), it was similar at 90 days (64% versus 67% among hospice-eligible patients).

Conclusions—A discharge hospice referral was associated with lower 30-day all-cause readmission among hospitalized patients with HF. However, most patients with HF who died within 6 months of hospital discharge did not receive a discharge hospice referral. (Circ Heart Fail. 2015;8:733-740. DOI: 10.1161/CIRCHEARTFAILURE.115.002153.)

Key Words: heart failure ■ hospice ■ Medicare ■ readmission

Heart failure (HF) is the leading cause for hospital readmissions in the United States. About 1 in 4 Medicare beneficiaries hospitalized for acute decompensated HF are readmitted within 30 days of hospital discharge.1 Hospital readmission accounts for $17 billion annually of Medicare spending and readmission reduction is a major focus of the Affordable Care Act.1,2 Under the law, hospitals with above-average readmission rates are subject to financial penalties and it has been projected that during the next 10 years US hospitals may collectively lose >$7 billion in Medicare payments.
Under pressure to reduce readmission rates, many hospitals are adopting unproven transition of care strategies.1 There has also been increased interest in better understanding the effects of evidence-based HF therapy on 30-day all-cause readmission in patients with HF. We have demonstrated that digoxin may reduce the risk of 30-day all-cause hospital readmission in patients with HF and reduced ejection fraction (EF) without any adverse effect on mortality, but not in HF with preserved EF.4–6 We also observed similar beneficial association with angiotensin-converting enzyme inhibitors or angiotensin receptor blockers, but not with β-blockers or spironolactone.7–9 Thus, there is a need to identify high quality, HF-specific, and evidence-based nonpharmacologica[l] strategies to reduce 30-day all-cause readmission in patients with HF.

Dyspnea is one of the cardinal symptoms of HF regardless of reduced or preserved EF.10 Worsening HF symptoms, such as dyspnea are often responsible for hospital admissions. Hospice and palliative care approaches to HF management including expert symptom control may be expected to improve HF symptoms and reduce hospitalization. However, the impact of discharge hospice referral on hospital readmissions in patients with HF remains unclear.11 In this study, we examined the association of discharge hospice referral with 30-day all-cause readmission in Medicare beneficiaries hospitalized for decompen(sated HF.

Methods

Data Sources and Study Population

The Alabama Heart Failure Project is a registry of hospitalized patients with HF based on a quality improvement project, the details of which have been presented elsewhere.12 Briefly, extensive data on baseline characteristics, past medical history, admission and discharge medications, in-hospital events, hospital care characteristics, and laboratory values were collected on 8555 Medicare beneficiaries discharged from 106 Alabama hospitals with a principal discharge diagnosis of HF between July 1, 1998 and October 31, 2001.12 Medical records of patients with HF were identified using International Classification of Diseases-Ninth Revision codes and were centrally abstracted and data were later linked to Medicare outcomes data.12 Of the 8555 Medicare beneficiaries with HF, 8049 were discharged alive. The Alabama Heart Failure Project data were approved for second-use by the Institutional Review Board of the University of Alabama at Birmingham.

Exposure Variables

Extensive data on discharge disposition were collected by chart abstraction that included discharge referral for hospice care. Of the 8049 patients discharged alive, data on discharge hospice referral was available for 8032 patients, of which 182 (2%) were referred for hospice care and were included in the hospice-referral group (Figure 1). To assemble a cohort of hospice-eligible patients, we identified patients who died within 6 months post discharge but did not receive discharge hospice referrals. Medicare hospice eligibility requires certification that a patient has a life expectancy of ≤6 months if the terminal illness runs its normal course. Of the 7850 patients who did not receive a discharge hospice referral, 1608 patients died within 6 months of hospital discharge and were considered to be hospice-eligible (Figure 1).

Outcomes Data

The primary outcome of our study was all-cause readmission within 30 days of hospital discharge. Secondary outcomes included all-cause readmission within 3 and 6 months of hospital discharge, HF readmission, all-cause mortality, and the composite end point of all-cause mortality or all-cause readmission at 1, 3, and 6 months after hospital discharge. All outcomes data were obtained from Center for Medicare Services (CMS) Medicare utilization files, CMS Denominator files, CMS Medicare Provider Analysis and Review files.12

Assembly of a Propensity-Matched Balanced Cohort

To reduce bias because of imbalances in baseline characteristics between hospice-referral and hospice-eligible patients, we used propensity scores to assemble a matched balanced cohort.13,14 We used a nonparsimonious multivariable logistic regression model using 28 key baseline characteristics (Table 1) to estimate propensity scores or predicted probability for hospice referral for each of the 1790 patients.15–19 We then used a greedy matching protocol to match patients based on their propensity scores, thus assembling a cohort of 179 pairs of hospice-referral and hospice-eligible patients (Table 1; Figure 2).

Statistical Analyses

Between-group differences in baseline characteristics were compared using Pearson χ² and Wilcoxon rank sum test for prematch, and McNemar test and paired sample t test for postmatch, as appropriate. Kaplan–Meier plots were used to compare adjusted primary outcome of 30-day all-cause readmission rates between propensity-matched hospice-referral and hospice-eligible patients. Bivariate Cox regression models were used to examine adjusted associations of hospice referral with the primary and other secondary outcomes among matched patients. A formal sensitivity analyses was conducted to quantify the degree of a hidden bias that would be required to explain away a significant primary association among matched patients.20 To examine if the association between hospice referral and 30-day all-cause readmission was influenced by a difference in 30-day mortality between the hospice-referral and hospice-eligible groups, we separately examined that association among matched patients who died versus survived during the 30-day post discharge period.

To examine if the primary outcome was affected by 6-month mortality, we examined the primary outcome among a subset of hospice-referral patients who died 6-month post discharge versus hospice-eligible patients, who by study design, died during 6-month post discharge. To examine the heterogeneity of association, we examined the association of hospice referral with 6-month all-cause readmission in several clinically important subgroups of matched patients. Finally, to complement the associations observed in the matched cohort (n=358), we repeated our analyses in the prematch cohort.
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Using 2 traditional multivariable-adjusted Cox regression models: first, adjusting for the 28 variables used to calculate propensity scores as described above, and then, adjusting for the propensity score variable alone as a composite variable representing the 28 variables. All statistical analyses were 2-tailed and $P<0.05$ were considered significant. All data analyses were performed using SPSS-21 for Windows (SPSS, Inc, 2012, Chicago, IL).

**Results**

**Baseline Characteristics**

Patients ($n=358$) had a mean age of 79 years, 58% were female, and 18% were non-white. Although prematch baseline characteristics of patients with HF receiving hospice-referral and hospice-eligible patients with HF not receiving hospice referral were generally similar, those in the hospice-referral group were likely to be sicker with higher prevalence of admission pulmonary edema and in-hospital pressure ulcer (Table 1; Figure 2). Postmatch absolute standardized differences for all 28 baseline characteristics were <10% suggesting that the balance achieved was substantial and any residual bias would be inconsequential (Figure 2).

**Hospice Referral and 30-Day Post Discharge Outcomes**

Among the 8032 prematch patients with data on hospice referral who were discharged alive, 21% ($n=1685$) were readmitted because of all causes within 30 days of hospital discharge.
Among the 358 matched patients, 23% (n=82) had 30-day all-cause readmissions, which occurred in 5% (9/179) and 41% (73/179) of hospice-referral and hospice-eligible patients, respectively (hazard ratio [HR] associated with hospice referral, 0.12; 95% confidence interval [CI], 0.06–0.24; Table 2; Figure 3). There were a total of 58 matched pairs with clear outcomes—for 56 of these pairs, hospice-referral patients were readmitted later than hospice-eligible patients. In the absence of a hidden bias, a sign-score test for matched data with censoring provides strong evidence (P<0.0001) that hospice-eligible patients had more readmissions than hospice-referral patients. Among the 310 matched hospice-referral patients who died during the 6 months of follow-up, 30-day all-cause readmissions occurred in 4% (versus 41% of the hospice-eligible patients; HR associated with hospice referral, 0.10; 95% CI, 0.04–0.25). Multivariable-adjusted and propensity score-adjusted HRs (95% CIs) for 30-day all-cause readmission among the 1790 prematch patients were 0.13 (0.07–0.26) and 0.13 (0.07–0.26), respectively. Hospice referral was also associated with lower 30-day HF readmission (Table 2).

Overall, 126 (35%) matched patients died during the first 30 days post discharge, which was higher in the hospice-referral group (43% versus 27% in the hospice-eligible group; HR, 1.86; 95% CI, 1.30–2.67; Table 2). As a result, hospice referral had no significant association with the composite end points of 30-day all-cause readmission or all-cause mortality (HR, 0.83; 95% CI, 0.62–1.11; Table 2). However, among the 232 matched patients who were alive during the first 30 days, 30-day all-cause readmission occurred in 8% and 39% of hospice-referral and hospice-eligible patients, respectively (HR, 0.17; 95% CI, 0.08–0.36). Among the 126 matched patients who died during the first 30 days, 30-day all-cause readmission occurred in 1% and 47% of hospice-referral and hospice-eligible patients, respectively (HR, 0.03; 95% CI, 0.04–0.21).

### Table 2. Association of Hospice Referral With Post Discharge Outcomes Among Propensity Score–Matched Medicare Beneficiaries Hospitalized for Heart Failure

<table>
<thead>
<tr>
<th></th>
<th>% (Total Events)</th>
<th>Hazard Ratio* (95% Confidence Interval); P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hospice Referral</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No (n=179)</td>
<td>Yes (n=179)</td>
</tr>
<tr>
<td>30-d Post discharge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All-cause readmission</td>
<td>41% (73)</td>
<td>5% (9)</td>
</tr>
<tr>
<td>Heart failure readmission</td>
<td>17% (31)</td>
<td>2% (4)</td>
</tr>
<tr>
<td>All-cause mortality</td>
<td>27% (49)</td>
<td>43% (77)</td>
</tr>
<tr>
<td>All-cause mortality or all-cause readmission</td>
<td>55% (99)</td>
<td>48% (85)</td>
</tr>
<tr>
<td>90-d Post discharge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All-cause readmission</td>
<td>59% (105)</td>
<td>13% (23)</td>
</tr>
<tr>
<td>Heart failure readmission</td>
<td>24% (42)</td>
<td>6% (10)</td>
</tr>
<tr>
<td>All-cause mortality</td>
<td>67% (120)</td>
<td>64% (114)</td>
</tr>
<tr>
<td>All-cause mortality or all-cause readmission</td>
<td>88% (158)</td>
<td>72% (129)</td>
</tr>
<tr>
<td>6-mo Post discharge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All-cause readmission</td>
<td>64% (115)</td>
<td>18% (32)</td>
</tr>
<tr>
<td>Heart failure readmission</td>
<td>27% (49)</td>
<td>8% (15)</td>
</tr>
<tr>
<td>All-cause mortality</td>
<td>100% (179)</td>
<td>73% (131)</td>
</tr>
<tr>
<td>All-cause mortality or all-cause readmission</td>
<td>100% (179)</td>
<td>82% (147)</td>
</tr>
</tbody>
</table>

*Hazard ratios comparing patients receiving hospice referral vs hospice-eligible patients not receiving hospice referral.
Hospice Referral and 3- and 6-Month Post Discharge Outcomes

Among the 358 matched patients, 3-month all-cause readmission occurred in 13% and 59% of patients in the hospice-referral and hospice-eligible groups, respectively (HR, 0.18; 95% CI, 0.12–0.29; Table 2). Hospice referral was associated with lower 3-month HF readmission but had no association with 3-month all-cause mortality (Table 2). Among the 124 matched patients who survived the first 3 months after hospital discharge, 3-month all-cause readmission occurred in 23% and 64% of hospice-referral and hospice-eligible patients, respectively (HR, 0.24; 95% CI, 0.13–0.43). Among the 234 matched patients who died during the first 3 months after hospital discharge, 3-month all-cause readmission occurred in 7% and 56% of hospice-referral and hospice-eligible patients, respectively (HR, 0.15; 95% CI, 0.07–0.31).

Among the 358 matched patients, 6-month all-cause readmission occurred in 18% and 64% of hospice-referral and hospice-eligible patients, respectively (HR, 0.18; 95% CI, 0.12–0.28; Table 2). This association between hospice referral and 6-month all-cause readmission was homogenous across various clinically relevant subgroups of patients (Figure 4). As expected, 6-month all-cause mortality was 100% among hospice-eligible patients, but was 73% among hospice-referral patients.

Discussion

Findings from this study demonstrate that among Medicare beneficiaries discharged alive after hospitalization because of acute decompensated HF, when compared with a propensity-score matched group of hospice-eligible patients who died within 6 months of hospital discharge, the receipt of a discharge hospice referral was associated with a significantly lower 30-day all-cause hospital readmissions. Furthermore, this beneficial association of hospice referral with readmission was observed throughout the entire 6 months post discharge period and was unaffected by all-cause mortality. To the best of our knowledge, this is the first study to report a robust independent association of discharge hospice referral and lower 30-day hospital readmission in Medicare beneficiaries with HF regardless of EF.

There are several potential explanations for the lower readmission rates among patients in the hospice referral group in our study. HF is typically characterized by periods of stability, interrupted by episodes of acute exacerbation, and variable functional ability. However, with disease progression, the mode of death in HF changes from predominantly sudden death to predominantly pump failure death, which is often accompanied by worsening symptoms.21,22 Yet, clinicians often are unable to predict outcomes in patients with HF, even toward the end of life.23,24 Patients with HF and their families generally have minimal prognostic awareness because of lack of knowledge about the disease trajectory. However, enrollment into hospice involves explicit discussion of prognosis, coordination of care and difficult decision making, all of which may enhance their understanding and awareness of the limited prognosis and influence a shift in goals of care toward a less aggressive comfort care at home. However, worsening dyspnea, which is experienced by most patients with HF toward the end of life, may still prompt some patients and families to seek care outside home.24 The substantially lower readmission rate in the hospice-referral group in our study suggests that the palliative care approach used by hospice teams may have been effective in alleviating HF symptoms, thus obviating needs for readmission. Hospice care also aims to address pain, anxiety, and depression, all common in end stage HF;24,25 Hospice patients are required to enter into a contractual agreement with hospice providers forgoing regular Medicare-covered benefits related to the treatment of the terminal illness and related conditions, which may also cause some patients and families to avoid hospitalization.

Another potential explanation for the low 30-day readmission rates is the short survival after hospital discharge, which may be a marker of late referral to hospice. Although all hospice patients were referred at the time of hospital discharge, some may have been near death. National estimates suggest that hospice median length of stay is only 19 days overall and 17 days for patients with HF, and that 35% of patients die or are discharged within 7 days of hospice admission.26,27 However, the higher 30-day mortality in the hospice group is unlikely to fully explain the lower 30-day readmission rates as hospice care was also associated with lower readmission among those who were alive during the first 30 days post discharge. Compared with hospice patients with cancer and HF, those with dementia are known to have longer hospice length of stay and fewer resource use, which may, in turn, result in lower hospitalizations.27 It is also possible that some patients with HF who were referred to hospice for non-HF–related diagnoses, such as advanced dementia. Although we did not have data on specific hospice-defining diagnosis, the impact of dementia-related differences in resource use maybe relatively low as there was no significant between-group difference in the baseline prevalence of dementia.

Over 40% of all patients in the hospice referral group (versus <30% of nonhospice patients) in our study died during the first 30 days post discharge. It is possible that hospice patients were sicker and prognostically different from the matched controls, at least during the first month post discharge. It is also possible that treatment of these sicker patients may have contributed to this higher early mortality. Although we had no data on the prevalence of opioid use post discharge, it is possible that some of the hospice patients received opioids, which are...
known to alleviate dyspnea, pain, and anxiety in end-stage HF patients. However, opioids use has also been shown to be associated with higher mortality. Thus, opioid use may, in part, explain the higher early mortality in the hospice-referral group, although selection bias cannot be ruled out. Intravenous inotropes, also recommended for short-term symptom management in end-stage HF, are also known to increase mortality. The 25% of the hospice-referral patients who were alive at 6 months may be different clinically (less sick or better responders) from the matched controls. However, the results of our sensitivity analysis suggest that the exclusion of those 25% of the survivors did not alter the primary association. By 90 days post discharge, mortality rates were similar between the groups and as a result, hospice referral was also associated with a significantly lower risk of the combined end point of 90-day all-cause readmission or 90-day all-cause mortality.

Several limitations of our study need to be acknowledged. As in any nonrandomized study, findings of our study may potentially be confounded by imbalances in unmeasured covariates. However, findings from our sensitivity analysis suggest that hospice referral associated lower all-cause readmission was rather insensitive to a potential unmeasured confounder. For an unmeasured covariate to explain away this association, it would need to increase the odds of hospice referral by nearly 7-fold. However, for such an imaginary unmeasured binary covariate to become a confounder, it would also need to be a near perfect predictor of 30-day all-cause readmission and could not be strongly correlated to any of the 28 variables used in our propensity score model. Other limitations include data derived from a single state during 1998 to 2001 may limit generalizability to more contemporary HF patients. However, resource use and prognostic characteristics of patients with end-stage HF have remained mostly unchanged in the past decade. Most of the recent changes in the management of HF are more relevant to younger HF patients with low EF. Patients in our study had a mean age of 79 years and over half of them had preserved EF. We had no data on patient and care characteristics such as advance directive and indicators of end-stage HF such as symptoms status and in-hospital inotrope use that are often considered for hospice referral. Finally, we had no data on socioeconomic and personal preferences of patients or their family members and other psychosocial factors.

Figure 4. Hazard ratio and 95% confidence interval (CI) for 6-month all-cause readmission among subgroups of propensity-matched hospice-referral and hospice-eligible patients with heart failure. COPD indicates chronic obstructive pulmonary disease.
factors, which may potentially influence hospice referral and partly explain our findings.

In conclusion, most patients with HF who died within 6 months of hospital discharge did not receive a discharge hospice referral, which was associated with lower 30-day all-cause readmission among Medicare beneficiaries hospitalized for decompensated HF. These data will hopefully stimulate much needed research to develop and test tools to identify hospice-eligible patients, and derive evidence about the impact of hospice care on 30-day all-cause readmission, for which HF is the leading cause and currently there are few sustainable effective interventions.

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References
CLINICAL PERSPECTIVE

About a quarter of Medicare beneficiaries hospitalized for decompensated heart failure (HF) returns to the hospital for readmission within 30 days of discharge. Hospital readmissions cost Medicare >$17 billion annually, the reduction of which is a priority under the Affordable Care Act. Under the new law, hospitals are projected to collectively lose >$7 billion in Medicare payments during the next 10 years for above-average 30-day all-cause readmissions, for which HF is the leading cause. There are few interventions with proven benefit to consistently lower readmission in patients with HF. Medicare beneficiaries with a terminal condition and a life expectancy of ≤6 months are eligible for hospice care. However, we observed that only 8% of hospitalized patients with HF who died within 6 months of discharge received hospice care. Because patients with HF become increasingly symptomatic toward their end of life and hospice care focuses on symptom palliation, we hypothesized that discharge hospice referral may be associated with lower readmission. We observed that only 5% of hospitalized patients with HF who received hospice referral at discharge were readmitted within 30 days of hospital discharge. In contrast, this rate was 41% for a group of hospice-eligible HF patients who died within 6 months of discharge. This significant benefit was observed throughout the first 6 months after discharge and was not affected by death. These findings suggest that a more accurate identification of hospice-eligible patients and a more appropriate hospice-referral approach may potentially lower 30-day all-cause readmission for hospitalized patients with HF.
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