

Relationship Between Early Physician Follow-up and 30-Day Readmission Among Medicare Beneficiaries Hospitalized for Heart Failure

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CLINICIANS, PAYERS, AND policy makers seeking to promote efficiency and quality in health care are targeting hospital readmission rates.¹ One-fifth of Medicare beneficiaries are rehospitalized within 30 days and more than one-third within 90 days.¹ Nearly 90% of these readmissions are unplanned and potentially preventable, which translates into \$17 billion or nearly 20% of Medicare's hospital payments.² As the most common diagnosis associated with 30-day readmission among Medicare beneficiaries, heart failure is a prime example of the challenges in transitional care.¹

Studies suggest that care coordination is important in preventing readmission.³ The days immediately following discharge are a vulnerable period due to the addition of therapies or changes to existing medical therapy that may worsen a patient's heart failure clinical status or other conditions such as chronic kidney disease.⁴ Early physician follow-up may have the poten-

Context Readmission after hospitalization for heart failure is common. Early outpatient follow-up after hospitalization has been proposed as a means of reducing readmission rates. However, there are limited data describing patterns of follow-up after heart failure hospitalization and its association with readmission rates.

Objective To examine associations between outpatient follow-up within 7 days after discharge from a heart failure hospitalization and readmission within 30 days.

Design, Setting, and Patients Observational analysis of patients 65 years or older with heart failure and discharged to home from hospitals participating in the Organized Program to Initiate Lifesaving Treatment in Hospitalized Patients With Heart Failure and the Get With the Guidelines-Heart Failure quality improvement program from January 1, 2003, through December 31, 2006.

Main Outcome Measure All-cause readmission within 30 days after discharge.

Results The study population included 30 136 patients from 225 hospitals. Median length of stay was 4 days (interquartile range, 2-6) and 21.3% of patients were readmitted within 30 days. At the hospital level, the median percentage of patients who had early follow-up after discharge from the index hospitalization was 38.3% (interquartile range, 32.4%-44.5%). Compared with patients whose index admission was in a hospital in the lowest quartile of early follow-up (30-day readmission rate, 23.3%), the rates of 30-day readmission were 20.5% among patients in the second quartile (risk-adjusted hazard ratio [HR], 0.85; 95% confidence interval [CI], 0.78-0.93), 20.5% among patients in the third quartile (risk-adjusted HR, 0.87; 95% CI, 0.78-0.96), and 20.9% among patients in the fourth quartile (risk-adjusted HR, 0.91; 95% CI, 0.83-1.00).

Conclusions Among patients who are hospitalized for heart failure, substantial variation exists in hospital-level rates of early outpatient follow-up after discharge. Patients who are discharged from hospitals that have higher early follow-up rates have a lower risk of 30-day readmission.

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tial to reduce readmission rates. However, few studies have examined follow-up care after heart failure hospitalization or its association with readmission.

In this study, we examined hospital-level variation in postdischarge physician follow-up and relationships between rates of early follow-up and patient outcomes.

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METHODS

Data Sources

We linked Medicare inpatient claims data from January 1, 2003, through December 31, 2006, with data from the Organized Program to Initiate Lifesaving Treatment in Hospitalized Patients With Heart Failure (OPTIMIZE-HF) and the Get With the Guidelines-Heart Failure (GWTG-HF) registries. In 2005, the former program transitioned to the latter under the sponsorship of the American Heart Association. The registries had the same design, inclusion criteria, and data collection methods.^{5,6} Patients were eligible for inclusion in the registries if they were admitted for an episode of worsening heart failure or had developed significant heart failure symptoms during a hospitalization for which heart failure was the primary discharge diagnosis. Hospital teams used heart failure case-ascertainment methods similar to those used by the Joint Commission⁷ and submitted data on medical history, signs and symptoms, medications, contraindications for or intolerance of medications, and diagnostic test results via a Web-based registry. The representativeness and validity of the OPTIMIZE-HF registry have been described previously.⁸

For each patient in this study, we obtained Medicare inpatient, outpatient, carrier, and denominator files from 2003 through 2007. We used the inpatient files to examine readmission rates and the denominator files to examine mortality rates. We used the carrier files to examine outpatient transitional care after discharge from the initial heart failure hospitalization. The carrier files contain claims from non-institutional providers for services covered under Medicare Part B, including Healthcare Common Procedure Coding System (HCPCS) codes, physician specialty codes, and service dates. We used data from 2007 for patients whose index discharge occurred in December 2006. The final date for 30-day patient follow-up was January 30, 2007. The institutional review board of the Duke University Health System approved this study.

Study Population

We used indirect identifiers to link data for patients 65 years or older from both registries with inpatient Medicare claims files, a method described previously by Hammill et al.⁶ Using this method, we linked 62 311 (78%) of the 79 837 program-eligible hospitalizations to Medicare inpatient claims. Eligible patients were enrolled in fee-for-service Medicare for at least 30 days after the index hospitalization and were discharged from a hospital participating fully in either program. If a patient had multiple hospitalizations, we selected the first as the index hospitalization. We excluded 9166 patients who were discharged to a skilled nursing facility and 804 discharged to hospice care. We excluded 1390 patients from 143 hospitals that had fewer than 25 patients remaining after prior exclusions.

Early Follow-up

At the patient level, the association between time from hospital discharge to outpatient follow-up with a physician and risk of readmission is confounded by severity of illness. Patients who have more severe heart failure, have greater comorbid illness, or are medically less stable are commonly seen sooner after hospital discharge but also are at greater risk of readmission. To avoid this confounding, we examined associations between hospital patterns of early follow-up and patient-level outcomes. We defined early follow-up as an outpatient evaluation and management visit with a physician (HCPCS codes 992.xx-994.xx) within 7 days after discharge from the index hospitalization. We selected 7 days to be consistent with current efforts to improve transitional care.⁹ We excluded emergency department visits from calculations of early follow-up rates because they were unplanned visits not reflective of a system of care.

We used the physician specialty code recorded on the claims to classify physicians as cardiologists or general internists. We considered patients who visited the same physician during the index hospitalization and at follow-up

to have experienced continuity of care. Using Medicare hospital identifiers from the index hospitalization claims, we aggregated patient-level follow-up at the hospital level and calculated the proportion of discharged patients who received early follow-up by hospital. We used the same approach to summarize hospital-level follow-up at 14, 21, and 28 days after discharge. We used the hospital rate of early physician follow-up—grouped in quartile rankings—as the exposure of interest.

Patient and Hospital Characteristics

From the registry data, we obtained patient demographic characteristics, medical history, results of admission laboratory tests and examinations, discharge pharmacy records, and procedural information from the index hospitalization. Patients were assigned to race/ethnicity categories using options available on the case report form. We used the reported category “black” and combined all others as “nonblack.” Variables in this analysis had low rates of missingness (ie, <5% of records), with the exception of evaluation of left ventricular function (12.1%). For continuous variables and the variable for evaluation of left ventricular function, we created categorical variables that included a category for missing values. For other dichotomous variables (ie, smoker within the past year, discharge processes and performance measures, and index hospitalization procedures), we imputed missing values to “no.” From the American Hospital Association annual survey,¹⁰ we obtained information on membership in the Council of Teaching Hospitals, presence of a cardiac intensive care unit, availability of adult diagnostic or interventional catheterization and heart transplantation services, total number of beds, annual number of Medicare and Medicaid discharges, and rural and geographic location.

Outcomes

We examined Medicare claims for up to 30 days after discharge from the in-

Table 1. Characteristics of the Study Population by Quartile of Hospital-Level Rates of Early Follow-up

Characteristics	Hospital-Level Percentage Rate of Early Follow-up by Quartile, No. (%)				P Value
	1 (<32.4)	2 (32.4-37.9)	3 (38.3-44.5)	4 (>44.5)	
No. of patients	7081	8662	7812	6581	
Age, y ^a					
65-69	1000 (14.1)	1207 (13.9)	1143 (14.6)	769 (11.7)	<.001
70-74	1312 (18.5)	1526 (17.6)	1409 (18.0)	1046 (15.9)	<.001
75-79	1630 (23.0)	1873 (21.6)	1653 (21.2)	1436 (21.8)	.04
≥80	3139 (44.3)	4056 (46.8)	3607 (46.2)	3330 (50.6)	<.001
Female sex	3847 (54.3)	4576 (52.8)	4135 (52.9)	3511 (53.4)	.24
Black race	1337 (18.9)	715 (8.3)	772 (9.9)	390 (5.9)	<.001
Medical history					
Anemia	1289 (18.2)	1492 (17.2)	1253 (16.0)	990 (15.0)	<.001
Atrial arrhythmia	2475 (35.0)	3239 (37.4)	2675 (34.2)	2303 (35.0)	<.001
COPD	2022 (28.6)	2589 (29.9)	2023 (25.9)	1636 (24.9)	<.001
Chronic renal insufficiency	1355 (19.1)	1657 (19.1)	1375 (17.6)	1068 (16.2)	<.001
Coronary artery disease	3839 (54.2)	4807 (55.5)	4032 (51.6)	3430 (52.1)	<.001
Depression	672 (9.5)	912 (10.5)	565 (7.2)	531 (8.1)	<.001
Diabetes mellitus	2900 (41.0)	3446 (39.8)	3118 (39.9)	2428 (36.9)	<.001
Hyperlipidemia	2545 (35.9)	3563 (41.1)	2759 (35.3)	2246 (34.1)	<.001
Hypertension	5278 (74.5)	6358 (73.4)	5437 (69.6)	4612 (70.1)	<.001
Peripheral vascular disease	976 (13.8)	1422 (16.4)	1013 (13.0)	764 (11.6)	<.001
Prior CVA or TIA	1098 (15.5)	1489 (17.2)	1188 (15.2)	1022 (15.5)	.002
Smoker within the past year	687 (9.7)	945 (10.9)	771 (9.9)	512 (7.8)	<.001
Findings on admission, median (IQR)					
Hemoglobin, g/dL	12.0 (10.7-13.4)	12.0 (10.7-13.4)	12.1 (10.8-13.4)	12.1 (10.8-13.4)	.30
Serum creatinine, mg/dL	1.4 (1.0-1.9)	1.3 (1.0-1.8)	1.3 (1.0-1.8)	1.3 (1.0-1.8)	<.001
Serum sodium, mEq/L	139.0 (136.0-141.0)	138.0 (135.0-141.0)	138.0 (135.0-141.0)	138.0 (135.0-141.0)	<.001
Systolic blood pressure, mm Hg	140.0 (122.0-161.0)	140.0 (120.0-161.0)	140.0 (120.0-160.0)	140.0 (120.0-160.0)	.08
Left ventricular function					
LVSD	2841 (40.1)	3404 (39.3)	2947 (37.7)	2300 (34.9)	<.001
Preserved systolic function	3441 (48.6)	4311 (49.8)	3930 (50.3)	3301 (50.2)	.16
Discharge processes or performance measures					
Referral to outpatient disease management program	697 (9.8)	1296 (15.0)	948 (12.1)	678 (10.3)	<.001
Discharge instructions completed	4355 (61.5)	5508 (63.6)	4633 (59.3)	3642 (55.3)	<.001
β-Blocker for patients with LVSD ^b	2210 (77.8)	2579 (75.8)	2256 (76.6)	1721 (74.8)	.08
ACE inhibitor or ARB for patients with LVSD ^b	2023 (71.2)	2425 (71.2)	2073 (70.3)	1621 (70.5)	.81
Characteristics of index hospitalization					
Coronary artery bypass graft surgery	39 (0.6)	47 (0.5)	48 (0.6)	45 (0.7)	.67
Implantable cardioverter-defibrillator	203 (2.9)	362 (4.2)	206 (2.6)	163 (2.5)	<.001
Percutaneous coronary intervention	110 (1.6)	114 (1.3)	89 (1.1)	91 (1.4)	.18
Right cardiac catheterization	177 (2.5)	259 (3.0)	233 (3.0)	172 (2.6)	.15
Length of stay, median (IQR), d	4.0 (3.0-7.0)	4.0 (2.0-6.0)	4.0 (2.0-6.0)	4.0 (2.0-6.0)	<.001

Abbreviations: ACE, angiotensin-converting enzyme; ARB, angiotensin II receptor blocker; COPD, chronic obstructive pulmonary disease; CVA, cerebrovascular accident; IQR, interquartile range; LVSD, left ventricular systolic dysfunction; TIA, transient ischemic attack.

SI conversion factor: To convert creatinine from mg/dL to μmol/L, multiply by 88.4

^aPercentages may not sum to 100 due to rounding.

^bOf the patients with LVSD, 2841 were in quartile 1, 3404 were in quartile 2, 2947 were in quartile 3, and 2300 were in quartile 4.

dex hospitalization. We calculated the time to first readmission as the number of days between the index discharge date and the readmission date. Transfers to or from another hospital and admissions for rehabilitation (diagnosis related group 462 or an admission diagnosis code of V57.xx) did not count as readmissions. Emergency department visits that did not result in admissions were not considered as a readmission outcome. We obtained mortality information from the Medicare denominator files and calculated time to death as the number of days between the index discharge date and the death date.

Statistical Analysis

We present hospital-level rates of early follow-up as medians with interquartile ranges. For baseline patient and hospital characteristics, we present categorical variables as frequencies with percentages and continuous variables as medians with interquartile ranges. We grouped patients and hospitals by quartiles of hospital rates of early follow-up. To test for differences by quartile, we used χ² tests for categorical variables and Kruskal-Wallis tests for continuous variables. We used the cumulative incidence function, which accounts for the competing risk of death, to calculate unadjusted 30-day readmission rates. We used Gray tests to compare 30-day readmission rates by quartile of hospital-level early follow-up. We calculated unadjusted 30-day mortality rates and 30-day mortality or readmission rates as proportions and used χ² tests to test for differences by quartile.

We used Cox proportional hazards models to examine unadjusted and adjusted relationships between hospital-level early follow-up and 30-day readmission. In multivariable analysis, we modeled 30-day readmission as a function of hospital-level early follow-up rate, age, sex, black race, medical history, results of admission laboratory tests and examinations, completion of discharge instructions, referral to a heart failure disease management program,

length of stay for the index hospitalization more than 7 days, and year of the index hospitalization. In secondary analyses, we examined associations between early follow-up with a cardiologist or continuity of care and 30-day readmission. In sensitivity analyses, we allowed early follow-up to occur within 14 days after discharge.

In all readmission models, we censored patients' data from the analysis on the date of death as obtained from the Medicare denominator file. We used robust standard errors to account for clustering of patients within hospitals. We also used Cox proportional hazards models to examine relationships between hospital-level early follow-up and risk-adjusted 30-day mortality and risk-adjusted 30-day mortality or readmission. We used a significance level of .05 and 2-sided tests for all hypotheses. In all analyses, we tested the proportionality assumption for the hospital-level exposure of interest. We did not conduct a prospective power analysis. However, for the primary analysis, with the observed rate of 30-day readmission and the observed sizes of each exposure group by hospital quartile of early follow-up, we had greater than 80% power to detect a hazard ratio of 0.90 between any 2 exposure groups. We used SAS version 9.2 (SAS Institute Inc, Cary, North Carolina) for all analyses.

RESULTS

The study included 30 136 patients from 225 hospitals. Median age was 79 years, 53.3% of patients were women, and 10.7% were black. The median number of study patients per hospital was 229, ranging from 25 to 693. Median length of stay was 4 days.

TABLE 1 shows characteristics of the study population by quartile of hospital-level rates of early follow-up. The proportion of black patients was markedly higher among hospitals with the lowest rates of early follow-up. The rate of coronary artery disease was similar across quartiles, whereas the proportion of documented left ventricular systolic dysfunction was highest among pa-

tients in the lowest quartile. Chronic obstructive pulmonary disease, depression, and chronic renal insufficiency were more common among patients in the lower 2 quartiles compared with patients in the upper 2 quartiles.

In 93.7% (28 229 of 30 136) of patients, it was documented that an outpatient follow-up was scheduled before hospital discharge. However, information on the date scheduled for the follow-up visit was not available. The FIGURE shows a histogram of hospital-level rates of early follow-up. At the hospital level, the median rate of early follow-up was 38.3% (interquartile range, 32.4%-44.5%) and the maximum was 63.7% (TABLE 2). A median of 18.1% of patients saw the same physician during the index hospitalization and during early follow-up. By 28 days after discharge, this rate increased to 50.0%. The median rate of inpatient evaluation by a cardiologist was 68.7%, but the rate of early follow-up with a cardiologist was 7.5%.

Across quartiles, hospitals were similar with respect to teaching status, availability of cardiac services such as cardiac catheterization and heart transplantation, and number of beds (eTable available at <http://www.jama.com>). There were higher rates of early follow-up in the West than in other geographic regions.

Predictors of 30-Day Readmission

In the first 30 days after discharge, 6428 patients (21.3%) were readmitted. As shown in TABLE 3, unadjusted 30-day readmission rates were highest among patients in hospitals in the lowest quartile of early follow-up (23.3% readmission). TABLE 4 shows unadjusted and adjusted associations between early physician follow-up and all-cause readmission. The proportionality assumption was met for the hospital-level exposure of interest ($\chi^2_3=4.66$; $P=.20$).

After adjustment for baseline patient characteristics of the index hospitalization, there was an inverse relationship between early follow-up and the hazard of 30-day readmission. Compared with patients whose index hos-

Figure. Variation in Physician Follow-up Within 7 Days After Discharge

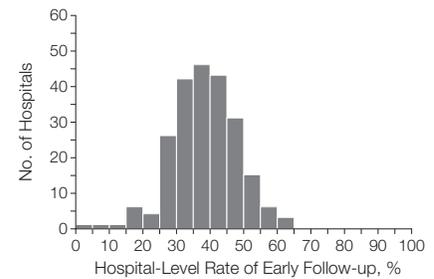


Table 2. Hospital-Level Rates of Early Follow-up During the Transitional Period

Physician Visited, by Days	Rate of Early Follow-up, Median (IQR)
Any physician	
≤7	38.3 (32.4-44.5)
≤14	64.6 (56.6-70.0)
≤21	76.5 (70.7-81.2)
≤28	81.5 (76.7-85.7)
Same physician during index hospitalization and transitional period	
≤7	18.1 (13.5-24.1)
≤14	34.9 (26.3-42.4)
≤21	44.3 (34.4-53.3)
≤28	50.0 (38.8-58.6)
Cardiologist	
≤7	7.5 (4.1-13.8)
≤14	17.1 (11.6-26.7)
≤21	25.2 (17.3-35.7)
≤28	31.3 (22.6-42.3)
Same cardiologist during index hospitalization and transitional period	
≤7	3.4 (1.2-7.0)
≤14	8.4 (4.1-15.8)
≤21	13.7 (7.4-22.7)
≤28	17.2 (9.1-26.9)

pitalization occurred in a hospital in the lowest quartile of early follow-up, the risk-adjusted hazard of 30-day readmission was significantly lower in the second quartile. We found no significant difference in readmission risk when we compared the second, third, and fourth quartiles ($\chi^2_2=2.20$; $P=.33$). Neither early follow-up with a cardiologist nor continuity of care from the same physician during the index hospitalization and during early follow-up was a significant predictor of 30-day readmission.

In sensitivity analyses, we varied the definition of early follow-up. The median frequency of follow-up within 2 weeks was 64.6% (interquartile range, 56.6%-70.0%). Results were similar when we increased the transitional period from 7 days to 14 days (Table 4).

Predictors of 30-Day Mortality

In the first 30 days after discharge, 1419 patients (4.7%) died. There was no sig-

nificant difference in unadjusted mortality rates by quartile of early follow-up (Table 3). After adjustment for baseline characteristics, no significant difference existed in the 30-day mortality by quartile of early follow-up (quartile 1: reference; quartile 2: HR, 0.95; 95% confidence interval [CI], 0.80-1.14; quartile 3: HR, 0.88; 95% CI, 0.74-1.04; quartile 4: HR, 0.84; 95% CI, 0.69-1.03). The risk-adjusted hazard of

30-day mortality was significantly lower among patients admitted to hospitals in the highest quartile of early follow-up with a cardiologist (quartile 4: HR, 0.75; 95% CI, 0.62-0.90) compared with the lowest quartile (quartile 1: reference) but there was no significant difference in quartile 2 (HR, 0.88; 95% CI, 0.74-1.06) or quartile 3 (HR, 0.85; 95% CI, 0.71-1.02) compared with the lowest quartile. Compared with patients admitted to hospitals in the lowest quartile of early follow-up, the risk-adjusted hazard of 30-day mortality or readmission was 10% to 14% lower among patients admitted to hospitals with higher frequency of early follow-up (quartile 1: reference; quartile 2: HR, 0.86; 95% CI, 0.79-0.94; quartile 3: HR, 0.88; 95% CI, 0.80-0.96; quartile 4: HR, 0.90; 95% CI, 0.83-0.98).

Table 3. Rates of Mortality, Readmission, and Mortality or Readmission at 30 Days by Quartile of Hospital Rate of Early Follow-up

Variable	Percentage Rate of Early Follow-up by Quartile, No. (%)				P Value
	1 (<32.4)	2 (32.4-37.9)	3 (38.3-44.5)	4 (>44.5)	
No. of patients	7081	8662	7812	6581	
Event, 30 d					
Mortality ^a	353 (5.0)	417 (4.8)	352 (4.5)	297 (4.5)	.44
Readmission ^b	1658 (23.3)	1787 (20.5)	1606 (20.5)	1377 (20.9)	<.001
Mortality or readmission ^a	1849 (26.1)	2015 (23.3)	1813 (23.2)	1544 (23.5)	<.001

^aBased on proportion of events.
^bBased on cumulative incidence function.

Table 4. Unadjusted and Adjusted Relationships Between Early Physician Follow-up by Quartile and 30-Day All-Cause Readmission^a

Quartile (% of Follow-up)	Unadjusted HR (95% CI)	P Value	Adjusted HR (95% CI)	P Value
Model 1: early follow-up with a physician				
1 (<32.4)	1 [Reference]		1 [Reference]	
2 (32.4-37.9)	0.86 (0.78-0.94)	.001	0.85 (0.78-0.93)	<.001
3 (38.3-44.5)	0.85 (0.76-0.94)	.002	0.87 (0.78-0.96)	.005
4 (>44.5)	0.87 (0.79-0.95)	.002	0.91 (0.83-1.00)	.05
Model 2: early follow-up with a cardiologist				
1 (<4.1)	1 [Reference]		1 [Reference]	
2 (4.1-7.4)	0.91 (0.82-1.02)	.09	0.92 (0.83-1.02)	.09
3 (7.5-13.8)	0.91 (0.82-1.00)	.05	0.91 (0.82-1.00)	.05
4 (>13.8)	0.91 (0.82-1.00)	.06	0.95 (0.85-1.05)	.30
Model 3: early follow-up with the same physician				
1 (<13.5)	1 [Reference]		1 [Reference]	
2 (13.5-17.5)	0.93 (0.84-1.04)	.20	0.96 (0.86-1.05)	.36
3 (18.1-24.1)	0.91 (0.81-1.02)	.11	0.94 (0.84-1.04)	.23
4 (>24.1)	0.93 (0.83-1.03)	.16	0.97 (0.87-1.08)	.54
Model 4: 14-d follow-up with a physician				
1 (<56.6)	1 [Reference]		1 [Reference]	
2 (56.6-64.5)	0.88 (0.80-0.97)	.01	0.89 (0.81-0.97)	.01
3 (64.6-70.0)	0.87 (0.78-0.97)	.009	0.90 (0.81-1.00)	.04
4 (>70.0)	0.87 (0.79-0.96)	.004	0.93 (0.84-1.02)	.13

Abbreviations: CI, confidence interval; HR, hazard ratio.
^aAll models included age, sex, black race, medical history (ie, anemia, atrial arrhythmia, chronic obstructive pulmonary disease, chronic renal insufficiency, coronary artery disease, depression, diabetes mellitus, hyperlipidemia, hypertension, peripheral vascular disease, prior cerebrovascular accident or transient ischemic attack, and smoker within the past year), results of admission laboratory tests and examinations (ie, serum creatinine level, serum sodium level, systolic blood pressure, and hemoglobin level, and left ventricular function), completion of discharge instructions, referral to a heart failure disease management program, length of stay for the index hospitalization more than 7 days, and year of the index hospitalization.

COMMENT

Despite the high risk of readmission among patients hospitalized for heart failure, most patients in this study did not visit a physician within a week of discharge. Rates of early follow-up varied substantially across hospitals. Most early follow-up care was handled by general internists rather than cardiologists and usually not by the same physician who evaluated the patient during the index hospitalization. Discharge from hospitals in which a greater proportion of patients received early follow-up was independently associated with lower rates of all-cause 30-day readmission.

Transitional care is designed to ensure coordination and continuity in health care as patients transfer between locations.¹¹ Important elements of transitional care include communication between sending and receiving clinicians, preparation of the patient and caregiver for what to expect at the next site of care, reconciliation of medications, follow-up plans for outstanding tests, and discussions about monitoring signs and symptoms of worsening conditions.^{11,12} For patients with heart failure, the transition from inpatient to outpatient care can be an especially vul-

nerable period because of the age of the patients, complex medical regimens, the large number of comorbid conditions, and the multiple clinicians who may be involved.

As we found in this study, a central element of transitional care, outpatient follow-up, varies significantly across hospitals and, for most patients, does not occur in a timely manner. It is common for different physicians to care for patients in the hospital setting and outpatient settings. Early evaluation after discharge is critical. This evaluation should include a review of therapeutic changes and a thorough assessment of the patient's clinical status outside of the highly structured hospital setting.

Our findings highlight a need for improvement and greater uniformity in coordination of care from inpatient to outpatient settings. Most follow-up during the transitional period, especially the first week, is handled by general internists. More than two-thirds of patients hospitalized for heart failure are evaluated by a cardiologist during the inpatient stay, but less than 10% visit a cardiologist within 7 days after discharge. As clinicians narrow the scope of their practices to a single setting (eg, hospital) or subspecialty, coordination of care will become increasingly challenging.^{13,14} Barriers to coordination of care include overextended primary care, lack of interoperable computerized records, lack of financial incentives, and lack of integrated systems of care.¹⁵ Early postdischarge follow-up may help to minimize gaps in understanding of changes to the care plan or knowledge of test results.¹⁶

Among hospitals with higher rates of early follow-up, risk for readmission is lower. After adjustment for case mix, admission laboratory results, provision of discharge instructions, and length of stay, the risk-adjusted hazard of 30-day readmission was 15% lower among patients in hospitals in the second quartile of early follow-up than among patients in hospitals in the lowest quartile. There was no additional risk reduction associated with the third

and fourth quartiles of early follow-up. Although we found that patients discharged from hospitals with high rates of early follow-up have a lower risk of readmission, even hospitals with the highest early follow-up rates had readmission rates of 20%. Documentation of discharge instructions is widely presumed to be a process of care that helps to ensure early follow-up and better outcomes, but this measure is inconsistent with hospital-level rates of early follow-up and is not associated with lower readmission rates.¹⁷ This finding raises the possibility that discharge instructions are becoming rote processes that do not adequately address elements of care that ensure a safe transition.¹⁸

Hospitals and clinicians are also interested in processes that improve 30-day mortality. We did not observe statistically significant improvement in 30-day mortality by hospital quartiles of early follow-up by any physician. We did find that patients discharged from hospitals with the highest rates of early follow-up by a cardiologist had lower risk of 30-day mortality, consistent with other studies of cardiology care for heart failure.^{19,20} Discharge from hospitals in the higher quartiles of early follow-up was associated with a 10% to 14% lower risk of mortality or readmission compared with the lowest quartile of early follow-up. Validation of these findings, and the potential for early follow-up to improve 30-day mortality or readmission, would be useful topics of investigation.

This study also provides evidence in support of guidelines recommending the use of postdischarge systems of care.^{21,22} Initiatives to encourage early follow-up are ongoing.⁹ Achieving early follow-up may be difficult for some physician practices, but models of care that include nurse practitioners or physician assistants under physician supervision may result in increased access to and timeliness of care. Given the low rate of early follow-up and variability across hospitals, early follow-up is a potential measure of quality that could be integrated into heart failure performance measure sets and tar-

geted for improvement by national initiatives.

Our study has several limitations. First, this was an observational study and patients were not randomly assigned to early follow-up. We cannot rule out the possibility of unmeasured confounding. Second, the analysis was restricted to fee-for-service Medicare beneficiaries enrolled in heart failure clinical registries, and hospitals that participated in the registry differed from nonparticipating hospitals.⁸ However, fee-for-service Medicare beneficiaries in the OPTIMIZE-HF registry (the precursor to the GWTG-HF registry) were similar to all fee-for-service Medicare beneficiaries with heart failure.⁸ Third, we did not have access to data on home health visits and disease management programs, such as telephone or other remote monitoring, which may be important for preventing 30-day readmission. If a significant proportion of patients received early home health visits or monitoring but not early physician visits and if these programs were effective in reducing readmissions, we would have a lower likelihood of detecting associations between early physician follow-up and improved outcomes. In addition, we were unable to determine whether early follow-up visits were with physician assistants or nurse practitioners with or without direct physician supervision but filed under the physician. Fourth, data on socioeconomic status were not available. Fifth, information about the types and extent of discharge protocols in use by participating hospitals was not available. Moreover, we did not explore the relationships between early follow-up and other clinical outcomes such as health status, quality of life, functional status, patient satisfaction, and cause-specific readmission. Finally, the potential mechanisms by which hospital-level early physician follow-up rates are associated with lower 30-day rehospitalization rates could not be determined.

In conclusion, among patients hospitalized for heart failure, rates of physician follow-up within 1 week of dis-

