

SUPPLEMENTAL MATERIAL

Supplemental Table 1. Comparison of All- Cause and Heart Failure-Specific 30-Day Readmission Rates in 2009 and 2012

Supplemental Table 2. Site level Characteristics by Center Percentage of Referrals to Heart Failure Readmission Rates Above and Below Median Referral Rate

Supplemental Table 3. Association of Site-Level Factors and General Risk-Adjusted 30-Day Readmission Rates in 2012

Supplemental Table 1. Comparison of 30-Day All-Cause and Heart Failure Readmission Rates in 2009 and 2012

Variable	Mean Rate (SD)
Unadjusted 30-day all-cause readmission rate in 2009	20.2 (7.5)
Unadjusted 30-day all-cause readmission rate in 2012	18.6 (6.5)
Unadjusted 30-day heart failure readmission rate in 2009	7.2 (4.1)
Unadjusted 30-day heart failure readmission rate in 2012	6.5 (3.8)

Supplemental Table 2. Hospital-Level Characteristics by Percentage of Referrals to Heart Failure Disease Management Programs

Variable	All Hospitals (N = 70)	Below the Median Referral Rate (n = 35)*	Above the Median Referral Rate (n = 35)*	P Value
Demographic characteristics, median (quartiles)				
Average age, y	80.0 (78.2 to 81.7)	81.3 (79.0 to 82.8)	79.2 (77.5 to 80.8)	.002
Women, %	53.6 (50.2 to 57.8)	57.2 (49.9 to 65)	52.2 (50.2 to 55.9)	.10
Race other than white, %	14.6 (6.5 to 31.3)	1.4 (3.9 to 27.1)	20.1 (10.1 to 35.7)	.01
Insurance, %				
Medicaid	3.0 (0.3 to 8.3)	0.5 (0.0 to 6.7)	6.6 (1.5 to 9.4)	.003
Medicare	83.1 (43.3 to 97.2)	89.7 (5.9 to 98.4)	77.8 (33.3 to 89.3)	.02
Other	13.0 (1.8 to 36.5)	5.4 (0.8 to 35.6)	13.9 (4.1 to 43.5)	.07
None or not documented	0.0 (0.0 to 0.2)	0	0.0 (0.0 to 0.3)	.03
Medical history, median (quartiles)				
Anemia, %	19.3 (14.3 to 26.0)	18.7 (12.4 to 27.7)	20.0 (14.8 to 25.5)	.79
Atrial fibrillation, %	40.0 (32.6 to 44.9)	39.6 (32.0 to 44.4)	40.2 (32.6 to 45.7)	.61
Cerebrovascular accident or transient ischemic attack, %	16.8 (13.3 to 19.6)	16.6 (11.1 to 19.3)	16.8 (13.9 to 19.8)	.22
Chronic obstructive pulmonary disease, %	29.2 (24.1 to 34.2)	28.4 (23.3 to 33.3)	30.7 (24.8 to 35.0)	.11
Depression, %	10.0 (5.8 to 13.1)	1.1 (6.1 to 13.1)	9.7 (5.4 to 15.0)	.83
Dialysis, %	2.7 (1.6 to 4.0)	2.4 (0.8 to 4.4)	2.7 (2.3 to 3.9)	.23
Hyperlipidemia, %	51.5 (44.1 to 58.3)	48.7 (39.4 to 52.8)	56.7 (47.2 to 60.9)	.01
Hypertension, %	78.5 (72.9 to 83.8)	77.5 (73.9 to 82.8)	79.5 (72.2 to 85.4)	.25
Ischemic history, %	58.8 (50.9 to 63.5)	54.6 (5.4 to 63.1)	59.7 (54.8 to 64.6)	.11
Peripheral vascular disease, %	12.7 (8.3 to 16.9)	12.4 (6.4 to 16.2)	13.3 (9.7 to 17.5)	.16
Renal insufficiency, %	19.5 (11.6 to 26.8)	16.9 (1.2 to 23.9)	22.9 (12.9 to 27.8)	.04
Smoking, %	10.1 (5.5 to 12.8)	8.8 (5.4 to 12.3)	10.9 (7.6 to 13.5)	.06
Vital signs at admission, median (quartiles)				
Average respiratory rate, bpm	20.8 (20.2 to 22.1)	2.8 (2.2 to 22.8)	20.8 (20.0 to 21.7)	.19
Average weight, kg	80.7 (77.1 to 82.8)	79.7 (74.2 to 82.2)	81.2 (78.6 to 83.7)	.08
Systolic blood pressure, mm Hg	141.6 (138.0 to 146.0)	142.9 (138.9 to 146.0)	140.4 (137.5 to 146.1)	.33
Admission laboratory test results, median (quartiles)				
Average blood urea nitrogen, mg/dL	29.7 (28.7 to 31.6)	29.4 (28.1 to 31.7)	30.3 (29.1 to 31.5)	.33
Average B-type natriuretic peptide, pg/mL	1216.6 (1017.1 to 1573.4)	123.2 (1050 to 189.7)	1196.8 (1016.7 to 1491.5)	.47
Average ejection fraction, %	43.8 (41.2 to 46.6)	45.2 (42.1 to 47.0)	42.4 (40.6 to 44.9)	.03
Average hemoglobin, g/dL	11.7 (11.5 to 12.0)	11.8 (11.7 to 12.1)	11.7 (11.4 to 11.9)	.02
Average serum creatinine, mg/dL	1.6 (1.5 to 1.7)	1.6 (1.4 to 1.7)	1.6 (1.6 to 1.8)	.04
Average sodium, mEq/L	137.4 (136.8 to 137.9)	137.3 (136.7 to 137.9)	137.5 (136.9 to 138.0)	.70
Average troponin, ng/dL	0.2 (0.1 to 0.4)	0.17 (0.1 to 0.4)	0.2 (0.2 to 0.4)	.53
Discharge laboratory test results, median (quartiles)				
Average potassium, mEq/L	4.1 (4.0 to 4.1)	4.1 (4.0 to 4.2)	4.1 (4.0 to 4.1)	.64
Average serum creatinine, mg/dL	1.7 (1.5 to 1.8)	1.6 (1.4 to 1.7)	1.7 (1.5 to 1.9)	.06
Average sodium, mEq/L	137.6 (137.0 to 138.2)	137.7 (137.4 to 138.3)	137.4 (136.7 to 138.2)	.10
Average weight difference from admission, kg	2.5 (1.6 to 2.9)	2.4 (1.0 to 2.7)	2.5 (1.8 to 3.1)	.27
Hospital characteristics, median (quartiles)				

Patients referred to heart failure disease management program, median (quartiles), %	5.4 (0.0 to 16.0)	0.0 (0.0 to 0.9)	16.0 (9.7 to 37.5)	< .001
Patients with discharge instructions completed, median (quartiles), %	95.8 (90.5 to 98.1)	94.1 (9.5 to 97.3)	96.8 (91.7 to 98.6)	.24
Patients with LVSD receiving β -blockers, median (quartiles), %	97.6 (95.0 to 99.0)	97.7 (94.4 to 100.0)	97.4 (95.0 to 98.9)	.60
Patients with LVSD receiving ACE inhibitor/ARB, median (quartiles), %	96.2 (92.5 to 98.9)	97.3 (93.3 to 100.0)	95.9 (92.5 to 98.8)	.30
Length of stay, median (quartiles), d	4 (4 to 5)	4 (4 to 4)	4 (4 to 5)	.02
Teaching hospital, %	67.1	51.4	82.7	.006
Presence of cardiac intensive care unit, %	74.6	65.5	82.4	.13
Adult diagnostic or interventional catheterization, %	88.9	79.3	97.1	.03
Heart transplant services, %	15.9	3.5	26.5	.01
Beds, median (quartiles)	370 (217 to 555)	280 (168 to 408)	475 (340 to 616)	< .001
Annual Medicare discharges, median (quartiles)	6534 (4534 to 9341)	4966 (2916 to 8296)	7930 (5930 to 11314)	.01
Annual Medicaid discharges, median (quartiles)	2715 (1281 to 4837)	2111 (1009 to 3284)	4130 (2343 to 6975)	.002
US geographic region, No. (%)				.01
Midwest	15 (21.4)	2 (5.7)	13 (37.1)	
Northeast	19 (27.1)	12 (34.3)	7 (20.0)	
South	23 (32.9)	12 (34.3)	11 (31.4)	
West	13 (18.6)	9 (25.7)	4 (11.4)	
Rural location, %	4.3	8.6	0	.08
Cardiologists per 100,000 residents	5.7 (4.8 to 7.7)	5.1 (4.3 to 5.7)	7.0 (5.7 to 7.9)	.004
Rate of leg amputation	0.6 (0.5 to 0.8)	0.6 (0.5 to 0.7)	0.6 (0.5 to 0.8)	.69
Discharges for ambulatory care-sensitive conditions per 1000 beneficiaries	56.7 (46.8 to 65.5)	53.2 (41.5 to 65.6)	57.8 (49.8 to 63.9)	.50
Patients filling β -blocker prescription in 1-6 months, %	84.0 (80.6 to 88.4)	83.8 (79.1 to 88.0)	84.3 (80.7 to 88.8)	.57
Patients filling β -blocker prescription in 7-12 months, %	79.2 (73.3 to 82.6)	79.3 (73.1 to 83.3)	77.6 (73.4 to 82.1)	.51
Patients filling ACE inhibitor/ARB prescription, %	74.3 (72.6 to 76.4)	74.0 (72.6 to 76.5)	74.8 (72.9 to 76.3)	.49
30-day risk-adjusted readmission rate in 2009	19.9 (19.3 to 20.7)	20.0 (19.4 to 20.8)	19.6 (19.1 to 20.6)	.22
30-day risk-adjusted readmission rate in 2012	18.8 (18.2 to 19.6)	19.1 (18.6 to 20.1)	18.4 (17.9 to 19.4)	
Relative change in 30-day readmission rate, %	-5.6 (-8.7 to 0.9)	-4.23 (-7.9 to 1.0)	-6.55 (-11.5 to 0.2)	.25

Abbreviations: ACE, angiotensin-converting enzyme; ARB, angiotensin II receptor blocker; LVSD, left ventricular systolic dysfunction.

* The median rate of referral to a heart failure disease management program was 5.35%.

† Not all sites had data for every variable.

Supplemental Table 3. Association of Site-Level Factors and General Risk-Adjusted 30-Day Readmission Rates in 2012*

Site Factor	Estimate (95% CI)	<i>P</i> Value	Global <i>P</i> Value
Percent ACE inhibitor/ARB for patients with LVSD	-0.07 (-0.14 to 0.00)	.05	
Percent discharge instructions completed	0.05 (-0.02 to 0.11)	.15	
Percent of patients referred to heart failure disease management program	-0.02 (-0.03 to -0.00)	.04	
Region: Midwest vs Northeast	-0.73 (-1.55 to 0.09)	.08	.02
Region: South vs Northeast	-0.65 (-1.37 to 0.06)	.07	
Region: West vs Northeast	-1.37 (-2.20 to -0.53)	.002	

Abbreviations: ACE, angiotensin-converting enzyme; ARB, angiotensin II receptor blocker; LVSD, left ventricular systolic dysfunction.

* Variables listed were chosen based on forward selection to be included in multivariable linear regression model. Each hospital site's general risk-adjusted 30-day readmission rate was used as the dependent variable in the model. Global *P* value presented for overall region variable.