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Hospice Care and Resource Utilization in Medicare Beneficiaries with Heart Failure

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Abstract

Background—Although hospice use may be increasing among heart failure patients, its association with both cost and intensity of care in this population has not been well examined.

Objective—To assess the association of hospice care with resource utilization among a national sample of Medicare beneficiaries with heart failure during the last six months of life.

Methods—We performed a cross-sectional analysis of the 5% sample of Medicare claims data. Negative binomial regression models were used to compare expenditures, hospitalization rates, and ICU days between hospice and non-hospice beneficiaries. We used Poisson regression models were used to compare utilization of certain procedures between hospice and non-hospice beneficiaries.

Results—Among 16,613 Medicare beneficiaries who died with heart failure in 2007, 6,436 (38.7%) received hospice care during the last six months of life. The mean total medical expenditures were $31,793 (SD 25,691) among decedents with hospice care, in comparison to $34,067 (SD 40,561) among decedents without hospice care. However, after adjustments for covariates, hospice care was associated with 4% higher expenditures (cost ratio 1.04, 95% CI 1.01–1.07). Hospice use was associated with reduced hospitalizations (adjusted incidence rate ratio (aIRR) 0.87, 95% CI 0.84–0.89), ICU days (aIRR 0.68, 95% CI 0.63–0.73), and procedures, including cardiac catheterization, noninvasive ventilation, and mechanical ventilation.

Conclusions—Despite lower rates of hospitalization, ICU days, and invasive procedures, hospice care was not associated with reduced expenditures in heart failure. Financial savings related to reduced intensive medical care appears to be offset by the expenditures related to hospice care itself.

Keywords

hospice; heart failure; resource utilization; Medicare

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Introduction

Heart failure imposes a substantial burden on public health in the United States, affecting 5 million adults and leading to one million hospitalizations annually. [1] Heart failure is among the most expensive chronic diseases in the developed world, [2–4] with an associated cost of nearly $40 billion in the United States. [1] Health care utilization, especially acute hospitalization, is particularly intensive in the last 6 months of life [5, 6] and appears to be increasing. [7, 8]

Hospice care aims at improving quality of life through comprehensive services for individuals with a terminal illness and a prognosis of less than six months. [9, 10] The hospice benefit in Medicare includes coverage for skilled nursing, counseling, pain medications, home health services, short term inpatient services, and bereavement related to the terminal illness. [11] Individuals who enroll in hospice agree to waive most curative treatments for the terminal illness. [11] Hospice care may reduce overall resource utilization near the end of life, but evidence has been mixed. [12, 13] Among individuals with end-stage heart failure, hospice use has been increasing, [8, 14] but its association with costs and intensity of care in heart failure has not been well described.

Medicare is the largest payer for hospice services in the United States [15] so the impact of hospice services on utilization has important implications for Medicare program costs. To test the hypothesis that hospice care for adults with heart failure reduces resource utilization, we analyzed data on a nationally representative sample of Medicare beneficiaries in their last 6 months of life.

Methods

Study Design

We conducted a cross-sectional analysis of claims data from a 5% national sample of Medicare beneficiaries. Datasets used were the Medicare Provider Analysis and Review (MedPAR) file and the 5% denominator, outpatient, home health agency, hospice, and carrier (formerly physician/supplier) files for the years 2005–2007.

We included Medicare beneficiaries who died in 2007 with a previous diagnosis of heart failure. Heart failure diagnosis was established with an International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) code of 428 listed either as a hospital discharge diagnosis or in at least two physician claims in the year preceding the last six months of life (i.e. the interval 18 months to 6 months prior to death). Inclusion criteria included at least two years of continuous enrollment in Medicare prior to time of death. To ensure that individuals were at least 65 years of age at the time of initial enrollment, we included beneficiaries with age greater than or equal to 67 at the time of death. We excluded beneficiaries who were enrolled in a health maintenance organization, did not have continuous Medicare Parts A and B coverage, or lived outside of the United States.

Exposure

Our primary exposure was receipt of any hospice care during the last six months of life. Individuals were considered to have received hospice care if Medicare had reimbursed at least one day of hospice services during the six months prior to death.

Outcomes

Our outcomes were measures of utilization during the last six months of life. Medicare expenditures were calculated by summing expenditures of the individual files (inpatient,

outpatient, skilled nursing facilities, home health, hospice and carrier files). We evaluated hospitalizations as both a total count and by relevant categories: heart failure-related (primary discharge diagnosis code 402.X1, 404.X1, 404.X3, 428.XX), cardiovascular-related (primary discharge diagnosis code 390 to 459), or non-cardiovascular-related (all other discharge codes). We assessed whether an individual had an intensive care unit (ICU) stay and the number of ICU days in the last six months of life. Finally, we measured whether beneficiaries had received certain procedures, including echocardiogram, cardiac catheterization, implantable cardioverter defibrillator (ICD), cardiac resynchronization therapy (CRT), non-invasive ventilation, or mechanical ventilations. Procedures were identified using ICD-9-CM codes from inpatient files and current procedure manual (CPT) codes from carrier files.

Covariates

Age, gender, race, region, and end stage renal disease (ESRD) status were obtained from the Medicare denominator file; all other covariates were assessed using the claims files. Age was categorized into five groups: 67–74, 75–79, 80–84, 85–89, and ≥90. In Medicare, race is self-identified as white, black, Asian, Hispanic, North American Native, or other. We categorized race as white, black, or other; in our dataset, this variable was complete for 99.8% of beneficiaries. Comorbidities were considered to be present if listed between 18 and 6 months prior to time of death on one inpatient or two outpatient claims. Comorbidities were defined by ICD-9-CM codes based on the Clinical Classification System (CCS) developed by the Agency for Healthcare Research and Quality (AHRQ) and included chronic obstructive pulmonary disease (COPD), hypertension, kidney disease, diabetes, cancer, dementia, cerebrovascular disease, coronary atherosclerosis, peripheral vascular disease, and depression. Prior hospitalizations were tabulated during the period of 18 to 6 months prior to date of death and categorized as no hospitalizations, 1–2 hospitalizations, and three or more hospitalizations in the previous year.

Statistical Analysis

Baseline characteristics were compared between individuals with and without hospice utilization using chi-squared tests for categorical variables. Because continuous variables did not meet the normality assumption, they were compared using non-parametric (Wilcoxon rank sum) tests.

Utilization outcomes were presented as means with standard deviations for continuous variables and percentage for binary variables. Hospitalizations were evaluated both as a binomial outcome and as count. To study the relationship between hospice and total expenditures, we calculated a cost ratio using a negative binomial regression model, which accounts for the high variance, or overdispersion, of the cost data. The cost ratio provided an estimate of the relative increase in expenditures related to receipt of hospice care. [16] We also used a negative binomial regression model to estimate the incidence rate ratio for number of hospitalizations, number of hospitalization days, and number of ICU days among individuals with and without hospice care. Binomial outcomes, including any hospitalization, any ICU admission, and procedures were compared between groups using a Poisson regression model with robust variance estimates to calculate prevalence ratios. [17, 18] We performed all regression analyses both unadjusted and adjusted for covariates, including age, gender, race, region, comorbidities, and prior hospitalization.

We tested for interactions between hospice and age, race, gender, and geographic location for the outcome of expenditures. A statistically significant interaction was found for age and geographic location, and we performed subgroup analyses for these categories. Additionally, to assess whether there were differences in the association between hospice care and

Medicare costs across the spectrum of total expenditures, we divided total expenditures into quintiles and calculated the cost ratio of hospice care within each quintile. Finally, we evaluated the association of dialysis and hospice care among the subgroup of individuals with ESRD.

We performed four sensitivity analyses. First, we repeated our analyses with exclusion of beneficiaries who were enrolled in hospice for 30 days or less. This was done to minimize the influence of individuals with short term hospice use on outcomes. Second, we compared utilization among beneficiaries who were enrolled in hospice care for the duration of the 6 month period to those who received no hospice care. We performed this analysis to exclude beneficiaries in the hospice cohort who may have had expenditures incurred either prior to enrollment in hospice or after stopping hospice. Third, given the possibility that enrollment for hospice care may have been for a disease other than heart failure, we repeated our analysis following exclusion of beneficiaries with a diagnosis of cancer. Fourth, to address potential confounding, we calculated the propensity that a beneficiary would receive hospice care and repeated our analysis with adjustment for the propensity score.

Statistical significance was pre-specified at an alpha level of 0.05 (two-tailed). Statistical analyses were performed using Stata 10 (Stata Statistical Software: Release 10, StataCorp, College Station, TX, 2007).

Results

In 2007, there were 16,613 deaths among Medicare beneficiaries aged 67 and older with a prior diagnosis of heart failure. Of these decedents, 38.7% received hospice care. Compared to their counterparts who received no hospice care, beneficiaries with heart failure who received hospice care were older, more likely to reside in the South or Midwest regions, more likely to be female or white, and more likely to have a prior diagnosis of cancer, dementia, and depression. (Table 1) In contrast, diabetes, end-stage renal disease (ESRD), and coronary atherosclerosis were less common in decedents who received hospice care compared to those who did not.

Medicare beneficiaries with heart failure who received hospice care spent an average of 47.6 (SD 60.5) days in hospice, with 36% of beneficiaries using hospice services for less than a week and 61% of beneficiaries using hospice services for 30 days or less. One tenth of beneficiaries who were enrolled in hospice care spent the last six of months of life in hospice. Mean total medical expenditures were $31,793 among beneficiaries with hospice as compared to $34,067 among beneficiaries without hospice, although expenditures were higher in the hospice group at both the 25^{th} and 50^{th} percentiles. (Table 2) Among hospice users, mean expenditures for hospice care was $7,461. Hospice recipients had substantially lower expenditures for non-hospice care, with a mean difference in expenditures of $9,736 between hospice and non-hospice beneficiaries for non-hospice care. Thus, in unadjusted analyses, hospice care was associated with a net lower cost of 7% (cost ratio 0.93, 95% CI 0.90–0.96). However, after adjustments for covariates, hospice care was associated with 4% higher expenditures (cost ratio 1.04, 95% CI 1.01–1.07; p=0.02). Younger age, Northeast region, white race, and previous hospitalizations were also associated with increased total Medicare expenditures. (Table 3) Hospice care was inversely related with all of these factors; therefore, adjusting for these covariates resulted in a relative increase in the total Medicare expenditures associated with hospice care.

In subgroup analysis, hospice care was associated with increased Medicare expenditures among 4,386 individuals older than 90 years of age (adjusted cost ratio 1.18, 95% CI 1.11–1.26), although this association was not observed among younger beneficiaries. Hospice

care was associated with increased expenditures among beneficiaries from the Midwest (n=4,506; adjusted cost ratio 1.13, 95% CI 1.07–1.20) and South regions (n=6,187; adjusted cost ratio 1.06, 95% CI 1.01–1.11) but not from the Northeast (n=3,641; adjusted cost ratio 0.96, 95% CI 0.89–1.03) or West (n=2,278; adjusted cost ratio 0.91, 95% CI 0.83–1.00). The association between hospice care and expenditures differed across the spectrum of total Medicare expenditures: among beneficiaries in the lowest quintile of total expenditures, hospice care was associated with increased costs; among beneficiaries with high total expenditures, hospice care was associated with reduced costs. (Table 4) The findings that hospice care was associated with increased expenditures among individuals with low total expenditures and associated with decreased expenditures among individuals with high total expenditures were observed in all regions. (data not shown)

In general, hospice care for decedents with heart failure was associated with reduced acute and other non-hospice utilization, including hospitalizations (both cardiovascular and non-cardiovascular), ICU stays, and various invasive and non-invasive procedures (Table 2). The strong inverse relationship between hospice care and utilization persisted even after adjustment for covariates, although in the case of cardiac resynchronization therapy, these findings were no longer statistically significant. (Table 5) Hospice was associated with a 13% reduction in hospitalization rate and 22% reduction in ICU admissions. In the last 6 months of life, decedents with heart failure who received no hospice care were nearly 60% more likely to have undergone cardiac catheterization and three times as likely to receive mechanical ventilation as compared to their counterparts who received hospice care. Although hospice care was associated with reduced prevalence of dialysis in the overall cohort, this association did not persist in the subgroup of individuals with ESRD (adjusted prevalence ratio 1.02, 95% CI 0.97–1.08).

Results from our sensitivity analyses were similar to our overall results. Beneficiaries with at least 30 days of hospice care (n=2511) had lower associated expenditures in the unadjusted analysis (cost ratio 0.87, 95% CI 0.83–0.92) but higher expenditures following adjustment for covariates (cost ratio 1.05, 95% CI 1.00–1.10). Hospice care had a similar association to expenditures (unadjusted cost ratio 0.85, 95% CI 0.78–0.93; adjusted cost ratio 1.14, 95% CI 1.04–1.24) when comparing beneficiaries who had received hospice care for the entirety of the last six months of life to those with no hospice care; hospice care was also associated with decreased prevalence of hospitalizations and procedures in this sensitivity analysis. After excluding beneficiaries with a diagnosis of cancer (n=2,925), the prevalence of hospice care was 37.1% among the remaining 13,688 beneficiaries. Within this subgroup, hospice care was associated with 6% lower expenditures (unadjusted cost ratio 0.94, 95% CI 0.90–0.97) and 6% increased expenditures after adjustment for covariates (cost ratio 1.06, 95% CI 1.02–1.10). Finally, after adjustment for propensity score, hospice care was associated with a small, and not statistically significant, increase in expenditures (cost ratio 1.01, 95% CI 0.98–1.04).

Discussion

Over one third of Medicare beneficiaries with heart failure received hospice care during the last six months of life. Hospice care was associated with substantial reductions in acute care utilization and related expenditures. After offsetting costs related to hospice care, the apparent net savings were about $3000 per decedent, among 16,000 heart failure decedents in 2007. However, these apparent savings appeared to be explained by confounding demographic factors related to both hospice care and end-of-life expenditures. After accounting for those confounders, total expenditures among decedents who used hospice care were 4% higher than their counterparts who did not receive hospice care. These results

suggest that in heart failure patients, hospice care substitutes for acute care with a slight increase in total costs.

Only about one third of elders with heart failure received hospice care during the last six months of life, but previous studies suggest that hospice use is increasing in this patient population. [8, 19] However, the majority of hospice enrollees in our study received less than one month of hospice care and over a third received hospice care for seven days or less, implying that, despite increases in enrollment, hospice care in many heart failure patients is introduced quite late, within days of death. These findings are consistent with prior studies that indicate lower use of hospice care for heart failure than for cancer. [14, 20, 21] One possible explanation for low hospice use in heart failure is the variable clinical course of the disease, which makes prognostication difficult. [9]

In our study, Medicare beneficiaries with heart failure who were enrolled in hospice care had lower rates of high intensity care including hospitalization, intensive care unit days, cardiac catheterizations, ICD placement, dialysis, and mechanical ventilation during the last six months of life. These results are consistent with findings of decreased utilization of intensive medical services related to hospice care among Medicare beneficiaries with cancer. [22] Decreased rates of hospitalizations and ICU admissions are considered to be an indicator of good quality of end of life care and are generally associated with increased patient satisfaction. [23, 24] We were unable to assess satisfaction or quality of life in our study, which was limited by the nature claims data.

Since the introduction of the hospice benefit in Medicare, there has been significant debate whether hospice care can reduce costs. [25] A number of studies have found hospice use to be associated with lower costs [13, 26, 27] although results have not been consistent. [26, 28] One study of Medicare beneficiaries during the last year of life during the period of 1996 to 1999 found hospice care to be associated with 4% increase in expenditures. [12] Our study expands upon this work by showing a similar increase in expenditures among a contemporary cohort of individuals specifically with heart failure. Furthermore, we demonstrated these increased expenditures despite reduced hospitalizations and procedures, implying a cost tradeoff of acute care services for hospice related care.

Our finding of an association between hospice care and increased expenditures was primarily driven by beneficiaries with low total expenditures; in fact, among beneficiaries in the highest quintile of total expenditures, beneficiaries with hospice care had lower mean expenditures as compared to those who had not enrolled in hospice. These results were partly due to the distribution of total expenditures for beneficiaries with hospice care, the majority of who were in the middle quintiles of total expenditures. Furthermore, expenditures for hospice beneficiaries were higher at the 25th percentile but lower at the 75th percentile as compared to beneficiaries with no hospice care. This less skewed, with a higher median, distribution of expenditures in the hospice group as compared to the non-hospice group may reflect that hospice is associated with constant expenses as compared to less regular and potentially high costs of medical treatment near the end of life. Among beneficiaries who are relatively low utilizers of care, the daily expenses for hospice, which include care management, home services, and medications, appear to exceed any savings due to reduced hospitalizations, procedures, and other medical services. Conversely, among beneficiaries who are high utilizers, the cost of hospice care appears to be more than offset by the associated reduction in acute medical care. The challenge for payers and providers is to identify individuals who are “at risk” of high utilization.

Demographic characteristics associated with reduced total expenditures in our study included increased age and Midwest or South regions. Previous studies have shown that

both age [29–31] and region [29, 32] influence expenditures near the end of life in the general population, although this has been less well studied among a cohort of individuals with heart failure. Additionally, among a cohort of Medicare beneficiaries with heart failure, we found that age and region mediate the association between hospice care and expenditures near the end of life.

In our study, age, gender, and race were associated with enrollment in hospice care among individuals with a prior diagnosis of heart failure. Older age has previously been shown to be correlated with increased hospice referral in the heart failure population. [19, 33] Our findings on racial differences were consistent with previous literature which has demonstrated that African Americans are less likely to receive hospice care than their white counterparts for cancer [34–37] and for heart failure. [33] These racial disparities may be due to unmeasured clinical or demographic characteristics, although cultural beliefs, physician mistrust, [38, 39] and lack of information [39] are also likely contributors. A better understanding of causes of racial differences in hospice use in end stage heart failure is needed, with a particular focus on the role of access versus patient preferences on utilization of this service.

Our study has several limitations which deserve mention. First, our reliance on ICD-9 diagnosis coding could have led to errors in misclassification, but we used a well-validated approach to identify heart failure. [40] Second, while we included individuals with a diagnosis of heart failure, we could not determine whether hospice care was directly related to heart failure. Nonetheless, we found similar results after excluding beneficiaries with cancer. Third, we lacked data on both direct and indirect costs to patients and their families, which would have underestimated the total expenditures in our sample. Fourth, our primary exposure was evaluated concurrently with our outcome meaning that utilization may have occurred either prior to hospice enrollment or after hospice disenrollment. However, in our sensitivity analysis, the results for total expenditures were similar for individuals who had spent at least thirty days or the full six months in hospice as for the overall cohort. Fifth, we were unable to determine the site of delivery of hospice care, although, within Medicare, over 95% of hospice days are provided as home care. [11] Sixth, like all ‘end-of-life’ studies based on a sample of decedents, we could not evaluate the influence of acute care, procedures, or hospice care on survival. [41] Although conventional wisdom is that acute care and procedures extend life, hospice care may also be associated with a reduction in mortality in heart failure. [42] Finally, our use of claims data did not allow for evaluation of patient preferences, quality of life, and other patient reported outcomes which are crucial in decision-making in end-of-life care.

In conclusion, despite lower rates of hospitalization, ICU days, and invasive procedures, hospice care was not associated with reduced expenditures for heart failure patients following adjustment for covariates. Within Medicare, financial savings related to reduced intensive medical care appear to be offset by the expenditures related to hospice care itself. As currently deployed, hospice care for heart failure patients does not appear to be cost-saving, but it may well have non-economic benefits that justify its additional cost. Whether more appropriate deployment of hospice care might enhance both economic and non-economic benefits for individuals with heart failure deserves further attention.

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Table 1

Characteristics of Medicare beneficiaries with heart failure who died in 2007, by Hospice Status

Characteristic	No Hospice (n=10,177)	Hospice (n=6,436)	p
Age Category			<0.001
67–74	15.1	11.0	
75–79	15.0	12.6	
80–84	22.2	21.0	
85–89	23.2	26.1	
≥90	24.6	29.3	
Age, years, mean (SD)	83.6 (7.9)	85.0 (7.6)	<0.001
Female	55.5	60.5	<0.001
Race			<0.001
White	87.2	91.4	
Black	8.9	6.2	
Other	3.9	2.5	
Region			<0.001
Northeast	24.0	18.7	
Midwest	26.5	28.1	
South	35.5	40.1	
West	14.0	13.2	
Comorbid Conditions			
COPD	45.4	44.5	0.27
Hypertension	80.5	81.0	0.42
Kidney disease	30.7	30.1	0.37
ESRD	6.5	4.0	<0.001
Diabetes	45.5	39.9	<0.001
Cancer	15.4	21.1	<0.001
Dementia	12.1	15.2	<0.001
Cerebrovascular Disease	30.9	33.2	<0.01
Coronary Atherosclerosis	58.6	55.9	<0.01
Peripheral vascular disease	22.1	22.6	0.42
Depression	16.9	19.8	<0.001
Hospitalizations, 6–18 months prior to death			0.01
None	30.4	28.3	
1–2	38.0	39.5	
≥3	31.6	32.2	
Hospitalizations, 6–18 months prior to death, mean (SD)	2.10 (2.44)	2.14 (2.40)	0.02

In percentage points unless otherwise specified

Table 2

Healthcare utilization among Medicare beneficiaries with heart failure during the last six months of life, by hospice status

Variable	No Hospice (n=10,177)	Hospice (n=6,436)	p
Expenditures, $			
Total	34,067 (40,561)	31,793 (25,691)	<0.001
Non-Hospice	34,066 (40,561)	24,330 (27,077)	<0.001
Inpatient	21,517 (33,364)	13,863 (19,507)	<0.001
Outpatient	2118 (4481)	1652 (3921)	<0.001
Carrier (formerly physician/supplier)	4273 (5258)	3401 (4327)	<0.001
Skilled nursing facility	4635 (8074)	3856 (7451)	<0.001
Home Health	1523 (3207)	1558 (2977)	<0.001
Hospice	1 (20)	7462 (8888)	<0.001
Total, median (25^{th}, 75^{th} percentile)	22,924 (8613, 45,207)	25,812 (15,352, 40,329)	<0.001
Hospitalizations			
Total	2.5 (2.3)	2.1 (2.2)	<0.001
CVD-related	0.8 (1.2)	0.6 (1.1)	<0.001
Heart failure-related	0.4 (0.9)	0.3 (0.8)	<0.001
Non-CVD-related	1.7 (1.9)	1.5 (1.8)	<0.001
Total, median (25^{th}, 75^{th} percentile)	2 (1,4)	1 (0,3)	<0.001
Hospitalized, %	81.1	73.3	<0.001
Hospitalization days	32.4 (41.3)	25.3 (36.0)	<0.001
ICU admission, %	41.8	30.6	<0.001
ICU days	4.1 (9.6)	2.5 (6.3)	<0.001
Procedures, percent receiving			
Echocardiogram	50.9	40.5	<0.001
Cardiac Catheterization	5.0	2.5	<0.001
Implantable Cardiac Defibrillator	1.3	0.7	<0.001
Dialysis	8.8	4.5	<0.001
Cardiac Resynchronization Therapy	0.6	0.3	<0.01
Non-invasive ventilation	5.3	3.4	<0.001
Mechanical ventilation	18.0	5.2	<0.001

Values are all mean number (SD) unless otherwise specified

Table 3

Association of Covariates with Total Medicare Expenditures for Beneficiaries with Heart Failure

Characteristic	Adjusted* Cost Ratio
Hospice	1.04 (1.01–1.07)
Age	
67–74	1 [reference]
75–79	0.97 (0.92–1.03)
80–84	0.89 (0.84–0.93)
85–89	0.80 (0.76–0.85)
≥90	0.65 (0.61–0.68)
Female	0.97 (0.94–1.01)
Race	
White	1 [reference]
Black	1.31 (1.23–1.38)
Other	1.24 (1.14–1.35)
Region	
Northeast	1 [reference]
Midwest	0.82 (0.79–0.86)
South	0.85 (0.81–0.88)
West	0.94 (0.89–0.99)
Comorbid Conditions	
COPD	1.09 (1.05–1.12)
Hypertension	1.12 (1.07–1.16)
Kidney disease	1.05 (1.01–1.09)
ESRD	1.59 (1.48–1.71)
Diabetes	1.09 (1.06–1.13)
Cancer	1.08 (1.04–1.13)
Dementia	0.86 (0.82–0.91)
Cerebrovascular Disease	1.06 (1.03–1.10)
Coronary Atherosclerosis	1.13 (1.10–1.17)
Peripheral vascular disease	1.03 (0.99–1.07)
Depression	0.95 (0.91–0.99)
Hospitalizations, 6–18 months prior to death	
None	1 [reference]
1–2	1.10 (1.06–1.14)
≥3	1.30 (1.24–1.36)

*Adjusted for all other variables in table

Table 4

Association of Hospice Care with Medicare Expenditures among Beneficiaries with Heart Failure, by Quintile of Total Expenditures

Quintile of Total Costs	% Hospice	Adjusted* Cost Ratio	p-value
First	22.7	1.53 (1.41–1.67)	<0.001
Second	41.5	1.04 (1.03–1.06)	<0.001
Third	53.3	1.01 (1.01–1.02)	0.007
Fourth	43.2	0.98 (0.97–0.99)	<0.001
Fifth	33.0	0.87 (0.84–0.90)	<0.001

*Adjusted for age, gender, race, geographic location, hospitalizations in the prior year, and comorbidities

Table 5

Association of Hospice Care with Healthcare Utilization in the Last 6 Months of Life

Outcome	Comparison Ratio* for Hospice vs. No Hospice	
	Unadjusted	Adjusted†
	Prevalence Ratio	
Any Hospitalization	0.90 (0.89–0.92)	0.92 (0.90–0.93)
Heart Failure Hospitalization	0.89 (0.84–0.94)	0.93 (0.88–0.98)
Cardiovascular Hospitalization	0.83 (0.80–0.87)	0.87 (0.84–0.90)
Non-Cardiovascular Hospitalization	0.90 (0.88–0.92)	0.91 (0.89–0.93)
ICU Stay	0.73 (0.70–0.76)	0.78 (0.74–0.81)
Cardiac Catheterization	0.50 (0.42–0.60)	0.63 (0.52–0.75)
Implantable Cardiac Defibrillator	0.54 (0.39–0.76)	0.70 (0.50–0.99)
Dialysis	0.52 (0.46–0.59)	0.74 (0.68–0.81)
Cardiac Resynchronization Therapy	0.51 (0.30–0.85)	0.66 (0.38–1.13)
Noninvasive Ventilation	0.63 (0.54–0.74)	0.67 (0.58–0.79)
Mechanical Ventilation	0.29 (0.26–0.32)	0.33 (0.29–0.37)
	Incident Rate Ratio	
Hospitalization Rate	0.84 (0.82–0.87)	0.87 (0.84–0.89)
Hospitalization Days	0.78 (0.74–0.82)	0.78 (0.75–0.82)
ICU Days	0.61 (0.56–0.66)	0.68 (0.63–0.73)
	Cost Ratio	
Total Expenditures	0.93 (0.90–0.96)	1.04 (1.00–1.07)
Non-Hospice Expenditures	0.71 (0.69–0.74)	0.77 (0.74–0.80)

*Represents prevalence ratios for bivariate outcomes, cost ratios for cost outcomes, and incident ratios for repeated outcomes

†Adjusted for age, gender, race, geographic location, hospitalizations in the prior year, and comorbidities