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Longer Hospice Stays Associated With Decreased End-Of-Life Spending For Patients In Regions With High Expenditures

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Abstract

Hospice is expected to decrease end-of-life care expenditures yet evidence for its financial impact remains inconclusive. One potential explanation is that hospice enrollment may produce differential cost saving effects by region, due to geographic variation in end-of-life care spending patterns. Accordingly, we examined 103,745 elderly Medicare fee-for-service beneficiaries in the Surveillance, Epidemiology, and End Results-Medicare database who died from cancer in 2004–2011. We created quintiles by the mean end-of-life expenditure per hospital referral region (HRR), and examined HRR-level variation in the associations between length of hospice enrollment and expenditures among quintiles. Results showed that longer hospice stays were associated with decreased end-of-life expenditures for patients residing in regions of high average expenditures, but not for those in regions with low average expenditures. Hospice use accounted for 8.0% of the expenditure variation between the highest and lowest quintile areas, demonstrating the powers and limitations of hospice use for cost saving.

For more than twenty-eight years, over 25 percent of total annual Medicare spending has gone to the 5 percent of Medicare enrollees in their final year of life.¹ Furthermore, more than 70 percent of all terminal-year expenses have been concentrated in the last six months of life.^{2,3} Although hospice use has been expected to reduce end-of-life health care spending, the existing literature provides inconsistent results on its financial impact, with

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some studies reporting large cost savings and others reporting minimal or no cost savings.^{4–10} Literature focusing on death from cancer, which accounts for more than one in five deaths among the elderly,¹¹ is much scarcer, yet it exhibits the same discrepancies.^{5,8,9}

Understanding the true financial impact of hospice use is crucial because recent reports have found that hospice use rose from 26 percent of elderly patients enrolled in traditional Medicare who died in 2002 to 47 percent who died in 2012¹² and that as beneficiaries grow older, spending on hospice care accounts for an increasing share of per capita costs.¹³ At this point, two complicating aspects appear to be the source of the discrepant findings on cost savings in the literature: subpopulations with differential cost-savings responses, and bias in study methodologies.¹²

Several studies have attempted to identify more specific subpopulation characteristics that might be responsible for differing responses in cost savings. Within the cancer literature, one study examining expenditures in the last year of life highlighted age as a contributing factor and reported that hospice use was associated with reduced Medicare expenditures among younger cancer decedents but with increased Medicare expenditures among older cancer decedents.⁹ Other studies with matching-sample approaches have identified duration of hospice use as a key factor in determining cost savings.^{5,8} The association appeared to be U-shaped: Expenditure savings were greatest when patients were enrolled in hospice care for five to eight weeks.⁵

A 2015 Medicare Payment Advisory Commission (MedPAC) report critically examined previous literature and discrepant results in the context of distinct research methodologies.¹² When studies used sample-matching approaches comparing the costs of hospice users during the hospice enrollment period to those of matched nonhospice users during a pseudo-enrollment period, savings attributed to hospice enrollment appeared to be overestimated. This is likely due to the fact that a hospice enrollment was endogenously determined by hospice patients, while pseudo-enrollment was exogenously selected by researchers, introducing bias. For example, unlike for a pseudo-enrollment period, a true hospice enrollment period is generally preceded by a high-cost hospital stay, which makes cost comparisons between the two problematic. Notably, the MedPAC report found that person-level analyses in general were subject to the weakness of potential unobserved bias, so the report's authors conducted regional-level analyses, finding that regions with higher or longer hospice use had higher end-of-life care expenditures.¹²

Building on prior research, this study examined the associations between hospice use and end-of-life care spending by providing a regional context. The existence of distinct local spending patterns surrounding end-of-life care might result in different cost-savings responses to hospice length-of-service from region to region. Substantial geographic variation in end-of-life care spending has been documented in the literature.^{14,15} This variation is driven by physicians' behavior,^{16,17} differences in health care supply, patient demographics, the severity of underlying illness, and patients' preferences.^{18–20} Thus, local health care spending patterns are likely an important force for determining patterns of end-of-life care and associated expenditures. We hypothesized that in regions characterized by high end-of-life care expenditures, length of hospice enrollment would be inversely

associated with end-of-life care expenditures. In contrast, we hypothesized that in regions characterized by low end-of-life care expenditures, length of hospice enrollment would not be significantly associated with end-of-life care expenditures. We expected that aggressive end-of-life care would be less common in regions with lower per capita end-of-life care expenditures (low-cost regions) compared to regions with higher per capita end-of-life care expenditures (high-cost regions); thus, in low-cost regions, expenditures on lengthy hospice care would be offset by the relatively low expenditures on end-of-life care.

Accordingly, using the Surveillance, Epidemiology, and End Results (SEER) Medicare data set, we identified patients who died as a result of cancer and calculated their end-of-life care expenditures using the last six months of claims for each decedent. We took into account not only the key factors identified in previous research, such as age and length of hospice enrollment, but also local health care spending patterns in the hospital referral regions (HRRs) where the patients resided. HRRs are commonly used to define health care market areas.¹⁹ We sorted the HRRs into quintiles based on mean end-of-life care expenditures, adjusted for patients' age, sex, and race. By analyzing the duration of hospice enrollment and end-of-life care expenditures across these quintiles, we were able to explore how local health care spending patterns affect the association between hospice length-of-service and end-of-life care spending. Finally, we examined what proportion of the variation in end-of-life care expenditures between the highest- and lowest-quintile regions could be explained by any hospice use (yes vs no) and the length-of-service in hospice.

Study Data And Methods

Data Source

Our data came from the SEER Medicare database, which links Medicare enrollment and claims records to tumor registries. The database covers approximately 30 percent of the US population.²¹ The Yale Human Investigation Committee determined that this study did not directly involve human subjects.

Sample

From the SEER Medicare database, we identified beneficiaries who had breast, prostate, lung, colorectal, pancreatic, liver, kidney, melanoma, or hematologic cancer diagnosed in the years 2004–11 and who had died from cancer within three years of diagnosis. We limited our sample to beneficiaries ages 66.5–94.9 at death who had died by December 2011 and who had been enrolled in Medicare Parts A and B during the final eighteen months of life. We excluded patients if their diagnoses occurred only upon certification of death or during autopsy or if they could not be assigned to a hospital referral region. We also excluded patients who lived less than six months after cancer diagnosis to ensure that the expenditures we measured were incurred after cancer diagnosis. We conducted sensitivity analyses including these decedents. The stepwise ascertainment of our cohort are reported in the online Appendix.²²

Measures

We used Medicare claims files to estimate end-of-life care expenditures for inpatient, outpatient, physician, home health, durable medical equipment, and hospice services during the last six months of life. We adjusted for inflation,²³ and all expenditures were expressed in 2011 US dollars. For each HRR, we calculated mean end-of-life care expenditures adjusted for patients' age, sex, and race. We then classified HRRs into quintiles, with quintile 1 representing the lowest mean spending per decedent and quintile 5 the highest. Each quintile accounted for approximately one-fifth of the population in our sample. We calculated unadjusted and age-sex-race-adjusted mean end-of-life care expenditures, according to HRR quintiles and length of hospice enrollment. Based on the types of services, we further calculated adjusted expenditures for hospice, inpatient, outpatient, and other services (including home health and durable medical equipment).

Key Independent Variables

For each decedent, we measured the duration of hospice enrollment within the final six months of life based on hospice claims. We categorized the length of enrollment in days into six groups (none, 1–3, 4–7, 8–28, 29–56, and 57 or more days), to have a sufficient sample size for each group. We also calculated the proportion of decedents who used hospice care, as well as the mean and median length of hospice enrollment within each HRR.

Control Variables

As covariates, we included patients' age, race (white, black, and other), Hispanic ethnicity (yes or no), sex, income, education, year of death, marital status, SEER registry region, urban status of residence, disability status, comorbidities, and tumor characteristics.²⁴ Adapting the Elixhauser method, we identified comorbidities by requiring the diagnosis code to appear on one inpatient claim or at least two physician or outpatient claims more than thirty days apart.²⁵ Because our cohort comprised patients who died of cancer, we did not include cancer as a comorbidity. We derived median household income and percentage of adults with a high school education or less from merged census data. Following prior literature, we identified services commonly needed by patients with poor functional performance status, and we constructed a claims-based indicator to measure disability status.²⁶ Tumor characteristics included tumor site, stage IV diagnosis (yes or no), multiple cancer diagnoses (yes or no), and duration between cancer diagnosis and death (6–12 months, 12–24 months, and 24–36 months), as reported in the SEER database.

Statistical Analyses

We used *t*-tests for continuous variables and chi-square tests for categorical variables to analyze differences in demographic data and clinical data between the highest and lowest quintiles. To estimate adjusted expenditures, we used hierarchical generalized linear models with a log link function and gamma distribution (for more details, see the Appendix).²² This type of modeling is able to account for the right-skewed spending data and the clustering of patients within HRRs simultaneously.^{27,28} To reduce variability caused by low HRR volumes, we excluded HRRs with fewer than twenty decedents from the models. We used the mean age-sex-race-adjusted expenditure per HRR to create the quintiles. For HRR

quintiles and hospice length-of-service, we calculated the mean adjusted end-of-life expenditures controlling for all variables described above. All statistical analyses were completed using SAS software, version 9.4, and a two-tailed $p < 0.05$ was used to define statistical significance.

The secondary analysis examined the relative contribution of hospice length-of-service to regional variation in end-of-life care expenditures. Following previous research,²⁸ we conducted a series of models: Model 1 controlled for age, sex, and race/ethnicity; model 2 adjusted for additional patient characteristics; model 3 adjusted for tumor characteristics and covariates in model 2; model 4 added a binary variable indicating hospice enrollment to model 3; and model 5 added a categorical variable indicating the length of hospice service use (0, 1–3, 4–7, 8–28, 29–56, and ≥ 57 days) to model 3. For each model, the difference in adjusted mean end-of-life care expenditure between quintile 1 and quintile 5 represented the variation that could be explained by the control variables in that model.

Limitations

Our findings should be interpreted in light of several limitations. First, our sample population was limited to elderly patients in fee-for-service Medicare with nine types of cancer in 2004–11. The results might not be generalizable to younger patients, those in health maintenance organization plans, those with other types of cancer or other diseases (for example, heart failure, Alzheimer diseases, or dementia), or the US population in recent years. Second, because our study was cross-sectional, we were unable to make causal inferences regarding the impact of length of hospice enrollment on end-of-life care expenditures. Third, we used a retrospective approach to study end-of-life care expenditures. This design could lead to biased conclusions because care received by confirmed decedents is not equivalent to care received by individuals who are predicted by care providers to be at the end of life. Fourth, while expenditures were adjusted for inflation, because data on the regional cost adjusters were lacking, we were unable to adjust for regional price differences. Finally, although our model adjusted for chronic conditions, we did not know the severity of disease, nor did we have information regarding patients' preferences for hospice length-of-service. However, prior literature has shown that patients' preferences explain little of the regional variation in end-of-life care use.¹⁸

Study Results

We identified 103,745 people who died of cancer (mean age: 77.8 years) in 129 HRRs during the study period (Exhibit 1). The unadjusted (that is, non-age-sex-race-adjusted) mean end-of-life care expenditure per decedent was \$39,600, ranging from \$31,256 in quintile 1 to \$49,680 in quintile 5. The mean length of hospice enrollment in the final six months of life was 10.9 days, ranging from 13.0 days in quintile 1 regions to 7.9 days in quintile 5 regions. Regions in quintile 1 had a lower proportion of decedents who never used hospice care compared with regions in quintile 5. Decedents in quintile 1 were more likely to have been female, white, and married; to have resided in low-income neighborhoods and non-metropolitan areas; and to have had no additional comorbid conditions ($p < 0.001$ for

all). Approximately 30 percent of decedents across the five quintiles had had a newly diagnosed stage IV cancer.

After we controlled for patient demographics and tumor characteristics, the associations between mean adjusted end-of-life care expenditures and length of hospice enrollment differed across quintiles of regional expenditures (Exhibit 2). In the lowest expenditure quintile, increasing lengths of hospice enrollment were not significantly associated with mean adjusted expenditure; expenditures for decedents with a hospice stay of more than four days were not significantly different. Additionally, the difference between mean adjusted end-of-life care expenditures for decedents who did not use hospice services and those who had a hospice stay longer than eight weeks was only \$4,400, which was approximately 13.7 percent of the expenditures incurred by decedents with longer than an eight-week hospice stay.

In contrast, in the highest expenditure quintile, a longer length of hospice enrollment was significantly associated with a lower mean adjusted end-of-life care expenditure. In quintile 5, the difference between mean end-of-life care expenditure for decedents who did not use hospice services and those who had a hospice stay longer than eight weeks was \$16,700, which translates to 41.1 percent of the expenditures incurred by decedents with longer than an eight-week stay. Notably, decedents in the highest-quintile regions who used hospice care longer than eight weeks incurred significantly higher expenditures (by \$4,000) than those who did not use hospice care at all in the lowest-quintile regions. Adjusting for other patient demographics and clinical factors did not change our results substantially.

The analyses of expenditures by type of services demonstrated the differences between hospice and inpatient expenditures attributed to hospice length-of-service and regional expenditure patterns (Exhibit 3). Expenditures for hospice services were directly related to length of hospice use and were not substantially different across quintile regions within each category. While inpatient expenditures decreased as hospice length-of-service increased, they differed considerably across quintile regions within each category. Consequently, the magnitude of reduction in inpatient expenditures attributable to an increase in hospice length-of-service was much greater in high-cost regions than in low-cost regions. The outpatient expenditures showed a similar trend as the inpatient expenditures (see the Appendix).²² Hence, in the lowest-quintile regions, as hospice length-of-service increased, a decrease in inpatient and outpatient expenditures was offset by an increase in hospice expenditures, when length of hospice use exceeded three days. No substantial difference was found in end-of-life care expenditures among the different categories of hospice length-of-service when length of hospice use exceeded three days. In contrast, in the highest-quintile regions, an increase in hospice length-of-service was positively associated with a decrease in inpatient and outpatient expenditures that was much larger than the corresponding increase in hospice expenditures. Hence, a long hospice enrollment was associated with a substantial reduction in expenditures.

Hospice length-of-service did not explain much of the end-of-life care expenditure variation between the highest and the lowest quintiles (Exhibit 4). The difference in age-sex-race-adjusted end-of-life care expenditures between quintiles 1 and 5 was \$19,800 (model 1).

After adjustment for other patient demographics (model 2), the difference in expenditures between quintiles 1 and 5 decreased to \$18,300, which suggests that patient demographics explained 7.6 percent (\$1,500 of \$19,800) of the expenditure variation between the highest and the lowest quintiles. Further adjustments for clinical factors resulted in a decrease in the difference in expenditures between quintiles 1 and 5 to \$17,800 (model 3), indicating that tumor characteristics could explain an additional 2.9 percent of the variation (\$500 out of \$19,800). Additional adjustments for hospice enrollment resulted in a decrease in the difference in expenditures between quintile 1 and quintile 5 to \$16,600 (model 4), indicating that hospice enrollment could explain an additional 5.8 percent of the variation in expenditures between the highest and the lowest quintiles. Adjusting for the length of hospice stay was able to explain another 2.2 percent of the variation, with a \$16,200 difference between the highest and the lowest quintiles (model 5). Sensitivity analyses including patients who died within one to six months after cancer diagnosis did not substantially change our results (see the Appendix).²²

Discussion

To our knowledge, this is the first study examining the extent to which hospice use and the duration of hospice stays explained variation in end-of-life care expenditures. We found that although the length of hospice stay varied across hospital referral regions, it accounted for only a little of the geographic variation in expenditures across the nation as a whole. Specifically, hospice use and the length of hospice stays explained only 8 percent of the variation in end-of-life care expenditures between the highest- and lowest-quintile regions. This suggests that the duration of hospice enrollment does not have a substantial impact on spending variation.

This study further advances understanding of the financial impact of hospice use, delineating both the potential power and the limitations of hospice use. The analyses revealed that in regions with higher levels of spending on end-of-life care, expenditures were strongly associated with the length of hospice enrollment. In contrast, in regions with lower levels of spending, end-of-life care expenditures did not differ much by the length of hospice enrollment. More specifically, whether or not hospice use results in cost savings is determined by the offset between the increase in hospice expenditures and the decrease in inpatient or outpatient expenditures. The associations between hospice expenditures and length of hospice enrollment are similar across HRRs because hospice payment is based on per diem rates. In contrast, the negative associations between inpatient and outpatient expenditures and the length of hospice stay differ substantially across HRRs because the variation in these associations is conditional on regional spending patterns.

The heterogeneous associations attributed to the duration of hospice enrollment have an important policy implication: Considering that certain care patterns are often practiced regionwide and on a large scale, interventions targeting a change in collective practices might have major effects on behavior and economics. Programs that encourage hospice use in regions with high end-of-life care spending will likely generate the greatest cost savings. Although an increase in the length of hospice enrollment has less economic impact in low-expenditure areas, research indicates that such an increase improved patients' quality of life

and reduced the risk of a major depressive disorder in family members during bereavement.^{29–31} Therefore, health care providers should encourage hospice use for an appropriate period of time.

Our findings shed crucial light on inconsistent findings from past studies that investigated associations between end-of-life care expenditures and the length of hospice service use without considering different end-of-life care intensity across regions.¹² These studies found that the association between hospice use and cost savings depends on the analytic method used, the population studied, and the time period (last year or half year of life).¹² The literature suggested that an increase in hospice length-of-service is generally predicted to be inversely associated with expenditures.^{9,10} A surprising finding from our regional-level analysis of six-month end-of-life care costs controlling for patient-level factors was that end-of-life care expenditures for patients who died without using hospice in the lowest-expenditure regions were lower than expenditures for those with more than eight weeks of hospice enrollment in the highest-expenditure regions. This result highlights the importance of understanding care patterns and expenditures in a regional context, since regional spending patterns could play a more important role in cost savings than length of hospice enrollment. Future health services research incorporating region-level analyses of health care spending patterns and hospice use are warranted to understand the financial impact of hospice use.

One potential extension of our findings is that the length of hospice service could produce differential cost-savings effects by region because of geographic variation in practice norms for end-of-life care. The literature suggests that while market supply and patients' preferences might drive geographic variation in end-of-life care expenditure,^{18–20} physicians' behavior also plays a major role in such variation.^{8,17} Since physicians' decisions drive much of health care spending,³² regional expenditures (quintiles of mean end-of-life care expenditures per HRR) could serve as a proxy to measure physician practice patterns and thus the type of collective behavior that defines a local practice norm.

It is well established that physicians in different geographic regions practice differently.^{17,33} For example, physicians practicing in high-expenditure regions may be more likely than those in low-expenditure regions to recommend discretionary services for which strong evidence is lacking, and to test and treat patients intensively.^{17,33–35} Physicians predominantly seek social approval from colleagues of equal or higher status.³⁶ To avoid being criticized by colleagues and losing approval, physicians may endeavor to “follow the pack,” especially when decisions fall into gray areas.³⁷ Future interventions targeting changes in practice norms at the HRR level could help narrow the variation in practice patterns and reduce spending.

Conclusion

Associations between length of hospice enrollment and end-of-life care expenditures differ based on regional levels of such expenditures. Longer hospice stays are associated with decreased end-of-life care expenditures for patients who live in high-expenditure regions but not in regions with low average expenditures. Hence, implementation of local incentives or

informational programs in high-expenditure regions to promote hospice use might be effective for decreasing individual expenses and reducing aggressive end-of-life care, as preferred by most terminally ill patients. Furthermore, such targeted cost-saving measures may provide substantial economic benefits on a national scale, given that intense end-of-life care expenditures constitute a significant proportion of annual Medicare expenditures. In low-expenditure regions, marked savings from hospice use would not be expected, but encouraging timely hospice enrollment remains beneficial for terminally ill patients and their family members.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Exhibit 2.

Adjusted mean end-of-life care expenditures, by expenditure quintile and hospice length-of-service

Source/Notes: SOURCE Authors' analysis of data from the Surveillance, Epidemiology, and End Results Medicare database, 2004–11. NOTES Mean end-of-life care expenditures were calculated for each category of hospice length-of-service, controlling for patient sociodemographic and disease factors, across spending quintiles. The quintiles consisted of hospital referral regions, with quintile 1 having the lowest mean spending per decedent, adjusted for age, sex, race, and inflation, and quintile 5 the highest. Adjusted expenditures in the low spending quintiles were similar when hospice length-of-service was greater than 3 days; thus, trend tests were applied to examine the difference in expenditures across four categories of hospice length-of-service: 4–7 days, 8–28 days, 29–56 days, and ≥57 days. The results show no significant relationship between hospice length-of-service and end-of-life expenditures in the low spending quintiles but an inverse relationship between hospice length-of-service and end-of-life expenditures in the high spending quintiles. **** $p < 0.001$

Exhibit 3.

Adjusted mean hospice and inpatient expenditures, by expenditure quintile and selected hospice lengths-of-service

Source/Notes: SOURCE Authors' analysis of data from the Surveillance, Epidemiology, and End Results Medicare database, 2004–11. NOTES Adjusted mean end-of-life care expenditures were categorized by hospice and inpatient services. Then the mean of adjusted hospice and inpatient expenditures were calculated for selected categories of hospice length-of-service, across the quintiles. The quintiles consisted of hospital referral regions, with quintile 1 having the lowest mean spending per decedent, adjusted for age, sex, race, and inflation, and quintile 5 the highest. Within each category of hospice length-of-service, hospice expenditures were not substantially different across quintile regions, but inpatient expenditures differed considerably across quintile regions.

Exhibit 4.

Models of patient, disease, and hospice use factors that explain regional variations in end-of-life care expenditures

Source/Notes: SOURCE Authors' analysis of data from the Surveillance, Epidemiology, and End Results Medicare database, 2004–11. NOTES End-of-life care expenditures were estimated in a series of models in which adjustments were added sequentially. Model 1 adjusted for patients' age, race/ethnicity, and sex; model 2 added patients' residence, marital status, income (based on census data), and education level (based on census data); model 3 added tumor factors, comorbidities, and disability measures; model 4 added any hospice care; and model 5 added hospice length-of-service. The quintiles consisted of hospital referral regions, with quintile 1 having the lowest mean spending per decedent, adjusted for age, sex, race, and inflation, and quintile 5 the highest. The difference between estimated expenditures in quintile 5 and quintile 1 was calculated for each model. Hospice use and hospice length-of-stay explain \$1,200 and \$400, respectively, of the difference in end-of-life expenditures between the highest-spending and lowest-spending quintiles (\$19,800), which suggests that hospice use may explain little variation in end-of-life care expenditures. The difference between quintile 1 and quintile 5 in each model is \$19,800 in model 1, \$18,300 in model 2, \$17,800 in model 3, \$16,600 in model 4, and \$16,200 in model 5.

Exhibit 1

Selected patient characteristics, by quintile of Medicare expenditure quintiles, adjusted for age, sex, and race

Variables	Quintile 1 (n = 19,960)	Quintile 2 (n = 21,212)	Quintile 3 (n = 20,257)	Quintile 4 (n = 19,990)	Quintile 5 (n = 22,326)
Mean cost per patient	\$31,256	\$34,815	\$38,041	\$43,160	\$49,680
Mean hospice length-of-service in days (median)	13.0 (3)	12.0 (3)	10.7 (3)	11.3 (2)	7.9 (2)
Hospice length-of-service					
No stay	25.9%	29.4%	30.8%	32.4%	37.8%
3 days	24.2	24	24.6	25.2	26.5
4–7 days	16.2	15.6	15.1	14.2	13.4
8–28 days	20.6	19.4	19.3	17.3	15.3
29–56 days	7.3	6.5	5.6	5.8	4.0
57 days	5.8	5.2	4.6	5.2	3.1
Mean age (years)	77.3	77.2	77.6	78.4	78.3
Sex					
Male	44.8%	45.9%	46.6%	50.0%	49.2%
Female	55.2	54.1	53.4	50.0	50.8
Race					
White	93.3%	84.5%	89.1%	88.7%	80.1%
Black	5.7	10.1	6.9	6.6	12.8
Other	1.1	5.5	4.0	4.7	7.1
Hispanic					
No	97.2%	98.0%	93.1%	96.2%	92.8%
Yes	2.8	2.0	6.9	3.8	7.2
Income					
<\$33,000	42.1%	26.2%	25.2%	10.4%	14.9%
\$33,000–\$39,999	26.4	18.8	18.4	7.8	8.7
\$40,000–\$49,999	18.9	22.6	21.8	19.0	19.2
\$50,000–\$62,999	8.8	18.4	19.4	27.4	20.7
\$63,000	3.7	14.0	15.0	35.4	36.4

	Quintile 1 (n = 19,960)	Quintile 2 (n = 21,212)	Quintile 3 (n = 20,257)	Quintile 4 (n = 19,990)	Quintile 5 (n = 22,326)
Comorbid conditions					
None	24.6%	25.1%	24.2%	20.6%	19.5%
1 to 2	41.9	41.2	40.5	39.8	38.2
3	33.5	33.8	35.3	39.6	42.3

SOURCE: Authors' analysis of data from the Surveillance, Epidemiology, and End Results Medicare database, 2004–11. NOTES: The sample includes 103,745 patients who died from cancer within three years of diagnosis and who were enrolled in Medicare Parts A and B. The quintiles consisted of hospital referral regions, with quintile 1 having the lowest mean spending per decedent, adjusted for age, sex, race, and inflation, and quintile 5 the highest. An unabridged version of this exhibit is in the online Appendix (see Note 22 in text). The difference between quintiles 1 and 5 is statistically significant ($p < 0.001$).