Emergency Care Use and the Medicare Hospice Benefit for Individuals with Cancer with a Poor Prognosis

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[See Editorial Comments by Katherine A. Ornstein and Diane E. Meier, pp 330–331]

OBJECTIVES: To compare patterns of emergency department (ED) use and inpatient admission rates for elderly adults with cancer with a poor prognosis who enrolled in hospice to those of similar individuals who did not.

DESIGN: Matched case–control study.

SETTING: Nationally representative sample of Medicare fee-for-service beneficiaries with cancer with a poor prognosis who died in 2011.

PARTICIPANTS: Beneficiaries in hospice matched to individuals not in hospice on time from diagnosis of cancer with a poor prognosis to death, region, age, and sex.

MEASUREMENTS: Comparison of ED use and inpatient admission rates before and after hospice enrollment for beneficiaries in hospice and controls.

RESULTS: Of 272,832 matched beneficiaries, 81% visited the ED in the last 6 months of life. At baseline, daily ED use and admission rates were not significantly different between beneficiaries in and not in hospice. By the week before death, nonhospice controls averaged 69.6 ED visits/1,000 beneficiary-days, versus 7.6 for beneficiaries in hospice (rate ratio (RR) = 9.7, 95% confidence interval (CI) = 9.3–10.0). Inpatient admission rates in the last week of life were 63% for nonhospice controls and 42% for beneficiaries in hospice (RR = 1.51, 95% CI = 1.45–1.57). Of all beneficiaries in hospice, 28% enrolled during inpatient stays originating in EDs; they accounted for 35.7% (95% CI = 35.4–36.0%) of all hospice stays of less than 1 month and 13.9% (95% CI = 13.6–14.2%) of stays longer than 1 month.

CONCLUSION: Most Medicare beneficiaries with cancer with a poor prognosis visited EDs at the end of life. Hospice enrollment was associated with lower ED use and admission rates. Many individuals enrolled in hospice during inpatient stays that followed ED visits, a phenomenon linked to shorter hospice stays. These findings must be interpreted carefully given potential unmeasured confounders in matching. **J Am Geriatr Soc 64:323–329, 2016.**

Key words: hospice; emergency medicine; end-of-life care; Medicare

Fifty-one percent of elderly adults visit the emergency department (ED) in the last month of life.[1] The decisions made for these individuals in the ED—about mechanical ventilation, invasive procedures, intensive care admission, and other high-intensity interventions[2–4]—have immediate and future implications for their care and quality of life, as well as for healthcare costs.[2,5,6] As a result, there is growing interest in promoting palliative and hospice care in the emergency setting.[7,8]

Although hospice enrollment in elderly Medicare beneficiaries is associated with fewer ED visits in the last month of life,[1] significant questions remain regarding how much of this effect can be attributed to hospice; individuals who choose hospice may simply be less likely to seek emergency care irrespective of their hospice enrollment, and there is little evidence of the trajectories of ED use before and after enrollment. In addition, the pattern of hospital admissions resulting from ED visits of individuals in hospice and that of those not in hospice is unknown. As a result, the effect of hospice on ED use and, more broadly, the relationship between emergency care and hospice remain poorly understood.

Patterns of ED use and ED admissions before and after hospice enrollment were studied in a large cohort of Medicare beneficiaries with cancer with a poor prognosis. Those

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enrolled in the Medicare hospice benefit were compared with matched controls receiving nonhospice care over the last year of life, and the association between hospice care and ED use and ED admission rates was investigated over a similar period. It was hoped that a more-complete assessment of the relationship between hospice and ED use would be provided and that current debates about the role of palliative care in the ED would be informed.

METHODS

Study Design and Participants

This was a matched case–control study of all hospice-eligible, fee-for-service Medicare beneficiaries with cancer with a poor prognosis who died in 2011. A palliative care screening instrument from a large cancer referral center was adapted to generate a list of *International Classification of Diseases* (ICD) codes corresponding to poor-prognosis malignancies, which were defined as those with a high risk of death within 6 months, including poor-prognosis primary cancers (e.g., lung, pancreatic, brain), any metastatic malignancy, and any hematological malignancy specifically designated as unremitted or relapsed.[9] Clinicians treating a wide range of individuals with cancer developed the diagnoses used in the algorithm to identify those with poor prognoses and lack of options for curative treatments. Beneficiaries with any of these ICD codes in the Medicare 100% inpatient, outpatient, and hospice files from 2008 to 2011 were considered eligible for hospice, which is available to those with terminal illness and expected survival of less than 6 months, and were included, correcting for use of outpatient codes appearing only once that are often associated with diagnostic tests to exclude specific illnesses.[10] Beneficiaries in hospice and nonhospice controls were thus eligible to enroll in hospice. Hospice enrollees were identified as those with at least one hospice claim submitted after the first cancer diagnosis.

To verify that this method successfully captured individuals at high risk of mortality, 1-year mortality was calculated in a prior year of Medicare data. The mortality of this cohort, 31% in the year after first diagnosis, was similar to and only slightly lower than mortality in previous research on cancer with a poor prognosis.[11]

The method of matching hospice enrollees with nonhospice controls is described in more detail elsewhere.[12] Briefly, beneficiaries were first matched according to individual-level characteristics, performing one-to-one exact matching of hospice beneficiaries to nonhospice individuals on hospital referral region (HRR), age, sex, and time from first diagnosis of cancer with a poor prognosis to death (in months). This last variable was used as a proxy for disease course and severity. Because individuals with cancer tend to decline in health at least 3 months before death,[13] it was assumed that nonhospice and hospice enrollees included would have had sufficient time to consider and enroll in hospice. With their diagnoses of cancer with a poor prognosis, all individuals in both groups were eligible.

Using a strategy of progressively coarsening exact matching (CEM),[14] beneficiaries were matched according to the finest strata of each variable (ZIP code, year of birth, sex, months from diagnosis to death). Remaining unmatched cases were then matched iteratively in increasingly broad categories, up to a maximum of 5-year age intervals, 4-month illness duration intervals, and HRR. Propensity score matching (PSM) was initially attempted, but this generated significant imbalances on important covariates (Table S1); for example, only 0.8% of matched pairs resided in the same HRR. Thus, CEM results are presented here, with PSM sensitivity analysis in the supplemental material; because of the computationally intensive nature of PSM, a nationally representative 20% sample of Medicare beneficiaries was used rather than the 100% sample used for CEM.

Exposure Period

An exposure period leading up to death was defined for each pair of matched individuals in hospice and not in hospice (controls). The exposure period was defined as the number of days the hospice enrollee claimed the benefit until death. For each matched pair, this exposure period was applied to the nonhospice control, counting backward from the control's death. Although the exact date of death differed between the beneficiaries in hospice and those not in hospice, the exposure time before death was equivalent. For example, if a beneficiary claimed hospice for 20 days before his or her death, the exposure period for the matched control would also be 20 days before the control's death.

Outcomes

The percentage of beneficiaries visiting the ED in the last 6 months of life was calculated; 6-month survival is the eligibility criterion for hospice enrollment in individuals with terminal illness. ED use and ED admission rates of hospice enrollees and matched nonhospice controls at baseline (defined as 1 year prior to the first week of hospice), the week before hospice enrollment, and the week before death were compared, taking into account the varying duration of the exposure period (in weeks) between hospice enrollment and death.

Statistical Analysis

Balance between case and control groups was confirmed for all variables used for matching by comparing group means or medians. Use of health services and medical comorbidity at baseline was measured using the Gagne comorbidity score, a composite mortality scale based on the Elixhauser and Charlson indices.[15] Variables describing health services use and comorbidity at baseline were not used for matching because the exposure periods for controls were defined retrospectively based on that of their matched hospice-enrolled pair. ED use was calculated per 1,000 beneficiaries per day, and ED admission rate was calculated as the number of beneficiaries with an ED visit leading to an inpatient hospitalization as a percentage of all beneficiaries visiting the ED. Both rates were compared in case and control groups using risk ratios. Finally, it was hypothesized that inpatient admission from an ED visit triggered hospice enrollment for some beneficiaries. The

percentage of hospice beneficiaries who enrolled during inpatient stays following admission from the ED were calculated, and the correlation between this phenomenon and length of hospice stay, which has been linked to quality of care, was explored.[16–19]

RESULTS

Study Population and Characteristics

Figure 1 shows the study population and the matching process; 1,572,326 Medicare fee-for-service beneficiaries who died in 2011 were considered for inclusion. Of these, 420,503 had a prior diagnosis of poor-prognosis malignancy and were thus eligible for hospice; 1,322 (0.31%) beneficiaries who had missing ZIP codes or non-U.S. addresses, 2,462 (0.59%) who had previously enrolled in hospice, and 12 with invalid dates (e.g., hospice or diagnosis dates after death date) were excluded. In the remaining group, 254,729 beneficiaries claimed hospice for a median duration of 15 days (interquartile range 5–47), compared with 161,978 who did not. The final study cohort consisted of 136,416 matched pairs (84.2% of the nonhospice group).

Table 1 shows baseline characteristics of the study cohort. There were no statistically significant differences between beneficiaries who did and did not enroll in hospice in any variables used for matching. Median comorbidity, inpatient admission, and ED visit rates were similar from 2006 to the beginning of the exposure period for both groups. Baseline differences in home health days, clinic visits, and daily expenses in the year before hospice were statistically significant; hospice beneficiaries had more days of home health assistance (median 6 vs 4, difference 2, 95% CI = 1.7–2.3) and more clinic visits (median 1 vs 0, difference 1, 95% CI = 0.9–1.1) but lower mean daily expenses in the year before hospice ($132.3 vs $141.5, difference $8.5, 95% CI = $7.5–9.5). Table S2 compares the study population with the overall population of all deaths of Medicare beneficiaries with cancer with a poor prognosis in 2011, showing no differences between the included study population and the broader population in terms of age or sex, although median time from diagnosis to death was 6 weeks shorter for the study population than for the overall population. The distribution of illness duration was right-skewed (more beneficiaries with shorter survival and a long tail of beneficiaries with survival times above the median), making it more difficult to match beneficiaries with above-median illness duration and resulting in a likewise right-skewed matched cohort.

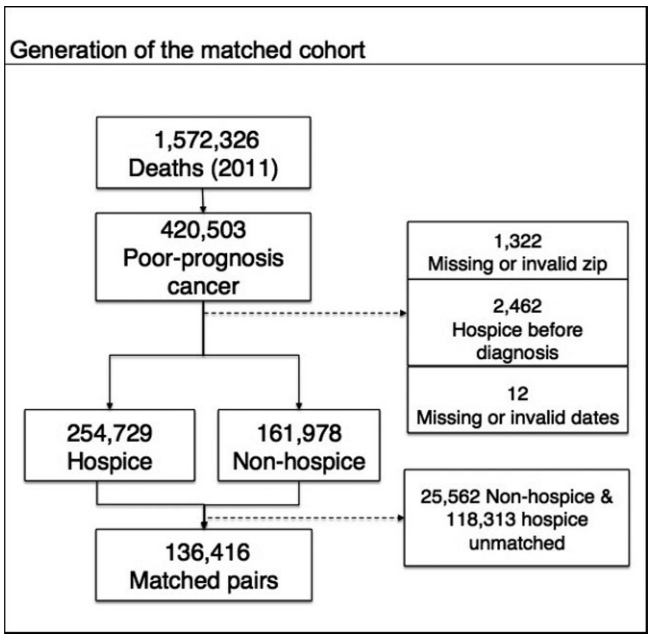

Figure 1. Study population. (A) Generation of the matched cohort. All Medicare beneficiaries who died in 2011 were identified, and those diagnosed with poor-prognosis cancer were selected. Beneficiaries with prior hospice enrollment suggesting a preceding terminal illness and those with missing geographic or date-of-death information were excluded. The remaining set was divided according to hospice enrollment and matched, with 84.2% of the nonhospice group paired.

ED Use

Of the entire study population, 81.3% (95% CI = 81.1–81.4%) had an ED visit in the last 6 months of life. For hospice enrollees, median hospice stay was 14 days; fewer than 3.7% of stays exceeded 6 months. Figure 2 compares the number of ED visits per 1,000 beneficiaries per day for hospice controls and hospice enrollees from 1 year before exposure period until death. Beneficiaries were separated into groups based on the length of exposure period (time from hospice enrollment to death or equivalent period for nonhospice controls). Because it was not feasible to show all 109 groups and because aggregating different exposure lengths obscured time trends, representative groups with exposure periods of 1, 2, and 4 weeks, which together make up 56.4% of the entire cohort, and every 4 weeks from 8 to 30 weeks, which make up 6.1% of the cohort, are shown. For each exposure period, the number of ED visits after enrollment was higher for the nonhospice controls than for hospice enrollees. Overall, 86.6% (95% CI = 86.4–86.8%) of nonhospice controls were seen in the ED in the last 6 months of life, compared with 75.9% (95% CI = 75.7–76.2%) of the hospice group (absolute difference: 10.7 percentage points, 95% CI = 10.4–11.0 percentage points).

These trends are summarized in Table 2, which shows the number of ED visits per 1,000 beneficiaries per day at baseline (from 2006 until 1 week before exposure period), 1 week before exposure, and 1 week before death. The ED visit rate was similar for hospice enrollees and nonhospice controls in the baseline period (rate ratio (RR) = 0.99, 95% CI = 0.98–0.99). In the week before the start of the exposure period, nonhospice controls were approximately half as likely as hospice enrollees to visit the ED (46.1 vs 88.1 visits per 1,000 beneficiary-days, RR = 0.56, 95% CI = 0.56–0.57), but in the final week of life, nonhospice controls were almost 10 times as likely as hospice beneficiaries to visit the ED (69.6 vs 7.6, RR = 9.7, 95% CI = 9.3–10.0). Nonhospice controls also visited the ED 10 times as often in the week before death as they did at baseline (5.4 at baseline vs 69.6 at 1 week before death),

Table 1. Study Population Characteristics

Characteristic	Nonhospice, n = 136,416	Hospice, n = 136,416	Difference
Characteristics used for matching			
Age[a]	77.5 (77.5–77.7)	77.5 (77.5–77.6)	−0.01 (−0.09–0.06)
Male, %[a]	50.2 (50.0–50.4)	50.2 (50.0–50.4)	0 (0–0)
Median distance between pairs, miles[b]	18.9 (7.5–45.0)		—
Days from diagnosis to death[b]	213 (45–646)	212 (49–645)	−1 (−5.2–3.2)
Illness and hospice course			
Days from diagnosis to exposure[b]	168 (23–601)	168 (23–600)	0 (−4–4)
Days from exposure start to death[b]	14 (4–42)	14 (4–42)	0 (0–0)
Comorbidity before exposure[c]			
From 2006 to cancer diagnosis[b]	6 (3–9)	6 (3–8)	0 (0–0)
From 2006 to start of exposure period[b]	8 (5–10)	8 (6–11)	0 (0–0)
Healthcare use from 2006 to start of exposure period			
Inpatient admissions[b]	3 (1–5)	3 (1–5)	0 (0–0)
Emergency visits[b]	4 (2–7)	4 (2–7)	0 (0–0)
Home health days[b]	4 (0–27)	6 (0–27)	2 (1.7–2.3)
Clinic visits[b]	0 (0–7)	1 (0–7)	1 (0.87–1.1)
Daily expenses in the year before hospice, $[a]	141.5 (140.6–142.3)	132.3 (132.2–133.7)	8.5 (7.5–9.5)

The baseline period is defined as the week 1 year before the first week of the exposure period. The last column shows differences between groups, calculated as described below.

[a]For normally distributed variables, means (95% confidence intervals) are reported. Differences and 95% CIs were calculated using the *t*-test.

[b]For nonnormally distributed variables, medians (interquartile ranges) are reported. Differences and 95% CIs were calculated using quantile regression.

[c]Gagne comorbidity score, measured on a composite scale synthesizing Elixhauser and Charlson indices. Scale ranges from −2 to 26.

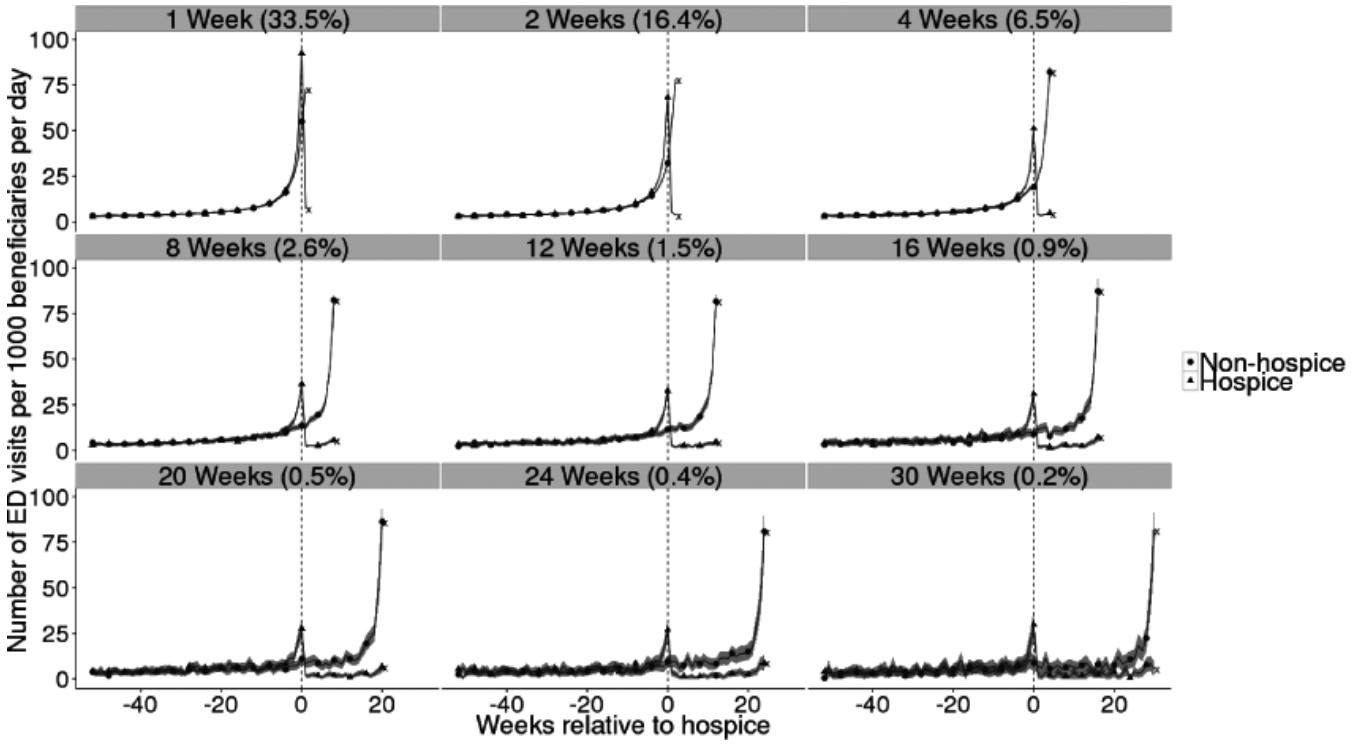

Figure 2. Mean daily number of emergency department (ED) visits per 1,000 individuals in hospice and not in hospice from 1 year before the start of the exposure period (week 0) until death. Beneficiaries were separated into groups based on length of exposure period (length of hospice or nonhospice care before death). Because not all 109 groups could be shown, and aggregating groups would obscure time trends, representative groups with exposure periods of 1, 2, and 4 weeks, which together make up 56.4% of the entire cohort and then at 4-week intervals from 8 to 30 weeks, which make up 6.1% of the cohort, are shown. Crosses mark the week of death for each group of beneficiaries. The vertical dash line at week 0 marks hospice enrollment and the start of the exposure period. The shaded area around the lines indicates the 95% confidence interval for the mean daily visits.

whereas hospice enrollees' ED visits increased only slightly (5.2 at baseline vs 7.6 at 1 week before death).

ED Admission Rates

There was no difference in ED admission rates between nonhospice controls and hospice enrollees at baseline (RR = 1.0, 95% CI = 1.0–1.0) or in the week before the start of the exposure period (RR = 0.99, 95% CI = 0.99–1.0). In the final week of life, nonhospice controls in the ED were 51% more likely to be admitted than hospice beneficiaries (RR = 1.51, 95% CI = 1.45–1.57). Nonhospice controls were admitted at higher rates in the week before death (rate = 0.63, 95% CI = 0.63–0.64) than they were at baseline (rate = 0.55, 95% CI = 0.55–0.55), whereas the opposite was true for hospice beneficiaries (0.42 at 1 week before death vs 0.54 at baseline).

Hospice Enrollment After ED Admission

Of all hospice beneficiaries, 28% enrolled during inpatient stays after admission from the ED. The correlation between ED admission and time between hospice enrollment and death was explored, and it was found that beneficiaries who enrolled in hospice after being admitted through the ED were more likely to have short hospice stays than those who did not enroll as inpatients. Of beneficiaries with less than 1 month of hospice care, 35.7% (95% CI = 35.4–36.0%) started hospice as inpatients after ED admission, whereas this was true for only 13.9% (95% CI = 13.6–14.2%) of those claiming hospice benefits for more than 1 month. This trend is summarized graphically in Figure S1.

Sensitivity Analysis

PSM produced 100% matching of the nonhospice group, for an included cohort of 69,854 beneficiaries. In this cohort, balance on important drivers of cost, most notably geography, was poor, with only 0.8% of matched pairs residing in the same HRR (Table S1). Nonetheless, general trends in ED visits and ED admissions were similar in PSM and CEM (Figure S2), as were rates of ED visits and ED admissions (Table S3).

DISCUSSION

Although a vast majority of Medicare beneficiaries with cancer with a poor prognosis visited the ED at the end of life, those enrolled in hospice had significantly fewer ED visits than matched nonhospice controls after hospice enrollment, despite generally similar patterns of ED use before enrollment. When hospice enrollees visited the ED, they were less likely to be hospitalized than nonhospice controls. A large minority of hospice enrollees who enrolled as inpatients after inpatient admission from the ED were also identified, a phenomenon linked to shorter hospice stays.

Although the lower rate of ED visits in hospice enrollees had been identified in previous, smaller studies,[1,20] an exact understanding of the nature of the correlation demanded a more-careful examination of the temporal relationship between the two; because the hospice program requires beneficiaries to forgo curative care, it might be more attractive to individuals with a baseline preference for less care. ED use was found to be similar between hospice enrollees and nonhospice controls at baseline, and a significant decrease in ED use immediately after hospice enrollment was observed; there was no such pattern in nonhospice controls. Given the temporal pattern, this result was unlikely to be a reflection of baseline differences between hospice and nonhospice populations. The pattern could reflect changes in underlying health status that precipitate hospice enrollment or a causal effect of choosing hospice, but such causality cannot be determined using this retrospective data. Inpatient admissions from the ED decreased for hospice enrollees after enrollment. Given studies suggesting that most people prefer to stay out of the ED and hospitals in the days before death,[21] the reduction in ED use and admissions indicates that hospice is an important correlate of quality of care at the end of life.

These findings also highlight important connections between ED use, hospital admission, and hospice enrollment, building on prior studies.[22–25] Nearly one-third of

Table 2. Emergency Department (ED) Visit Rate and ED Admission Rate for Nonhospice Controls and Hospice Enrollees

Variable	Nonhospice	Hospice	Ratio[a]
Baseline[b]			
ED visits per 1,000 beneficiaries per day	5.4 (5.3–5.4)	5.2 (5.2–5.2)	0.99 (0.98–0.99)
ED admission rate	0.55 (0.55–0.55)	0.54 (0.54–0.55)	1.0 (1.0–1.0)
Week before exposure start			
ED visits per 1,000 beneficiaries per day	46.1 (45.4–46.9)	88.1 (87.1–89.1)	0.56 (0.56–0.57)
ED admission rate	0.77 (0.77–0.78)	0.78 (0.78–0.78)	0.99 (0.99–1.0)
Week before death			
ED visits per 1,000 beneficiaries per day	69.6 (68.3–70.9)	7.6 (7.3–8.0)	9.7 (9.3–10.0)
ED admission rate	0.63 (0.63–0.64)	0.42 (0.41–0.44)	1.51 (1.45–1.57)

[a]Ratio of hospice to nonhospice percentage, calculated as proportion of nonhospice controls over hospice enrollees, with 95% confidence interval in parentheses, calculated as a relative risk.

[b]2006 to 1 week before the beginning of the exposure period.

hospice beneficiaries enrolled as inpatients after ED admission, and these beneficiaries had shorter hospice stays. It is likely that this phenomenon reflects the growing role of palliative and hospice interventions in the emergency setting and shortly afterward and failure to address palliative care needs earlier in the outpatient setting,[26] as demonstrated in previous work connecting late referrals, emergency use, and aggressive end-of-life care.[16] Visits to the ED, and especially admissions from the ED, may represent an important "pause point" for individuals with cancer with a poor prognosis and a window of opportunity for emergency care providers to engage with individuals in end-of-life care conversations, which oncologists, hospitalists, intensivists, and other providers in the hospital could continue in more depth, but given that these individuals had shorter hospice stays, which are increasingly considered indicative of poorer-quality end-of-life of care,[16–19] hospice enrollment in the emergency setting or shortly thereafter is unlikely to represent optimal care. These results reinforce the need to increase discussion of hospice and palliative care at multiple points in the care of individuals with advanced illnesses—including the ED and inpatient hospitalizations, but especially the routine outpatient setting.

There were limitations to this study. In matching, assumptions were made about the correlation between illness severity and illness length: first, that the two were in fact correlated; second, that hospice enrollment was not correlated with illness length. If hospice enrollment had been correlated with shorter survival time, then hospice beneficiaries would have been healthier than they appeared from their illness length, a difference that could partially account for the lower ED visit and ED admissions rates after enrollment, but if hospice enrollment had been correlated with longer survival times, then hospice beneficiaries would have been sicker than they appeared from their illness length, a difference that would buffer the decrease in ED visit and admissions rates after enrollment. Because there is some evidence that hospice care may prolong life,[27] the latter seems more likely; the results of the current study may thus not capture the full reduction in ED visits and admissions of hospice beneficiaries after enrollment. Hospice enrollees had higher comorbidity scores, indicating that they may have been sicker than the nonhospice controls, but if it is correct that illness length was correlated with disease severity, the matching process would have corrected for any such discrepancies.

In addition, although matching according to age, sex, geography, and illness severity captured relevant similarities between two matched individuals, it was not possible to account for all potential variables, and thus it cannot be said with certainty that the two groups were fully comparable. It is reassuring that, despite matching on only four variables, it was possible to achieve balance on a wide range of other measured variables, including median comorbidity, inpatient admissions, and ED visits, increasing confidence in the matching procedure, although it is impossible to assess balance on unmeasured covariates, and the results must be interpreted in this light.

There are also potential limitations to generalizability. To create a matched cohort balanced on illness duration, demographic characteristics, and geography, a subset of unmatched beneficiaries was excluded, potentially biasing results, although additional sensitivity analysis with PSM matched all beneficiaries and produced largely similar results. Other limitations included the restricted analysis to all fee-for-service Medicare beneficiaries with cancer and incomplete data on skilled nursing facility expenses.

Finally, individuals with cancer with a poor prognosis and high risk of mortality were identified through ICD codes in their Medicare claims files. Such claims-based diagnoses can be inaccurate. These codes may also include cancers that range in severity, although ICD codes were specified to exclude more-indolent cancers with better prognoses (e.g., restricting to hematological malignancies specifically designated as relapsed or not in remission). Additionally, there are, to the authors' knowledge, no data on the specificity and sensitivity of these codes in predicting survival, although it was verified that this method identified high-mortality subgroups by calculating 1-year mortality in a year of prior claims data and finding 31% mortality. The high mortality of this group suggested that using ICD codes was an effective method to identify individuals with a high risk of near-term death. Lastly, all studies of decedents encounter an important limitation in identifying individuals at high risk of death, because their prognoses may not always be clear to themselves or their providers. It was also assumed that individuals with such poor prognoses were knowledgeable about their eligibility for hospice, when they may have had hospice presented to them as an option late in the course of their illness and then only after a hospitalization.

In conclusion, most Medicare beneficiaries with cancer with a poor prognosis visited EDs at the end of life. Hospice enrollment was associated with less-intense emergency care, including lower ED use and rates of inpatient admission than nonhospice care. Nearly one-third of hospice enrollees enrolled in hospice as inpatients after an ED admission, probably reflecting failures to address palliative care needs in the outpatient setting, and this phenomenon was linked to shorter hospice stays.

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SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article:

Table S1. Baseline Characteristics of Propensity Score Matching Study Cohort.

Table S2. Characteristics of Study Population and all Medicare Fee-for-Service Poor-Prognosis Cancer Deaths (2011).

Table S3. Emergency Department (ED) Visit Rate and ED Admission Rate for Propensity Score Matching Cohort for Individuals in Hospice and not in Hospice.

Figure S1. Length of hospice stay for beneficiaries who enrolled as inpatients through the emergency department (ED).

Figure S2. Mean daily ED use per 1,000 beneficiaries for individuals not in hospice (left) and in hospice (center) from 1 year before start of exposure period (week 0) until death. Beneficiaries were separated into groups based on length of exposure period (length of hospice or nonhospice care before death).

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