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Disclosures provided by the authors are available with this article at jop.ascopubs.org.



DOI: <https://doi.org/10.1200/JOP.2017.020883>; published online ahead of print at jop.ascopubs.org on August 22, 2017.

Effect of Palliative Care on Aggressiveness of End-of-Life Care Among Patients With Advanced Cancer

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QUESTION ASKED: What is the effect of palliative care on healthcare use at end-of-life among Medicare patients with advanced cancer?

SUMMARY ANSWER: Exposure to palliative care reduced health-care use among Medicare beneficiaries with advanced cancer.

WHAT WE DID: We examined the effect of exposure to palliative care on healthcare use at the end of life among 6,580 Medicare beneficiaries with advanced prostate, breast, lung, or colorectal cancer. We compared healthcare use before and after palliative care consultation to a matched nonpalliative care cohort.

WHAT WE FOUND: The palliative care cohort had higher rates of health-care use in the 30 days before palliative care consult compared with the nonpalliative cohort, with higher rates of hospitalization, invasive procedures, and chemotherapy administration. The opposite pattern emerged in the interval from palliative care consultation through death, where the palliative care cohort had lower rates of

hospitalization, invasive procedures, and chemotherapy administration. Patients with earlier palliative care consultation in their disease course had larger absolute reductions in healthcare use.

BIAS, CONFOUNDING FACTOR(S), REAL-LIFE IMPLICATIONS: Our study offers insight into the real world influence of palliative care on a diverse cohort of patients with advanced cancer. These findings have important implications given the current emphasis of early palliative care integration alongside standard oncologic care in patients with advanced cancer.

As a retrospective observational study the palliative care exposure was identified from billing claims, and the two comparator groups were not randomized. The validity of this study hinges on the accuracy of the matching process. Our matching algorithm provided a good balance on most measured variables, however the possibility for residual confounding from unmeasured variables remains a potential source of bias and should be considered in the interpretation of our results. **JOP**

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ASSOCIATED CONTENT



Appendix available online

Abstract

Purpose

Palliative care's role in oncology has expanded, but its effect on aggressiveness of care at the end of life has not been characterized at the population level.

Methods

This matched retrospective cohort study examined the effect of an encounter with palliative care on health-care use at the end of life among 6,580 Medicare beneficiaries with advanced prostate, breast, lung, or colorectal cancer. We compared health-care use before and after palliative care consultation to a matched nonpalliative care cohort.

Results

The palliative care cohort had higher rates of health-care use in the 30 days before palliative care consultation compared with the nonpalliative cohort, with higher rates of hospitalization (risk ratio [RR], 3.33; 95% CI, 2.87 to 3.85), invasive procedures (RR, 1.75; 95% CI, 1.62 to 1.88), and chemotherapy administration (RR, 1.61; 95% CI, 1.45 to 1.78). The opposite pattern emerged in the interval from palliative care consultation through death, where the palliative care cohort had lower rates of hospitalization (RR, 0.53; 95% CI, 0.44-0.65), invasive procedures (RR, 0.52; 95% CI, 0.45 to 0.59), and chemotherapy administration (RR, 0.46; 95% CI, 0.39 to 0.53). Patients with earlier palliative care consultation in their disease course had larger absolute reductions in health-care use compared with those with palliative care consultation closer to the end of life.

Conclusion

This population-based study found that palliative care substantially decreased health-care use among Medicare beneficiaries with advanced cancer. Given the increasing number of elderly patients with advanced cancer, this study emphasizes the importance of early integration of palliative care alongside standard oncologic care.

INTRODUCTION

Over the past decade, the use of palliative care has increased across the United States health-care system, particularly in the field of oncology. The proportion of hospitals

with a palliative care program increased from less than a quarter in 2000 to more than two-thirds in 2011.¹ Palliative care plays a central role in oncology because of its proven effect, with improved symptoms,



DOI: <https://doi.org/10.1200/JOP.2017.020883>; published online ahead of print at jop.ascopubs.org on August 22, 2017.

quality of life, patient and caregiver satisfaction, improved mood, prolonged survival, and less aggressive care at the end of life.²⁻⁸ Current clinical guidelines recommend dedicated palliative care services early in the disease course concurrent with active treatment of patients with advanced cancer.⁹⁻¹¹ Cancer remains the second leading cause of death in the United States and often involves intense treatment that draws on substantial patient and economic resources.^{12,13} With the aging population, there exists a critical public health need for health-care services, such as palliative care, that can improve patients' quality of life and family satisfaction without straining the existing health-care system.^{14,15}

Aggressive health-care measures at the end of life aim to extend survival, however, have been associated with decreased quality of care.¹⁶⁻¹⁸ Previous studies have found less intensive end-of-life health-care use among hospital patients who received palliative care compared with those who did not,¹⁹⁻²² but the relationship between palliative care and end-of-life care in the United States has not been characterized at a population level. Validation of these previous studies in a real-world, population-based setting is critical to demonstrate the practical benefits of palliative care as it is actually implemented. The objective of this study was to define the effect of palliative care consultation on health-care use at the end of life among patients with metastatic prostate, breast, lung, or colorectal cancer.

METHODS

Data

This project used data within the SEER-Medicare linked database. SEER cancer registry data, compiled by the National Cancer Institute, include information from patients from individual cancer registries representing 28% of the US population. Medicare provides federally funded health insurance for people 65 and older. The SEER-Medicare linked database contains Medicare claims data for eligible patients within the SEER registries. This dataset enables the evaluation of health-care delivery and use at a population level over the course of a patient's diagnosis. The Institutional Review Board of University of California, San Diego, considered this study exempt from review.

Patients

This project focused on the four most commonly diagnosed cancer sites in the United States: prostate, breast, lung, and

colorectal cancer.¹² We initially identified 166,124 persons with histologically confirmed distant metastatic cancer over the age of 65 years diagnosed between 2000 and 2009. We excluded those who had multiple primary tumors and those who were diagnosed on autopsy or on death certificate only. The goal of the study was to evaluate patterns of care at the end of life among patients dying of cancer. Therefore, we excluded patients who were alive at the end of the study period (December 31, 2010) and those who died of causes other than cancer. We included only patients with complete Medicare claims data, including those with continuous enrollment in Medicare Part A and B from 1 year before diagnosis through death. We also excluded those enrolled in Medicare Part C, because most patients with Part C have it through health maintenance organization plans for which claims data are not readily available. Finally, we excluded patients who received their first palliative care consultation on the day of death, because of lack of time to evaluate patterns of care at the end of life. The prematched study population consisted of 81,651 patients; [Figure 1A](#) presents details of the patient-selection process.

Matching

To minimize selection bias resulting from nonrandom assignment of palliative care, we used coarsened exact matching^{23,24} to form two groups balanced on measured covariates. Prior research evaluating patients enrolled in hospice found coarsened exact matching produces a more balanced match compared with other matching strategies, including propensity score matching.²³ The "exposure" of interest in this study was consultation with a palliative care provider, defined as the presence of the International Classification of Diseases, version 9 code V66.7, which denotes an "encounter for palliative care." This palliative care encounter diagnosis code was captured from both inpatient and outpatient Medicare billing claims. Among palliative care encounters during an inpatient hospitalization, the precise date of the encounter was not always available. Typical palliative care encounters often occur toward the end of hospitalizations²⁵; therefore, we assigned the date of palliative care as the last day of hospitalization. The exact date of a palliative encounter was available and used among patients with outpatient palliative care visits.

After dividing our sample into two cohorts on the basis of exposure status, patients were iteratively matched from more to less granular strata on sex, age, place of residence, and year of

diagnosis. SEER data do not capture disease severity; therefore, we matched patients on survival measured in months from diagnosis of cancer through death as a proxy for severity of disease.²³ The details of the coarsened exact matching process are described elsewhere.²⁴ In brief, the first matching iteration finds exact matches on sex, age, place of residence, year of diagnosis, and number of months from diagnosis to death. Gradually, these matching variables are relaxed into coarser strata to discover additional matched pairs. The maximum levels of coarseness were 5-year age blocks, 3-year diagnosis groups, and 4-month illness duration blocks; place of residence was coarsened from health-care service area to hospital referral region.

The final phase of our matching procedure involved determining a matched exposure period for each pair. In the cohort with a palliative care consultation, the exposure period extended from the day after the palliative care encounter through death. Among patients with a record of multiple palliative care encounters, the first encounter was used as the exposure date. Among the nonexposure cohort of patients, we assigned a pseudo-exposure date (because this cohort did not have a palliative care exposure) and a corresponding pseudo-exposure period that matched the time interval in the exposed matched counterpart (Fig 1B).

End Points Studied

We identified an array of end points for health-care use at the end of life defined previously in the literature.^{16,23} The specific end points evaluated include visits to the emergency room (ER), hospitalization, intensive care unit (ICU) admission, and hospice use. Other end points evaluated include the use of chemotherapy, initiation of a new chemotherapy agent, and invasive procedures such as venous catheterization, intubation, transfusion of blood products, thoracentesis, lung or liver biopsy, or cardiopulmonary resuscitation. We identified these end points separately in the 30-day window before exposure and again in the interval from exposure through death to better understand the effect of palliative care exposure on health-care use.

Study Covariates

Demographic characteristics acquired from SEER data included age at diagnosis, sex, race, Hispanic ethnicity, marital status, and median household income divided into quartiles, which was calculated from the 2000 US Census favoring census tract data over zip code-level data. Individuals with missing

household income (< 0.1%) were grouped into the bottom quartile.²⁶ We implemented the Deyo adaptation of the Charlson Comorbidity Index, which uses inpatient and outpatient Medicare claims data from the year before diagnosis of cancer.^{27,28} Additional covariates included tumor site, SEER Registry region, urban or rural setting, and year of diagnosis. Health-care delivery in a teaching hospital was defined as any indirect medical education payment during a postdiagnosis hospitalization.

Statistical Analysis

Descriptive statistics were used to illustrate general patient characteristics, stratified by matching group. To evaluate balance between the two cohorts, standardized differences (the difference in group means divided by the common standard deviation)²⁹ were measured for patient covariates. Standardized differences < 0.1 reflect a good balance between matched groups.²⁹ To assess differences in the means of continuous end points, we used paired *t* tests. The differences in dichotomous end points were assessed with risk ratios and 95% CIs, which were calculated using Mantel-Haenszel standard error estimates stratified on the matched sets. One variable in particular was not balanced between the palliative and nonpalliative cohorts after our matching algorithm. Care at a teaching hospital was higher among patients receiving palliative care compared with control patients (65% *v* 52%). We used a conditional logistic regression as a sensitivity analysis to verify associations between our exposure and outcomes, adjusting for care at a teaching hospital. The conditional logistic regression results did not vary (data not shown), and we presented only the relative risks for simplicity. We evaluated the effect of timing of the palliative care consultation (measured from death) by assessing for statistical interaction between time of consultation and presence of a palliative care consultation. Significant interactions implied the influence of palliative care varied among those with a palliative care consultation early in diagnosis compared with those with consultations closer to death. All statistical tests were two-sided and *P* values < .05 were considered significant. Analyses were performed using SAS version 9.4 (SAS Institute, Cary, NC).

RESULTS

Of 81,651 unmatched patients, 3,665 (4.5%) had received at least one consultation with a palliative care provider. After 108 matching iterations, coarsened exact matching yielded 3,290

matched pairs for a final sample size of 6,580 patients (Fig 1). Appendix Table A1 (online only) demonstrates descriptive characteristics of the matched cohort. All covariables were well balanced between matched groups with the exception of care at a teaching hospital, which was higher among patients with a palliative care encounter (65% v 52%). The median time from diagnosis to death was 4.8 months (interquartile range, 2.1 to 11.0 months). In general, palliative care delivery was more frequent toward the end of the study period, more commonly used among patients with lung cancer, and more prevalent on the West coast. The timing of the palliative care encounter occurred relatively late in a patient’s disease course, with a median time from consultation to death of 12 days (interquartile range, 4 to 38 days).

Overall, patients who received palliative care had increased use of most health-care services in the 30 days before consultation compared with the nonpalliative care group (Table 1).

The palliative cohort had increased rates of hospitalization, ER visits, ICU admissions, and multiple invasive procedures. The palliative care group had a 61% higher rate of receiving any chemotherapy regimen but a 25% lower rate of starting a new chemotherapy regimen in the 30 days before exposure.

Although patients receiving palliative care had higher rates of health-care use before palliative consultation, this cohort had lower rates of health-care use after palliative consultation compared with the nonpalliative care group (Table 2). Patients receiving palliative care consultation had lower rates of hospitalization, ER visits, ICU admissions, and invasive procedures. The palliative cohort was 54% less likely to receive chemotherapy, and 35% less likely to start a new chemotherapy regimen. The group receiving palliative care was 24% more likely to enroll in hospice and had longer durations on hospice (25.5 days v

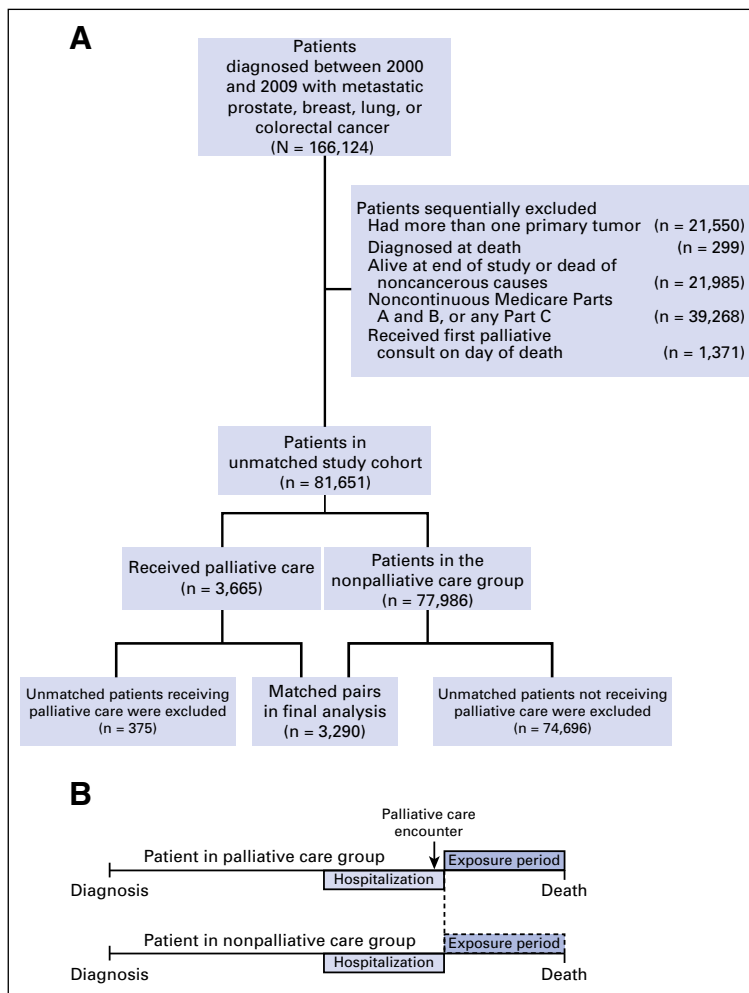


Fig 1. Patient selection criteria. (A) Patient selection and matching. (B) Matching-patient exposure periods.

Table 1. Care Use in the 30 Days Before Exposure

Measure of Care Use	Palliative Care Consultation, No. (%)		Risk Ratio (95% CI)
	Yes (n = 3,290)	No (n = 3,290)	
Hospitalization end points			
> 1 hospital admission	705 (21.4)	212 (6.4)	3.33 (2.87 to 3.85)
> 14 days of hospitalization	477 (14.5)	225 (6.8)	2.12 (1.82 to 2.47)
> 1 ER visit	620 (18.8)	251 (7.6)	2.47 (2.15 to 2.84)
ICU admission	823 (25.0)	497 (15.1)	1.66 (1.50 to 1.83)
Chemotherapy			
Any chemotherapy regimen	774 (23.5)	481 (14.6)	1.61 (1.45 to 1.78)
New chemotherapy regimen	350 (10.6)	466 (14.2)	0.75 (0.66 to 0.86)
Invasive procedures			
Venous catheterization	303 (9.2)	150 (4.6)	2.02 (1.67 to 2.44)
Respiratory tract intubation	126 (3.8)	81 (2.5)	1.56 (1.18 to 2.05)
Packed cell transfusion	430 (13.1)	212 (6.4)	2.03 (1.73 to 2.37)
Platelet transfusion	33 (1.0)	20 (0.6)	1.65 (0.95 to 2.87)
Thoracentesis	364 (11.1)	205 (6.2)	1.78 (1.51 to 2.09)
Lung or liver biopsy	519 (15.8)	373 (11.3)	1.39 (1.23 to 1.58)
Continuous outcomes, mean (SD)*			
Hospitalization duration, day†	7.49 (6.60)	3.62 (5.81)	
Hospital admissions	1.11 (0.65)	0.47 (0.64)	
ER visits	0.95 (0.79)	0.45 (0.68)	

Abbreviations: ER, emergency room; ICU, intensive care unit; SD, standard deviation.

**P* values were calculated using paired *t* tests. *P* < .001 for all.

†Average hospitalization duration was calculated among patients who were hospitalized at least once.

21.3 days). Despite the longer average duration of hospice care, patients receiving palliative care were more likely to be admitted to hospice within 3 days of death.

Figure 2 demonstrates the effect of palliative care consultation timing on select markers of health-care use. For several end points, the size of the effect of palliative care depended on the timing of the palliative care consultation, as assessed by the interaction of time and palliative care consultation in each statistical model. Earlier palliative care encounters were associated with greater reductions in chemotherapy use ($P < .001$), greater reductions in average hospitalization days ($P < .05$), and increased time enrolled in hospice ($P < .001$). For example, patients receiving palliative care had a 0.5% absolute decrease in chemotherapy use when palliative consultation occurred in the last week of life versus a 24.3% decrease in chemotherapy use when palliative consultation occurred > 8 weeks from death. Although palliative care consultation did reduce the chances of receiving any invasive procedure, the timing of consultation did not affect the magnitude of effect ($P = .90$).

DISCUSSION

The key findings of this study relate to the marked reductions in health-care use at the end of life after exposure to palliative care. These results add to a growing literature demonstrating the effect of palliative care in a large cohort of elderly patients with cancer.³⁰

Overall, our results complement findings of other single-institution studies demonstrating reduced health-care use with palliative care services.¹⁹⁻²² Additionally, the landmark randomized controlled trial by Temel et al² found early palliative care was associated with improved quality of life, prolonged survival, and less aggressive end-of-life care among patients with metastatic lung cancer. The differences we observed in care use before and after exposure to palliative care concur with the discovery of Morrison et al¹⁵ that health-care costs for patients receiving palliative care in eight hospitals reliably declined within 24 to 48 hours after palliative consultation. Essentially, we found palliative care represents an inflection point in patient care, with higher use of health-care services before palliative care consultation and lower use after.

Table 2. Care Use After Exposure

Measure of Care Use	Palliative Care Consultation, No. (%)		Risk Ratio (95% CI)
	Yes (n = 3,290)	No (n = 3,290)	
Hospitalization end points			
> 1 hospital admission	148 (4.5)	277 (8.4)	0.53 (0.44 to 0.65)
> 14 days of hospitalization	148 (4.5)	206 (6.3)	0.72 (0.58 to 0.88)
> 1 ER visit	190 (5.8)	305 (9.3)	0.62 (0.52 to 0.74)
ICU admission	447 (13.6)	549 (16.7)	0.81 (0.73 to 0.91)
Death in acute care hospital	480 (14.6)	743 (22.6)	0.65 (0.58 to 0.72)
Death in SNF or long-term hospital	15 (0.5)	26 (0.8)	0.58 (0.31 to 1.09)
Chemotherapy			
Any chemotherapy regimen	224 (6.8)	491 (14.9)	0.46 (0.39 to 0.53)
New chemotherapy regimen	187 (5.7)	288 (8.8)	0.65 (0.54 to 0.78)
Invasive procedures			
Venous catheterization	106 (3.2)	140 (4.3)	0.76 (0.59 to 0.97)
Respiratory tract intubation	46 (1.4)	115 (3.5)	0.40 (0.29 to 0.56)
Packed cell transfusion	118 (3.6)	224 (6.8)	0.53 (0.42 to 0.65)
Platelet transfusion	11 (0.3)	33 (1.0)	0.33 (0.17 to 0.66)
Thoracentesis	77 (2.3)	119 (3.6)	0.65 (0.49 to 0.86)
Cardiopulmonary resuscitation	11 (0.3)	41 (1.2)	0.27 (0.14 to 0.52)
Lung or liver biopsy	42 (1.3)	133 (4.0)	0.32 (0.22 to 0.45)
Hospice use			
Hospice admission	1,214 (36.9)	982 (29.8)	1.24 (1.15 to 1.32)
Hospice admission ≤ 3 days before death	654 (19.9)	392 (11.9)	1.67 (1.49 to 1.87)
Continuous outcomes, mean (SD)*			
Hospitalization duration, day†	2.67 (7.0)	3.33 (6.9)	
Hospital admissions	0.23 (0.7)	0.44 (0.8)	
ER visits	0.28 (0.9)	0.46 (0.9)	
Hospice duration, day‡	25.5 (54.0)	21.3 (49.8)	

Abbreviations: ER, emergency room; ICU, intensive care unit; SNF, skilled nursing facility; SD, standard deviation.

**P* values were calculated using paired *t* tests. *P* < .001 for all.

†Average hospitalization duration was calculated among patients who were hospitalized at least once.

‡Average hospice duration were calculated among patients who enrolled in hospice.

Beyond the overall effect on health-care use, we also found the timing of palliative care consultation differentially influenced use. Earlier encounters with palliative care were associated with larger absolute effects on chemotherapy delivery and hospice duration. This correlates with prior findings that early, versus late, palliative care referrals translate into less intensive care, improved quality outcomes, and cost savings at the end of life for patients with cancer.³¹ These findings are particularly relevant given the current emphasis of early palliative care integration alongside standard oncologic care in patients with advanced cancer. To date, multiple randomized trials have demonstrated the benefits of early palliative care,^{2-4,7,8,32} which include improved quality of life, improved mood, decreased aggressiveness of end-of-life care, improved survival, and improved patient and caregiver satisfaction. Importantly, our study does not supersede or replace randomized

clinical trials, although it offers additional insight into the real-world influence of palliative care on a diverse cohort of patients with advanced cancer.

This observational study has several limitations worth considering. First, the patient encounter with palliative care was not randomized, and the validity of this study hinges on the accuracy of the matching process. Prior evidence has suggested patients with a higher number of comorbidities have higher cost-saving effect, which we attempted to control for through matching.³³ Our matching algorithm provided a good balance on most measured variables; however, the possibility for residual confounding from unmeasured variables remains a potential source of bias. For example, the palliative care cohort had higher use of health-care services before their eventual encounter with palliative care. This implies patients receiving a

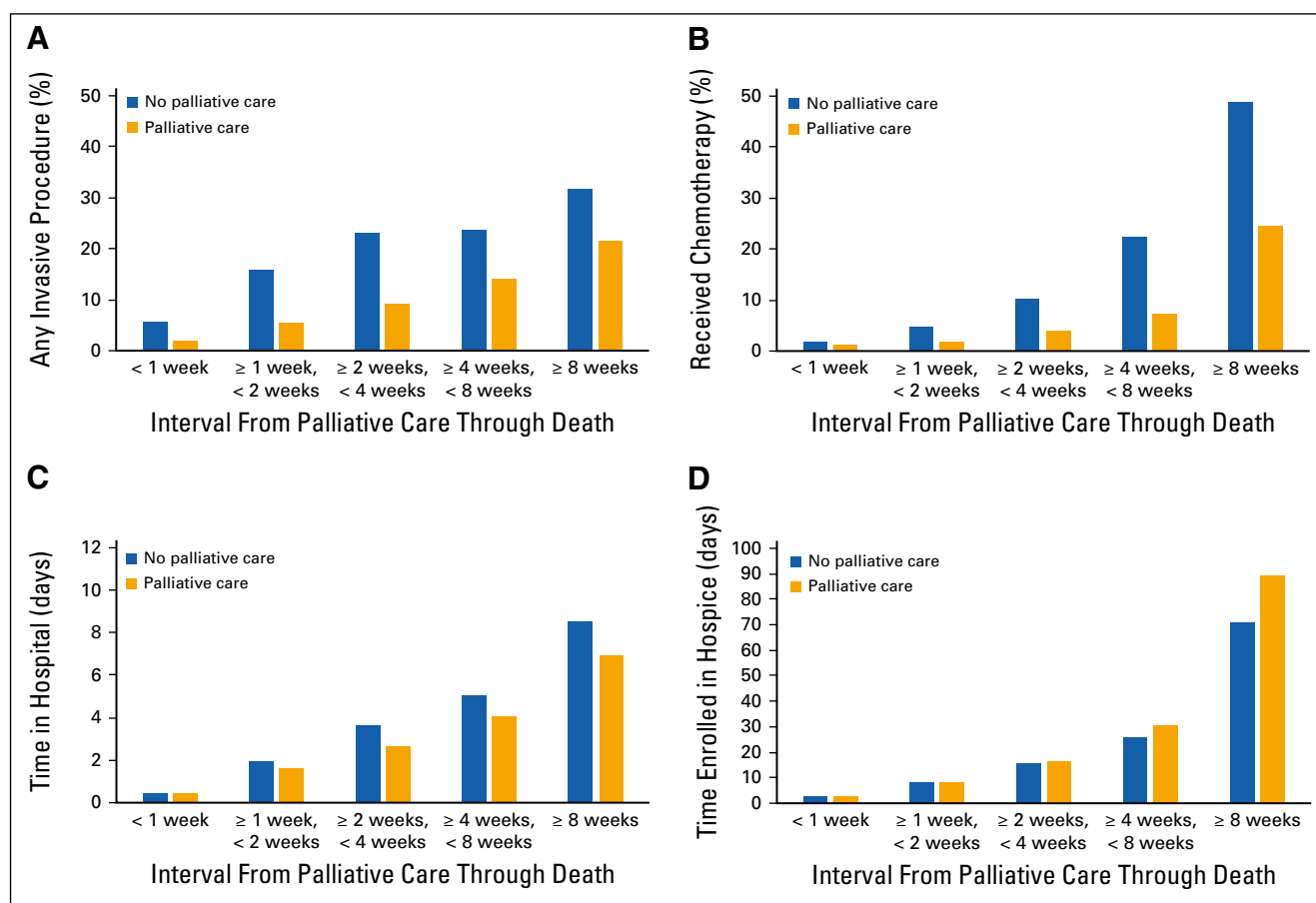


Fig 2. Impact of timing of palliative care consultation on health-care use.

palliative consultation might have greater disease severity or different health-care preferences compared with patients not receiving palliative care. However, if the palliative cohort had greater disease severity, this would add bias that would lead us to underestimate the effect of palliative care and, therefore, the true effect of palliative care in a more balanced population could be greater than observed in this study. We also cannot determine whether the palliative care consultation resulted from a prepalliative decision to de-escalate care. If patients make the decision to de-escalate care due to adverse effects, or if they exhaust all treatment options, they may seek palliative consultation, which means the decreased use may reflect a natural transition in care that did not come from the influence of the palliative care consultation itself.

Another issue to consider relates to the fact that our exposure of interest (ie, palliative care consultation) could not be validated within Medicare claims data, potentially leading to misclassification. However, we suspect this misclassification would primarily manifest as missed palliative coding among a

small fraction of the nonpalliative cohort, as opposed to improper coding among the palliative cohort. This misclassification would bias our results toward the null, and would unlikely affect our overall conclusions. We also note that although we found statistically significant differences between palliative care arms in multiple outcomes, some differences were small in absolute terms and may not represent clinically significant differences. Most of our sample comprised patients with lung cancer, a result of the higher proportion of these patients who present at a metastatic stage compared with other cancers in the study; this may limit the generalizability of our findings to other cancers.

A final limitation relates to the fact that palliative care teams often contain multiple, diverse members including physicians, nurses, social workers, pharmacists, and spiritual counselors. The data in this project lack detail on the frequency, intensity, and granularity of the palliative care consultations. Therefore, we cannot identify the specific aspects of a palliative care team that drives health-care use patterns among patients. Addressing these questions will require probing more detailed datasets.

Despite these limitations, in this representative sample of Medicare patients with advanced cancer, we found patients who received palliative care experienced significantly less aggressive care, lower rates of hospitalization, increased use of hospice, and fewer invasive procedures near the end of life. Given the increasing number of elderly patients with advanced cancer, the findings in this study emphasize the important role palliative care plays in global public health. **JOP**

Acknowledgment

Supported by National Institutes of Health Grant No. KL2 RR031978 (J.D.M.). This study used the linked SEER-Medicare database. The interpretation and reporting of these data are the sole responsibility of the authors. The authors acknowledge the efforts of the National Cancer Institute; the Office of Research, Development and Information, Centers for Medicare and Medicaid Services; Information Management Services; and the SEER Program tumor registries in the creation of the SEER-Medicare database.

Authors' Disclosures of Potential Conflicts of Interest

Disclosures provided by the authors are available with this article at jop.ascopubs.org.

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Collection and assembly of data: Daniel P. Triplett; James D. Murphy

Data analysis and interpretation: All authors

Manuscript writing: All authors

Final approval of manuscript: All authors

Accountable for all aspects of the work: All authors

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AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST**Effect of Palliative Care on Aggressiveness of End-of-Life Care Among Patients With Advanced Cancer**

The following represents disclosure information provided by authors of this manuscript. All relationships are considered compensated. Relationships are self-held unless noted. I = Immediate Family Member, Inst = My Institution. Relationships may not relate to the subject matter of this manuscript. For more information about ASCO's conflict of interest policy, please refer to www.asco.org/rwc or ascopubs.org/journal/jop/site/misc/ifc.xhtml.

Daniel P. Triplett

No relationship to disclose

Wendi G. LeBrett

No relationship to disclose

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No relationship to disclose

Rayna K. Matsuno

No relationship to disclose

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No relationship to disclose

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No relationship to disclose

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Honoraria: Pfizer

Consulting or Advisory Role: Eisai (Inst), Helsinn Healthcare (Inst), HERON

Research Funding: XBiotech (Inst), AstraZeneca (Inst), Merck (Inst)

Travel, Accommodations, Expenses: Eisai, Teva, Helsinn Healthcare

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No relationship to disclose

James D. Murphy

No relationship to disclose

Appendix

Table A1. Baseline Characteristics of Matched Cohort

Characteristic	Palliative Care Consultation, No. (%)		Standardized Difference*
	Yes, (n = 3,290)	No (n = 3,290)	
Variables used for matching			
Age, years			
66-69	666 (20.2)	654 (19.9)	0.01
70-74	852 (25.9)	893 (27.1)	-0.03
75-79	815 (24.8)	799 (24.3)	0.01
80-84	590 (17.9)	602 (18.3)	-0.01
≥ 85	367 (11.2)	342 (10.4)	0.02
Women	1,734 (52.7)	1,734 (52.7)	0
Days from cancer diagnosis to death, median (IQR)	147 (62-329)	143 (62-329)	0.00
Region			
East	768 (23.3)	768 (23.3)	0
Midwest	623 (18.9)	623 (18.9)	0
South	521 (15.8)	521 (15.8)	0
West	1,378 (41.9)	1,378 (41.9)	0
Year of diagnosis			
2000-2001	281 (8.5)	280 (8.5)	0.00
2002-2003	397 (12.1)	464 (14.1)	-0.06
2004-2005	605 (18.4)	539 (16.4)	0.05
2006-2007	849 (25.8)	927 (28.2)	-0.05
2008-2009	1,158 (35.2)	1,080 (32.8)	0.05
Other patient covariates			
Race			
White	2,709 (82.3)	2,794 (84.9)	-0.07
Black	387 (11.8)	326 (9.9)	0.06
Asian or Pacific Islander	173 (5.3)	153 (4.7)	0.03
Other/unknown	21 (0.6)	17 (0.5)	0.02
Hispanic ethnicity	151 (4.6)	135 (4.1)	0.02
Median income quartile			
Bottom quartile	815 (24.8)	780 (23.7)	0.02
2nd quartile	802 (24.4)	819 (24.9)	-0.01
3rd quartile	828 (25.2)	864 (26.3)	-0.03
Top quartile	845 (25.7)	827 (25.1)	0.01
Married status	1,571 (47.8)	1,595 (48.5)	-0.01
Charlson score			
0	1,564 (47.5)	1,563 (47.5)	0.00
1	930 (28.3)	908 (27.6)	0.01
2	427 (13.0)	410 (12.5)	0.02
≥ 3	369 (11.2)	409 (12.4)	-0.04
Tumor site			
Breast	165 (5.0)	146 (4.4)	0.03
Colorectal	516 (15.7)	551 (16.7)	-0.03
Lung	2,472 (75.1)	2,489 (75.7)	-0.01
Prostate	137 (4.2)	104 (3.2)	0.05
Urban setting	2,853 (86.7)	2,876 (87.4)	-0.02
Teaching hospital	2,153 (65.4)	1,714 (52.1)	0.27
Palliative care time course, median (IQR)			
Cancer diagnosis to exposure start, days	101 (38-272)	100 (39-272)	0.00
Exposure start to death, days	12 (4-38)	12 (4-38)	0

Abbreviation: IQR, interquartile range.

*A standardized difference was defined as the difference in group means divided by the common standard deviation. Standardized differences less than |0.1| indicate minimal imbalance between groups.