

Health Care Costs in the Last Week of Life

Associations With End-of-Life Conversations

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Background: Life-sustaining medical care of patients with advanced cancer at the end of life (EOL) is costly. Patient-physician discussions about EOL wishes are associated with lower rates of intensive interventions.

Methods: Funded by the National Institute of Mental Health and the National Cancer Institute, Coping With Cancer is a longitudinal multi-institutional study of 627 patients with advanced cancer. Patients were interviewed at baseline and were followed up through death. Costs for intensive care unit and hospital stays, hospice care, and life-sustaining procedures (eg, mechanical ventilator use and resuscitation) received in the last week of life were aggregated. Generalized linear models were applied to test for cost differences in EOL care. Propensity score matching was used to reduce selection biases.

Results: Of 603 participants, 188 (31.2%) reported EOL discussions at baseline. After propensity score matching, the remaining 415 patients did not differ in socio-

demographic characteristics, recruitment sites, illness acknowledgment, or treatment preferences. Further analyses, adjusted by quintiles of propensity scores and significant confounders, revealed that the mean (SE) aggregate costs of care (in 2008 US dollars) were \$1876 (\$177) for patients who reported EOL discussions compared with \$2917 (\$285) for patients who did not, a cost difference of \$1041 (35.7% lower among patients who reported EOL discussions) ($P=.002$). Patients with higher costs had worse quality of death in their final week (Pearson production moment correlation partial $r=-0.17$, $P=.006$).

Conclusions: Patients with advanced cancer who reported having EOL conversations with physicians had significantly lower health care costs in their final week of life. Higher costs were associated with worse quality of death.

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HEALTH CARE EXPENDITURES in the United States exceeded \$2 trillion in 2006 and are expected to rise rapidly during the next decade.¹ A disproportionate share is spent at the end of life (EOL). Thirty percent of Medicare expenditures are attributable to 5% of beneficiaries who die each year²; about one-third of the expenditures in the last year of life is spent in the last month.³ Previous investigations have found that most of these costs result from life-sustaining care (eg, mechanical ventilator use and resuscitation), with acute care in the final 30 days of life accounting for 78% of costs incurred in the final year of life.⁴

A recent study⁵ using data from a longitudinal multi-institutional cohort study, Coping With Cancer (CWC), showed that EOL conversations between patients and physicians are associated with fewer life-sustaining procedures and lower rates of intensive care unit (ICU) admission. These findings suggest that EOL discussions might reduce health care expenditures by reduc-

ing the use of ICU care by patients with cancer. Singer and Lowy⁶ have suggested that policies asking patients about their wishes regarding life-sustaining treatment and incorporating them into advance directives might result in cost savings by reducing undesired care at the EOL. However, other researchers^{7,8} have not found an association between advance directives and cost reduction. To our knowledge, the association between patient-reported discussions of EOL care preferences with their physicians and health care expenditures has not been well studied.

This study sought to monetize the differences in health care use in the final week of life for patients with advanced cancer who reported having EOL discussions with their physicians compared with those who did not. We also examined the association between expenditures and patients' quality of life in the final week of life to determine whether costly life-sustaining care might be justified by better quality of life that these expensive procedures may afford.

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STUDY SAMPLE

Patients were recruited from September 1, 2002, through December 7, 2007, as part of an ongoing prospective multi-institutional longitudinal evaluation (funded by the National Institute of Mental Health and the National Cancer Institute) of patients with advanced cancer and their primary informal (unpaid) caregivers in the CWC study. Participating sites included Yale Cancer Center (New Haven, Connecticut), Veterans Affairs Connecticut Healthcare System Comprehensive Cancer Clinics (West Haven), Parkland Hospital Palliative Care Service (Dallas, Texas), Simmons Comprehensive Cancer Center (Dallas), Massachusetts General Hospital (Boston), Dana-Farber Cancer Institute (Boston), and New Hampshire Oncology-Hematology (Hookset). Approval was obtained from the human subjects committees of all participating centers; all enrolled patients provided written informed consent.

Eligibility criteria included the following: (1) diagnosis of advanced cancer (presence of distant metastases, disease refractory to first-line chemotherapy, and a clinician's estimate that the patient would live <6 months), (2) diagnosis at a participating site, (3) age 20 years or older, (4) presence of an identified unpaid informal caregiver, and (5) clinic staff and interviewer assessments that the patient had adequate stamina to complete the interview. Patient-caregiver dyads in which the patient or the caregiver met criteria for dementia or delirium (by neurobehavioral cognitive status examination) or did not speak English or Spanish were excluded from the study. Potentially eligible patients were identified by physicians. Trained research staff approached identified patients to offer participation in a study examining patients' experiences in coping with cancer. Once a patient's written informed consent was obtained, medical records and physicians were consulted to confirm eligibility.

Of 875 patients approached for inclusion in the study and confirmed to be eligible, 627 patients (71.6%) were enrolled. The most common reasons for nonparticipation among 248 patients (28.3%) included "not interested" (n=118) and "caregiver refuses" (n=37). Compared with participants, nonparticipants were less likely to be of Hispanic race/ethnicity (5.5% vs 13.5%, $P=.001$). Otherwise, nonparticipants did not differ significantly from participants in age, sex, education status, or white, black, or Asian race/ethnicity. Of 627 patients enrolled, 603 (96.2%) responded to the question regarding prior EOL discussions that forms the basis for this study. Nonrespondents to the question did not differ significantly from respondents in cancer type, health status, recruitment site, or sociodemographic characteristics.

PROTOCOL AND MEASURES

Each enrolled patient was interviewed at baseline (on average, 6 months before death) and followed up until death. Interviewers were trained by research staff at Yale University School of Medicine and were required to achieve a level of accuracy based on concordance with the Yale training director's rating of the Structured Clinical Interview for the *Diagnostic and Statistical Manual of Mental Disorders* (Fourth Edition) diagnoses ($\kappa > 0.85$). The study was described to participants as a research protocol designed to understand how patients and their caregivers cope with cancer. Interviews were conducted in English or Spanish and took approximately 45 minutes to complete. Patients and caregivers received \$25 as compensation for completing the interview. Information on care received in the last week of life was obtained from medical record review.

Age, sex, religion, education status, marital status, race/ethnicity, and health insurance status were reported by patients and caregivers at baseline. Each patient's primary cancer was identified by physicians, and his or her functional status was assessed using the scale by Karnofsky et al⁹ (score range, 0-100, where 0 indicates dead and 100 indicates asymptomatic) and the comorbidity index by Charlson et al¹⁰ (score range, 0-37, where higher scores indicate a greater burden of comorbid conditions). A patient's self-reported health status was measured using the physical health and symptom burden subscales of the McGill Quality of Life Questionnaire (score range, 0-10, where 0 indicates desirable and 10 indicates undesirable).¹¹

Patients were asked whether they trusted their physician, and "If your doctor knew how long you had left to live, would you want him or her to tell you?" Patients were also asked whether they described their health status as "seriously and terminally ill" or not. End-of-life discussions were assessed at baseline by asking "Have you and your doctor discussed any particular wishes you have about the care you would want to receive if you were dying?"

Patients were asked specific questions regarding individual treatment preferences at the EOL (eg, "If you could choose, would you prefer [1] a course of treatment that focused on extending life as much as possible even if it meant more pain and discomfort or [2] a plan of care that focused on relieving pain and discomfort as much as possible even if that meant not living as long?"). Medical services that patients received in the last week of life (eg, mechanical ventilator use, resuscitation, and hospice care) were reported by nurses present at the death or by caregivers 1 month after the death. The type of care and length of stay were assessed by specific questions (eg, "Was the patient on a ventilator in the week leading up to his/her death?"; "If yes, how long prior to death? [in days]"; and "For about how long did [the patient] get inpatient hospice care before [his/her] death?"). After the patient's death, formal caregivers (ie, paid clinicians such as nurses) and informal caregivers (ie, unpaid caregivers such as spouses) were asked to assess the patient's quality of life in the period immediately before death (eg, "In your opinion, how would you rate overall quality of the patient's death/last week of life?"). The responses were measured on a Likert-type scale ranging from 0 (eg, worst possible) to 10 (eg, best possible).

Nationally representative per capita costs for hospital stays, including intensive medical procedures (eg, mechanical ventilator use and resuscitation), and for hospice use were aggregated based on the EOL care that each patient received in the last week of life. Cost data for hospitalizations that involved chemotherapy, resuscitation, mechanical ventilator use, use of a feeding tube, or general hospital stays were taken from the 2004 Nationwide Inpatient Sample as part of the Healthcare Cost and Utilization Project of the Agency for Healthcare Research and Quality.¹² The Nationwide Inpatient Sample is the largest all-payer inpatient care database in the United States and includes inpatient data from a national sample of more than 1000 hospitals. Specifically, the cost data of different hospitalizations were extracted from an online query of HCUPnet¹² by using *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)* codes—a clinical grouper that puts ICD-9-CM codes into clinically homogeneous categories. Inpatient and outpatient hospice payments are cited from the Centers for Medicare and Medicaid Services (CMS), Office of the Actuary, Center for Health Plans and Providers (November 2006).¹³ Data for routine home care and general inpatient care were used to calculate hospice costs. Because all payers use the same Medicare reimbursement cap for hospice care and because the Healthcare Cost and Utilization Project is an all-payer inpatient database, the inpatient hospitalization and hospice costs aggregated in this analysis are from the perspective

of all payers. Cost data have been inflated to 2008 US dollars by using an inflation rate per year as measured by the US gross domestic product deflator.¹⁴

STATISTICAL ANALYSIS

t Test, Cochran-Mantel-Haenszel, and χ^2 test statistics were used, as appropriate, to test for significant differences in sociodemographic characteristics and other factors (eg, recruitment sites and treatment preferences) between patients who did or did not report EOL discussions with their physicians at baseline. Propensity score matching¹⁵ was used to remove the observed differences between the 2 groups. Covariates were used in predicting the conditional likelihood of having an EOL discussion, including the following: age, sex, religion, education status, marital status, race/ethnicity, health insurance status, treatment preferences, desire to know life expectancy, Karnofsky scale score, Charlson comorbidity index, McGill Quality of Life Questionnaire physical and symptom subscales, and recruitment site (Yale Cancer Center, New Hampshire Oncology-Hematology, Simmons Comprehensive Cancer Center, Parkland Hospital Palliative Care Service, Dana-Farber Cancer Institute/Massachusetts General Hospital, or Veterans Affairs Connecticut Healthcare System Comprehensive Cancer Clinics). Each patient who reported an EOL conversation was matched with a patient who did not on the basis of an estimated propensity score by using the greedy algorithm ("gmatch" macro in SAS [SAS Institute, Cary, North Carolina])¹⁶ within a 0.01 caliper of propensity.¹⁷

Conditional on quintiles of the estimated propensity score in the deceased propensity score–matched cohort, logistic regression analyses were performed to test for differences in medical care use and location of death by the presence or absence of EOL conversations. Stratified 1-way analysis of variance (ANOVA) with fixed-effects levels was conducted to examine the association between EOL discussions and continuous measures (eg, patient's quality of life). Cox proportional hazards models were used to examine differences in probability of survival for patients who reported EOL discussions vs those who did not. Generalized linear models,¹⁸ using a log-link function and a gamma distribution specified for the error term, were performed to test for cost differences in EOL care during the week before death between patients who did and did not report EOL discussions. Using the backward selection procedure, models examined potential confounders of the following: religion, cancer type, survival time, recruitment site, treatment preferences, Karnofsky scale score, illness acknowledgment, and sociodemographic characteristics. Multivariate models were adjusted for confounds that remained significant ($P < .05$). In addition, the association between cost and a patient's quality of life in the final week of life was investigated among 316 deceased patients in the study sample. Particularly, the adjusted relationship between cost and patient's quality of death was plotted using a "lowess" procedure. Statistical analyses were performed using commercially available software (SAS version 9.1, SAS Institute).

RESULTS

PATIENT CHARACTERISTICS

Six hundred three participants with advanced cancer were 71.3% white, 14.8% black, 11.9% Hispanic, 1.7% Asian, and 51.1% male (**Table 1**). Among them, 188 (31.2%) reported having discussed their EOL wishes with physicians. Patient report of EOL discussions was unassociated with age, sex, religion, education status, cancer type, marital status, race/ethnicity, or health insurance sta-

tus. Rates of reporting EOL conversations varied by treatment center ($P < .001$).

As summarized in Table 1, patients reporting EOL discussions had worse performance status (Karnofsky scale score), more comorbid conditions (Charlson Comorbidity Index), and greater symptom burden (McGill Quality of Life Questionnaire Physical and Symptom subscales). Patients who reported EOL discussions with their physicians were more likely to want to know their life expectancy, to acknowledge that they were terminally ill, and to report a preference to avoid dying in the ICU. They were less likely to prefer life extension over comfort or to prefer that the physicians do everything possible to extend life for a few days.

After propensity score matching, the respondents who reported an EOL discussion and those who did not were balanced on all of the variables listed in Table 1. These findings are summarized in **Table 2**.

The 248 matched and 355 unmatched subjects did not differ by age, sex, cancer type, race/ethnicity, Karnofsky scale score, or McGill Quality of Life Physical subscale score (**Table 3**). However, the matched subjects were less educated, more likely to be of the Baptist faith, and less likely to have health insurance. They had more comorbid conditions but had lesser symptom burden. They also differed from the unmatched subjects by recruitment site and by treatment preferences.

MEDICAL CARE AT EOL, LOCATION AND QUALITY OF DEATH, AND SURVIVAL

One hundred forty-five deceased patients in the propensity score–matched cohort did not differ by the variables given in Table 2. Patients who reported EOL conversations with their physicians at baseline were less likely to undergo mechanical ventilator use or resuscitation or to be admitted to or die in an ICU in the final week of life. They were more likely to receive outpatient hospice care and be referred to hospice earlier. Patients who reported EOL discussions had less physical distress in the last week of life than those who did not, but the 2 groups did not differ in psychological distress, quality of death, or survival time (**Table 4**).

MEDICAL COSTS IN THE FINAL WEEK OF LIFE ASSOCIATED WITH EOL DISCUSSIONS

Adjusted analyses using the deceased propensity score–matched cohort ($n = 145$) revealed that the mean (SE) aggregate medical costs for EOL care (in 2008 US dollars) were \$1876 (\$177) for patients who reported EOL discussions compared with \$2917 (\$285) for patients who did not (**Table 5**). The costs of care were 35.7% lower among those who reported EOL discussions compared with those who did not (cost difference, \$1041; $P = .002$).

ASSOCIATION BETWEEN MEDICAL COSTS, PATIENTS' QUALITY OF DEATH, AND SURVIVAL IN THE FINAL WEEK OF LIFE

Additional analyses shown in **Table 6** using the deceased cohort of patients in the study sample ($n = 316$)

Table 1. Sample Characteristics by the Presence or Absence of End-of-Life (EOL) Care Discussion

Characteristic ^a	Total Sample (N=603)	Discussed EOL Care Preferences With Physician		P Value
		Yes (n=188)	No (n=415)	
Age, mean (SD), y	59.0 (13.2)	59.8 (12.9)	58.6 (13.2)	.28
Sex, No. (%)				.86
Male	308 (51.1)	95 (50.5)	213 (51.3)	
Female	295 (48.9)	93 (49.5)	202 (48.7)	
Race/ethnicity, No. (%)				.26 ^b
White, non-Hispanic	430 (71.3)	139 (73.9)	291 (70.1)	.34
Black, non-Hispanic	89 (14.8)	26 (13.8)	63 (15.2)	.66
Hispanic	72 (11.9)	22 (11.7)	50 (12.0)	.90
Asian	10 (1.7)	0	10 (2.4)	.04 ^c
Other	2 (0.3)	1 (0.5)	1 (0.2)	.53
Marital status, No. (%)				.27
Married	380 (64.1)	112 (60.5)	268 (65.5)	
Unmarried	214 (36.0)	73 (39.5)	141 (34.5)	
Education, mean (SD), y	12.8 (4.0)	12.8 (3.7)	12.8 (4.1)	.97
Health insurance status, No. (%)				.12
Insured	412 (69.0)	119 (64.7)	293 (71.1)	
Uninsured	184 (30.9)	65 (35.3)	119 (28.9)	
Religion, No. (%)				.97 ^b
Catholic	259 (44.0)	82 (45.1)	177 (43.6)	.84
Protestant	112 (19.0)	33 (18.1)	79 (19.5)	.66
Jewish	19 (3.2)	5 (2.7)	14 (3.4)	.64
Baptist	67 (11.4)	23 (12.6)	44 (10.8)	.56
Other	99 (16.8)	28 (15.4)	71 (17.5)	.49
None	32 (5.4)	11 (6.0)	21 (5.2)	.69
Cancer type, No. (%)				.80
Breast	64 (10.6)	21 (11.2)	43 (10.4)	.73
Colorectal	68 (11.3)	25 (13.3)	43 (10.4)	.27
Pancreatic	50 (8.3)	15 (8.0)	35 (8.4)	.88
Other gastrointestinal	74 (12.3)	20 (10.6)	54 (13.0)	.44
Lung	144 (23.9)	41 (21.8)	103 (24.8)	.47
Other ^d	203 (33.7)	66 (35.1)	137 (33.0)	.61
Baseline health status, mean (SD)				
Karnofsky scale score	67.3 (16.8)	61.8 (16.7)	69.8 (16.2)	<.001
Charlson comorbidity index	8.2 (2.7)	8.7 (2.8)	8.0 (2.6)	.002
McGill Quality of Life Questionnaire score				
Physical subscale	6.1 (2.7)	4.4 (2.8)	3.7 (2.6)	.002
Symptom subscale	11.3 (4.4)	9.9 (4.3)	8.1 (4.4)	<.001
Recruitment site, No. (%)				<.001
Yale Cancer Center, New Haven, Connecticut	153 (26.8)	20 (11.4)	133 (33.7)	<.001
Veterans Affairs Connecticut Healthcare System Comprehensive Cancer Clinics, West Haven	21 (3.7)	10 (5.7)	11 (2.8)	.09
Parkland Hospital Palliative Care Service, Dallas, Texas	178 (31.2)	67 (38.3)	111 (28.1)	.02
Simmons Comprehensive Cancer Center, Dallas	40 (7.0)	8 (4.6)	32 (8.1)	.13
Dana-Farber Cancer Institute/ Massachusetts General Hospital, Boston	47 (8.2)	13 (7.4)	34 (8.6)	.64
New Hampshire Oncology-Hematology, Hookset	131 (23.0)	57 (32.6)	74 (18.7)	<.001
Illness acknowledgment, No. (%)				
Wants to know life expectancy	426 (70.6)	149 (79.3)	277 (66.7)	.002
Trusts physician	591 (98.0)	185 (98.4)	406 (97.8)	>.99 ^c
Acknowledges self to be terminally ill	203 (33.7)	95 (50.5)	108 (26.0)	<.001
Treatment preferences, No. (%)				
Values life extension over comfort	158 (26.2)	25 (13.3)	133 (32.0)	<.001
Prefers everything possible to extend life for a few days	122 (20.2)	29 (15.4)	93 (22.4)	.04
Prefers chemotherapy to extend life	311 (51.6)	87 (46.3)	224 (54.0)	.06
Prefers ventilator use to extend life	142 (23.5)	36 (19.1)	106 (25.5)	.06
Preference against death in intensive care unit	221 (36.7)	90 (47.9)	131 (31.6)	<.001

^a Some characteristic totals do not sum to column totals because of missing data.

^b Cochran-Mantel-Haenszel statistics because of small cell counts.

^c The remainder had cancer types representing less than 5% of the sample.

^d Fisher exact test because of small cell counts.

Table 2. Characteristics by the Presence or Absence of End-of-Life (EOL) Care Discussion After Propensity Score Matching

Characteristic ^a	Discussed EOL Care Preferences With Physician		P Value
	Yes (n=124)	No (n=124)	
Age, mean (SD), y	58.8 (13.3)	60.0 (13.7)	.50
Male sex, No. (%)	60 (48.4)	57 (46.0)	.70
Race/ethnicity, No. (%)			.71
White, non-Hispanic	85 (69.1)	84 (67.7)	.89
Black, non-Hispanic	21 (17.1)	20 (16.1)	.86
Hispanic	17 (13.8)	19 (15.3)	.72
Asian	0	1 (0.8)	>.99
Married, No. (%)	75 (60.5)	73 (58.9)	.80
Education, mean (SD), y	12.2 (3.7)	12.4 (3.8)	.65
Health insurance coverage, No. (%)	72 (58.1)	74 (59.7)	.80
Religion, No. (%)			.98
Catholic	55 (47.8)	58 (50.0)	.70
Protestant	18 (15.7)	19 (16.4)	.86
Jewish	3 (2.6)	4 (3.4)	>.99
Baptist	20 (17.4)	18 (15.5)	.72
Other	13 (11.3)	16 (13.8)	.41
None	6 (5.2)	1 (0.9)	.12
Cancer type, No. (%)			.94
Breast	12 (9.7)	17 (13.7)	.33
Colorectal	20 (16.1)	15 (12.1)	.35
Pancreatic	10 (8.1)	11 (8.9)	.83
Other gastrointestinal	14 (11.3)	16 (12.9)	.71
Lung	27 (21.8)	27 (21.8)	.97
Other	41 (33.1)	38 (30.6)	.68
Baseline health status, mean (SD)			
Karnofsky scale score	66.0 (15.6)	66.0 (16.6)	.97
Charlson comorbidity index	8.4 (2.6)	8.7 (2.6)	.35
McGill Quality of Life Questionnaire score			
Physical subscale	6.0 (2.7)	5.8 (2.9)	.60
Symptom subscale	10.6 (4.3)	10.2 (4.3)	.48
Recruitment site, No. (%)			.55
Yale Cancer Center, New Haven, Connecticut	14 (11.3)	14 (11.5)	>.99
Veterans Affairs Connecticut Healthcare System Comprehensive Cancer Clinics, West Haven	8 (6.5)	4 (3.3)	.24
Parkland Hospital Palliative Care Service, Dallas, Texas	56 (45.2)	54 (44.3)	.80
Simmons Comprehensive Cancer Center, Dallas	7 (5.6)	13 (10.7)	.17
Dana-Farber Cancer Institute/ Massachusetts General Hospital, Boston	12 (9.7)	8 (6.6)	.35
New Hampshire Oncology-Hematology, Hookset	27 (21.8)	29 (23.8)	.76
Illness acknowledgment, No. (%)			
Wants to know life expectancy	92 (74.2)	95 (76.6)	.66
Trusts physician	122 (98.4)	120 (96.8)	.62
Acknowledges self to be terminally ill	49 (39.5)	45 (36.3)	.60
Treatment preferences, No. (%)			
Values life extension over comfort	20 (16.1)	16 (12.9)	.47
Prefers everything possible to extend life for a few days	24 (19.4)	24 (19.4)	>.99
Prefers chemotherapy to extend life	72 (58.1)	71 (57.3)	.90
Prefers ventilator use to extend life	27 (21.8)	26 (21.0)	.88
Preference against death in intensive care unit	52 (41.9)	47 (37.9)	.52

^aSome characteristic totals do not sum to column totals because of missing data.

demonstrated that higher medical costs in the final week of life were associated with more physical distress in the last week of life (Pearson product moment correlation partial $r=0.18$, $P=.003$) and with worse overall quality of death as reported by the caregiver ($r=-0.17$, $P=.006$) after controlling for age, sex, education status, survival time, race/ethnicity, and source of report (**Figure**). There was no survival difference associated with higher health care expenditures at the EOL.

COMMENT

Our findings demonstrate that patients with advanced cancer who reported EOL conversations with physicians had lower medical costs in their final week of life compared with those who did not, which is largely a function of their more limited use of intensive interventions. In this study, higher health care costs were unassociated with

Table 3. Characteristics of Matched vs Unmatched Cohort

Characteristic ^a	Matched		P Value
	Yes (n=248)	No (n=355)	
Age, mean (SD), y	59.4 (13.5)	58.7 (12.8)	.54
Male sex, No. (%)	117 (47.2)	191 (53.8)	.11
Race/ethnicity, No. (%)			.10
White, non-Hispanic	169 (68.4)	261 (73.7)	.15
Black, non-Hispanic	41 (16.6)	48 (13.6)	.31
Hispanic	36 (14.6)	36 (10.2)	.10
Asian	1 (0.4)	9 (2.5)	.05
Married, No. (%)	100 (40.3)	113 (31.8)	.06
Education, mean (SD), y	12.3 (3.8)	13.1 (4.1)	.01
Health insurance coverage, No. (%)	146 (58.9)	266 (74.9)	<.001
Religion, No. (%)			.04
Catholic	113 (53.1)	146 (51.6)	.29
Protestant	37 (17.4)	75 (26.5)	.05
Jewish	7 (3.3)	12 (4.2)	.70
Baptist	38 (17.8)	29 (10.2)	.006
Other	12 (5.6)	20 (7.1)	.66
None	6 (2.8)	1 (0.4)	.20
Cancer type, No. (%)			.45
Breast	29 (11.7)	35 (9.9)	.54
Colorectal	35 (14.1)	33 (9.3)	.08
Pancreatic	21 (8.5)	29 (8.2)	.97
Other gastrointestinal	30 (12.1)	44 (12.4)	.83
Lung	54 (21.8)	90 (25.4)	.24
Other	79 (31.9)	124 (34.9)	.43
Baseline health status, mean (SD)			
Karnofsky scale score	66.0 (16.1)	68.3 (17.2)	.11
Charlson comorbidity index	8.5 (2.7)	7.9 (2.7)	.007
McGill Quality of Life Questionnaire score			
Physical subscale	5.9 (2.8)	6.2 (2.6)	.32
Symptom subscale	10.4 (4.3)	12.0 (4.4)	<.001
Recruitment site, No. (%)			<.001
Yale Cancer Center, New Haven, Connecticut	28 (11.4)	125 (38.6)	<.001
Veterans Affairs Connecticut Healthcare System Comprehensive Cancer Clinics, West Haven	12 (4.9)	9 (2.8)	.20
Parkland Hospital Palliative Care Service, Dallas, Texas	110 (44.7)	68 (21.0)	<.001
Simmons Comprehensive Cancer Center, Dallas	20 (8.1)	20 (6.2)	.37
Dana-Farber Cancer Institute/Massachusetts General Hospital, Boston	20 (8.1)	27 (8.3)	.92
New Hampshire Oncology-Hematology, Hookset	56 (22.8)	75 (23.1)	.89
Illness acknowledgment, No. (%)			
Wants to know life expectancy	187 (75.4)	239 (67.3)	.08
Trusts physician	242 (97.6)	349 (98.3)	>.99
Acknowledges self to be terminally ill	94 (37.9)	109 (30.7)	.12
Treatment preferences, No. (%)			
Values life extension over comfort	36 (14.5)	122 (34.4)	<.001
Prefers everything possible to extend life for a few days	48 (19.4)	74 (20.8)	.49
Prefers chemotherapy to extend life	143 (57.7)	168 (47.3)	.04
Prefers ventilator to extend life	53 (21.4)	89 (25.1)	.19
Preference against death in intensive care unit	99 (39.9)	122 (34.4)	.47

^aSome characteristic totals do not sum to column totals because of missing data.

better outcomes at the EOL. There was no survival difference associated with health care expenditures, and patients whose insured health care costs were higher had worse quality of life in their final week of life. These results also support findings from another CWC study¹⁹ that found that life-sustaining care is associated with worse quality of death at the EOL.

A strength of this study is that the matched subjects did not differ in observed variables, including patients' cancer type, recruitment site, treatment preferences, illness acknowledgment, and sociodemographic charac-

teristics. In addition, these variables were examined as potential confounders and were controlled for if they remained significant in the multivariate analyses. Therefore, the results were drawn from a well-balanced and adjusted study sample.

Our cost estimates may be conservative in terms of the low frequency of intensive medical treatment compared with other studies of patients with advanced cancer. For example, our study participants had a lower rate of chemotherapy use (6.7% vs 15.7%) compared with a previous study²⁰; compared with another study,²¹ they were less likely

Table 4. Medical Care, Location and Quality of Death, and Survival Time by the Presence or Absence of End-of-Life (EOL) Care Discussion Among the Deceased Propensity Score–Matched Cohort

Variable	Discussed EOL Care Preferences With Physician		Adjusted Odds Ratio (95% Confidence Interval) ^a	P Value
	Yes (n=75)	No (n=70)		
Medical care received during the last week of life, No. (%)				
Intensive care unit stay	2 (2.7)	10 (14.3)	0.01 (0.02-0.60)	.01
Ventilator use	1 (1.3)	10 (14.3)	0.030 (0.002-0.300)	.005
Resuscitation	1 (1.3)	6 (8.6)	0.10 (0.02-1.30)	.09
Chemotherapy	4 (5.3)	7 (10.0)	0.5 (0.1-1.8)	.30
Inpatient hospice used	8 (10.7)	5 (7.1)	1.8 (0.5-6.5)	.34
Inpatient hospice stay ≥1 wk	4 (5.3)	2 (2.9)	3.7 (0.4-38.2)	.27
Outpatient hospice used	58 (77.3)	40 (57.1)	3.2 (1.5-6.9)	.004
Outpatient hospice stay ≥1 wk	52 (69.3)	34 (48.6)	2.5 (1.2-5.0)	.01
Place of death, No. (%) ^b				
Intensive care unit	2 (2.9)	9 (13.2)	0.10 (0.03-0.70)	.02
Hospital	15 (21.7)	18 (26.5)	0.7 (0.3-1.6)	.45
Inpatient hospice	5 (7.2)	3 (4.4)	1.9 (0.4-8.8)	.44
Home	47 (68.1)	38 (55.9)	1.3 (0.6-2.6)	.49
Quality of life at death, mean (SD) ^c				
Psychological distress	3.7 (3.0)	3.2 (3.3)	0.5 (0.6) ^d	.37
Physical distress	3.6 (3.2)	4.5 (3.7)	-1.2 (0.6) ^d	.04
Quality of death	6.3 (2.7)	5.7 (3.3)	0.5 (0.5) ^d	.39
Survival time, median [quartiles]	88 [54-218]	85 [30-253]	0.8 (0.6-1.1) ^e	.22

^aThe odds ratio is conditional on quintiles of predicted propensity scores and is adjusted for confounders of sociodemographic characteristics, health status measures, recruitment sites, terminal illness acknowledgment, treatment preferences, and survival time if they remain significant in the multivariate model.

^bPercentages are based on 69 patients for yes and 68 patients for no because of missing data.

^cHigher score indicates more distress for psychological and physical scales, whereas higher score for quality of death indicates better quality of death.

^dβ (SE).

^eHazard ratio (95% confidence interval).

Table 5. Association of Cost Experience in the Final Week of Life With End-of-Life (EOL) Care Discussion Among 145 Members of the Deceased Propensity Score–Matched Cohort

Variable	Estimate			
	Univariate Model		Multivariate Model	
	β (SE)	P Value	β (SE)	P Value
EOL care discussion with physician at baseline	-0.4 (0.2)	.02	-0.4 (0.1)	.002
Male sex	...	...	0.5 (0.1)	<.001
Black race/ethnicity	...	...	0.5 (0.2)	.005
Parkland Hospital Palliative Care Service recruitment site	...	...	-0.4 (0.1)	.02
McGill Quality of Life Questionnaire physical subscale	...	...	0.05 (0.02)	.04
Values life extension over comfort	...	...	0.6 (0.2)	.003
	EOL Care Discussion With Physician			
	Mean (SD) ^a		Least Squares Mean (SD) ^b	
Outcome	Yes	No	Yes	No
Cost per patient, \$	1925 (203)	2780 (303)	1876 (177)	2917 (285)

Abbreviation: Ellipses indicate not estimated/included in the unadjusted model.

^a $\chi^2=5.7$, $P=.02$. Cost difference per patient, \$855.

^b $\chi^2=9.9$, $P=.002$. Cost difference per patient, \$1041.

to die in the ICU (4.7% vs 8.0%), where the highest medical costs are often incurred. Study subjects also had higher rates of hospice use (74.3% vs 38.8%) and were more likely to die at home (53.8% vs 37.8%) compared with national means and other study findings.^{22,23} Despite this and low power to detect differences in EOL care, our cost estimates yielded significant results.

Because this is an observational study, we cannot conclude that there is a causal relationship between EOL conversations and cost differences in the last week of life. Although propensity score matching is one of the most robust methods to correct for selection bias in observable factors, it cannot account for hidden biases (eg, the effect of who initiates the conversation). Patients who have

Table 6. Association of Quality of Death and Survival Time With Cost Experience in the Final Week of Life Among 316 Members of the Deceased Cohort

Variable	Medical Cost in the Final Week of Life			
	Unadjusted Analysis		Adjusted Analysis ^a	
	β (SE)	P Value	β (SE)	P Value
Quality of life at death ^a				
Psychological distress	0.4 (0.2)	.06	0.4 (0.2)	.09
Physical distress	0.5 (0.2)	.008	0.7 (0.2)	.003
Quality of death	-0.5 (0.2)	.003	-0.5 (0.2)	.006
Survival time	0.8 (0.7-1.0) ^b	.007	1.0 (0.9-1.1) ^b	.70

^aAdjusted for age, sex, education status, survival time, race/ethnicity, and source of report.

^bHazard ratio (95% confidence interval). Adjusted for age, sex, education status, survival time, race/ethnicity, and significant confounders of health insurance coverage, Karnofsky scale score, and New Hampshire Oncology-Hematology recruitment site.

experienced traumatic death of their loved ones might be more motivated to initiate an EOL discussion to ensure that they do not receive unwanted care.

Another limitation is that cost estimates were based on aggregated costs from national means for hospitalizations, life-sustaining procedures, and hospice care instead of from medical claims data. Although this method may be viewed as less accurate, our cost estimates are comparable to those of other studies^{23,24} that used medical claims data. Like most studies^{2,3,23,24} of medical expenditures that rely heavily on costs covered by insurers or by Medicare, this study likely underestimates the total cost of care, as it does not include outpatient services or out-of-pocket expenditures (eg, for additional pharmaceutical and home care payments) or opportunity costs incurred by patients and their caregivers.

Moreover, the EOL care and patients' quality of life in the final week before death were reported by nurses or by informal caregivers. Future research should use a consistent source of reporting of patients' quality of death and should examine how a caregiver's relationship to the patient affects assessment of the patient's degree of comfort and quality of care at the EOL. In addition, we acknowledge that patients and caregivers may value care differently. Patients may consider extra dollars spent and more life-sustaining care worth the added expense, whereas caregivers may devalue life-sustaining care. In addition, exclusion of unmatched subjects from the study may limit generalizability of our results to the general population.

Lastly, health care costs near the EOL rise exponentially. Further research is needed to examine whether the cost difference remains significant or not during a longer period close to death. A study following up patients with advanced cancer longitudinally in the final months of life with paired survey data and claims data to capture monthly measurements of costs might provide a more accurate and dynamic estimate of the effect of EOL conversations on health care costs in the period leading up to a patient's death.

Despite these limitations, our findings suggest a potential strategy for reducing medical care expenditures and for improving patients' quality of life at the EOL. If the national proportion of individuals reporting EOL discussions was increased to 50%, our results suggest that we

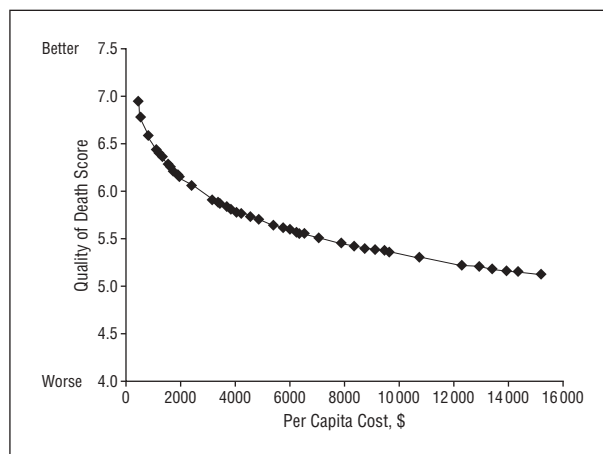


Figure. Association between cost and quality of death in the final week of life (adjusted $P=.006$). Age, sex, education status, survival time, race/ethnicity, and source of report were controlled for in the adjusted analysis of per capita cost predicting quality of death in the deceased cohort ($n=316$).

would expect a cost difference of \$76 466 891 between individuals who had EOL discussions vs those who had not based on the total number of US cancer deaths per year.²⁵

There are several reasons to be cautious about this estimate. The cost differences we observed may decrease when generalized to an older population, as medical costs at the EOL decline with increasing age and the mean age in our sample was 59 years.²⁶ Although propensity score matching balanced differences among the recruitment sites, our study does not include all geographic areas in the United States, which may be particularly important because there are documented regional differences in the intensity of EOL care.²⁷ Because of a lower rate of acute care and a greater use of hospice care in our sample compared with the national population, the cost differences might increase when generalized to other geographic areas with higher use of intensive care.

Nevertheless, results of our study suggest that increasing communication between patients and their physicians is associated with better outcomes and with less expensive medical care. These results are consistent with other studies^{4,28} showing that the greatest cost differences come from a reduction in acute care services at the EOL. Our study is unique in that our findings suggest that these cost deductions are accompanied by better qual-

ity of life at the EOL for patients with advanced cancer. Policies that promote increased communication such as direct reimbursement for EOL conversations, enhanced physician education about EOL communication, expansion of palliative care programs in hospitals, and comanagement of patients with late-stage cancer by oncologists and palliative care physicians may be cost-effective ways to improve care and to reduce some of the rising health care expenditures.

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