Hospice Care and Survival among Elderly Patients with Lung Cancer

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Abstract

Background: Recently observed trends toward increasingly aggressive end-of-life care may reflect providers' concerns that hospice may hasten death.

Methods: Using the Surveillance, Epidemiology, and End Results-Medicare linked database, we identified 7879 patients aged 65 years or older who died of advanced non-small-cell lung cancer from 1991 through 1999 after surviving for at least 3 months from their cancer diagnoses. Length of hospice admission post-cancer diagnosis and indicators of aggressive end-of-life care were ascertained based on claims data. We evaluated overall survival and care near death after controlling for baseline characteristics by using propensity score (PS) and instrumental variable analyses (IVA).

Results: Hospice patients were older, more likely to be non-Hispanic white and female, more likely to reside in urban areas with high hospice availability and higher socioeconomic status, more likely to be treated in a teaching hospital, and received less aggressive end-of-life care compared to nonhospice patients. Among hospice patients, those experiencing short-term hospice admissions within 3 days of death were more likely to be male, reside in urban areas, be treated in a teaching hospital, and receive more aggressive end-of-life care. PS analysis found that survival favored hospice patients slightly relative to nonhospice patients by 5.0 percentage points (25.7% versus 20.7%) at 1 year and 1.4 percentage points (6.9% versus 5.5%) at 2 years postdiagnosis ($p < 0.001$), while there was no significant difference between those with short- and longer duration hospice stays ($p = 1.00$). IVA confirmed these findings.

Conclusions: Hospice enrollment did not compromise length of survival following advanced lung cancer diagnosis.

Introduction

THE GOAL OF HOSPICE CARE is not to cure the illness, but to keep the pain and suffering of a terminally ill patient to a minimum. Although hospice and palliative care are now well established as appropriate¹⁻³ and the use of hospice services in the United States has increased for over 30 years since the Medicare hospice benefit was established by Congress in 1982,^{4,5} hospice still remains underutilized.

In retrospective analyses, Connor et al.⁶ showed that hospice did not shorten survival among Medicare patients who died

within 3 years with breast, colon, lung, prostate or pancreatic cancers, or congestive heart disease. The only randomized controlled trial, published in 1984 by Kane et al.,⁷ did not find a relationship between survival and hospice care for patients who were expected to die within 6 months of lung, prostate, ear, nose, throat, brain, or other cancers. Temel et al.⁸ concluded that patients with metastatic non-small-cell lung cancer (NSCLC) who received early palliative care, which provides care both in and outside the hospice, lived 2 months longer than those receiving standard care, although fewer patients in the palliative care group than in the standard care group received aggressive

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Accepted April 4, 2011.

end-of-life care. Despite these results, recently observed trends toward increasingly aggressive care near death associated with late or nonhospice admission^{5,9,10} may reflect concerns by some practitioners or patients that hospice may hasten death.¹¹ Thus, we compared survival and patterns of care near death in elderly patients with advanced NSCLC who received hospice care and those without hospice services, after controlling for baseline patient and disease characteristics with advanced statistical methods, to gain a better understanding of the clinical implications of hospice care.

Patients and Method

Data sources for this study

The linked Surveillance, Epidemiology, and End Results (SEER)-Medicare database¹² was used to identify the study cohort. SEER is a source of information on cancer incidence and survival. Eleven tumor registries participated in the SEER program during the study period and approximately 97% of incident cases for these regions were ascertained,¹³ covering a representative sample of approximately 14% of the U.S. population.^{12,14} Medicare claims for eligible patients have been linked to the SEER database, as have sociodemographic data from the 2000 Census.^{15,16}

Identification of study cohort

Among the potentially eligible study cohort ($N = 15,391$) as patients who died from American Joint Committee on Cancer stage III/IV NSCLC between 1991 and 1999, we limited the study cohort as those after surviving at least 3 months with their cancer. Patients were continuously enrolled in Parts A and B of Medicare while simultaneously not in a health maintenance organization (HMO) in the last 3 months of life. They qualified for Medicare on the basis of age and diagnoses were not made from death certificate or autopsy, yielding a study cohort of 7879 patients. The 3-month survival criterion was to exclude patients with rapidly progressive disease in order to get more homogeneous population with respect to prognosis, as these patients were more likely to experience aggressive-approach chemotherapy near death and were less likely to receive longer term hospice care. Our sensitivity analyses confirmed that the inclusion of the excluded cohort did not change the results. In aggregate, we believe that the study cohort is valid. Patients in HMOs were excluded as complete data on explanatory variables is not available for them. This study was deemed exempt by the Dana-Farber Cancer Center/Partners Cancer Care Institutional Review Board because we used publicly available, deidentified data.

Variables used in this study

"Hospice patients" were defined as those with claims for hospice care at least once between diagnosis and death, while "nonhospice patients" were those without such claims. "Hospice patients" were further divided into two groups according to whether the length of hospice stay was 3 or fewer days ("short-term hospice patients") or that of 4 or more days ("longer term hospice patients"). Length of stay was calculated from the first admission to hospice until death.

Explanatory variables included nine baseline characteristics (age at diagnosis, gender, race/ethnicity (non-Hispanic white or other), Charlson comorbidity index (0, 1, 2, or more),

socioeconomic quintiles, urban/rural residence, year of diagnosis, provider characteristics (ever received care in a teaching hospital at any time after their cancer diagnosis or not and availability of hospice). Socioeconomic quintiles were developed using the following prioritization scheme: the median income from census tract, then zip code median income, and then per capita income according to zip code when median income was not available. A Charlson comorbidity index was calculated by examining ICD-9 Clinical Modification diagnosis and procedure codes recorded in the year prior to diagnosis, according to the Deyo method and applied to inpatient and outpatients claims as suggested by Klabunde et al.¹⁷⁻¹⁹ Availability of hospice per million population in 1999 was calculated from the Area Resource file as the number of hospices or hospitals with hospice services within each Health Care Service Area (HCSA).²⁰

Statistical analysis

Univariate comparisons for baseline characteristics and indicators of aggressive end-of-life care^{21,22} (a new chemotherapy regimen starting less than 30 days before death, the last dose of chemotherapy within 14 days of death, more than one emergency department visit in the last month of life, an intensive care unit admission in the last month of life, more than one hospital admission in the last month of life, and spending more than 14 days in hospital in the last month of life) were made with the χ^2 test for categorical variables and the Wilcoxon rank-sum test for continuous variables. Overall survival (OS), defined as the length of time from the date of advanced cancer diagnosis to death from their disease was calculated by using the Kaplan-Meier method,²³ and the log-rank test²⁴ was used for group comparisons of hospice utilization. Cox proportional hazards regression models²⁵ were used to estimate hazard ratios (HRs) and 95% confidence intervals (CIs) for comparisons of unadjusted hospice utilization and then adjusted for nine baseline characteristics. Whether a patient ever received chemotherapy at any time after their cancer diagnosis was also included in the Cox model, according to our previous findings.²⁶

Because our prior work, as well as work by others^{9,21,22,27-32} suggesting that the decision to refer patients to hospice care is affected by various patient and provider characteristics, we additionally analyzed patients closely matched for the likelihood that they would have hospice care by using PS methods.³³ Since the PS approach is primarily designed to be applied to two-group comparisons, we developed two scenarios: (1) to evaluate the effect of hospice service versus (versus) nonhospice in all patients and (2) to assess the effect of longer-term versus short-term hospice stays among hospice patients. In each scenario, we included nine variables to estimate PSs for each patient as an adjustment for baseline characteristics. Each hospice patient was matched with a nonhospice patient (matched cohort A in Table 1) based on the "greedy" matching techniques described elsewhere, which matches the nearest neighbor within each matching caliper.³⁴ Likewise, short-term hospice patients were matched with longer-term hospice patients (matched cohort B in Table 2). We first compared OS, practice patterns at the end of life and place of death (hospital, hospice, or other) by using the unmatched cohort, then did the same analyses by using the matched cohorts A and B. The impact of hospice care or length

TABLE 1. CHARACTERISTICS OF PATIENTS BY HOSPICE UTILIZATION

Variables	Unmatched cohort			Matched cohort A		
	No hospice stay	Hospice stay	p value	No hospice stay	Hospice stay	p value
Number of patients (%)	4104 (52.1)	3775 (47.9)	Total 7879	3186	3186	Total 6372
Baseline variables						
Age at diagnosis, years	72.8 ± 5.9	73.2 ± 5.9	<0.01	72.9 ± 5.9	73.0 ± 5.9	0.54
Gender, n (%)						
Female	1608 (39.2)	1729 (45.8)	<0.001	1339 (42.0)	1356 (42.6)	0.67
Male	2496 (60.8)	2046 (54.2)		1847 (58.0)	1830 (57.4)	
Race/ethnicity, n (%)						
Non-Hispanic, white	3307 (80.6)	3209 (85.0)	<0.001	2679 (84.1)	2663 (83.6)	0.59
Others	797 (19.4)	566 (15.0)		507 (15.9)	523 (16.4)	
Availability of hospice, n (%)						
Highest tertile	1119 (32.5)	1086 (33.5)	<0.001	910 (28.6)	892 (28.0)	0.67
Second tertile	955 (27.7)	1162 (35.9)		803 (25.2)	846 (26.6)	
Lowest tertile	1373 (39.8)	990 (30.6)		971 (30.5)	950 (29.8)	
Missing	657 (16.0)	537 (14.2)		502 (15.8)	498 (15.6)	
Urban residence, n (%)						
Yes	3709 (90.4)	3476 (92.1)	<0.01	2906 (91.2)	2906 (91.2)	1.00
No	395 (9.6)	299 (7.9)		280 (8.8)	280 (8.8)	
Socioeconomic status, n (%)						
Highest quintile	715 (17.4)	801 (21.2)	<0.001	625 (19.6)	628 (19.7)	0.60
Fourth quintile	826 (20.1)	703 (18.6)		621 (19.5)	611 (19.1)	
Third quintile	800 (19.5)	813 (21.5)		684 (21.5)	640 (20.1)	
Second quintile	829 (20.2)	711 (18.8)		614 (19.3)	627 (19.7)	
Lowest quintile	934 (22.8)	747 (19.8)		642 (20.2)	680 (21.3)	
Median income, \$	43,851 ± 21,179	44,268 ± 20,130	0.06	45,027 ± 22,032	43,869 ± 20,242	0.08
Teaching hospital, n (%)						
Yes	39,432 [30,898–51,556]	39,835 [31,599–52,174]	<0.001	40,442 [31,581–52,143]	39,371 [31,151–51,862]	0.90
No	2076 (50.6)	2065 (54.7)		1680 (52.7)	1675 (52.6)	
Charlson comorbidity index, n (%)						
0	2028 (49.4)	1710 (45.3)	0.05	1506 (47.3)	1511 (47.4)	0.95
1	3028 (73.8)	2722 (72.1)		2313 (72.6)	2302 (72.3)	
2 or more	692 (16.9)	717 (19.0)		578 (18.1)	583 (18.3)	
Year of diagnosis, n (%)						
1991	384 (9.4)	336 (8.9)	<0.001	295 (9.3)	301 (9.5)	0.92
1992	845 (20.6)	377 (10.0)		398 (12.5)	377 (11.8)	
1993	595 (14.5)	397 (10.5)		373 (11.7)	388 (12.2)	
1994	516 (12.6)	431 (11.4)		408 (12.8)	407 (12.8)	
1995	440 (10.7)	472 (12.5)		412 (12.9)	408 (12.8)	
1996	496 (12.1)	464 (12.3)		423 (13.3)	429 (13.5)	
1997	435 (10.6)	486 (12.9)		409 (12.8)	421 (13.2)	
1998	368 (9.0)	500 (13.3)		359 (11.3)	380 (11.9)	
1999	290 (7.1)	439 (11.6)		285 (9.0)	274 (8.6)	
Yes	119 (2.9)	209 (5.5)		119 (3.7)	102 (3.2)	
Indicators of aggressive care at the end-of-life						
A new chemotherapy regimen starting less than 30 days before death, n (%)	62 (1.5)	20 (0.5)	<0.001	50 (1.6)	17 (0.5)	<0.001

(continued)

TABLE 1. (CONTINUED)

Variables	Unmatched cohort			Matched cohort A		
	No hospice stay	Hospice stay	p value	No hospice stay	Hospice stay	p value
The last dose of chemotherapy within 14 days of death, <i>n</i> (%)	241 (5.9)	58 (1.5)	<0.001	206 (6.5)	47 (1.5)	<0.001
More than one emergency room visit in the last month of life, <i>n</i> (%)	1286 (31.3)	545 (14.4)	<0.001	1017 (31.9)	444 (13.9)	<0.001
More than one hospital admission in the last month of life, <i>n</i> (%)	400 (9.8)	82 (2.2)	<0.001	319 (10.0)	69 (2.2)	<0.001
Spending more than 14 days in hospital in the last month of life, <i>n</i> (%)	369 (9.0)	83 (2.2)	<0.001	299 (9.4)	71 (2.2)	<0.001
An intensive care unit admission in the last month of life, <i>n</i> (%)	359 (8.8)	78 (2.1)	<0.001	288 (9.0)	61 (1.9)	<0.001
Outcomes						
Place of death, <i>n</i> (%)	1631 (39.7)	107 (2.8)	<0.001	1265 (39.7)	97 (3.0)	<0.001
	<11 ^a	3495 (92.6)		<11 ^a	2900 (91.0)	
Other	2473 (60.3)	173 (4.6)		1921 (60.3)	189 (5.9)	
Median (months)	6.4	6.9	<0.01	6.4	7.1	<0.001
0.5 year (%)	54.1	58.1		53.7	59.4	
1 year (%)	21.4	24.6		20.7	25.7	
2 years (%)	6.4	6.2		5.5	6.9	

^aCell sizes less than 11 are not reported to fit the SEER-Medicare policy.
SD, standard deviation; IQR, interquartile range.

TABLE 2. CHARACTERISTICS OF PATIENTS BY LENGTH OF HOSPICE STAY

Variables	Unmatched cohort			Matched cohort B		
	Short-term hospice stay	Longer term hospice stay	p value	Short-term hospice stay	Longer term hospice stay	p value
Number of patients (%)	379 (10.0)	3,396 (90.0)	Total 3,775	379 (50.0)	379 (50.0)	Total 758
Baseline patient and disease characteristics						
Age at diagnosis, years	73.0 ± 5.7	73.2 ± 5.9	0.61	73.0 ± 5.7	72.9 ± 5.6	0.83
Gender, n (%)	72 [69–76]	72 [68–77]		72 [69–76]	72 [69–77]	
Female	153 (40.4)	1576 (46.4)	0.03	153 (40.4)	162 (42.7)	0.51
Male	226 (59.6)	1820 (53.6)		226 (59.6)	217 (57.3)	
Race/Ethnicity, n (%)	311 (82.1)	2898 (85.3)	0.09	311 (82.1)	310 (81.8)	0.92
non Hispanic, white	68 (17.9)	498 (14.7)		68 (17.9)	69 (18.2)	
Others	90 (23.8)	996 (29.3)	0.02	90 (23.8)	90 (23.8)	0.98
Availability of hospice, n (%)	140 (36.9)	1022 (30.1)		140 (36.9)	137 (36.2)	
Highest tertile	91 (24.0)	899 (26.5)		91 (24.0)	96 (25.3)	
Second tertile	58 (15.3)	479 (14.1)		58 (15.3)	56 (14.8)	
Lowest tertile	359 (94.7)	3117 (91.8)	0.04	359 (94.7)	360 (95.0)	0.87
Missing	20 (5.3)	279 (8.2)		20 (5.3)	19 (5.0)	
Yes	79 (20.8)	722 (20.1)	0.53	79 (20.8)	76 (20.1)	0.66
No	73 (19.3)	630 (18.6)		73 (19.3)	85 (22.4)	
Socioeconomic status, n (%)	89 (23.5)	724 (21.3)		89 (23.5)	78 (20.6)	
Highest quintile	75 (19.8)	636 (18.7)		75 (19.8)	83 (21.9)	
Fourth quintile	63 (16.6)	684 (20.1)		63 (16.6)	57 (15.0)	
Third quintile	45,542 ± 20,334	44,126 ± 20,105	0.08	45,542 ± 20,334	45,176 ± 20,905	0.56
Second quintile	41,172 [33,550–52,442]	39,694 [31,450–52,143]		41,172 [33,550–52,442]	41,055 [31,971–52,007]	0.56
Lowest quintile	232 (61.2)	1833 (54.0)	<0.01	232 (61.2)	230 (60.7)	0.88
Mean ± SD	147 (38.8)	1563 (46.0)		147 (38.8)	149 (39.3)	
Median [IQR]	265 (69.9)	2,457 (72.4)	0.60	265 (69.9)	258 (68.1)	0.82
Teaching hospital, n (%)	77 (20.3)	640 (18.9)		77 (20.3)	84 (22.2)	
Charlson comorbidity	37 (9.8)	299 (8.8)		37 (9.8)	37 (9.8)	
Index, n (%)	32 (8.4)	345 (10.2)	0.75	32 (8.4)	30 (7.9)	0.96
2 or more	44 (11.6)	353 (10.4)		44 (11.6)	47 (12.4)	
Year of diagnosis, n (%)	36 (9.5)	395 (11.6)		36 (9.5)	32 (8.4)	
1991	45 (11.9)	427 (12.6)		45 (11.9)	52 (13.7)	
1992	43 (11.4)	421 (12.4)		43 (11.4)	35 (9.2)	
1993	56 (14.8)	430 (12.7)		56 (14.8)	56 (14.8)	
1994	54 (14.3)	446 (13.1)		54 (14.3)	49 (12.9)	
1995	47 (12.4)	392 (11.5)		47 (12.4)	53 (14.0)	
1996	22 (5.8)	187 (5.5)		22 (5.8)	25 (6.6)	
1997	<11 ^a	15 (0.4)	0.03	<11 ^a	<11 ^a	0.25
1998						
1999						
Indicators of aggressive care at the end-of-life						
Started new chemo regimen within 1 month of death, n (%)	<11 ^a	15 (0.4)	0.03	<11 ^a	<11 ^a	0.25
Yes						

(continued)

TABLE 2. (CONTINUED)

Variables	Unmatched cohort			Matched cohort B		
	Short-term hospice stay	Longer term hospice stay	p value	Short-term hospice stay	Longer term hospice stay	p value
Aggressive chemo within 14 days of death, <i>n</i> (%)	Yes	33 (1.0)	<0.001	25 (6.6)	<11 ^a	<0.001
More than 1 emergency department visit in the last month of life, <i>n</i> (%)	Yes	413 (12.2)	<0.001	132 (34.8)	59 (15.6)	<0.001
Had more than 1 hospital admission in the last month of life, <i>n</i> (%)	Yes	54 (1.6)	<0.001	28 (7.4)	<11 ^a	0.001
Had more than 14 days in hospital in the last month of life, <i>n</i> (%)	Yes	58 (1.7)	<0.001	25 (6.6)	<11 ^a	0.009
ICU admission in the last month of life, <i>n</i> (%)	Yes	58 (1.7)	<0.001	20 (5.3)	<11 ^a	0.02
Outcomes						
Place of death, <i>n</i> (%)	Hospital	87 (2.6)	<0.001	20 (5.3)	<11 ^a	<0.001
	Hospice	3,099 (91.3)		355 (93.7)	347 (91.6)	
	Other	210 (6.2)		<11 ^a	22 (5.8)	
Survival	Median (months)	6.9	0.39	7.0	6.8	1.00
	0.5 year (%)	58.1		58.0	57.8	
	1 year (%)	24.9		22.2	23.7	
	2 years (%)	6.4		4.7	5.3	

^aCell sizes less than 11 are not reported to fit the SEER Medicare policy.
SD, standard deviation; IQR, interquartile range.

of hospice stay on survival, respectively, was also calculated across quintiles of PS. To see if the practice patterns near death affected survival via hospice utilization, we also evaluated these data after adding six indicators of aggressive end-of-life care to nine baseline characteristics in each model.

For sensitivity analyses, we performed an instrumental variable analysis (IVA)^{26,35-39} to evaluate whether unobserved characteristics of patients might explain differences in survival associated with any hospice utilization or the length of hospice utilization. Based on our previous work demonstrating significant unexplained geographic variation in use of hospice but not of survival, we chose regional availability of hospice care as the instrument.^{28-30,32} Under the assumption that unmeasured patient characteristics such as performance status do not differ according to where a patient receives care, comparison of survival for patients living in areas of higher availability of hospice with those living in areas of lower availability of hospice can indicate the effect on survival. The instrumental variable estimate (IVE) reflects the patients who received hospice care if they lived in an area of high availability of hospice but would not have received hospice care if they lived in an area of low availability of hospice, otherwise known as "marginal patients."

All statistical tests were two-sided, and 95% CIs are presented for adjusted results. All analyses were conducted using SAS 9.1 software (SAS Institute, Cary, NC).

Results

Characteristics of cohorts

The characteristics of 7879 patients before and after they were matched based on their propensity to receive care in a hospice are shown in Table 1. In the unmatched cohort, 3775 patients (47.9%) had ever received care in a hospice. Compared to the nonhospice group, the hospice group was older, more likely to be female and non-Hispanic white, more likely to reside in urban areas with higher socioeconomic status and greater availability of hospice, more likely to be treated in a teaching hospital, and was diagnosed in more recent years. All 6 indicators of aggressive end-of-life care were less likely to be provided to hospice patients compared to nonhospice patients. Of 3775 hospice patients, 3186 (84.4%) were matched based on the baseline characteristics to a similar nonhospice patient; no significant differences in baseline characteristics were noted among matched patients in these two groups (Table 1).

Ten percent ($n = 379$) of 3775 hospice patients experienced short-term hospice stays (Table 2). Short-term hospice patients were more likely to be male, reside in urban areas, and be treated in a teaching hospital. Indicators of aggressive end-of-life care were associated with short-term hospice stays. After controlling for the baseline characteristics, 100% of the 379 short-term hospice patients were matched with similar longer-term hospice patients. The availability of hospice differed significantly between the two groups in the unadjusted comparison, but not in the matched cohort B, and there were no significant differences in explanatory variables between the two groups in the matched cohort B.

Survival

OS at 1 and 2 years in the unmatched cohort were respectively 21.4% and 6.4% for nonhospice patients, and 24.6% and 6.2% for hospice patients ($p < 0.01$). After controlling for baseline vari-

ables, the absolute differences in survival between nonhospice and hospice patients of 3.2% at 1 year and 0.2% at 2 years in the unmatched cohort were increased to 5.0% (20.7% versus 25.7%) at 1 year and 1.4% (5.5% versus 6.9%) at 2 years in the matched cohort A, and remained statistically significant ($p < 0.001$). Using identical methods, among hospice patients, point estimates of survival between short-term and longer-term hospice patients were calculated (Table 2). The absolute difference in estimated survival between the two groups of 2.7% at 1 year and 1.7% at 2 years in the unmatched cohort ($p = 0.39$), and 1.5% at 1 year and 0.6% at 2 years in the matched cohort B ($p = 1.00$), respectively, did not differ significantly. Similar results were seen even after matching with practice patterns as well as baseline variables (data not shown). The survival curves for matched cohorts A and B are shown in Figure 1.

In the adjusted Cox regression analysis, longer-term hospice patients were found to have longer survival than nonhospice patients (HR 0.87, 95% CI 0.83 to 0.91, $p < 0.001$), and similar survival was observed between short-term and nonhospice patients (HR 0.94, 95% CI 0.85 to 1.05, $p = 0.26$). The effects were similar in all strata of propensity score. Worse survival was noted for men, those not treated in a teaching hospital, those with worse comorbidity, those diagnosed in more recent years, and those who never received chemotherapy (Table 3). Race/ethnicity, urban residence, hospice availability were not associated with survival. Inclusion of six indicators of aggressive end-of-life care in the model produced similar results, suggesting that the longer term hospice care is independently associated with survival.

We also estimated the impact of hospice use or length of hospice stay on survival by using IVA to test the robustness of the foregoing results from the two statistical tools. We separated the patients into two groups based on HCSA of higher or lower availability of hospice, using the median hospice availability (6.4 per million population in 1999) as the cut point. Patients who lived in an area of high hospice availability were more likely to experience care in a hospice compared to those who lived in an area of low hospice availability (53.1% versus 42.9%). Although the groups differed significantly in terms of some demographic variables, such as gender, race/ethnicity, urban/rural residence, year of diagnosis, and experiencing care in a teaching hospital, the difference was smaller than that between hospice patients vs. nonhospice patients in the unmatched cohort (Table 1). There were no significant differences between the two groups in the age at diagnosis, Charlson comorbidity index, socioeconomic status, and survival (21.8% versus 23.4% at 1 year; 5.5% versus 6.5% at 2 years, $p = 0.08$). These findings validated our assumption that the regional availability of hospice significantly influences whether a patient received care in a hospice, and is not associated with patients' severity of disease and outcomes, which supports the IV being a strong and valid instrument. We could not clearly identify a survival effect based on receipt of hospice care for marginal patients at 1 year (IVE [standard error, SE] 14.7% [10.2%], $p = 0.15$) or at 2 years (IVE [SE] 11.8% [5.9%], $p = 0.04$) even after controlling for the practice patterns at the end of life and/or baseline characteristics.

Place of death

In the unmatched cohort, 92.6% of the hospice patients died in hospice care and fewer hospice patients died in an acute

FIG. 1. Kaplan-Meier Survival Curves after diagnosis of advanced non-small cell lung cancer by the hospice utilization. **A:** A matched cohort A of 3186 nonhospice patients and 3186 hospice patients after controlling for baseline characteristics. **B:** A matched cohort B of 379 short-term hospice patients and 379 longer term hospice patients after controlling for baseline characteristics.

care hospital compared to nonhospice patients (2.8% versus 39.7%, $p < 0.001$). After controlling for baseline characteristics, much the same pattern in the matched cohort A was observed. Among hospice patients, the proportion who died in a hospital was higher in the short-term hospice group both in the unmatched cohort and matched cohort B (both 5.3% versus 2.6%, $p < 0.01$).

Discussion

Palliative, rather than life-prolonging or curative care, is the primary goal for hospice patients. As a result, despite the

higher quality of life and better pain management that has been observed in hospice patients,^{40,41} there is a concern that hospice care might be associated with shorter survival compared to ongoing anticancer care outside of a hospice.

In accordance with the previous literature,^{9,27-32,42} our data have shown that baseline characteristics, including age at diagnosis, gender, race/ethnicity, urban residence, experiencing care in a teaching hospital, and comorbid conditions were associated with choice of hospice care,³⁰ although hospice availability did not affect length of hospice admission among those with hospice care. After controlling for these baseline characteristics by using the multiple Cox regression analysis

TABLE 3. FACTORS SIGNIFICANTLY ASSOCIATED WITH SURVIVAL IN MULTIPLE COX REGRESSION ANALYSIS

Variables		HR	95% CI	p value
Hospice utilization	No hospice stay	1.00	—	—
	Short-term hospice stay (3 or fewer days)	0.94	0.85–1.05	0.26
	Longer-term hospice stay (at least 4 days)	0.87	0.83–0.91	<0.001
Gender	Female	1.00	—	—
	Male	1.11	1.06–1.16	<0.001
Teaching hospital	No	1.00	—	—
	Yes	0.90	0.86–0.94	<0.001
Charlson comorbidity index	0	1.00	—	—
	1	1.07	1.01–1.14	0.02
	2 or more	1.16	1.07–1.25	<0.001
Year of diagnosis	1991	1.00	—	—
	each increasing year	1.10	1.09–1.11	<0.001
Ever had chemotherapy at any time after cancer diagnosis	No	1.00	—	—
	Yes	0.72	0.69–0.76	<0.001

The following variables, race/ethnicity, availability of hospice, and urban residence were not found to be associated with survival. HR, hazard ratio; CI, confidence interval.

and the propensity score analysis, we could not detect a detrimental effect on survival by entering hospice, as expected.^{6–8} However, these traditional logistic regression models could be biased because admissions to hospices are likely to be confounded by unobserved variables. Therefore, we attempted to remove residual selection bias by choosing the regional availability of hospices as an IV. Results from the IVA indicate that regional availability of hospice was associated with any hospice use, but not with length of hospice stay. Instead, experiencing aggressive end-of-life care was more predictive of (shorter) duration of hospice use. Despite a significant relationship between aggressive end-of-life care and no or only short-term hospice stay, hospice patients were found to have comparable or even longer survival compared to nonhospice patients based on three different statistical approaches.

Advances in medical technologies and a perception that patients favor receiving aggressive care even very near death for small expected benefits may reduce the number of patients referred to hospice,^{9,10,43,44} especially in the black patients.⁴⁵ Short-term hospice use was not associated with longer survival, suggesting that continuing aggressive care close to death did not necessarily translate into better outcomes or inaccurate estimation of the prognoses. Together, these data suggest that provider or patient preferences and resource considerations, rather than clinical factors, may be driving end-of-life care for marginal patients.

Our study had several limitations. First, this study cohort did not include patients aged less than 65 years and those insured by an HMO in the Medicare program so the current results cannot necessarily be generalized to younger patients and those with managed care insurance. However, 60% of cancer cases occur in patients aged 65 or older⁴⁶ and Medicare covers the majority of cancer patients in the United States.⁴⁷ In addition, although a previous study showed that Medicare beneficiaries with managed care insurance were more likely than those with fee-for-service insurance to enroll in hospice and stay longer, the length of hospice stay for most hospice patients was less than one month regardless of whether they were enrolled in managed care or fee-for-service.⁴⁸ We did not capture information if patients, who elected their hospice benefit, withdrew later. Our study was

limited to patients who had died from lung cancer, which is the leading cause of cancer mortality in the United States, but the choice of hospice use, treatment options, and/or clinical outcomes for these patients may differ from those with other types of cancer.^{6,42} As with any study using administrative data, the accuracy of some of the variables used, including the identification of hospice use and the calculation of the comorbidity score, may be limited.^{49,50} Lastly, selection bias cannot be completely excluded without randomization. For example, physicians may be more likely to refer patients to hospice when they think they are going to live long enough to benefit from it.

In conclusion, use of hospice and length of hospice stay for Medicare patients with advanced NSCLC did not compromise survival. Appropriate timing of referral to hospice gives terminally ill cancer patients and their families more time and opportunity to benefit from palliative services and avoid futile interventions. Concern about hastening death should not be a barrier to hospice care.

Acknowledgments

This research was supported by a grant CA 91753-02 from the National Cancer Institute.

Author Disclosure Statement

No competing financial interests exist.

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