Hospice Admissions for Cancer in the Final Days of Life: Independent Predictors and Implications for Quality Measures

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A B S T R A C T

Purpose

To define patient characteristics associated with hospice enrollment in the last 3 days of life, and to describe adjusted proportions of patients with late referrals among patient subgroups that could be considered patient-mix adjustment variables for this quality measure.

Methods

Electronic health record–based retrospective cohort study of patients with cancer admitted to 12 hospices in the Coalition of Hospices Organized to Investigate Comparative Effectiveness network.

Results

Of 64,264 patients admitted to hospice with cancer, 10,460 (16.3%) had a length of stay ≤ 3 days. There was significant variation among hospices (range, 11.4% to 24.5%). In multivariable analysis, among patients referred to hospice, patients who were admitted in the last 3 days of life were more likely to have a hematologic malignancy, were more likely to be male and married, and were younger (age < 65 years). Patients with Medicaid or self-insurance were less likely to be admitted to hospice within 3 days of death.

Conclusion

Quality measures of hospice lengths of stay should include patient-mix adjustments for type of cancer and site of care. Patients with hematologic malignancies are at especially increased risk for late admission to hospice.

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INTRODUCTION

In 2011, more than 400,000 patients with cancer died while receiving hospice care.^{1,2} Hospice is associated with less aggressive care at the end of life, improved quality of life for patients, and reduction in grief-related psychiatric illness among caregivers.^{3,4} In addition, earlier hospice enrollment may provide added benefits of increased family satisfaction and greater cost savings.^{5,6}

Despite the potential benefits of early hospice enrollment, many patients with cancer are admitted to hospice close to the end of life. In 2012, for instance, the median length of stay in hospice in the United States was only 18.7 days.² Furthermore, previous studies have reported that approximately 14.3% of patients with cancer enroll in hospice in the last 3 days of life.⁷

The National Quality Forum and the American Society for Clinical Oncology have jointly endorsed several quality measures for end of life care in cancer patients.⁷⁻⁹ One measure is the proportion of hos-

pice enrollments within the last three days of life, which is included in the American Society of Clinical Oncology's voluntary quality improvement initiative, the Quality Oncology Practice Initiative.¹⁰ Although individual performance on this measure is not yet publicly reported, the Affordable Care Act will require physicians to report quality measures like this in the future.¹¹ This and other quality measures may also be linked to incentive payments through programs such as the Center for Medicare and Medicaid's Physician Quality Reporting Initiative.¹²

Little is known about the patient characteristics that are associated with late admissions to hospice. Previous studies have shown significant geographic variability¹³ as well as differences in patient characteristics, such as sex and diagnosis.⁷ However, these data were collected in the early 1990s and may not reflect current practice patterns. Furthermore, it is unknown whether these results extend to non-Medicare populations. Nor is it known how much these characteristics influence the probability of a

late hospice enrollment, and how they might affect a physician or hospital's quality scores.

If late hospice enrollment is to be used as a quality measure, it will be important to understand how patient characteristics influence performance. These variables can then be included in patient-mix adjustments, ensuring that this measure takes into account variability in patient populations between practices. These variables could also be used to identify patient populations for targeted interventions promoting earlier hospice discussions. Therefore, the goal of this study was to define the patient characteristics associated with late hospice enrollment among patients with cancer.

METHODS

Patient data were extracted from the electronic medical records of 12 hospices in the Coalition of Hospices Organized to Investigate Comparative Effectiveness (CHOICE) network.¹⁴ CHOICE is a research-focused network of hospices that all use Suncoast Solutions Electronic Health Record Software and have agreed to share their data for research purposes. CHOICE projects are defined and approved by a steering committee composed of leaders from all hospices in the network. Participating hospices range in size from 400 to 1,700 patients per day and are located in New Mexico, California, Florida, Pennsylvania, Wisconsin, Michigan, Kentucky, Ohio, Texas (three hospices), and Kansas/Missouri. All are not-for-profit.

CHOICE obtains data from a data warehouse (Solutions Intelligence; Suncoast Solutions, Clearwater, FL) that participating hospices use for tracking, quality measurement, and benchmarking. Warehouse data reside on a secure server that is managed by Suncoast Solutions. Extracted data are then stripped of identifiers to create a Health Insurance Portability and Accountability Act–compliant limited data set that is transferred as an encrypted file to the University of Pennsylvania for analysis.

Patients were included if they were admitted to a participating hospice between January 1, 2008 and May 15, 2013. We first extracted a data set containing basic demographic variables (age, sex, race, marital status) and diagnoses (admitting diagnosis and up to three additional diagnoses). We restricted the data set to patients with a primary diagnosis of cancer but retained information on secondary diagnoses.

Data also included site of care at the time of enrollment (ie, home, long-term care facility, residential hospice, hospital, hospice inpatient unit) and payer type (ie, commercial, Medicare, Medicaid, self, charity). In coding the site of care, we combined nursing home care and residential hospice care, because both provide similar levels of staffing and are reimbursed at much lower rates than inpatient hospice care. When patients had several types of insurance, we coded the payer that was billed for hospice care. Length of stay was determined by the patient's total number of days in hospice, regardless of site of care.

In examining mortality, we divided the sample into those who died within 3 days of hospice admission and those who were still alive after 4 days. To identify potential predictors of 3-day mortality, we examined each patient characteristic in Table 1 in univariable logistic regression models. For these and all subsequent models, we calculated bootstrapped CIs with 50 replications and robust SEs clustered by hospice. We then considered all characteristics in a forward stepwise logistic regression model.¹⁵ We retained characteristics in the final model if they were independent predictors of 3-day mortality. Finally, we used that model to estimate the adjusted 3-day mortality of patients in the sample, stratified by model variables.

In estimating power, we anticipated a sample of at least 60,000 patients with cancer and a 3-day mortality rate of at least 10%. This would provide adequate power ($1-\beta = 0.92$; $\alpha = 0.05$) to detect a 2.0% difference in mortality (12% v 10%), even if a characteristic were present in 5% of the population.

Stata statistical software (Stata MP2 version 11.0) was used for all analysis. The University of Pennsylvania institutional review board provided approval for use of secondary data.

RESULTS

A total of 64,264 patients with a primary diagnosis of cancer were admitted to the 12 participating hospices (Table 1). The majority of patients were male ($n = 32,430$; 50.5%), white ($n = 55,769$; 86.8%), single ($n = 35,996$; 56.0%), and age 65 years or older ($n = 43,058$; 67.0%). Most patients were admitted to hospice at home ($n = 44,053$; 68.6%), with the remainder in nursing home or inpatient hospice settings. Patients had a wide range of payers including commercial insurance ($n = 28,467$; 44.3%), Medicare ($n = 26,644$; 41.5%), Medicaid ($n = 5,340$; 8.3%), and self-pay ($n = 3,813$; 5.9%).

Of the 64,264 patients in the sample, 10,460 (16.3%) had a hospice length of stay of 3 days or less. Using univariable logistic regression models, we identified several characteristics that were associated with hospice length of stay ≤ 3 days (Table 1). For instance, men were more likely to be admitted to hospice within the last 3 days of life (odds ratio [OR], 1.21; 95% CI, 1.16 to 1.26). Among cancer types, patients with hematologic malignancies were also more likely to enroll in the last 3 days of life. ORs ranged from 1.82 for leukemia (95% CI, 1.60 to 2.07) to 1.30 for multiple myeloma (95% CI, 1.11 to 1.54). Patients with CNS malignancies were less likely to enroll in the last 3 days of life (OR, 0.54; 95% CI, 0.47 to 0.63) as were patients with oropharyngeal cancer (OR, 0.65; 95% CI, 0.52 to 0.81).

Hospices in this sample varied widely in the proportion of their patients enrolled in the last 3 days of life (range, 11.4% to 24.5%). However, the proportion of late enrollments was stable throughout the study period (2008–2013). Subsequent multivariable analysis used standard deviations that were clustered by hospice.

When these data were analyzed using multivariable models, several independent predictors of short length of stay were identified (Table 2). Male sex (OR, 1.22; 95% CI, 1.16 to 1.28), presence of a spouse (OR, 1.23; 95% CI, 1.17 to 1.29), older age (age ≥ 65 years: OR, 0.90; 95% CI, 0.85 to 0.95), and nonwhite ethnicity (white: OR, 0.89; 95% CI, 0.82 to 0.97) were all independently associated with a short length of stay in hospice.

Site of care and insurance type were also independent predictors of short length of stay in hospice. Patients living in a nursing home or hospice residence were more likely than patients at home to have a length of stay of ≤ 3 days in hospice (OR, 2.15; 95% CI, 1.98 to 2.34), and patients admitted to hospice in a hospital or inpatient hospice unit were much more likely to have a length of stay of ≤ 3 days (OR, 6.22; 95% CI, 5.92 to 6.53). Patients with Medicaid were less likely to have a short hospice length of stay (OR, 0.83; 95% CI, 0.76 to 0.91), as were self-insured patients (OR, 0.74; 95% CI, 0.66 to 0.84). Patients with Medicare, commercial insurance, and no insurance were equally likely to enroll in hospice within the last 3 days of life.

Finally, cancer type and comorbidities were analyzed as potential predictors in the multivariable model. Hematologic malignancy was independently associated with a hospice length of stay ≤ 3 days (OR, 1.52; 95% CI, 1.41 to 1.64). Comorbid conditions were associated with an increased risk of late hospice enrollment (OR, 1.04; 95% CI, 1.01 to 1.08).

For each predictor in the multivariable model, we then calculated the adjusted percentage of patients with a length of stay in hospice of ≤ 3 days (Table 2). The greatest predictor of short length of stay was care in a hospital or inpatient hospice (37.1%) compared with care in

Table 1. Characteristics Associated With Length of Stay ≤ 3 Days in Patients With Cancer Who Enrolled in Hospice

Characteristic	Length of Stay ≤ 3 Days		Odds Ratio	95% CI	P
	No.	%			
Age, years					
< 65 (n = 21,206)	3,506	16.5	—	—	—
≥ 65 (n = 43,058)	6,954	16.2	0.97	0.93 to 1.02	.217
Sex					
F (n = 31,834)	4,767	15.0	—	—	—
M (n = 32,430)	5,693	17.6	1.21	1.16 to 1.26	< .001
Hospice					
0 (n = 3,265)	532	16.3	—	—	—
1 (n = 6,499)	1,580	24.3	1.65	1.48 to 1.84	< .001
2 (n = 1,507)	290	19.2	1.22	1.05 to 1.43	.012
3 (n = 5,932)	1,123	18.9	1.20	1.07 to 1.34	.002
4 (n = 4,107)	469	11.4	0.66	0.58 to 0.76	< .001
5 (n = 10,437)	1,454	13.9	0.83	0.75 to 0.93	.001
6 (n = 4,166)	547	13.1	0.78	0.68 to 0.88	< .001
7 (n = 3,217)	380	11.8	0.69	0.60 to 0.79	< .001
8 (n = 1,039)	254	24.5	1.66	1.40 to 1.97	< .001
9 (n = 10,430)	1,743	16.7	1.03	0.93 to 1.15	.576
10 (n = 5,252)	890	17.0	1.05	0.93 to 1.18	.433
11 (n = 8,413)	1,198	14.2	0.85	0.76 to 0.95	.005
Year of admission					
2008 (n = 7,939)	1,282	16.2	—	—	—
2009 (n = 12,130)	1,902	15.7	0.97	0.89 to 1.04	.375
2010 (n = 12,486)	2,008	16.1	1.00	0.92 to 1.07	.900
2011 (n = 10,920)	1,784	16.3	1.01	0.94 to 1.10	.729
2012 (n = 12,798)	2,153	16.8	1.05	0.97 to 1.13	.204
2013 (n = 7,991)	1,331	16.7	1.04	0.95 to 1.13	.387
Race					
Nonwhite (n = 5,079)	857	16.9	—	—	—
White (n = 55,769)	8,854	15.9	0.93	0.86 to 1.00	.063
Missing (n = 3,416)	749	21.9	—	—	—
Site of care					
Home (n = 44,053)	4,006	9.1	—	—	—
Nursing home or hospice residence (n = 5,526)	904	16.4	1.96	1.81 to 2.11	< .001
Hospital or inpatient hospice unit (n = 14,685)	5,550	37.8	6.07	5.80 to 6.36	< .001
Payer					
Commercial (n = 28,467)	4,659	16.4	—	—	—
Medicare (n = 26,644)	4,469	16.8	1.03	0.98 to 1.08	.199
Medicaid (n = 5,340)	776	14.5	0.87	0.80 to 0.94	.001
Self (n = 2,767)	391	14.1	0.84	0.75 to 0.94	.002
Charity (n = 1,046)	165	15.8	0.96	0.81 to 1.13	.611
Marital status					
Single (n = 35,996)	5,560	15.5	—	—	—
Married (n = 28,268)	4,900	17.3	1.15	1.10 to 1.20	< .001
Comorbidities					
None (n = 19,997)	3,199	16.0	—	—	—
At least one comorbidity (n = 44,267)	9,296	21.0	1.40	1.34 to 1.46	< .001
Primary cancer					
Breast (n = 4,891)	825	16.9	—	—	—
Ovarian (n = 1,940)	264	13.6	0.78	0.67 to 0.90	.001
Cervical (n = 654)	86	13.2	0.75	0.59 to 0.95	.016
Uterine (n = 938)	133	14.2	0.81	0.67 to 0.99	.042
GU (n = 1,703)	266	15.6	0.91	0.78 to 1.06	.233
Renal (n = 135)	22	16.3	0.96	0.60 to 1.52	.861
Bladder/ureter (n = 1,812)	287	15.8	0.93	0.80 to 1.07	.315
Prostate (n = 2,929)	377	12.9	0.73	0.64 to 0.83	< .001
Testicular (n = 35)	8	22.9	1.46	0.66 to 3.23	.349
Oropharynx (n = 857)	100	11.7	0.65	0.52 to 0.81	< .001
Larynx (n = 393)	53	13.5	0.77	0.57 to 1.04	.084

(continued on following page)

Table 1. Characteristics Associated With Length of Stay ≤ 3 Days in Patients With Cancer Who Enrolled in Hospice (continued)

Characteristic	Length of Stay ≤ 3 Days		Odds Ratio	95% CI	P
	No.	%			
Lung (n = 17,990)	3,110	17.3	1.03	0.95 to 1.12	.490
Leukemia (n = 1,741)	470	27.0	1.82	1.60 to 2.07	< .001
Lymphoma (n = 1,787)	395	22.1	1.40	1.22 to 1.60	< .001
Multiple myeloma (n = 1,095)	229	20.9	1.30	1.11 to 1.54	.002
MDS (n = 533)	127	23.8	1.54	1.25 to 1.91	< .001
Hematologic (n = 28)	7	25.0	1.64	0.70 to 3.88	.257
Melanoma (n = 1,151)	200	17.4	1.04	0.87 to 1.23	.679
Basal/squamous skin (n = 52)	7	13.5	0.77	0.34 to 1.71	.515
CNS (n = 2,638)	262	9.9	0.54	0.47 to 0.63	< .001
Neuroendocrine (n = 90)	20	22.5	1.43	0.86 to 2.36	.165
Endocrine (n = 341)	53	15.5	0.91	0.67 to 1.23	.527
GI (n = 1,406)	195	13.9	0.79	0.67 to 0.94	.007
Esophageal (n = 1,530)	229	15.0	0.87	0.74 to 1.02	.080
Gastric (n = 1,202)	178	14.8	0.86	0.72 to 1.02	.085
Colorectal (n = 5,600)	785	14.0	0.80	0.72 to 0.89	< .001
Hepatic (n = 2,364)	478	20.2	1.25	1.10 to 1.42	< .001
Pancreatic (n = 4,580)	656	14.3	0.82	0.74 to 0.92	.001
Soft tissue and bone (n = 530)	70	31.2	0.75	0.58 to 0.97	.032
Unknown (n = 3,320)	568	17.1	1.02	0.90 to 1.14	.775

Abbreviations: GU, genitourinary; MDS, myelodysplastic syndrome.

a nursing home or hospice residence (19.4%) or home (13.5%). Patients with hematologic cancer were also much more likely to have a short length of stay in hospice (24.2%). Among payers, the greatest predictor of short stay was no insurance (19.5%) compared with self-insured (16.8%), Medicare (16.7%), commercial (15.6%), and Medicaid (14.8%). Additional predictors include age younger than 65 years (18.4%), married status (18.1%), male sex (17.9%), nonwhite ethnicity (17.0%), and having at least one comorbidity (16.4%).

DISCUSSION

In this large retrospective study of patients with cancer who enrolled in hospice, approximately one in six patients was admitted to hospice within 3 days of death. This is a relatively large proportion, given the benefits of early hospice admissions.¹⁶⁻¹⁸ This proportion is consistent with the results of previous studies.⁷ However, the current study provides three new insights into the challenges of late enrollments in hospice for patients with cancer.

First, married patients were more likely to enroll in hospice within the last 3 days of life. This finding is consistent with other studies that have found higher rates of chemotherapy and radiation in the last month of life among married patients.^{7,19} It is not known why this association exists. It is possible that marriage provides informal caregiving (ie, transportation to appointments, assistance with medications, meal preparation) that makes continued treatment possible. It is also possible that marriage provides emotional support that leads to greater motivation to continue treatment. Finally, it is also possible that some married patients continue treatment for their spouse's sake. Further research is needed to explore these possibilities.

Second, we found that payer status affects the timing of hospice enrollment. Previous studies suggest that Medicaid patients are less likely to elect for hospice than patients with other types of insurance,²⁰

but we found that Medicaid patients who did enroll did so earlier than those with commercial insurance or Medicare. Self-insured patients also had lower rates of late hospice admissions compared with those with commercial insurance. These two categories of patients may be less able to shoulder the out-of-pocket expenses associated with prolonged aggressive or experimental treatment. They may be less likely to have nonworking caregivers to facilitate appointments and to assist with activities of daily living. Finally, they may receive care in different oncology practices than patients with Medicare or commercial insurances, resulting in different hospice utilization patterns.

Third, patients with hematologic malignancies were admitted to hospice much later than patients with other types of cancer. Previous studies have found that patients with hematologic malignancies have lower rates of hospice utilization,²¹⁻²³ but our study addresses the timing of hospice admission. Potentially curative treatments (including bone marrow and stem-cell transplants) are often pursued for hematologic malignancies until late in the disease course. Patients with hematologic malignancies may also be dependent on blood products, which delays hospice admission. Finally, patients with hematologic malignancies may have a more abrupt decline close to the end of life.^{24,25} This makes it difficult to identify natural transitions to palliative goals of care.^{26,27}

In addition to these three primary findings, several other patient characteristics were identified that were independently associated with late hospice enrollment. These include male sex, comorbidities, and nonwhite ethnicity. It is not known why these patterns exist, but previous studies have reported that male sex and nonwhite ethnicity are associated with lower rates of hospice utilization and more aggressive treatment at the end of life.^{7,28} Future research is needed to better understand patterns of treatment and hospice utilization in these groups that might be modifiable.

One unexpected result of this study was the wide variation among participating hospices in the rate of late enrollment. Since

Table 2. Independent Predictors of Length of Stay ≤ 3 Days in Patients With Cancer Who Enrolled in Hospice Based on Multivariable Analysis

Characteristic	OR	95% CI	P	Adjusted %
Cancer type				
Other	—	—	—	15.3
Hematologic	1.52	1.41 to 1.64	< .001	24.2
Sex				
F	—	—	—	14.6
M	1.22	1.16 to 1.28	< .001	17.9
Age, years				
< 65	—	—	—	18.4
≥ 65	0.90	0.85 to 0.95	< .001	14.0
Payer				
Commercial	—	—	—	15.6
Medicare	1.06	1.00 to 1.11	.050	16.7
Medicaid	0.83	0.76 to 0.91	< .001	14.8
Self	0.74	0.66 to 0.84	< .001	16.8
Charity	0.93	0.76 to 1.12	.439	19.5
Site of care				
Home	—	—	—	13.5
NH or hospice residence	2.15	1.98 to 2.34	< .001	19.4
Hospital or inpatient hospice	6.22	5.92 to 6.53	< .001	37.1
Race				
Nonwhite	—	—	—	17.0
White	0.89	0.82 to 0.97	.005	15.9
Marital Status				
Single	—	—	—	13.1
Married	1.23	1.17 to 1.29	< .001	18.1
Comorbidities				
None	—	—	—	15.7
At least one comorbidity	1.04	1.01 to 1.08	.045	16.4

NOTE. Only characteristics independently associated with short stays in hospice were retained in the final model. Characteristics are listed in arbitrary order.
Abbreviations: NH, nursing home; OR, odds ratio.

study hospices were drawn from multiple regions of the United States, this variation may reflect regional differences in the intensity of medical care at the end of life.²⁹ In addition, local geographic differences may have contributed to this variation. Areas with more teaching hospitals have lower rates of hospice utilization and shorter lengths of stay in hospice, whereas areas with more hospice providers have higher rates of hospice utilization and longer lengths of stay in hospice.⁷ Unfortunately, the small total number of hospices included in this study did not allow for analysis of these geographic variables.

The variation between participating hospices might also be attributable to differences in referral patterns from individual oncology practices.³⁰ Understanding the sources of this variation could help hospices to identify opportunities for earlier hospice utilization. For instance, hospices could identify practices with consistently late referrals for targeted outreach efforts. More importantly, as oncology practices seek to improve this quality measure, hospices can assist by providing practices with length of stay data. However, oncologists control the timing of hospice referral but not necessarily the timing of hospice enrollment. Some patients refuse or delay hospice enrollment even when a referral is made.³¹

If the results of this study are replicated, the patient characteristics identified in this study could be considered for inclusion in patient-mix adjustment of quality measures. For instance, key patient-mix

variables might include payer, marital status, diagnosis, and site of care. Cancer centers with predominantly outpatient practices will refer more patients to hospice from the home setting, and these patients usually have a longer length of stay in hospice. Cancer centers with significant numbers of patients in nursing homes or the hospital should be expected to have more short-stay hospice patients. Further research is needed to validate the characteristics described here and to explore other patient characteristics beyond an oncologist's control that might influence the timing of hospice enrollment.

These results could also inform outreach and quality improvement efforts. For instance, by integrating palliative care into protocols for the treatment of hematologic malignancies (including therapies with curative intent), oncologists could promote anticipatory guidance about hospice for patients and families, under the framework of "hoping for the best but preparing for the worst."³² Similarly, support groups for spouses of patients with cancer should include information about hospice early in the disease course; this information can be presented in a sensitive way that equips families for future decisions without compromising hope in current treatment courses.³³

This study has two limitations that should be noted. First, these data were drawn from only 12 hospices, all of which were not-for-profit. Furthermore, not all regions were represented in our sample of hospices. It is possible that other hospices, with different patient populations, might show different results. It is reassuring that the proportion of late enrollment reported here is consistent with previous reports. Moreover, the goal of this study was not to define the proportion of patients who enroll in hospice late but rather to identify patient characteristics that might be associated with late enrollment. Nevertheless, future research should evaluate these associations in a broader sample of hospices, including those that are for-profit. Future research should also examine the potential effects of hospice characteristics such as size, staffing, and proximity to a cancer center, because our sample size of 12 hospices did not allow these analyses.

Second, we were not able to include data about referring providers. For instance, we cannot determine whether a given patient was referred from a comprehensive cancer center or an academic medical center. These and other factors might influence the timing of hospice referral. However, our study design, with its large hospice-based sample, should minimize this concern by including patients across multiple care settings and multiple referring providers. In addition, the patients described here had a wide range of diagnoses and were referred from a wide range of settings.

As efforts to improve palliative and end-of-life care for patients with cancer continue, it will be essential to find ways to optimize transitions to hospice. One measure of the success of these efforts is the timing of referral, but this measure does not include those patients who are never referred to hospice. Nor does it reflect those patients who are referred but who refuse. Thus, a more comprehensive set of measures is needed to assess overall hospice utilization. Finally, process measures that assess the timing and quality of goals of care discussion are also needed. Trustworthy quality measures tied to data and adequate case-mix adjustment strategies will be increasingly important for oncologic practice improvement initiatives.

AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

The author(s) indicated no potential conflicts of interest.

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REFERENCES

1. National Hospice and Palliative Care Organization: NHPCO's facts and figures: Hospice care in America. http://www.nhpco.org/sites/default/files/public/Statistics_Research/2013_Facts_Figures.pdf
2. National Hospice and Palliative Care Organization: NHPCO FY2012 national summary of hospice care. http://www.nhpco.org/sites/default/files/public/NDS_2012_National_Summary_20131106.pdf
3. Bergman J, Saigal CS, Lorenz KA, et al: Hospice use and high-intensity care in men dying of prostate cancer. *Arch Intern Med* 171:204-210, 2011
4. Wright AA, Keating NL, Balboni TA, et al: Place of death: Correlations with quality of life of patients with cancer and predictors of bereaved caregivers' mental health. *J Clin Oncol* 28:4457-4464, 2010
5. Schockett ER, Teno JM, Miller SC, et al: Late referral to hospice and bereaved family member perception of quality of end-of-life care. *J Pain Symptom Manage* 30:400-407, 2005
6. Taylor DH Jr, Ostermann J, Van Houtven CH, et al: What length of hospice use maximizes reduction in medical expenditures near death in the US Medicare program? *Soc Sci Med* 65:1466-1478, 2007
7. Earle CC, Landrum MB, Souza JM, et al: Aggressiveness of cancer care near the end of life: Is it a quality-of-care issue? *J Clin Oncol* 26:3860-3866, 2008
8. Earle CC, Neville BA, Landrum MB, et al: Evaluating claims-based indicators of the intensity of end-of-life cancer care. *Int J Qual Health Care* 17: 505-509, 2005
9. National Quality Forum: Endorsement summary: Cancer measures—October 2012. http://www.qualityforum.org/Projects/Cancer_Endorsement_Maintenance_2011.aspx
10. The Quality Oncology Practice Initiative: Measures summary, Spring 2014. <http://qopi.asco.org/documents/QOPI-Spring-2014-Measures-Summary.pdf>
11. Moy B, Polite BN, Halpern MT, et al: American Society of Clinical Oncology policy statement: Opportunities in the Patient Protection and Affordable Care Act to reduce cancer care disparities. *J Clin Oncol* 29:3816-3824, 2011
12. Federman AD, Keyhani S: Physicians' participation in the Physicians' Quality Reporting Initiative and their perceptions of its impact on quality of care. *Health Policy* 102:229-234, 2011
13. Barnato AE, Herndon MB, Anthony DL, et al: Are regional variations in end-of-life care intensity explained by patient preferences? A study of the US Medicare population. *Med Care* 45:386-393, 2007
14. Casarett DJ, Harrold J, Oldanie B, et al: Advancing the science of hospice care: Coalition of Hospices Organized to Investigate Comparative Effectiveness. *Curr Opin Support Palliat Care* 6:459-464, 2012
15. Katz M: Multivariable analysis: A practical guide for clinicians. Cambridge, United Kingdom, Cambridge University Press, 2006
16. Rickerson E, Harrold J, Kapo J, et al: Timing of hospice referral and families' perceptions of services: Are earlier hospice referrals better? *J Am Geriatr Soc* 53:819-823, 2005
17. Finlay E, Shreve S, Casarett D: Nationwide Veterans Affairs quality measure for cancer: The family assessment of treatment at end of life. *J Clin Oncol* 26:3838-3844, 2008
18. Saito AM, Landrum MB, Neville BA, et al: Hospice care and survival among elderly patients with lung cancer. *J Palliat Med* 14:929-939, 2011
19. Guadagnolo BA, Liao KP, Elting L, et al: Use of radiation therapy in the last 30 days of life among a large population-based cohort of elderly patients in the united states. *J Clin Oncol* 31:80-87, 2013
20. Mack JW, Chen K, Boscoe FP, et al: Underuse of hospice care by Medicaid-insured patients with stage IV lung cancer in New York and California. *J Clin Oncol* 31:2569-2579, 2013
21. Howell DA, Shellens R, Roman E, et al: Haematological malignancy: Are patients appropriately referred for specialist palliative and hospice care?—A systematic review and meta-analysis of published data. *Palliat Med* 25:630-641, 2011
22. Fadul N, Elsayem A, Palmer JL, et al: Predictors of access to palliative care services among patients who died at a Comprehensive Cancer Center. *J Palliat Med* 10:1146-1152, 2007
23. Iwashyna TJ, Zhang JX, Christakis NA: Disease-specific patterns of hospice and related healthcare use in an incidence cohort of seriously ill elderly patients. *J Palliat Med* 5:531-538, 2002
24. Baudrier F, Capdupuy C, Renoux M: Characteristics of deaths in a department of oncohaematology within a general hospital: A study of 81 cases. *Support Care Cancer* 8:302-306, 2000
25. Stalfelt AM, Brodin H, Pettersson S, et al: The final phase in acute myeloid leukaemia (AML): A study on bleeding, infection and pain. *Leuk Res* 27:481-488, 2003
26. Auret K, Bulsara C, Joske D: Australasian haematologist referral patterns to palliative care: Lack of consensus on when and why. *Intern Med J* 33:566-571, 2003
27. McGrath P, Holewa H: Special considerations for haematology patients in relation to end-of-life care: Australian findings. *Eur J Cancer Care (Engl)* 16:164-171, 2007
28. Haas JS, Earle CC, Orav JE, et al: Lower use of hospice by cancer patients who live in minority versus white areas. *J Gen Intern Med* 22:396-399, 2007
29. Goodman DC, Fisher ES, Wennberg JE, et al: The Dartmouth Atlas of health care. www.dartmouthaltas.org
30. Keating NL, Herrinton LJ, Zaslavsky AM, et al: Variations in hospice use among cancer patients. *J Natl Cancer Inst* 98:1053-1059, 2006
31. Vig EK, Starks H, Taylor JS, et al: Why don't patients enroll in hospice? Can we do anything about it? *J Gen Intern Med* 25:1009-1019, 2010
32. Olver IN: Evolving definitions of hope in oncology. *Curr Opin Support Palliat Care* 6:236-241, 2012
33. Gaertner J, Weingartner V, Wolf J, et al: Early palliative care for patients with advanced cancer: How to make it work? *Curr Opin Oncol* 25:342-352, 2013