Comparison of Prospective and Retrospective Indicators of the Quality of End-of-Life Cancer Care

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ABSTRACT

Purpose

To compare prospectively and retrospectively defined benchmarks for the quality of end-of-life care, including a novel indicator for the use of opiate analgesia.

Methods

Linked claims and cancer registry data from 1994 to 2003 for New Jersey and Pennsylvania were used to examine prospective and retrospective benchmarks for seniors with breast, colorectal, lung, or prostate cancer who participated in state pharmaceutical benefit programs.

Results

Use of opiates, particularly long-acting opiates, was low in both the prospective and retrospective cohorts (9.1% and 10.1%, respectively), which supported the underuse of palliative care at the end-of-life. Although hospice was used more commonly in the retrospective versus prospective cohort, admission to hospice within 3 days of death was similar in both cohorts (28.8% v 26.4%), as was the rate of death in an acute care hospital. Retrospective and prospective measures identified similar physician and hospital patterns of end-of-life care. In multivariate models, a visit with an oncologist was positively associated with the use of chemotherapy, opiates, and hospice. Patients who were cared for by oncologists in small group practices were more likely to receive chemotherapy (retrospective only) and less likely to receive hospice (both) than those in large groups. Compared with patients who were cared for in teaching hospitals, those in other hospitals were more likely to receive chemotherapy (both) and to have toxicity (prospective) but were less likely to receive opiates (both) and hospice (retrospective).

Conclusion

Retrospective and prospective measures, including a new measure of the use of opiate analgesia, identify some similar physician and hospital patterns of end-of-life care.

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INTRODUCTION

Although cancer causes more than one half million deaths each year in the United States,¹ initiatives to study the quality of cancer care have focused largely on initial treatment.²⁻⁵ Prior work suggests important deficiencies in the quality of end-of-life care.⁶⁻⁸ The treatment of pain has been highlighted as an area in particular need of improvement.⁹⁻¹³

Although quality of care initiatives have focused on prospective measurement, as this approach is directly amenable to intervention, two approaches have been used to examine the quality of end-of-life care, each with strengths and limitations:¹⁴⁻¹⁶ identification of patients who have died and the retrospective examination of care before death;^{6,17,18} and identification of patients who have a poor prognosis and a prospective examination of their care.^{19,20} A retrospective approach is efficient

and allows the examination of care at the end of life, but it may lead to biased conclusions, as some patients who are expected to die may recover.¹⁶ Prospective evaluation, however, is limited by the inability of physicians to adequately assess prognosis.¹⁹ Although the adequate treatment of pain is a cornerstone of end-of-life care,¹² prior claims-based analyses have focused on the utilization of hospital-based services and hospice care^{6,17,18} and have not included measures of opiate use that require claims for prescription drugs. As these claims become more available, it is important to develop measures for the use of opiates.

The purpose of this analysis was to evaluate novel claims-based measures of the use of opiate analgesia as a potential indicator of the quality of end-of-life care for seniors with cancer by making it operable in claims, by comparing its performance with previously validated measures of the quality of

end-of-life care in both retrospectively and prospectively defined cohorts, and by relating patterns of variation to physician and hospital characteristics. Our hypotheses are that opiate benchmarks provide valuable new information about the quality of end-of-life care and that retrospective and prospective measures identify similar factors associated with the quality of care at the end of life, which would thus support the use of retrospective measures for quality improvement interventions.

METHODS

Data Sources

Linked Medicare claims (Part A, hospital and nursing home; Part B, outpatient and procedures and patient enrollment data), pharmaceutical claims, and cancer registry data for January 1, 1994 to May 31, 2003, were used for New Jersey (NJ) and Pennsylvania (PA). Medicare claims were linked with pharmaceutical claims from the NJ Pharmaceutical Assistance for the Aged and Disabled (PAAD) Program and the PA Pharmaceutical Assistance Contract for the Elderly (PACE) Program, respectively.^{21,22} PACE is the largest state prescription benefits program for the indigent and near-poor elderly. PACE has no deductibles or maximum annual benefit and charges a modest copayment (\$6 generic; \$9 brand name). The 2007 income eligibility ceiling was \$17,700 for a married couple. The PAAD program has no deductible and has a copayment of \$5. The 2007 income ceiling for eligibility was \$27,676 for a married couple. Claims were additionally linked to state cancer registry data to provide data on cancer characteristics, treatment, and vital status.²² The Brigham and Women's Hospital institutional review board reviewed and approved this study.

Definition of Cohorts

Both the retrospective and the prospective cohorts include individuals aged 65 years and older who had breast, colorectal, lung, or prostate cancer. The retrospective cohort included those who died during the study period. We included individuals who had at least one Medicare claim and who filled at least one prescription within 14 months before death to ensure continuous eligibility. The date of death was considered the index date for the retrospective cohort analyses. The cause of death was only available for patients from NJ (1994 to 2002). These individuals were examined as a subgroup, as prior benchmarks for end-of-life care have focused specifically on cancer-related deaths.^{6,8} The prospective cohort included individuals who had at least 14 months of claims data after their cancer diagnosis date (or until death, if death occurred during this period). The date of cancer diagnosis was considered the index date for the prospective cohort. Patients in the prospective cohort were additionally classified on the basis of their predicted probability of death ($\geq 40\%$, $\geq 60\%$, and $\geq 80\%$ probability of death within 14 months) by using logistic regression models that included baseline characteristics, including age, sex, ethnicity, primary cancer site, comorbidity, histology type, and cancer stage (variables defined below). The c-statistics for these models ranged from 0.78 to 0.83.

Independent Variables

Patient characteristics. Sociodemographic data (ie, age, sex, ethnicity) were drawn from Medicare enrollment files. We used the 2000 median household income for each individual's zip code as a proxy for socioeconomic status.²³ Comorbidity was measured by using the Charlson algorithm.²⁴ We defined stage (ie, in situ, localized, regional, distant, unknown) from cancer registry data. In addition, Medicare claims were used to define distant spread of cancer (International Classification of Diseases, 9th revision, [ICD9] diagnosis codes 197.xx to 198.xx) within 2 weeks of diagnosis. Cancer type was defined by Surveillance, Epidemiology, and End Results histology codes (eg, adenocarcinoma). Both cancer diagnosis date and death date were defined from cancer registry data. The cause of death, extracted from death certificates, was available for patients from NJ.

Physician and Hospital Characteristics

For patients from PA, Unique Provider Identification Numbers (UPINs) for each treating physician were linked with the 2003 American Medical Association Masterfile to obtain specialty data. UPINs were not available for patients from NJ. In the prospective cohort, physicians were defined as the first surgeon, primary care physician, medical oncologist, and radiation oncologist after the date of diagnosis. In the retrospective cohort, these were defined as the last physician seen before death. Oncologists were additionally categorized by type of practice (defined as solo or two-physician practice; group practice; hospital-based; medical school–based; and other, which included government, health maintenance organization, and no classification) and by the number of years since medical school graduation. Of the UPINs represented in the outpatient claims, 85% of both cohorts matched the Masterfile. We examined data from 1994 to 2003; however, some of the physicians who were practicing in prior years may have retired or moved by 2003.

For each patient, we identified a treating hospital from Medicare Part A. The treating hospital was defined as the first acute care hospital visited after the date of diagnosis, for the prospective cohort, or the last hospital visited before death, for the retrospective cohort. Hospital characteristics were defined from the 2003 American Hospital Association file and included teaching status (defined as membership in the Council of Teaching Hospitals),²⁵ number of beds, ownership (for profit, nonprofit), and whether the hospital had a surgical cancer program or provided chemotherapy. We also determined whether the hospital was a National Cancer Institute (NCI)–designated cancer facility.²⁶

Cancer End-of-Life Quality Benchmark Measures

New measures were defined for the use of opiate analgesia, which included the proportion of patients who received an outpatient prescription for a long-acting opiate; a short-acting or a long-acting opiate; or both a short-acting and a long-acting opiate. We defined benchmark measures for the quality of end-of-life cancer care previously developed by Earle et al⁷ that were constructed to identify overly aggressive care at the end of life, and that included the proportion of patients who received chemotherapy within 14 days of death; started a new chemotherapy regimen within 30 days of death; had greater than one emergency department (ED) visit; had greater than one hospitalization; had at least one admission to the intensive care unit (ICU); were not admitted to hospice; were admitted to hospice within 3 days of death; and died in an acute care setting.^{6,8,15} In addition to these measures, we also refined the measure of chemotherapy overuse by examining the proportion of patients who had an ED visit or hospitalization for chemotherapy toxicity.

Use of chemotherapy was defined by using the Healthcare Common Procedure Coding System, Current Procedural Terminology codes, ICD9 diagnosis and procedure codes, and Diagnosis-Related Groups used by Earle et al.⁸ In the retrospective cohort, a new chemotherapy regimen was defined by Medicare J-codes.⁸ Prescriptions for the opiate analgesics were based on National Drug Codes for both generic and brand opiates and were identified through the PACE/PAAD claims. We defined chemotherapy toxicity by using previously validated algorithms.²⁷

In the prospective cohort, benchmark measures were calculated for the 14 months after the date of cancer diagnosis, except for the benchmarks for chemotherapy toxicity and admission to hospice within 3 days of death. Chemotherapy toxicity was calculated for events that occurred between the receipt of the first chemotherapy and the last chemotherapy plus 90 days. In the retrospective cohort, benchmark measures were calculated during the 30 days before death, except for the benchmarks for chemotherapy toxicity and admission to hospice within 3 days of death.⁶⁻⁸ The chemotherapy toxicity benchmark was calculated from receipt of last chemotherapy plus 90 days and was truncated at date of death.

Data Analysis

We calculated the distribution (frequencies or means) of patient, physician, and hospital characteristics as well as each of the benchmark measures for each cohort. We examined the correlation coefficients between the benchmarks for both cohorts. To compare the performance of the benchmarks between prospective cohorts and retrospective cohorts, we estimated the effect of physician and hospital characteristics on a subset of clinically important benchmarks: any opiate use (long or short-acting), lack of hospice, use of

chemotherapy, and chemotherapy toxicity. For each benchmark, we developed three sets of multivariate logistic regression models: patient-level characteristics (patient model); patient and physicians' characteristics (physician model); and patient and hospital characteristics (hospital model). Although some of these associations are expected (eg, the association of seeing an oncologist and receiving chemotherapy), we included visits with all relevant providers, because omission of these variables could lead to biased estimates for other covariates. Each of these models also adjusted for year of diagnosis. Because the data on physician characteristics was available only for PA, and because the data on cause of death was available only for NJ, we could not build a single model with all three components. Generalized estimating equations were used to adjust for the clustering of patients within physicians and hospitals.²⁸ Odds ratios with 95% CIs for each physician and hospital characteristic were summarized and compared among different cohorts. SAS for Windows software (release 9.2; SAS Institute, Cary, NC) was used for all statistical analyses.

RESULTS

We identified a total of 33,675 patients for the prospective cohort and 32,810 patients for the retrospective cohort (Table 1). Compared with

the retrospective cohort, individuals in the prospective cohort were younger, were less likely to be male, and had less comorbidity. In both cohorts, colorectal cancer was the most common cancer, and prostate cancer was the least common. The median number of days between diagnosis and death was 539 days for the prospective cohort and 1,053 days for the retrospective cohort. Within the prospective cohort, individuals with a higher predicted probability of death were older, were more likely to be male, were more likely to have lung cancer, and were more likely to have later stage disease than individuals with a lower probability of death. The median number of days from diagnosis to death decreased from 539 days for the full cohort to 73 days for the subgroup, with a predicted probability of death of greater than 80%.

Among patients from PA, almost all patients saw a primary care physician, whereas only 46% to 62% were seen by a medical oncologist (Table 2). In the prospective cohort, the proportion of patients seen by a surgeon declined as the probability of death increased, whereas the proportion of patients who were seeing an oncologist increased. The characteristics of the oncologists were similar in both cohorts. Among

Table 1. Baseline Characteristics of Patients From the Combined Pennsylvania and New Jersey Cancer Registries

Characteristic	Cohort						
	Prospective				Retrospective		
	Full Cohort	P(Death) > 40%	P(Death) > 60%	P(Death) > 80%	Full Cohort	NJ Cancer Deaths*	NJ Non-Cancer Deaths*
No. of patients	33,675	9,065	6,097	3,252	32,810	4,945	3,753
% per age group, years							
65-69	10.8	8.3	8.0	6.6	6.0	10.0	3.4
70-74	21.2	17.0	16.4	15.4	13.2	16.9	8.8
75-79	26.6	25.7	26.1	25.6	21.3	25.1	16.9
80-84	22.4	23.5	24.3	24.6	24.2	22.7	24.2
≥ 85	19.0	25.5	25.3	27.8	35.3	25.4	46.7
Sex, % male	34.0	35.6	37.2	38.6	38.2	38.7	42.3
Ethnicity, % white	88.4	89.8	89.7	90.1	89.5	82.7	85.3
% median income group of the zip code of residence, \$							
< 25,000	5.6	6.8	6.6	6.5	6.0	4.7	3.9
25,000-49,999	59.5	65.7	67.2	68.4	63.4	43.1	42.8
50,000-74,999	27.1	21.9	20.9	19.7	24.2	40.1	40.7
≥ 75,000	6.5	4.3	4.0	4.3	5.3	10.6	11.4
Unknown	1.2	1.3	1.3	1.2	1.2	1.6	1.3
Primary cancer site, %							
Breast	29.5	4.3	3.4	2.0	25.1	18.2	29.8
Colon	30.7	22.6	17.2	12.8	29.9	27.3	32.4
Lung	22.4	70.9	77.8	84.0	26.3	41.1	10.3
Prostate	17.5	2.2	1.7	1.2	18.7	13.4	27.4
Median Charlson comorbidity score	3.46	5.50	5.88	6.75	7.35	8.08	6.81
Death by cancer class, %†							
Breast	9.7	3.5	2.7	1.8	9.6	7.2	15.1
Colon	29.5	20.1	16.1	12.1	28.4	25.5	39.9
Lung	55.1	74.6	79.7	85.0	55.3	63.6	28.2
Prostate	5.7	1.8	1.5	1.1	6.4	3.7	11.3
Death by cancer stage at diagnosis, %†							
Localized	20.6	8.8	3.3	0.6	19.1	11.8	35.3
Regional	25.3	20.7	15.1	5.3	25.6	25.6	28.3
Distant	41.3	57.4	70.3	88.9	42.4	50.3	16.8
Unknown	11.3	12.9	11.4	5.2	11.6	11.8	15.8
Median days to death†	539	158	110	73	1,053	970	1,687

Abbreviations: P(death), probability of death; NJ, New Jersey.

*Full cohort also include 5,867 patients who had missing causes of death. The cause of death in New Jersey was only available through 2002.

†For the prospective cohort, this calculation is based on only those patients who died within 14 months of diagnosis.

Table 2. Characteristics of Physicians and Medical Oncologists From Pennsylvania

Characteristic	Cohort				
	Prospective				Retrospective (PA Cohort)
	Full Cohort	P(Death) > 40%	P(Death) > 60%	P(Death) > 80%	
Physicians					
No. of patients	14,802	5,044	3,469	1,908	17,947
Type of physician for patient visits, %					
Surgeon	81.3	62.1	57.8	54.1	71.4
Medical oncologist	47.6	56.2	58.2	61.8	46.2
Radiation oncologist	32.7	37.8	38.9	39.5	27.4
PCP	97.5	97.8	97.8	98.0	98.5
PCP only	7.6	13.8	14.7	14.6	15.2
PCP and medical oncologist	46.8	55.3	57.2	60.9	45.7
Medical oncologists					
Median time since medical school, years	22.0	21.9	21.8	21.7	22.6
Type of practice, %					
Solo or two-physician	22.7	23.3	23.1	21.9	23.3
Group	50.3	51.0	50.7	51.9	51.1
Hospital-based	7.6	6.4	6.1	5.7	5.8
Medical school-based	3.4	3.5	3.5	3.9	3.6
Other	16.0	15.9	16.6	16.7	16.3

NOTE: Visits were captured during a period of 14 months prospectively or 14 months retrospectively, depending on the cohort. Physicians were defined as the first specialist visited for the prospective cohort and the last one visited for the retrospective cohort.

Abbreviations: P(death), probability of death; PA, Pennsylvania; PCP, primary care physician.

patients who had at least one hospitalization, approximately 40% of both cohorts received care at an NCI-designated cancer facility (69 of 207 hospitals), and approximately 20% were hospitalized at a teaching hospital. Greater than 98% of all hospitalizations occurred

at a nonprofit facility. Hospital characteristics did not vary between the cohorts.

Table 3 lists the proportion of patients who received the end-of-life benchmarks in the prospective and retrospective cohorts. In both

Table 3. Measures of Opioid Use and Other Benchmarks

Measure	Cohort					
	Prospective				Retrospective	
	Full Cohort	P(Death) > 40%	P(Death) > 60%	P(Death) > 80%	Full Cohort	NJ Cancer Deaths*
No. of patients	33,675	9,065	6,097	3,252	32,810	4,284
Opiate prescription received, %						
Long-acting	9.1	15.9	17.0	16.1	10.1	14.7
Short-acting	42.3	44.1	43.0	40.5	20.5	26.9
Short- or long-acting	44.1	47.0	46.4	44.0	24.6	31.7
Short- and long-acting	7.2	12.9	13.6	12.6	6.1	10.0
Chemotherapy regimen received, %	24.8	26.1	26.5	25.1	6.5	11.4
New chemotherapy regimen started within 30 d of death, %					0.8	1.6
> 1 emergency department visit, %	24.6	30.8	29.2	27.6	10.2	8.3
> 1 acute care hospital admission, %	30.1	36.0	33.9	31.1	13.5	10.9
Admission to ICU, %	14.6	16.6	14.2	12.0	12.2	8.5
No admission to hospice, %	88.75	68.5	64.8	61.2	65.8	87.0
Admission to hospice ≤ 3 days prior to death, %	26.4	26.1	26.2	27.9	28.8	35.9
Death in an acute care hospital, %	31.3	28.9	28.7	28.4	30.1	22.5
Chemotherapy toxicity, %	33.8	54.9	57.4	58.9	46.1	47.5

NOTE: In the prospective cohort, all benchmarks were measured in the 14 months after the diagnosis date, except for chemotherapy toxicity and admission to hospice within 3 days of death. Chemotherapy toxicity was calculated between the receipt of the first chemotherapy and the last chemotherapy plus 90 days (ie, the denominator for this measure included only those patients who had chemotherapy within 14 months of diagnosis). In the retrospective cohort, all benchmark measures were calculated during the 30 days before death, except for chemotherapy toxicity and admission to hospice within 3 days of death. The toxicity benchmark was calculated from receipt of last chemotherapy regimen plus 90 days and was truncated at the date of death.

Abbreviations: P(death), probability of death; NJ, New Jersey; ICU, intensive care unit.

*New Jersey cancer deaths exclude prostate cancer.

Quality of End-of-Life Cancer Care

Table 4. Association of Physician and Hospital Characteristics With Measures of Opioid Use and Selected Benchmarks

Covariate by Group	Cohort							
	Prospective				Retrospective			
	P(Death) ≥ 40%		P(Death) ≥ 60%		Full Cohort		NJ Cancer Deaths	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Use of opiates*								
Patient								
Visit with surgeon	1.59	1.40 to 1.81	1.57	1.35 to 1.82	1.22	1.11 to 1.34		
Visit with medical oncologist	1.50	1.32 to 1.70	1.43	1.23 to 1.67	1.31	1.19 to 1.44		
Visit with radiation oncologist	1.61	1.42 to 1.84	1.76	1.51 to 2.05	1.3	1.19 to 1.45		
Visit with primary care physician	1.18	0.80 to 1.76	1.10	0.69 to 1.75	1.23	0.90 to 1.70		
Physician								
Oncologist practice								
Small v group	0.98	0.81 to 1.19	0.89	0.71 to 1.12	0.93	0.78 to 1.10		
Hospital-based v group	1.18	0.84 to 1.67	0.95	0.64 to 1.40	0.73	0.56 to 0.94		
Medical school v group	1.28	0.71 to 2.33	1.23	0.59 to 2.53	1.14	0.85 to 1.54		
Other v group	1.04	0.83 to 1.30	1.00	0.78 to 1.29	1.03	0.87 to 1.22		
Hospital								
Not an NCI-designated cancer facility	1.13	1.00 to 1.26	1.04	0.89 to 1.22	1.05	0.90 to 1.23	1.01	0.79 to 1.28
For-profit v nonprofit hospital	1.75	1.75 (1.16 to 2.64)	1.97	0.91 to 4.28	1.22	0.86 to 1.72	2.28	1.16 to 4.48
Lack of hospice								
Patient								
Visit with surgeon	1.40	1.20 to 1.64	1.31	1.09 to 1.57	1.34	1.22 to 1.47		
Visit with medical oncologist	0.87	0.74 to 1.02	0.81	0.67 to 0.98	0.61	0.55 to 0.66		
Visit with radiation oncologist	0.94	0.80 to 1.11	0.98	0.82 to 1.19	0.69	0.63 to 0.77		
Visit with primary care physician	1.12	0.69 to 1.80	1.15	0.65 to 2.05	1.49	1.11 to 1.99		
Physician								
Oncologist practice								
Small v group	1.34	1.00 to 1.79	1.33	0.97 to 1.84	1.22	1.00 to 1.48		
Hospital-based v group	0.99	0.60 to 1.63	1.11	0.67 to 1.84	1.03	0.80 to 1.34		
Medical school v group	1.01	0.61 to 1.65	1.19	0.71 to 1.99	1.46	1.04 to 2.05		
Other v group	1.18	0.85 to 1.64	1.19	0.82 to 1.73	1.01	0.80 to 1.27		
Hospital								
Not an NCI-designated cancer facility	1.11	0.95 to 1.31	1.11	0.93 to 1.34	1.07	0.93 to 1.23	0.97	0.78 to 1.20
Not COTH	0.96	0.77 to 1.19	1.21	0.92 to 1.58	1.25	1.03 to 1.52	1.54	1.21 to 1.97
No chemotherapy services	1.26	0.94 to 1.69	1.38	0.98 to 1.93	1.14	0.91 to 1.42	1.45	1.02 to 2.04
Receipt of chemotherapy								
Patient								
Visit with surgeon	2.00	1.69 to 2.37	2.04	1.68 to 2.47	1.42	1.19 to 1.69		
Visit with medical oncologist	7.38	5.98 to 9.11	7.71	5.97 to 9.95	4.25	3.60 to 5.02		
Visit with radiation oncologist	1.62	1.37 to 1.91	1.46	1.20 to 1.77	1.02	0.88 to 1.18		
Visit with primary care physician	2.09	1.05 to 4.16	1.16	0.58 to 2.32	1.37	0.69 to 2.75		
Physician								
Oncologist practice								
Small v group	1.30	1.02 to 1.65	1.29	0.97 to 1.72	0.92	0.72 to 1.18		
Hospital-based v group	0.83	0.58 to 1.20	0.91	0.62 to 1.35	0.63	0.43 to 0.92		
Medical school v group	0.76	0.44 to 1.33	0.83	0.46 to 1.51	0.56	0.37 to 0.83		
Other v group	1.35	1.05 to 1.72	1.30	0.97 to 1.73	1.10	0.84 to 1.43		
Hospital								
Not an NCI-designated cancer facility	1.02	0.85 to 1.24	1.03	0.82 to 1.30	1.06	0.87 to 1.29	0.99	0.70 to 1.38
Not COTH	1.39	1.05 to 1.83	1.41	1.04 to 1.90	1.54	1.20 to 1.99	1.38	0.90 to 2.12
No. of hospital beds								
101-149 v < 100	1.02	0.82 to 1.27	1.06	0.80 to 1.41	1.06	0.80 to 1.41	1.31	0.80 to 2.16
150-249 v < 100	0.97	0.75 to 1.28	1.00	0.72 to 1.39	1.27	0.97 to 1.67	1.88	1.17 to 3.02
≥ 250 v < 100	1.08	0.81 to 1.45	1.11	0.79 to 1.56	1.27	0.96 to 1.67	1.50	0.89 to 2.53
No surgical cancer program	0.79	0.65 to 0.95	0.72	0.57 to 0.91	0.90	0.73 to 1.11	0.87	0.63 to 1.20
No chemotherapy services	1.15	0.89 to 1.48	1.14	0.85 to 1.55	0.98	0.78 to 1.24	0.60	0.38 to 0.97

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Table 4. Association of Physician and Hospital Characteristics With Measures of Opioid Use and Selected Benchmarks (continued)

Covariate by Group	Cohort							
	Prospective				Retrospective			
	P(Death) $\geq$ 40%		P(Death) $\geq$ 60%		Full Cohort		NJ Cancer Deaths	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Chemotherapy toxicity								
Patient								
Visit with surgeon	1.50	1.12 to 2.01	1.55	1.11 to 2.16	1.38	1.16 to 1.64		
Visit with medical oncologist	1.58	1.05 to 2.36	1.66	1.00 to 2.75	1.02	0.86 to 1.22		
Visit with radiation oncologist	1.01	0.79 to 1.30	0.97	0.72 to 1.31	0.90	0.79 to 1.03		
Visit with primary care physician	3.03	0.63 to 14.49	2.48	0.50 to 12.25	2.36	1.13 to 4.91		
Physician								
Oncologist practice								
Small v group	1.32	0.91 to 1.90	1.44	0.93 to 2.22	1.18	0.98 to 1.43		
Hospital-based v group	0.88	0.49 to 1.57	1.16	0.54 to 2.49	1.02	0.78 to 1.32		
Medical school v group	2.92	1.34 to 6.38	2.24	1.10 to 4.57	1.23	0.79 to 1.90		
Other v group	0.99	0.69 to 1.42	1.00	0.65 to 1.52	1.03	0.86 to 1.24		
Hospital								
Not an NCI-designated cancer facility	1.01	0.83 to 1.24	1.11	0.85 to 1.43	0.95	0.80 to 1.13	0.97	0.73 to 1.29
Not COTH	1.23	0.96 to 1.57	1.10	0.77 to 1.58	1.01	0.82 to 1.26	1.31	0.87 to 1.97
No chemotherapy services	0.98	0.77 to 1.25	1.18	0.86 to 1.62	1.21	0.97 to 1.51	1.59	1.05 to 2.41

NOTE. Variables included in patient model were age, sex, ethnicity, income, primary site of cancer, Charlson score, cancer stage, year of diagnosis, visit with surgeon, visit with medical oncologist, visit with radiation oncologist, and visit with primary care physician. Variables included in physician model were age, sex, ethnicity, income, primary site of cancer, Charlson score, cancer stage, year of diagnosis, sex of oncologist, years since medical school, international medical graduate, small practice, hospital-based practice, and practice at medical school. Variables included in hospital model were age, sex, ethnicity, income, primary site of cancer, Charlson score, cancer stage, year of diagnosis, non-National Cancer Institute facility, nonteaching hospital, number of hospital beds, for-profit hospital, chemotherapy services, and hospice or palliative care.

Abbreviations: P(death), probability of death; OR, odds ratio; NJ, New Jersey; NCI, National Cancer Institute; COTH, Council of Teaching Hospitals.

*Opiate use included long- and short-acting opiates.

cohorts, use of long-acting opiates alone or in combination was low (< 20%). In the prospective cohort, use of long-acting opiates and hospice was greater among those with a higher probability of death. The majority of patients in both cohorts were never admitted to hospice. In the prospective cohort, approximately one quarter of these patients received chemotherapy or had greater than one ED visit, and one third had greater than one hospitalization. These rates were lower in the retrospective cohort. In the prospective cohort, the probability of chemotherapy toxicity was higher among those with a higher probability of death. There were temporal increases in the use of chemotherapy, ED, hospital, hospice, and opiates and in chemotherapy toxicity from 1994 to 2003 ($P < .001$ for each). The correlations between the benchmark measures were generally low, which suggested that each measure represented a fairly distinct dimension of end-of-life care. The highest correlations were seen between the measures of ED, hospital, and ICU use (0.40 to 0.50). In both the retrospective and prospective cohorts, the opiate measures had low correlations with the other benchmarks (< 0.15). The chemotherapy toxicity measure was moderately correlated with the hospitalization and ICU benchmarks in the prospective cohort (0.39 and 0.50, respectively), but they had lower correlations in the retrospective cohort (0.13 and 0.17, respectively).

Table 4 lists the association of physician and hospital characteristics on selected benchmarks for the different cohorts after adjustment for patient characteristics. Although the magnitude of the effects of physician and hospital characteristics on the receipt of the benchmark measures varied among cohorts, we found several similar patterns of association. Care from a medical oncologist was positively

associated with the receipt of chemotherapy (both cohorts), opiates (both cohorts), chemotherapy toxicity (prospective cohort only), and use of hospice (both cohorts). The practice type of the treating oncologist also was associated with several of the benchmarks. For example, patients who were cared for by oncologists in small, solo practices were more likely to receive chemotherapy (retrospective cohort) and to lack hospice (both cohorts) than patients who received care in a group practice. Patients of hospital-based oncologists were less likely to receive chemotherapy (retrospective cohort) or opiates (retrospective cohort) than those who were cared for in a group practice. Patients who received care in a nonteaching hospital were less likely to receive opiates (both cohorts) and hospice (retrospective cohort) and were more likely to receive chemotherapy (both cohorts) and to have toxicity (prospective cohort) compared with those who were cared for in a teaching hospital.

DISCUSSION

This work advances our understanding of the use of administrative data to assess the quality of end-of-life care for patients with cancer. The new measure of opiate use as a potential indicator of the quality of end-of-life care provides information that is distinct from existing benchmarks. In contrast to prior benchmarks that have focused primarily on overuse of aggressive disease-modifying therapy, this benchmark measures underuse of palliative care. With the advent of Medicare Part D, outpatient pharmacy claims are more available. In addition, our work demonstrates that retrospective and prospective

approaches identify some similar physician and hospital patterns in end-of-life care. This provides support of the use of retrospective measures for the assessment of the quality of end-of-life care. As the measurement of the quality of care is an explicit goal of many health care organizations, and as reimbursement is increasingly linked to performance, these findings can be used to inform efforts to measure the quality of end-of-life care.

Although we do not know what the appropriate rate of opiate use should be in this population, prior work suggests that 25% to 70% of patients suffer from significant pain at the end of life,¹⁰⁻¹³ which suggests that opiates likely are underused. The adequate treatment of pain is one of the primary concerns in end-of-life care.¹² Opiates are considered essential medicines for palliative care by the WHO.²⁹ The Joint Commission on Accreditation of Healthcare Organizations requires screening and treatment for pain. Consistent with prior reports on the quality of end-of-life care, the use of opiates was low.³⁰ These findings suggest that the use of opiates at the end of life can be improved.¹⁰⁻¹³ Our measure of chemotherapy toxicity may be a more refined measure of over-zealous chemotherapy use near the end-of-life. In the prospective cohort, the prevalence of this indicator increased with the predicted probability of death, whereas the overall prevalence of chemotherapy use was fairly constant.

Measures of end-of-life care can be divided into those that assess overuse of aggressive care (ie, chemotherapy, acute care hospitalization) and those that measure underuse of palliative services (ie, hospice, opiates).⁷ Although indicators for end-of-life care on the basis of aggressive disease-modifying cancer care are conceptually appropriate benchmarks for a retrospective cohort, they are more problematic for a prospective cohort, because many patients with a new diagnosis of cancer receive a trial of chemotherapy no matter how somber their prognosis.⁷ Measures focused on underuse, however, are conceptually relevant for both prospective and retrospective approaches. For selected benchmark measures, retrospective and prospective approaches identified similar physician and hospital patterns of end-of-life care. This provides support for the use of retrospective measures for the assessment of the quality of end-of-life care. Although we were able to look at broad categories of physician and hospital characteristics, future work should examine the performance of these measures for specific physicians and hospitals.

Our work has some limitations. Importantly, data about cause of death and a physician identifier were not available for both states. Most importantly, our data are limited to disadvantaged elders who participated in the pharmacy benefit programs of two states. Although approximately half of the states have had similar pharmacy assistance programs, the use of end-of-life care by this population may not be generalizable to others, particularly to younger or more advantaged groups. Although this work suggests that opiates are generally underused, they may be overused by specific individuals.

This analysis suggests that benchmarks for the underuse of palliative services, which includes opiates, may be more similar between prospective and retrospective approaches to assess the quality of end-of-life care than measures of overuse of aggressive disease-modifying therapy. Among measures of overuse, those that more specifically identify complications of aggressive treatment may be more generalizable than those that look at overall usage patterns. Measures of underuse of palliative services may also be more actionable, from the perspective of ongoing quality improvement. Although retrospective measures are not directly actionable for quality improvement, they may be useful to identify populations in need of quality improvement initiatives.

AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

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

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