

ORIGINAL RESEARCH

Characteristics Associated With Higher Cost Per Day or Longer Length of Stay in Hospitalized Patients Who Died During the Hospitalization or Were Discharged to Hospice

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BACKGROUND: Palliative care has been recommended as an approach to improve the quality of care for patients with advanced illness, while achieving hospital cost savings. However, studies are lacking that identify hospitalized patients who are more likely to have higher cost per day or length of stay (LOS) who may benefit from palliative care consultation.

OBJECTIVE: Identify characteristics associated with higher cost per day or longer LOS in hospitalized patients at the end of life—those likely to benefit from palliative care consultation.

DESIGN: Observational study.

SETTING: Academic medical center.

PATIENTS: Adult inpatients who died during the hospitalization or were discharged to hospice.

INTERVENTION: None.

MEASUREMENTS: We hypothesized that several patient characteristics would be associated with higher cost per

day and/or longer LOS. Using administrative data, we developed univariate and multivariate models to evaluate association between these patient characteristics and cost per day and LOS.

RESULTS: Patients cared for on the cardiothoracic surgery service had significantly higher cost per day (\$12,937; $P < 0.0001$) and LOS (7.0 days; $P = 0.001$). Neurosurgery patients also had higher cost per day (\$2255; $P = 0.03$), and surgical oncology patients had a longer length of stay (5.3 days; $P = 0.003$). Patients 65 years and older had a significantly lower cost per day (-\$811; $P = 0.02$) and LOS (-1.8 days; $P = 0.003$) for each decade increase in age.

CONCLUSIONS: Our data suggest that younger patients and those cared for by surgical specialty services may receive the most benefit from palliative care consultation, a finding that needs to be corroborated in other centers. *Journal of Hospital Medicine* 2011;6:338–343. © 2011 Society of Hospital Medicine

Patients with advanced illness frequently do not receive care that meets their physical and emotional needs at the end of life,¹ despite significant expenditures. Palliative care has been recommended as an approach to improve the quality of care for patients with advanced illness,^{2–6} while achieving hospital cost savings.⁷ Studies show that palliative care consults are associated with decreased hospitalization cost^{7–12} and length of stay^{13,14} in the acute care setting.

Identifying which hospitalized patients are likely to benefit most from palliative care has not been well defined. The Hamilton Chart Audit tool was developed to estimate the number of patients that would benefit from a palliative care consult, in order to determine hospital palliative care staffing and financial

needs.¹⁵ The CARING criteria identifies patients on admission to the hospital who are at high risk of death within one year and may, therefore, benefit from palliative care.¹⁶ The literature from the medical intensive care unit (MICU) identifies palliative care core competencies and quality measures, but does not describe patient factors that should trigger a palliative care consult.^{17–19} Norton et al. studied proactive palliative care consultation in the MICU, finding that palliative care consultation in the high-risk group (serious illness and high risk of dying) was associated with a shorter MICU length of stay without a significant difference in mortality rates.¹⁴

The most specific triggers for a palliative care consult comes from the surgical intensive care guidelines. The American College of Surgeons Surgical Palliative Care Task Force published a consensus guideline based on expert opinion identifying the top ten triggers for a palliative care consultation in the surgical intensive care unit (SICU).²⁰ The top 10 criteria to identify SICU patients for palliative care consultation listed in order of priority were: 1) family request; 2) futility considered or declared by the medical team; 3) family disagreement with the team, advance directive, or each other lasting greater than seven days; 4) death

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expected during the same SICU stay; 5) SICU stay of greater than one month; 6) diagnosis with a median survival of less than six months; 7) greater than three SICU admissions during the same hospitalization; 8) Glasgow Coma Score of less than eight for greater than one week in a patient greater than 75 years old; 9) Glasgow Outcome Score of less than three (i.e., persistent vegetative state); and 10) multisystem organ failure of greater than three systems.

Studies are lacking that identify hospitalized patients who are more likely to have higher cost per day or length of stay, as these are patients who may benefit from palliative care. We sought to identify patient characteristics that are associated with higher cost per day or longer length of stay in hospitalized patients who died during the hospitalization or were discharged to hospice—patients likely to benefit from targeted palliative care services. We hypothesized that hospitalized patients with the following characteristics who died during the hospitalization or were discharged to hospice would have a higher cost per day or longer length of stay: older patients, lack of insurance, and patients receiving care from a critical care specialty.

METHODS

Study Design

We analyzed administrative data from a single academic hospital, the University of Colorado Hospital, a tertiary care, academic hospital with approximately 400 beds. The study population consisted of hospitalized adult patients (age ≥ 18 years) who died during hospitalization or were discharged to hospice in 2006 and 2007. We included both patients discharged to hospice and those who died during hospitalization, as we were seeking to identify a hospitalized patient population who might be expected to benefit from palliative care: those at high risk of death in the near future. Predictors were selected on the basis of clinical experience and the literature. Cost per day and length of stay were the outcome variables. Institutional Review Board (IRB) approval was not necessary because all of the study patients were deceased at the time of analysis.

Due to resource limitations, we were only able to gather clinical information (presence of organ failure [cardiac, respiratory, renal, hepatic, neurologic] or sepsis on admission, and presence or absence of palliative care consultation during hospitalization) from chart review in a subset of the sample population: those that had the highest 10% total hospitalization costs ($n = 115$). Organ failure was defined as chart documentation of any of the following: 1) cardiac: ST segment elevation myocardial infarction, non-ST segment elevation myocardial infarction, congestive heart failure, heart failure ($n = 28$); 2) respiratory: respiratory failure ($n = 36$); 3) renal: acute kidney injury, acute renal failure, chronic renal failure, dialysis, end-

stage renal disease ($n = 42$); 4) hepatic: hepatic failure, end-stage liver disease ($n = 10$); and 5) neurologic: altered mental status, delirium ($n = 4$). Sepsis was defined as chart documentation of any of the following: sepsis, severe sepsis, or septic shock.

Outcomes

We found total cost and length of stay to be correlated. Therefore, we used cost per day in lieu of total cost as the primary outcome. Length of stay was the secondary outcome. Using cost per day as the primary outcome reduced the correlation between our primary and secondary outcomes.

Predictors

Potential predictors (age, insurance status, and attending physician specialty) were selected on the basis of clinical experience, the literature, and patient variables available from the administrative data. We also considered diagnosis-related group (DRG), however, the wide range of unique DRGs for this population did not allow for sensible groupings, so DRG was excluded from further analyses. For descriptive purposes, mean (standard deviation, SD) age was reported. For modeling, age was centered at 65 years, because this is the age of Medicare eligibility and thus a likely point at which insurance status would change. Sixty-five was also close to the mean age of the full population, 62 years, therefore ensuring that interactions were assessed over the bulk of the data, rather than at outlying points. We also divided age into ten-year increments for easier interpretation of model estimates. The relationship between age and primary and secondary outcomes differed among younger vs older patients. Therefore, age was included as a piecewise term in the final multivariate linear model which allowed a separate slope to be fit for patients age < 65 years vs those ≥ 65 years.

Insurance status was dichotomized as insured vs uninsured. Attending physician specialty categories (internal medicine, pulmonary critical care, neurosurgery, surgical oncology, and cardiothoracic surgery) were selected because they were the five most common specialties. The remaining specialties were grouped together as “other,” which was used as a reference group in the multivariate analyses as it constituted a nontrivial proportion of the study population.

Statistical Analyses

Univariate analyses were performed separately for the primary and secondary outcomes. Univariate associations between the outcomes and categorical predictors were tested using analysis of variance (ANOVA) models with adjustment for multiple comparisons. Associations between the outcomes and the binary predictors were assessed with *t*-tests. Predictors that were significant at the 0.10 level and considered clinically relevant were included in the multivariate model.

Interaction terms between predictors were examined and included in the final multivariate piecewise linear models, when inclusion of the interaction terms altered the magnitude of the model estimates.

RESULTS

The study population comprised 1155 hospitalizations. Nine hospitalizations were excluded from analysis (five for organ donation, three were erroneous—the patients were not discharged to hospice or did not die during the hospitalization, and one was a pediatric patient), resulting in a study population of n = 1146 hospitalizations.

Table 1 depicts study population characteristics. The average patient age was 62 years (SD = 16), and 96% of patients were insured. The average length of stay was 10.7 days (SD = 14.1), with an average total cost per admission of \$44,410 (SD = 76,355), as com-

pared to an overall hospital admission (excluding obstetrics/neonatology) average length of stay of 5.7 days (SD = 8.5) and average total cost per admission of \$17,410 (SD = 36,633) during the same time period. The average cost per day was \$5095 (SD = \$8546). About one-third of patients were admitted to internal medicine, 20% to pulmonary critical care, and 18% to surgical specialties. The remaining 29% belonged to other specialties.

Univariate Analyses

Overall, younger patients had a higher cost per day (Pearson -0.09; *P* = 0.02) and longer length of stay (Pearson -0.15; *P* < 0.0001) than older patients (data not shown). According to age groups defined by quartiles, patients who were age <51 and between 61-72 years had significantly higher cost per day than patients age ≥73 years (\$5787 and \$5826 vs \$3649, respectively; ANOVA *P* = 0.005; pairwise *P* < 0.05). The length of stay for the age groups under 73 years of age were significantly longer than for the patients who were 73 years of age and older (11.9, 11.9, and 11.2 vs 8.0 days, respectively; ANOVA *P* = 0.001; pairwise *P* < 0.05; Table 2). Uninsured patients had a higher cost per day (\$6618 vs \$5023; *P* = 0.02) than insured patients. In pairwise comparisons, patients on the cardiothoracic surgery service had a higher cost per day (\$17,942) than any other specialty (ANOVA *P* < 0.0001; pairwise *P* < 0.05). Neurosurgery patients had a higher cost per day (\$7089) than the internal medicine patients (\$3173; pairwise *P* < 0.05). Cardiothoracic surgery patients also had a significantly higher LOS (18.3 days) than internal medicine (8.0 days), critical care (11.6 days), neurosurgery (10.0 days), and the “other” (10.9 days) specialties (ANOVA *P* < 0.0001; pairwise *P* < 0.05). The LOS

TABLE 1. Patient Characteristics

Number of patients, n (%)	1146
Death in hospital	730 (63.7)
Discharged with hospice	416 (36.3)
Age (years), mean (SD)	61.7 (15.9)
Insurance, n (%)	
Uninsured	52 (4.5)
Insured	1,094 (95.5)
Length of stay (days), mean (SD)	10.7 (14.1)
Total cost, mean (SD)	\$44,410 (76,355)
Cost per day, mean (SD)	\$5,095 (8,546)
Attending MD specialty, n (%)	
Cardiothoracic Surgery	56 (4.9)
Pulmonary Critical Care	230 (20.1)
Surgical Oncology	70 (6.1)
Internal Medicine	383 (33.4)
Neurosurgery	77 (6.7)
Other	330 (28.8)

TABLE 2. Univariate Analysis: Cost per Day and Length of Stay

Variable	N	Cost per day [\$] (mean [SD])	<i>P</i> Value	Length of stay [days] (mean [SD])	<i>P</i> Value
	1146				
Age group, quartiles					
<51 years	281	5,787 (8,008)	0.005	11.9 (16.4)	0.001
51-60	264	5,202 (7,643)		11.9 (15.4)	
61-72	297	5,826 (12,272)		11.2 (14.1)	
≥73	304	3,649 (3,978)		8.0 (9.7)	
Insurance					
Insured	1094	5,023 (8,691)	0.02	10.8 (14.2)	0.23
Uninsured	52	6,618 (4,297)		8.4 (13.5)	
Attending MD specialty					
Internal Medicine	383	3,173 (2,647)	<0.0001*	8.0 (11.0)	<0.0001†
Pulmonary Critical Care	230	4,671 (2,734)		11.6 (14.3)	
Neurosurgery	77	7,089 (6,103)		10.0 (13.5)	
Surgical Oncology	70	5,768 (3,521)		15.9 (17.9)	
Cardiothoracic Surgery	56	17,942 (26,943)		18.3 (23.6)	
Other	330	4,833 (8,641)		10.9 (13.6)	

*The Cardiothoracic Surgery group has significantly higher cost per day than the other five categories. Cost per day for Internal Medicine is significantly lower than for the Neurosurgery specialty. †The Cardiothoracic Surgery group has significantly higher length of stay than Internal Medicine, Pulmonary Critical Care, Neurosurgery, and “Other” categories. Length of stay for Internal Medicine is significantly lower than Pulmonary Critical Care, Surgical Oncology, and Cardiothoracic Surgery.

TABLE 3. Final Model for Cost per Day Using Piecewise Age Function Centered at Age 65 Years

Predictors	Estimated Effect (\$)	95% Confidence Interval	P Value to Test if = 0
Other specialty (reference group at 65 yr)	5209	(4,133, 6,284)	
Internal Medicine	-1,531	(-2,709, -353)	0.01
Pulmonary Critical Care	-217	(-1,562, 1,128)	0.75
Neurosurgery	2255	(278, 4,232)	0.03
Surgical Oncology	1064	(-994, 3,122)	0.31
Cardiothoracic Surgery	12937	(10,676, 15,198)	<0.0001
Age per 10 yr/age <65	7	(-506, 519)	0.98
Age per 10 yr/age ≥65	-811	(-1,497, -125)	0.02

TABLE 4. Final Model for Length of Stay (Days) Using Attending Physician Specialty and Piecewise Age Function Centered at 65 Years

Predictors	Estimated Effect (days)	95% Confidence Interval	P Value to Test if = 0
Other specialty (reference group at 65 yr)	11	(9.1, 12.9)	
Internal Medicine	-2.4	(-4.4, -0.3)	0.02
Pulmonary Critical Care	0.5	(-1.9, 2.8)	0.7
Neurosurgery	-0.9	(-4.3, 2.6)	0.62
Surgical Oncology	5.3	(1.8, 8.9)	0.003
Cardiothoracic Surgery	6.9	(3.0, 10.9)	0.001
Age per 10 yr/age <65	-0.8	(-1.7, 0.1)	0.08
Age per 10 yr/age ≥65	-1.8	(-3.0, -0.6)	0.003

for internal medicine (8.0 days) was significantly lower than critical care (11.6 days), surgical oncology (15.9 days), and cardiothoracic surgery (18.3 days; pairwise $P < 0.05$).

Multivariate Analyses

Cost per Day

The final multivariate linear model included age and attending physician specialty. Insurance status was excluded because it lost significant association with cost per day when it was added to the model (Table 3). Compared to the “other” specialty, internal medicine decreased cost per day by \$1531 ($P = 0.01$), neurosurgery increased cost per day by \$2255 ($P = 0.03$), and cardiothoracic surgery increased cost per day by \$12,937 ($P < 0.0001$). Cost per day decreased by \$811 (SE = 349; $P = 0.02$) for each age decade ≥65 years, however, no effect was observed on cost per day for those younger than 65 years.

Length of Stay

Because age and attending physician specialty had a significant effect on length of stay, multivariate analyses were performed with these two predictor variables (Table 4). Compared to the “other” specialty, internal medicine decreased length of stay by 2.4 days ($P = 0.02$), surgical oncology increased LOS by 5.3 days ($P = 0.003$), and cardiothoracic surgery increased length of stay by 6.9 days ($P = 0.001$). Length of stay was

significantly decreased by 1.8 days (SE = 0.61; $P = 0.003$) for each age decade ≥65 years.

DISCUSSION

We found several characteristics that were significantly associated with higher cost per day or longer length of stay in patients who died during hospitalization or were discharged to hospice. Among this patient population, the surgical specialty services had overall higher cost per day and length of stay than other services. Patients cared for on the cardiothoracic surgery service had higher cost per day and length of stay; in contrast, internal medicine patients had lower cost per day and length of stay. Neurosurgery patients had higher cost per day, while surgical oncology patients had higher length of stay. Patients age 65 years and older had a significantly lower cost per day and shorter length of stay than those less than 65 years of age.

Higher cost per day for cardiothoracic surgery and neurosurgery patients may partially be explained by cardiothoracic surgery patients’ usage of clinical services, including operating room services, which are higher in costs compared with those of nonsurgical specialties. Some patients may require repeat surgeries in the same hospitalization which further increases the cost per day. Longer length of stay in surgical oncology patients may be related to complex surgeries and possible postoperative complications that may take longer to recover from than standard surgeries.

Our findings that older patients have lower cost per day and shorter length of stay are corroborated by other studies. Lubitz and Riley²¹ found that in 1976 and 1988, Medicare payments per person year decreased with age. Levinsky et al.²² had similar findings in a review of Medicare data in 2001, but noted smaller reductions in total cost—about \$400 decrease for each year above 65. Their explanation of the lower cost is that older patients receive less aggressive care. Physicians, as well as patients and families, may continue to pursue expensive, invasive therapies for terminally ill patients who are younger for a longer period of time than with older patients, which would increase cost per day as well as length of stay.

The finding that patients on the surgical specialty services may be a focus for active palliative care intervention has many implications. The American College of Surgeons Surgical Palliative Care Task Force consensus guideline triggers for a palliative care consultation in SICU applied clinically did not result in a change in palliative care consultation rate.²³ The use of triggers for palliative care consultation may be an ineffective approach because knowledge and application of the triggers did not change behavior. Focusing on integrating palliative care interventions or consultation for all high-risk surgical patients, as opposed to relying upon triggers, may be a more effective approach to meeting these patients' palliative care needs while lowering cost per day and length of stay and warrants further study. For instance, palliative care consult teams may consider routine or daily rounds with the surgical specialty services in order to effectively integrate palliative care for these patients. Such an integrative approach may foster familiarity and comfort with palliative care approaches, facilitating access to palliative care services for those patients with palliative needs.

Our study is limited in that it is a retrospective, single-center study. Our results may not be applicable to the general population. The experience of additional centers analyzed prospectively would provide additional context. The available administrative data limited the analyses to only a small number of predictors. In the subset population with the highest 10% total hospitalization costs, from which clinical information was gathered, the presence of respiratory failure was associated with shorter LOS (33 days vs 42 days; $P = 0.03$), but not associated with cost per day. Having sepsis at admission was associated with lower cost per day (\$5783 vs \$10,071; $P = 0.04$); however, this finding was based on only four patients with sepsis at admission. Patients who were evaluated by the palliative care service ($n = 35$) had a significantly lower cost per day (\$4896 vs \$12,210; $P = 0.01$) but longer LOS (46.5 vs 35.7 days; $P = 0.03$) than those who were not. These, and other, clinical characteristics need further testing in larger samples. An additional limitation is that we combined hospital decedents

with patients discharged to hospice as our study population. These groups were combined since they are both at high risk of death in the near future; the median hospice length of stay in Colorado is 20 days.²⁴ There may exist important differences in these populations that are not accounted for in our findings. Despite these unidentified differences, both populations are at high risk of death in the near future, making it likely that they would benefit from palliative care. Those who died during hospitalization did have a longer LOS (11.5 vs 9.2 days; $P = 0.003$) and higher cost per day (\$6734 vs \$2221; $P < 0.0001$) than those who were discharged to hospice.

Palliative care consultations can lead to improved quality of care for patients and families by addressing suffering and addressing quality of life measures (2, 4, 5, 6). We sought to identify characteristics associated with high cost and prolonged hospitalizations in patients who died during hospitalization, or were discharged to hospice, in order to inform targeting of palliative care services. Our data suggest that younger patients and those cared for by surgical specialty services may have the most palliative needs. Palliative care teams may consider focusing efforts at integrating palliative care with surgical specialty services to address these needs. These findings need to be corroborated in other centers, and include clinical outcomes.

Disclosure: Jean Kutner does consultant work for the Foundation for Informed Medical Decision Making and is a Board Member of the American Academy for Hospice and Palliative Medicine. Jeanie Youngwerth does consultant work for the Foundation for Informed Medical Decision Making. The other authors have no relevant conflicts of interest to disclose.

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