Title
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Journal
JCO Oncology Practice, 12(10)

ISSN
2688-1527

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Publication Date
2016-10-01

DOI
10.1200/jop.2016.012823

Peer reviewed

The full version of this article may be viewed online at jop.ascopubs.org

No Exit: Identifying Avoidable Terminal Oncology Intensive Care Unit Hospitalizations

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Disclosures provided by the authors are available with this article at jop.ascopubs.org.

BACKGROUND AND QUESTION ASKED: Terminal oncology intensive care unit (ICU) hospitalizations are associated with high cost and inferior quality care. The National Quality Forum endorses ICU admissions in the last 30 days of life as a marker of poor quality care. Can we identify and characterize potentially avoidable terminal oncology ICU admissions?

SUMMARY ANSWER: During a 1-year study period, nearly half of the terminal oncology ICU hospitalizations at an urban academic medical center were determined to be potentially clinically avoidable.

WHAT WE DID: Retrospective case series of patients cared for in an academic medical center's ambulatory oncology practice who died in an ICU during July 1, 2012 to June 30, 2013. An oncologist, intensivist, and hospitalist reviewed each patient's electronic health record from 3 months preceding terminal hospitalization until death. The primary outcome was the proportion of terminal ICU hospitalizations identified as potentially avoidable by two or more reviewers. Univariate and multivariate analysis was performed to identify characteristics associated with avoidable terminal ICU hospitalizations.

WHAT WE FOUND: Seventy-two patients met inclusion criteria. The majority had solid tumor malignancies (71%), poor performance status (51%), and multiple encounters with the health care system. Despite high intensity health care utilization, only 25% had documented advance directives. During a 4-day median ICU length of stay, 81% were intubated and 39% had cardiopulmonary resuscitation. Forty-seven percent of these hospitalizations were identified as potentially avoidable (Fig). Avoidable hospitalizations were associated with factors including: worse performance status before admission (median 2 *v* 1; $P = .01$), worse Charlson comorbidity score (median 8.5 *v* 7.0; $P = .04$), reason for hospitalization ($P = .006$), and number of prior hospitalizations (median 2 *v* 1; $P = .05$). In addition, using our data warehouse we identified 35 patients (30% of the provided sample) who were oncology patients who expired in our ICU but had never been seen in the outpatient setting. Holding institutions accountable for and tying reimbursements to these oncology ICU deaths could create structural bias against tertiary care centers.

BIAS, CONFOUNDING FACTOR(S), DRAWBACKS: A limitation of this study is that it is a subjective majority-driven medical record review. We chose this methodology because it matched prior work on avoidability and allowed us to thoroughly probe the characteristics of these hospitalizations. We adopted best practices for determining avoidability, including employing at least three reviewers and multiple sources of information. The study is also limited by its external validity as it was conducted at a single institution. However, the characteristics of the oncology patients in this study are concordant with those from other studies examining aggressive care at the end-of-life and likely have applicability to other institutions.

REAL-LIFE IMPLICATIONS: Delivering patient-centered, high-quality care to oncology patients at the end-of-life has become a national health priority. This is the first study to evaluate the quality metric of terminal oncology ICU hospitalizations. Our findings revealed that despite frequent

DOI: 10.1200/JOP.2016.012823; published online ahead of print at jop.ascopubs.org on September 6, 2016.

contacts with outpatient care providers, aggressive end-of-life care occurred and almost half of these hospitalizations are potentially avoidable with different medical management. Beyond the issues of cost and resource scarcity, these ICU deaths often create a traumatic experience for patients and families. In the changing economic landscape ushered in by the Oncology Care Model, providers will need to innovate in how advance care planning is delivered. Health care leaders should test strategies to prospectively identify patients at high risk for avoidable terminal hospitalizations and formulate interventions to improve end-of-life care. JOP

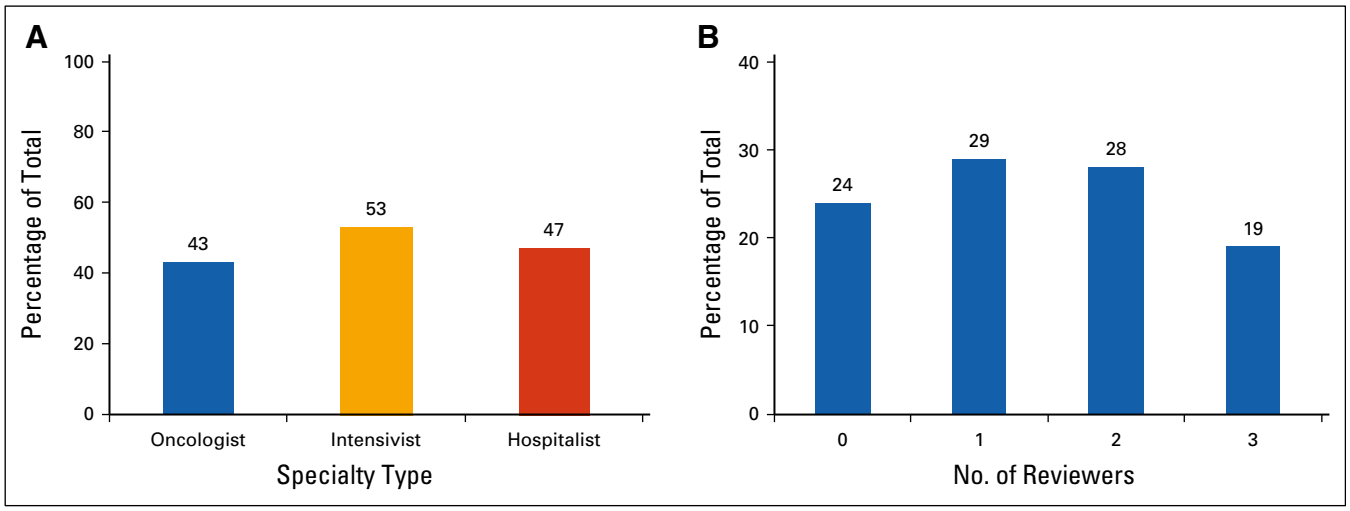

FIG. Terminal oncology intensive care unit (ICU) hospitalizations identified as potentially avoidable. Each hospitalization was reviewed by an oncologist, intensivist, and hospitalist. (A) The *y*-axis shows the percentage of the 72 terminal oncology ICU hospitalizations identified as potentially avoidable. The *x*-axis shows medical specialty type. (B) The *y*-axis shows the percentage of the 72 terminal oncology ICU hospitalizations identified as potentially avoidable. The *x*-axis shows number of reviewers.

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Abstract

Purpose

Terminal oncology intensive care unit (ICU) hospitalizations are associated with high costs and inferior quality of care. This study identifies and characterizes potentially avoidable terminal admissions of oncology patients to ICUs.

Methods

This was a retrospective case series of patients cared for in an academic medical center's ambulatory oncology practice who died in an ICU during July 1, 2012 to June 30, 2013. An oncologist, intensivist, and hospitalist reviewed each patient's electronic health record from 3 months preceding terminal hospitalization until death. The primary outcome was the proportion of terminal ICU hospitalizations identified as potentially avoidable by two or more reviewers. Univariate and multivariate analysis were performed to identify characteristics associated with avoidable terminal ICU hospitalizations.

Results

Seventy-two patients met inclusion criteria. The majority had solid tumor malignancies (71%), poor performance status (51%), and multiple encounters with the health care system. Despite high-intensity health care utilization, only 25% had documented advance directives. During a 4-day median ICU length of stay, 81% were intubated and 39% had cardiopulmonary resuscitation. Forty-seven percent of these hospitalizations were identified as potentially avoidable. Avoidable hospitalizations were associated with factors including: worse performance status before admission (median 2 *v* 1; $P = .01$), worse Charlson comorbidity score (median 8.5 *v* 7.0, $P = .04$), reason for hospitalization ($P = .006$), and number of prior hospitalizations (median 2 *v* 1; $P = .05$).

Conclusion

Given the high frequency of avoidable terminal ICU hospitalizations, health care leaders should develop strategies to prospectively identify patients at high risk and formulate interventions to improve end-of-life care.

ASSOCIATED CONTENT

Appendix & Data Supplements
DOI: 10.1200/JOP.2016.012823

DOI: 10.1200/JOP.2016.012823; published online ahead of print at jop.ascopubs.org on September 6, 2016.

INTRODUCTION

Because of both an aging population and improvements in cancer-specific survival, the cost of cancer care in the United States is projected to increase by 27% to $158 billion from 2010 to 2020.[1,2] These costs

are increasing in part because patients are receiving increasingly aggressive care at the end of life.[3-6] An examination of claims data for Medicare patients with cancer demonstrated that intensity of end-of-life care, including ICU admissions in the month before death, continues to increase.[4] Terminal hospitalizations, defined as a hospitalization in which death occurred, are an especially significant cost driver, and those associated with an ICU admission accounted for 80% of terminal hospitalization costs.[7] Critically ill patients with cancer constitute a large percentage of ICU admissions,[8] 25% of Medicare cancer beneficiaries receive ICU care in the last month of life,[9] and 8% of patients with cancer die there.[7,10]

Prior studies have found that high-intensity end-of-life care, including ICU use, improves neither survival nor quality of life for patients with cancer.[10-14] There is also considerable variation in end-of-life care for oncology patients,[9,15] indicating that these terminal ICU hospitalizations may be avoidable.[16] In a study examining site of death for patients with cancer in seven developed countries, Bekelman et al[15] found that 27% of decedents in the United States were admitted to the ICU in the last 30 days of life, more than twice the rate of other countries.

The Institute of Medicine's report, *Dying in America*, advocates for measures to improve the quality and sustainability of end-of-life care, urging the federal government to "require public reporting on quality measures, outcomes, and costs regarding care near the end-of-life."[17(p17)] The National Quality Forum endorses ICU admissions in the last 30 days of life as a marker of poor-quality cancer care. In addition, groups such as the Oncology Quality Improvement Collaborative have identified the proportion of patients with advanced cancer dying in the ICU as a quality-of-care metric.[18] However, neither the characteristics of oncology patients who expire in the ICU nor the potential avoidability of their deaths there has been examined. Understanding these hospitalizations will contribute to the design of interventions aimed at avoiding unnecessary aggressive end-of-life care.

METHODS

This study was conducted at the University of Chicago Medicine, a 600-bed urban academic medical center with 96 ICU beds. The Institutional Review Board approved the study with a waiver of informed consent.

Data Source

We identified patients using the cancer registry and the organization's clinical data warehouse. The clinical data warehouse includes records of all clinic visits and inpatient admissions, including location and timing of death. Manual chart review was conducted in the electronic health record. Two physicians (A.H. and B.D.) used a standardized chart abstraction tool to cull patient demographic, clinical, and operational characteristics from the record. Demographic characteristics included sex, age, ethnicity, and insurance type. Examples of clinical characteristics included cancer site, disease status, most recent modality of treatment, Eastern Cooperative Oncology Group (ECOG) performance status, and Charlson comorbidity index (CCI) score. Cancer was included in the CCI score to reflect stage of disease. Patients with no evidence of disease who still followed with their oncologist because of adverse effects from treatment or risk of relapse were included in the study and were a small minority of included subjects. Finally, examples of operational characteristics included documentation of advance directives, documentation of an inpatient or outpatient palliative care consult, and number of outpatient clinic visits and hospitalizations in the 12 months before death.

Patients

We included all oncology patients who expired in adult ICUs or on the general oncology unit within 1 week of ICU transfer during fiscal year 2013 (July 1, 2012 to June 30, 2013). We excluded patients who did not have at least one prior oncology-related outpatient visit, as they would not be amenable to an institution-specific outpatient intervention. Thirty-five patients initially identified through our data warehouse and subsequently confirmed to have a cancer diagnosis and to have expired in the ICU were excluded, because these patients had no prior outpatient oncology visits at our institution. Seventy-two patients met the inclusion criteria (Appendix Fig A1, online only).

Identification of Potentially Avoidable Terminal Oncology ICU Hospitalizations

To identify potentially avoidable terminal oncology ICU hospitalizations, we adapted the methodology of Brooks et al.[16,19] and were informed by the systematic review by van Walraven et al,[20] which examined studies evaluating avoidability in readmissions. van Walraven et al[20] found that avoidability cannot be accurately identified based on diagnostic codes and instead is better determined through a peer review process. We adopted best practices for

determining avoidability, including using at least three reviewers and multiple sources of information. We convened a panel of 10 physicians in the fields of hematology/oncology, hospital medicine, and pulmonary/critical care. Each patient's electronic health record was reviewed by one physician from each of these specialties from 3 months before hospitalization until death. The electronic health record contents included inpatient and outpatient provider notes, the death note, laboratory/imaging/pathology data, chemotherapy records, and procedure notes. Physicians were instructed on using a standardized assessment tool (Data Supplement) modeled after the prior work by Brooks et al[16] that relied on clinical judgement to determine avoidability specific to the ICU admission during the terminal hospitalization. We chose these specialties to reflect the continuum of patient care from the outpatient to the inpatient and intensive care settings.

Statistical Methods

The primary outcome was the proportion of hospitalizations identified as potentially avoidable by two or more of the three reviewers. After determining the clinically avoidable terminal oncology ICU hospitalizations, we calculated descriptive statistics regarding patient demographic, clinical, and operational characteristics. Using the χ^2 test, Fisher's exact test, or the Wilcoxon nonparametric rank sum test, we compared characteristics of potentially avoidable terminal oncology ICU hospitalizations with those deemed clinically unavoidable. We then constructed a multivariable logistic regression model of characteristics associated with potentially avoidable terminal oncology ICU hospitalizations. We selected variables on the basis of a univariate screen with a significance level of $P < .10$ along with weighing their clinical importance and other model fitting issues. For example, residential setting could not be included because 94% of patients came from the home setting. A backward elimination procedure (until all variables included had $P < .10$) was then used to arrive at a final model. To confirm goodness of fit, a Hosmer-Lemeshow test was performed. In addition, we calculated the kappa statistic for agreement among the different specialty reviewers.[21,22] Statistical analyses were performed using Stata 14 (StataCorp, College Station, TX).

RESULTS

Patient Demographic and Clinical Characteristics

The majority of the terminal oncology ICU deaths were in men (72%), and one-third of this population was age 70 years or older (Table 1). Seventy-one percent had solid tumor malignancies, and the most represented tumors were thoracic (26%) and leukemia (18%; Fig 1). The majority of patients with solid tumors had metastatic disease (53%). The most recent modality of treatment was chemotherapy (62%), and 34% of those who had received chemotherapy were on their third or greater line. At the last outpatient visit, the ECOG performance status was ≥ 2 for 51% of patients, and the median CCI score was 7. The primary reason for the hospitalization was cancer symptom (32%) or treatment complication (37%), with only 17% being planned hospitalizations for bone marrow transplant or other procedures.

Operational Characteristics

The median duration of the oncologist-patient relationship was 267 days, and 67% of patients had seen their oncologist within 1 month of terminal hospitalization. Sixty-eight percent had at least one prior hospitalization that year. The median number of outpatient visits in the year before death was 12.5. Despite these frequent engagements with the health care system, as well as the preponderance of advanced disease and poor performance status, 87% of patients did not have an outpatient palliative care consult. Advance directives and power of attorney were noted in only 25% and 49% of patients' charts, respectively, before the terminal hospitalization.

The median length of stay in the ICU was 4 days. Despite these short ICU stays, 82% had a central line, 81% were intubated, 44% received a feeding tube, 39% received cardiopulmonary resuscitation, 22% initiated hemodialysis, and 8% received chemotherapy (Fig 1). Only 6% of these patients received an inpatient palliative care consult.

Avoidable Terminal Oncology ICU Hospitalizations

Forty-seven percent of these hospitalizations were determined to be potentially avoidable by the majority of reviewers (Fig 2). Critical care physicians were more likely to view a terminal hospitalization as potentially avoidable (53%). All three specialties agreed about avoidability 43% of the time. The kappa statistic for agreement was 0.24, indicating fair agreement. An illustrative example of agreement about clinical avoidability was the case of a 60-year-old woman with metastatic non–small-cell lung cancer complicated by cord compression, admitted from a nursing facility with dyspnea. A computed tomography scan showed bilateral pulmonary embolisms. She had two prior hospitalizations and 16 outpatient visits that year. Her last outpatient appointment was

Table 1. Patient Demographic, Clinical, and Operational Characteristics

Variable	All Patients (N = 72)	Potentially Avoidable Terminal ICU Hospitalizations		*P*
		No (n = 38)	Yes (n = 34)	
Age, years	63 (58-74)	64 (57-75)	62 (58-69)	.59
Female sex	20 (28)	10 (26)	10 (29)	.77
Race/ethnicity				.45*
African American	28 (39)	13 (34)	15 (44)	
White	33 (46)	17 (45)	16 (47)	
Hispanic	6 (8)	5 (13)	1 (3)	
Other	5 (7)	3 (8)	2 (6)	
Religion				.40*
Buddhist	1 (1)	1 (3)	0 (0)	
Catholic	28 (39)	16 (42)	12 (35)	
Jewish	1 (1)	0 (0)	1 (3)	
Muslim	4 (6)	1 (3)	3 (9)	
Other Christian	28 (39)	13 (34)	15 (44)	
Unknown/none	10 (14)	7 (18)	3 (9)	
Marital status				.55*
Divorced	9 (13)	6 (16)	3 (9)	
Married	44 (61)	24 (63)	20 (59)	
Single	16 (22)	6 (16)	10 (29)	
Widowed	3 (4)	2 (5)	1 (3)	
Insurance				.73*
Commercial	27 (37)	16 (42)	11 (32)	
Medicaid/charity	7 (10)	3 (8)	4 (12)	
Medicare	38 (53)	19 (50)	19 (56)	
Residential setting before hospitalization				.045*
Home setting	68 (94)	38 (100)	30 (88)	
Rehabilitation or nursing facility	4 (6)	0 (0)	4 (12)	
Cancer type				.32
Solid	51 (71)	25 (66)	26 (76)	
Hematologic	21 (29)	13 (34)	8 (24)	
Disease status				.07
NED	10 (14)	8 (21)	2 (6)	
Localized	16 (22)	9 (24)	7 (21)	
Metastatic	46 (64)	21 (55)	25 (73)	
Most recent treatment				.06*
Chemotherapy ± RT	45 (62)	20 (53)	25 (73)	
Surgery	16 (22)	11 (29)	5 (15)	
RT	9 (13)	7 (18)	2 (6)	
None	2 (3)	0 (0)	2 (6)	
Latest line of chemotherapy				.28
None	22 (31)	15 (39)	7 (21)	
First	23 (32)	9 (24)	14 (41)	
Second	10 (14)	5 (13)	5 (15)	
Third or greater	17 (24)	9 (24)	8 (24)	

(continued on following page)

Table 1. Patient Demographic, Clinical, and Operational Characteristics (continued)

Variable	All Patients (N = 72)	Potentially Avoidable Terminal ICU Hospitalizations		*P*
		No (n = 38)	Yes (n = 34)	
ECOG performance status before hospitalization	2 (1-2)	1 (1-2)	2 (1-3)	.01
Charlson Comorbidity Index score before hospitalization	7 (5.5-9)	7 (4-8)	8.5 (6-9)	.04
Days since diagnosis	436 (143-1,375)	445 (188-2,349)	352 (80-1,043)	.05
Duration of oncologist-patient relationship	267 (62.5-1,051)	298 (85-1,357)	190 (37-907)	.32
Primary oncologist years in practice				.55
< 15	28 (39)	16 (42)	12 (35)	
≥ 15	44 (61)	22 (58)	22 (65)	
Days since last outpatient oncology visit	32 (15-66.5)	41 (23-86)	21 (10-38)	.006
Number of outpatient clinic visits	12.5 (5-20)	11 (5-20)	15 (7-20)	.61
Number of hospitalizations	1 (0-3)	1 (0-3)	2 (1-4)	.05
Outpatient palliative care consult				.08*
Yes	9 (13)	2 (5)	7 (21)	
No	63 (87)	36 (95)	27 (79)	
Advance directives before hospitalization				
Yes	18 (25)	9 (24)	9 (26)	.79
No	54 (75)	29 (76)	25 (74)	
Power of attorney before hospitalization				.49
Yes	35 (49)	17 (45)	18 (53)	
No	37 (51)	21 (55)	16 (47)	
Site of initial evaluation				.58*
Clinic	9 (13)	4 (11)	5 (15)	
Direct admission	18 (25)	12 (32)	6 (18)	
Emergency department	28 (39)	14 (37)	14 (41)	
Outside hospital transfer	17 (24)	8 (21)	9 (26)	
Reason for hospitalization				.006*
Cancer symptom	23 (32)	6 (16)	17 (50)	
Noncancer symptom	10 (14)	7 (18)	3 (9)	
Planned	12 (17)	10 (26)	2 (6)	
Treatment complication	27 (37)	15 (39)	12 (35)	
Palliative care consult during hospitalization				.34*
Yes	4 (6)	1 (3)	3 (9)	
No	68 (94)	37 (97)	31 (91)	

NOTE. Data presented as No. (%) or median (25%-75%). Between-group comparisons were performed using Wilcoxon rank sum tests for continuous or ordinal variables and χ^2 tests for categorical variables unless otherwise noted.
Abbreviations: ECOG, Eastern Cooperative Oncology Group; ICU, intensive care unit; NED, no evidence of disease; RT, radiation therapy.
*Fisher's exact test.

18 days prior, and her ECOG performance status had been 4. The reviewers had the following comments:

- Medical oncologist: "Patient's transfers to ICU and especially intubation could have been avoided with goals of care discussion with patient and family in clinic or on floor given patient's poor performance status."
- Intensivist: "Patient was known to have cord compression and was nonfunctional, living in a nursing

Tumor type	% of study population	Patients Receiving ICU Intervention by Tumor Type (%)						
		Cardiopulmonary resuscitation	Central line	Chemotherapy	Feeding tube	Hemodialysis	Intubation	Noninvasive ventilation
Solid tumor malignancies (toal)	71	41	82	0	51	18	80	20
Thoracic	26	26	79	0	37	5	84	32
Other solid tumor malignancies	44	50	84	0	59	25	78	13
Hematologic maligancies (total)	29	33	81	29	29	33	81	33
Leukemia	18	31	85	31	38	31	92	31
Other hematologic malignancies	11	38	75	25	13	38	63	38
Total population	100	39	82	8	44	22	81	24

FIG 1. Heat map: intensive care unit (ICU) intervention by tumor type.

home at least 1 month prior to ICU admission. She had advanced disease and even indicated in the ICU that she 'wanted help to die.' This could have been a discussion in the clinic appointment prior to her admission."

- Hospitalist: "Potentially avoidable due to known rapid disease progression, palliative care consult semi-onboard, and admitting physicians wanting to focus on comfort."

In comparison, agreement regarding a clinically unavoidable terminal ICU hospitalization was the case of a 41-year-old woman with acute myelogenous leukemia (AML) admitted for stem-cell transplantation. Her hospital course was complicated by gram-negative sepsis and multiorgan failure. Her performance status before admission was 0. During the year, she had three prior hospitalizations and 13 outpatient visits. She had last seen her oncologist 14 days before admission. The reviewers commented:

- Medical oncologist: "Unavoidable. Patient was admitted for matched unrelated donor stem cell transplant from AML in complete remission. Died from complications of stem cell transplant."
- Intensivist: "Unavoidable—rapid progression of septic shock."
- Hospitalist: "This patient developed rapidly progressive septic shock post initial stem cell transplant for AML. Unavoidable given her age, lack of comorbidities, and potential reversibility of septic shock."

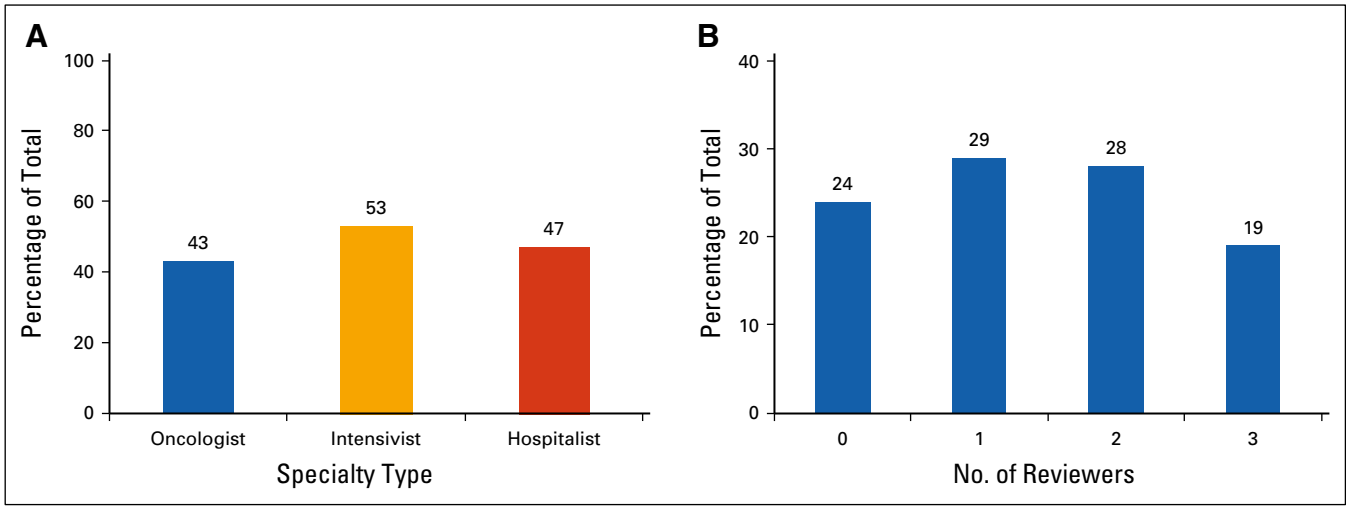

FIG 2. Terminal oncology intensive care unit (ICU) hospitalizations identified as potentially avoidable. Each hospitalization was reviewed by an oncologist, intensivist, and hospitalist. (A) The *y*-axis shows the percentage of the 72 terminal oncology ICU hospitalizations identified as potentially avoidable. The *x*-axis shows medical specialty type. (B) The *y*-axis shows the percentage of the 72 terminal oncology ICU hospitalizations identified as potentially avoidable. The *x*-axis shows number of reviewers.

As exemplified in the former case above, a significant number of those hospitalizations identified as clinically avoidable were due to absent or insufficient advance care planning (ACP).

Factors Associated With Avoidable Terminal Oncology ICU Hospitalizations

Potentially avoidable terminal oncology ICU hospitalizations were associated with home status (more likely to be residing in an institutional setting, $P = .05$), disease status (more likely to be metastatic, $P = .07$), most recent treatment (more likely to be receiving chemotherapy, $P = .06$), worse performance status (median 2 *v* 1, $P = .01$), worse CCI score (median 8.5 *v* 7.0, $P = .04$), fewer days since diagnosis (median 352 days *v* 445 days, $P = .05$), reason for hospitalization (more likely to be hospitalized for a cancer symptom, $P = .006$), and number of hospitalizations in the 12 months before terminal admission (median 2 *v* 1, $P = .05$). Potentially avoidable hospitalizations were also associated with fewer days since last outpatient oncology clinic visit (median 21 days *v* 41 days, $P = .006$) and an outpatient palliative care consult (21% *v* 5%, $P = .08$), possibly indicating the severity of illness in these patients. Avoidable hospitalizations were not significantly associated with race ($P = .45$).

On the basis of the above univariates, we conducted multivariable analysis of independent risk factors for a potentially avoidable ICU hospitalization. The final model included performance status, CCI score, reason for hospitalization, recent treatment type, and number of hospitalizations. The Hosmer-Lemeshow goodness of fit test gave $P = .44$.

DISCUSSION

The study reveals that nearly half of terminal oncology ICU hospitalizations in our study population were potentially avoidable. Overall, the common characteristics of patients with cancer who expired in the ICU were that they had solid tumors with metastatic disease, poor performance status, frequent interactions with the health care system, and had been seen by their outpatient oncologist within 1 month of the terminal hospitalization. This study serves to highlight terminal ICU hospitalizations as an area of focus to improve the quality and value of cancer care.

There are several limitations to our study. We designed our analysis as a retrospective case series, and it has been asserted that measures starting at death and looking backward "can lead to invalid conclusions about the quality or type of care provided."[23(p2765)] We chose this methodology because terminal oncology ICU hospitalizations have been championed as a quality metric, and no prior study has investigated the validity of this measure. Thus, given that the metric was death in the ICU, we believed it prudent to base our investigation from that point. In addition, studies have demonstrated that mortality reviews can identify quality gaps, and a diversity of specialty reviewers can illuminate system-wide challenges that are not visible at the section level.[24]

An interesting finding related to this point is the validity of terminal oncology ICU hospitalizations as a quality metric. Using our data warehouse, we identified 35 patients (30% of the provided sample) who were oncology patients who expired in our ICU but had never been seen in the outpatient setting. It would thus be difficult to design an intervention to prevent an avoidable terminal hospitalization in these patients, because they are first introduced to our institution during their terminal hospitalization. Holding institutions accountable for and tying reimbursements to these oncology ICU deaths would, therefore, seem unreasonable, and such a quality metric could create structural bias against tertiary care centers.

Another limitation is our subjective majority-driven medical record review. Because there cannot be an objective study of avoidability, we chose our methodology because it matched prior work on avoidable hospitalizations and allowed us to thoroughly probe the characteristics of these hospitalizations. As with Brooks et al,[16] we found that this granular methodology yielded "unexpected observations about patterns of care,"[16(p502)] such as our findings on the dearth of palliative care consults and advance directives and surfeit of aggressive ICU interventions.

Our study is also limited by its external validity, because it was conducted at a single institution. However, the characteristics of the oncology patients in this study are concordant with those from a qualitative study of ICU cancer deaths. In that study of 22 patients, 77% were treated with palliative intent, 68% were intubated, and 23% were resuscitated.[25] In another recent study of 28,731 younger patients with cancer, 71% to 76% received aggressive care within the last 30 days of life, including hospitalization and ICU care.[26] Thus, our findings likely have applicability to other institutions.

In looking forward to interventions to prevent avoidable aggressive care at the end of life, there is a clear need for improved ACP. We found that only 13% of patients had an outpatient palliative care consult, similar to rates at other academic institutions,[16,27] and only 25% had advance

directives. Despite recognition of the importance of ACP by organizations such as the American Society of Clinical Oncology,[28] a recent study found no growth in the past decade in key ACP domains, such as discussions of care preferences.[29]

If oncology providers do not take steps to improve ACP and end-of-life care, not only will it be to patients' detriment but also they will put themselves at financial risk. The Centers for Medicare and Medicaid Services recently launched the Oncology Care Model. The model seeks to find savings through aligning payment incentives and improving care coordination, with one goal being fewer avoidable hospitalizations and better end-of-life care.[30] Demonstration projects have shown that oncology practices can achieve savings by targeting avoidable inpatient utilization.[31,32] Participating Oncology Care Model practices must formulate a care plan that contains the components of the Institute of Medicine Care Management Plan, which includes ACP documentation.[33]

These care models will depend on innovation in how ACP is provided. In their recent review of information and communication technologies in end-of-life care, Ostherr et al[34] concluded that scalable new technologies are "sorely needed to improve quality of life at the end-of-life while reducing costs of care."[34(p417)] The risk factors associated with potentially avoidable terminal oncology ICU hospitalizations could potentially be used as a starting point to structure a precision algorithm to identify patients with cancer at high risk for avoidable aggressive end-of-life care. These patients can then be prioritized for interventions such as palliative care or ACP discussions. An algorithm could provide guidance on timing of these discussions, thus overcoming a significant barrier to ACPs.[35] This study highlights that specialty physicians are not always in agreement regarding avoidable terminal hospitalizations, as indicated by the low kappa. This key finding demonstrates the need for education on end-of-life care issues and the potential usefulness of an algorithm to help unify physicians' perspectives and assist in shared decision making with patients. The Rothman Index is an example of a technology that has been used to communicate a declining patient's status and facilitate discussions between providers and patients and their families.[36] Given current limitations on availability of palliative care physicians in both the outpatient and inpatient settings, continued studies related to timing,[37-40] frequency, and effectiveness of palliative care and ACP interventions are warranted.

In conclusion, delivering patient-centered, high-quality care to oncology patients at the end of life has become a national health priority. This is the first study to evaluate the quality metric of terminal oncology ICU hospitalizations. Our findings revealed that despite frequent contacts with outpatient care providers, aggressive end-of-life care occurred, and almost half of these hospitalizations are potentially avoidable with different medical management. Beyond the issues of cost and resource scarcity, these ICU deaths often create a traumatic experience for patients and families.[10] As the Institute of Medicine recognizes, there are "no decisions that are more profound than those made near the end of life."[17(p1)] Health care leaders should test strategies to prospectively identify patients at high risk for avoidable terminal hospitalizations and formulate interventions to improve end-of-life planning and care. JOP

Acknowledgment

The production of this manuscript was funded by the Conquer Cancer Foundation Mission Endowment. Supported by a T-32 National Institutes of Health /National Cancer Institute basic research training grant in medical oncology (B.D.). Presented at the 2016 ASCO Quality Care Symposium, Phoenix, AZ, February 26-27, 2016.

Authors' Disclosures of Potential Conflicts of Interest

Disclosures provided by the authors are available with this article at jop.ascopubs.org.

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AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

No Exit: Identifying Avoidable Terminal Oncology Intensive Care Unit Hospitalizations

The following represents disclosure information provided by authors of this manuscript. All relationships are considered compensated. Relationships are self-held unless noted. I = Immediate Family Member, Inst = My Institution. Relationships may not relate to the subject matter of this manuscript. For more information about ASCO's conflict of interest policy, please refer to www.asco.org/rwc or jop.ascopubs.org/site/misc/ifc.xhtml.

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Appendix

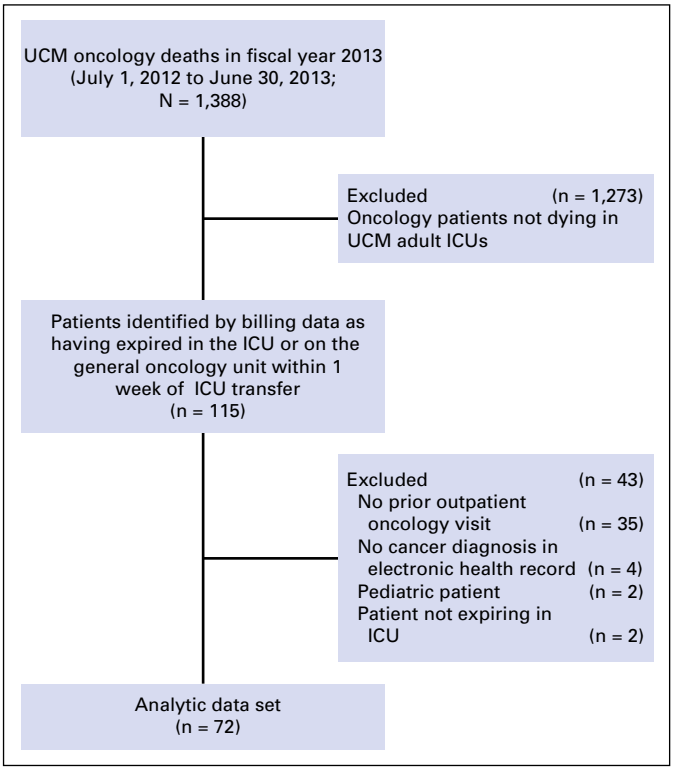

FIG A1. Study flow diagram. ICU, intensive care unit; UCM, University of Chicago Medicine.