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Authors

Klotz, Adam

Caterino, Jeffrey

Durham, Danielle

et al.

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Observation Unit Use Among Patients with Cancer Following Emergency Department Visits: Results of a Multicenter Prospective Cohort from CONCERN

Adam D. Klotz, MD[1], **Jeffrey M. Caterino, MD, MPH**[2], **Danielle Durham, MPH, PhD**[3], **Juan Felipe Rico, MD**[4], **Daniel J. Pallin, MD, MPH**[5], **Corita R. Grudzen, MD, MSHS**[6], **Caroline McNaughton, BS**[7], **Isabelle Marcelin, MD**[8], **Beau Abar, PhD**[9], **David Adler, MD, MPH**[10], **Aveh Bastani, MD**[11], **Steven L. Bernstein, MD**[12], **Jason J. Bischof, MD**[13], **Christopher J. Coyne, MD, MPH**[14], **Daniel J. Henning, MD, MPH**[15], **Matthew F. Hudson, PhD, MPH**[16], **Gary H Lyman, MD, MPH**[17], **Troy E. Madsen, MD**[18], **Cielito C. Reyes-Gibby, DrPH**[19], **Richard J. Ryan, MD**[20], **Nathan I Shapiro, MD**[21], **Robert Swor, DO**[22], **Charles R. Thomas Jr., MD**[23], **Arvind Venkat, MD**[24], **Jason Wilson, MD, MA**[25], **Sai-Ching Jim Yeung, MD, PhD**[26], **Sule Yilmaz, PhD**[27], **Robin Stutman, MD**[28], **Christopher W. Baugh, MD, MBA**[29]

[1]Department of Medicine, Memorial Sloan Kettering Cancer Center, New York, NY, USA.

[2]Departments of Emergency Medicine and Internal Medicine, The Ohio State University Wexner Medical Center, Columbus, OH, USA.

[3]Danielle D. Durham, PhD, MPH. Department of Radiology, University of North Carolina at Chapel Hill School of Medicine, Chapel Hill, North Carolina, USA.

[4]Department of Pediatrics, University of South Florida Morsani College of Medicine. Tampa, FL, USA.

[5]Daniel J. Pallin, MD, MPH.

[6]Ronald O. Perelman Department of Emergency Medicine and Population Health, New York University School of Medicine, New York, NY, USA.

[7]University of Chicago Pritzker School of Medicine, Chicago, Illinois, USA.

[8]Ronald O. Perelman Department of Emergency Medicine and Population Health, New York University School of Medicine, New York, NY, USA.

[9]Department of Emergency Medicine, University of Rochester, Rochester, NY, USA.

[10]Department of Emergency Medicine, University of Rochester, Rochester, NY, USA.

[11]Department of Emergency Medicine, William Beaumont Hospital – Troy Campus, Troy, MI, USA.

[12]Department of Emergency Medicine, Yale School of Medicine, New Haven, CT, USA.

Corresponding author: Adam Klotz, MD, Urgent Care Service H104, Memorial Sloan Kettering Cancer Center, 1275 York Avenue, New York, NY 10065, klotza@mskcc.org, 212-639-6821 (work), 646-717-3367 (fax).

Authorship contributions:

All authors conceived the study. ADK and CWB were responsible for data acquisition. DD performed the statistical analysis under the supervision of ADK and CWB. ADK and CWB drafted the manuscript, and all authors contributed substantially to its revision. ADK, CWB and DD designed the statistical analysis. ADK takes responsibility for the paper as a whole.

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[13]Department of Emergency Medicine, The Ohio State University Wexner Medical Center, Columbus, OH, USA.

[14]Department of Emergency Medicine, University of California San Diego, San Diego, CA, USA.

[15]Department of Emergency Medicine, University of Washington, Seattle, WA, USA.

[16]Prisma Health Cancer Institute, Greenville, SC, USA.

[17]Hutchinson Institute for Cancer Outcomes Research, Fred Hutchinson Cancer Research Center and the Department of Medicine, University of Washington School of Medicine, Seattle, WA, USA.

[18]Division of Emergency Medicine, University of Utah, Salt Lake City, UT, USA.

[19]Department of Emergency Medicine and Biostatistics, The University of Texas MD Anderson Cancer Center, Houston, TX, USA.

[20]Department of Emergency Medicine, University of Cincinnati, Cincinnati, OH, USA.

[21]Department of Emergency Medicine, Beth Israel Deaconess Medical Center, Boston, MA, USA.

[22]Department of Emergency Medicine, William Beaumont Hospital, Royal Oak, MI, USA.

[23]Department of Radiation Medicine, Knight Cancer Institute, Oregon Health & Sciences University, Portland, OR, USA.

[24]Department of Emergency Medicine, Allegheny Health Network, Pittsburgh, PA, USA.

[25]Department of Emergency Medicine, University of South Florida Morsani College of Medicine. Tampa, FL, USA.

[26]Department of Emergency Medicine, The University of Texas MD Anderson Cancer Center, Houston, TX, USA.

[27]Department of Geriatric Oncology, University of Rochester Medical center, Rochester, NY, USA.

[28]Department of Medicine, Memorial Sloan Kettering Cancer Center, New York, NY, USA.

[29]Department of Emergency Medicine, Brigham and Women’s Hospital, Boston, MA, USA.

Abstract

Purpose—Emergency department (ED) visits by patients with cancer frequently end in hospitalization. As concerns about ED and hospital crowding increase, observation unit care may be an important strategy to deliver safe and efficient treatment for eligible patients. In this investigation, we compared the prevalence and clinical characteristics of cancer patients who received observation unit care with those who were admitted to the hospital from the ED.

Methods—We performed a multicenter prospective cohort study of patients with cancer presenting to an ED affiliated with one of 18 hospitals of the Comprehensive Oncologic Emergency Research Network (CONCERN) between March 1, 2016 and January 30, 2017. We compared patient characteristics with the prevalence of observation unit care usage, hospital admission, and length of stay.

Results—Of 1,051 enrolled patients, 596 (56.7%) were admitted as inpatients, and 72 (6.9%) were placed in an observation unit. For patients admitted as inpatients, 23.7% had a length of stay

≤2 days. The conversion rate from observation to inpatient was 17.1% (95% CI 14.6–19.4) among those receiving care in an observation unit. The average observation unit length of stay was 14.7 hours. Patient factors associated ED disposition to observation unit care were female gender and low Charlson Comorbidity Index.

Conclusion—In this multicenter prospective cohort study, the discrepancy between observation unit care use and short inpatient hospitalization may represent underutilization of this resource and a target for process change.

INTRODUCTION

Emergency department (ED) visits continue to increase, up to nearly 140 million in 2017.[1] Concomitantly, 4.2% of adult ED visits are cancer related,[2] with an increasing frequency and acuity due to screening and treatment advances that prolong survival and reduce mortality. The widespread application of immuno-oncology has led to a new spectrum of treatment-related toxicities, many of which are managed in the ED.[3] Simultaneously, inpatient crowding is a common challenge resulting in ED boarding. The COVID-19 pandemic has forced EDs to accommodate an acutely ill and highly contagious patient population while decreasing patient density, particularly for individuals with impaired immunity.[4]

The inpatient admission rate following an ED visit is higher for patients with cancer than for the overall population.[5],[6],[7] However, not all of these patients who present through the ED require prolonged inpatient hospitalizations (i.e. >2 days).[8] When discharge of patients to home with close outpatient follow up is not feasible, hospitalization via a short-stay inpatient hospitalization or observation unit visit may be necessary.

Observation units are an established resource for providers caring for complex and often vulnerable patients who require further diagnostic testing and treatment prior to making an informed decision about inpatient hospitalization.[9] Nationally across all Medicare patients, observation visits are increasingly replacing short inpatient hospitalizations.[2] Many observation visits occur via a billing change to an outpatient status in the same inpatient area of the hospital, with care delivered by an inpatient team.[5] However, when observation care is delivered in a dedicated unit using condition-specific protocols, patients receive more efficient care.[10]

Little is known about the use of observation unit care among patients with cancer who visit EDs. In the Medicare population, observation status is used less frequently by patients with cancer than matched patients without cancer.[11] A recent retrospective review at a designated cancer hospital demonstrated fewer inpatient admissions following the implementation of an observation program.[12] We studied observation unit and short-stay inpatient hospitalization among a multi-center prospective cohort of ED patients with cancer.

METHODS AND MATERIALS

Study Design and Participants

This multicenter prospective cohort study of patients with cancer presenting to the ED was conducted at 18 member hospitals of the Comprehensive Oncologic Emergency Research Network (CONCERN) between March 1, 2016 and January 30, 2017. The Institutional Review Board at each site approved the study and investigators adhered to STROBE guidelines.[6] Members of CONCERN include academic EDs with mean annual visit volume of 71,886 (standard deviation [SD] 31,157) and 30% overall admission rate (SD 7.2%). Seventeen sites were urban and thirteen were affiliated with comprehensive cancer centers. Two sites were standalone cancer hospitals.

Procedure

Study participants consisted of ED adults (age ≥18 years) with active cancer. Enrollment occurred during daytime and overnight hours seven days a week when the research staff was present. We previously defined active cancer as a patient with (1) ongoing (or within 12 months) antineoplastic therapy (radiation, chemotherapy, or other), (2) previously identified or ED provider-identified cancer recurrence or metastasis, or (3) cancer-related symptoms. [13] Participants did not meet criteria #1 or #2 if only receiving hormonal therapy for post-cure maintenance. Exclusion criteria included pregnancy, incarceration, psychiatric chief complaint, trauma response activation, non-English speaking, previous enrollment, or unable to participate in the survey administration.

Research staff obtained informed consent and administered a questionnaire to the participant in the ED. While the participant was the primary responder, family and caregivers could assist with survey completion. Study staff collected chart review data at 30 days post-enrollment using standardized electronic forms. All chart reviewers underwent a one-hour training at their site and used a data dictionary. Electronic records reviewed included the ED chart, inpatient chart, and subsequent outpatient notes over a 30-day time period.

Outcome Measures

We recorded key patient demographic and health history items (e.g., age, sex, cancer type), ED and hospital length of stay (LOS) and diagnosis, and initial ED disposition. The primary outcomes were the overall inpatient admission rate, the short-stay (≤2 days) inpatient admission rate, and initial observation unit rate. Secondary outcomes included the conversion rate from observation status to inpatient status among observation unit visits, observation unit LOS and most common discharge diagnoses among various disposition categories.

Survey variables included demographics, cancer type and cancer therapy within the proceeding 30 days (chemotherapy, radiation or cancer-related surgery). We also collected data for the Eastern Cooperative Oncology Group (ECOG) performance status. Chart review data included comorbidities sufficient to calculate the Charlson Comorbidity Index (CCI) [7], primary cancer type, ED disposition, inpatient diagnoses and hospital LOS. We grouped International Classification of Diseases-10 (ICD-10) codes using the Clinical Classifications

Software (CCS) to explore he most common themes of conditions managed in each setting. [2]

Data Analysis

We used descriptive statistics to characterize the demographic and clinical characteristics of the study population. We assessed differences in proportions using the Pearson chi-square statistic and differences in means using t-tests. We used multivariable logistic regression to estimate the associations between patient demographic and clinical factors, and short-stay (<2 days) inpatient admission and report adjusted odds ratios with 95% confidence intervals (95% CI). The adjusted model included all demographic and clinical variables. We conducted analyses using SAS software (version 9.4; SAS Institute, Inc., Cary, NC) and note missing values in the tables. We considered an alpha level of 0.05 statistically significant for all analyses.

RESULTS

We included 1,051 patients and describe their characteristics in Table 1. Of these, 94 (8.9%) were admitted between 11pm and 7am. We excluded 12 patients from the final analysis because a disposition after observation unit care could not be determined. An additional 19 admitted patients whose length of stay was not recorded were also excluded from the final analysis. The initial overall inpatient admission rate was 56.7% (n = 596) and 6.9% (n = 72) initially received observation unit care. The conversion rate from observation to inpatient status was 17.1% (95% CI 14.6–19.4) among those receiving care in an observation unit. Of all inpatient admissions, 141 (23.7%) had a LOS ≤2 days. Female patients were more likely to receive observation unit care (68.1% of observation unit visits versus 47.6% of inpatient visits ≤2 days, p =0.0032). Additionally, patients with lower CCI scores were more likely to be placed in an observation unit versus an inpatient stay of ≤2 days (p =0.0323). We did not observe any differences between the observation unit group and inpatient stay ≤2 days group across age, 30-day treatments (chemotherapy, radiation, surgery) preceding the ED visit, or ECOG score.

After grouping the ICD-10 discharge diagnoses using the CCS tool, we list the most common discharge diagnoses by initial disposition in Table 2. A description of the most common diagnoses in each CCS category is listed in the bottom of each cell in Table 2. The most common diagnoses for patients with an initial disposition to both observation unit care and hospital admission were symptoms; signs; and ill-defined (21.2%), diseases of the circulatory system (20.0%), and diseases of the blood and blood-forming (8.6%). No difference in CCS categories was observed between long and short stay admissions.

Table 3 displays the multivariable logistic regression analysis used to examine patient characteristics associated with an inpatient hospital admission LOS ≤2 days. Age, gender, race, tumor type, recent antineoplastic therapy, CCI, and ECOG score were not statistically significant predictors of short stay admission.

In the appendix we describe the ED characteristics and observation unit programs at individual study sites. The relative breakdown of the initial disposition by study site is

shown in Figure S1. In Table 4 we compare site-specific observation unit characteristics. Most sites operated emergency medicine directed dedicated observation units contiguous with the ED and staffed with a 4:1 patient to nurse ratio. The use of observation status outside of these units was rare and represented only 1.2% of all visits. On average, 8.3% of all ED visits encompassing patients with and without cancer resulted in an observation unit stay.

DISCUSSION

In this multicenter investigation of more than 1,000 ED visits by patients with cancer, we found that patients requiring ≤2 days of hospital care were more often admitted as inpatients than managed in an observation unit setting. Patients placed in an observation unit were more often female and had fewer medical comorbidities than those admitted as inpatients. This observed gender difference has not been previously reported in observation care use by non-oncologic populations. As breast cancer was the most common underlying primary malignancy placed in observation care, it is possible that many of these patients were receiving adjuvant or neoadjuvant treatment. These individuals tend to have fewer medical comorbidities, a smaller burden of cancer-related symptoms[14], and receive care for complaints such as such as nausea, dehydration, and fever which can often be managed in the observation setting.

On average, 8.3% of all ED visits at our study sites resulted in an observation unit visit, a finding consistent with national practice. However, only 6.9% of study patients had this disposition, suggesting underutilization of this resource for patients with cancer. The most likely explanation for this gap is the perception by ED providers that patients with cancer are inherently more complex and will not be ready for discharge within 2 days. This belief is thought to influence other medically conservative decisions in the ED, such as admitting low risk febrile neutropenia.[15, 16] Providers may also perceive patients with cancer as requiring more resources than can be realistically provided in the observation setting, such as a higher intensity of nursing care.

The relatively low rate of observation care is notable when juxtaposed with the high percentage of hospital admissions with a LOS ≤2 days. Patients with cancer typically wish to minimize their time in the hospital – both to ensure comfort and well-being and minimize nosocomial infection risk. The recent COVID-19 pandemic has sharply amplified this trend.[17] Similarly, inpatient medical and surgical care is embracing evidence based clinical pathways that focus on high quality cost-effective interventions while minimizing LOS.[18] In the noncancer ED population, numerous studies comparing routine hospital admission versus protocolized observation unit care for common conditions (e.g., chest pain, asthma and syncope) reveal achievable and substantial reductions in hospital LOS.[5, 10, 11] Similar studies of protocolized observation unit care for cancer patients have not been published, although introduction of an observation unit at Memorial Sloan Kettering resulted in a 50% reduction in short stay admissions for chest pain.[8]

Critics of observation care often cite patient out of pocket costs as a reason to advocate for inpatient care if the patient requires hospitalization. However, data from the Office of

the Inspector General reveal that for Medicare beneficiaries, the patient expense for an observation hospitalization is lower than the Medicare Part A inpatient deductible expense in 94% of visits.[19] Visits most likely to result in a high patient out of pocket expense are those involving a prolonged skilled nursing facility stay following a hospitalization lacking a qualifying hospital stay (e.g., three inpatient days for Medicare). Furthermore, the Centers for Medicare & Medicaid Services is piloting skilled nursing facility waiver programs that would allow some patients to transition directly from an observation unit stay to a skilled nursing facility with their coverage intact.[20]

The use of CCS and ICD-10 in Table 2 created a similar spectrum of ED diagnoses among observation and admitted patients. Similarly, the multivariable regression analysis presented in Table 3 did not identify statistically significant predictors of short stay inpatient admission. This is likely due to the use of overly broad variables and supports the need to better define these populations. Further analysis of discrete clinical syndromes in specific cancer populations may identify other variables that are associated with short stay admission. Significantly, a greater proportion of patients with low CCIs were managed in the observation setting. This aligns with development of observation-based protocols for discrete clinical syndromes in patients with few comorbidities. The most common conditions placed in observation care in this study were: anemia, syncope, pulmonary embolus, chest pain, and fever (Table 2). Similar diagnoses were identified in a retrospective cohort analysis of 10,000 ED visits by patients with cancer.[8] Many sites have independently developed observation unit protocols for the management of the following conditions: chemotherapy-induced nausea and vomiting, acute management of cancer-related pain, correction of dehydration and associated metabolic derangements, initiation of anticoagulation for venous thromboembolism, fever of unclear significance, low risk febrile neutropenia (by MASCC or CISNE criteria)[21],[12],[6] and transition to home hospice. Some hospitals favor creating multiple observation units, with higher staffing levels and longer anticipated LOS to selectively manage patients with more complex needs; such facilities may particularly attend to an oncology population.[22]

Some patients with cancer bypass nearby EDs and travel long distances to be evaluated in hospitals affiliated with their oncologist. Consequently, discharge home during certain times of day (e.g., overnight) or in extreme weather can impede discharge, and augment admissions. Observation units offer a “safe space” to delay discharge, allowing time to optimize the patients’ clinical issues and to arrange for care (e.g., physical therapy evaluation and enrollment of home health services) that may not be available in the evening or at night during an ED stay.[19] Without access to an observation unit, a short-stay inpatient admission could also accomplish these goals but may entail longer hospital stays.

ED practitioners may reasonably conclude some patients with cancer are “too sick” to benefit from the observation unit setting. These patients typically receive care in environments with lower patient: nurse ratios when admitted (3:1 in inpatient areas versus 4:1 or 5:1 in most observation units). Nearly all observation units were staffed by emergency physicians who may have less experience managing complications of cancer therapy for extended periods of time. It is unlikely that observation bed capacity significantly influenced utilization as all but one site met or exceeded the current benchmark of 2 observation

beds per 10,000 ED visits. Observation units at participating centers were reflective of national practice and consistent with recommended operating characteristics by the Society for Academic Emergency Medicine and American Academy of Emergency Medicine Physicians. The significant variation in the physical location, size, staffing, and performance metrics of the observation units that participated in this study, noted in Table 4 and Figure 1, suggests an opportunity to more explicitly define the optimal operational parameters of these units and implications of infrastructure variations.

The common benchmark for an ideal conversion to inpatient rate from an observation unit setting is 20%.[13] The 17.1% conversion rate from observation to hospital admission found in this study supports the hypothesis that observation unit care can be appropriately delivered to patients with cancer. Conversion rates among other patient populations with increased complexity and clinical needs have been shown to be significantly higher. For example, a 31.8% conversion rate among older patients with chest pain was found in a recent analysis yet those patients are still considered a high-value target for observation unit care.[7] As observation unit care is delivered to more patients with cancer, the conversion to inpatient rate is an important balancing metric to track, with the understanding that it will likely exceed the 20% benchmark among all-comers. Similar to other challenging populations, a tolerance for higher conversion rates may be reasonable in the population with cancer.

Future research should clarify several important clinical and operational aspects of the care of patients with cancer in the observation unit setting. There is a lack of evidence affirming equal benefits from using condition-specific protocols in a dedicated unit for patients with cancer as for those without cancer. Additionally, patients with cancer may have unique goals of care in the observation setting, such as symptom improvement, avoidance of inpatient hospital admission, and improved functional status. Moreover, an observational unit's design, amenities and staffing may require optimization to meet the specific needs of patients with cancer. Furthermore, given that our sites were primarily comprised of large academic centers, our findings suggest that there is an opportunity to educate ED clinicians on observation management of patients with cancer.

LIMITATIONS

This study has several limitations. First, it includes patients from large, primarily urban, academic medical centers which may differ in patient characteristics, resource availability, and outcomes from community hospital ED cancer care. Thus, our study potentially lacks generalizability to all patient populations. Rivera et al. examined ED visits among adult patients with cancer using the Nationwide Emergency Department Sample (NEDS) and found similar admission rates (59.7%), distribution of cancer types, and sex distribution, although observed a greater proportion of patients ≥65 years old.[2] Also, approximately 7% of approached patients were "too ill or otherwise unable to participate," representing 21% of the total ineligible. As a result, our study may underestimate the symptom burden or illness severity of patients with cancer in the ED. Non-English-speaking patients comprised approximately 6% of study candidates and 18% of those deemed ineligible. Patients with cancer and limited English proficiency report inferior treatment outcomes[14] and our

sample may under-estimate the number or degree of cancer-related morbidity in this cohort. Third, 19 admitted patients did not have a LOS recorded and were excluded from the analysis. This should not significantly alter the overall proportions of short and long LOS among admitted patients. Finally, the scope of this study was limited to care rendered in the ED. While outpatient opportunities to mitigate symptoms prior to ED evaluation are an essential element of good oncologic care, CONCERN's primary objective was to describe the current state of ED utilization and disposition. Finally, we were unable to track ED revisits and hospital readmissions to outside hospitals, which may result in underestimates of those events.

CONCLUSION

In this multicenter prospective cohort of cancer patients, observation unit care appears to be underutilized given the significant proportion of admitted patients that were discharged within two days. Unique barriers may discourage observation unit use in this population, but the prevalence of short-stay inpatient admissions suggests an opportunity to increase observation care. Further research may specifically consider observation protocols for cancer patients and observation unit staffing and design that meet the unique needs of this population.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Conflicts of interest:

Dr. Yeung was a member of an expert panel for Celgene, Inc. Dr. Yeung had funding support from Bristol-Myer Squibb, Inc. and DepoMed, Inc. (now Assertio Therapeutics, Inc.). Dr. Bischoff receives funding support from Beckman Coulter. Dr. Baugh is a speaker for Roche Diagnostics and advisory board member for Salix Pharmaceuticals and AcelRx Pharmaceuticals.

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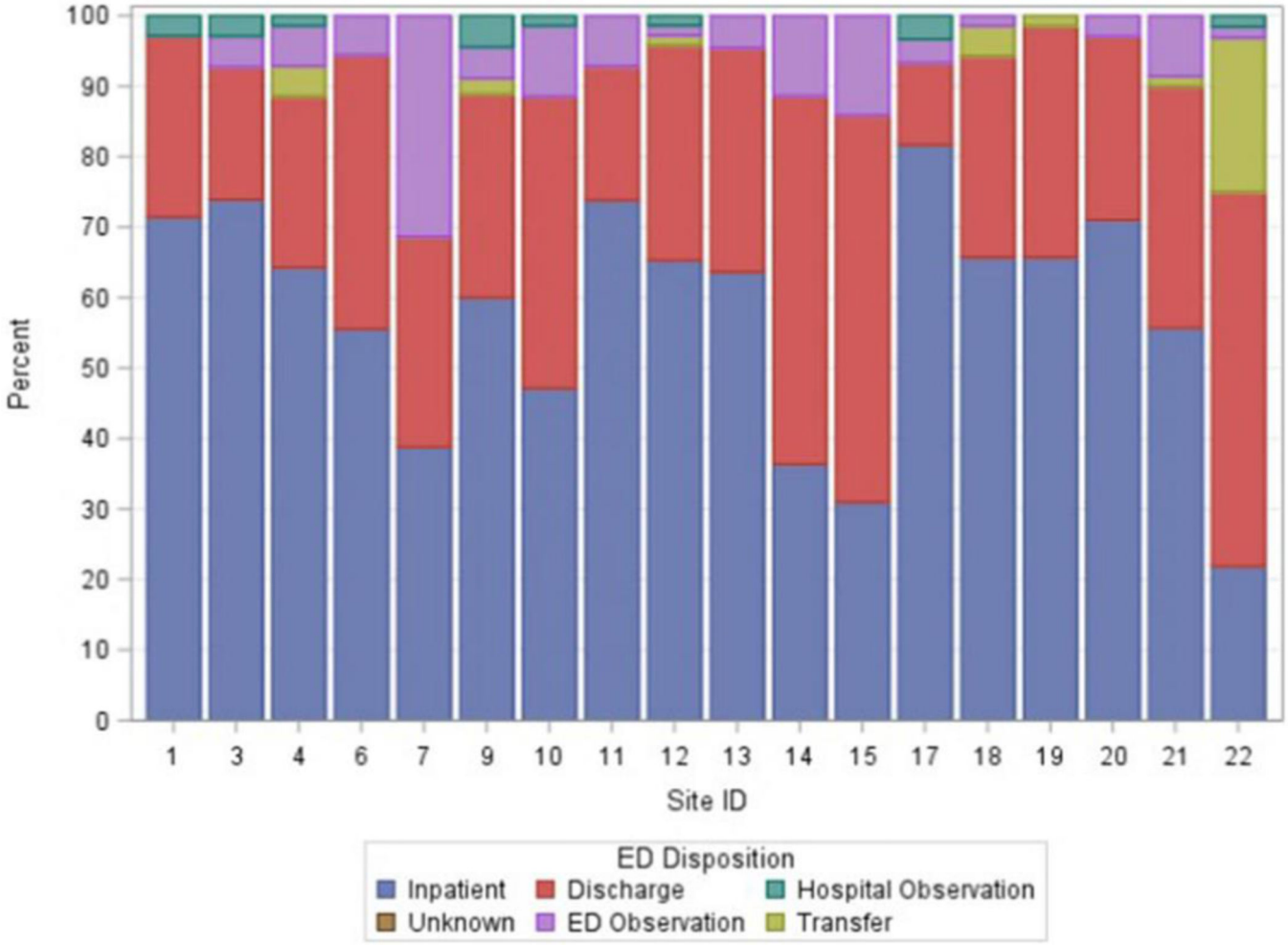

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Table 1:

Patient Characteristics by Initial Emergency Department Disposition and Length of Stay (LOS)

Characteristic	Admitted (%)	Observation Unit (%)	p-value*	Inpatient LOS ≤2 days (% of Admitted)	Inpatient LOS >2days (% of Admitted)	p-value
Total	596 (56.7)	72 (6.9)		141 (23.7)	455 (76.3)	.
Sex						
Female	296 (28.1)	49 (4.7)	0.0032	67 (11.2)	229 (38.4)	0.5596
Male	300 (28.5)	23 (2.2)		74 (12.4)	226 (37.9)	
Mean age (SD)	63.3 (13.7)	64.9 (11.9)	<.0001	62.2 (14.0)	63.7 (13.0)	<.0001
Race						
White	485 (46.1)	54 (5.0)	0.3593	117 (19.1)	368 (61.7)	0.1238
African-American	67 (6.4)	12 (1.1)		12 (2.0)	55 (9.2)	
Other	20 (1.9)	3 (0.2)		8 (1.3)	12 (2.0)	
Unknown	24 (2.3)	3 (0.2)		4 (0.7)	20 (3.4)	
Cancer type						
Solid tumor	481 (45.8)	64 (6.1)	0.0906	113 (19.0)	368 (61.7)	0.8463
Liquid tumor	115 (10.9)	8 (0.8)		28 (4.7)	87 (14.6)	
Charlson weighted score						
0	103 (9.8)	8 (0.8)	0.0323	30 (5.0)	73 (12.2)	0.8310
1	37 (3.5)	5 (0.5)		11 (1.8)	26 (4.3)	
2	93 (8.8)	7 (0.7)		24 (4.2)	69 (11.6)	
3	53 (5.0)	0 (0)		11 (1.9)	42 (7.0)	
4	25 (2.2)	7 (0.7)		4 (0.7)	21 (3.5)	
5	14 (1.3)	5 (0.5)		5 (0.8)	9 (1.5)	
6	120 (11.4)	17 (1.6)		25 (4.2)	95 (15.9)	
7	59 (5.6)	5 (0.5)		12 (2.0)	47 (7.9)	
8	36 (3.4)	7 (0.7)		7 (1.2)	29 (4.9)	
≥9	53 (5.4)	10 (1.0)		12 (2.0)	41 (6.9)	
Unknown	3 ()	1 (0.1)		0 (0)	4 (0.7)	
Treatment						
Chemotherapy past 30 days	296 (28.2)	32 (3.0)	0.4027	66 (11.0)	230 (38.6)	0.4376
Surgery past 30 days	46 (4.4)	9 (0.9)	0.1632	7 (1.2)	39 (6.5)	0.1609
Radiation past 30 days	58 (5.5)	7 (0.7)	0.9980	16 (2.7)	42 (7.0)	0.4587
Number of Cancer-related hospital admissions within prior 30 days						
0	407 (38.7)	49 (4.7)	0.0006	103 (17.3)	304 (51.0)	0.3268
1	157 (14.9)	18 (1.7)		34 (5.7)	123 (20.6)	
2	29 (2.8)	1 (0.1)		4 (0.7)	25 (4.2)	

Characteristic	Admitted (%)	Observation Unit (%)	p-value*	Inpatient LOS ≤2 days (% of Admitted)	Inpatient LOS >2days (% of Admitted)	p-value
3+	3 (0.3)	4 (0.4)		0 (0)	3 (0.5)	
ECOG score						
0 Asymptomatic	151 (14.4)	16 (1.5)	0.3268	38 (6.4)	113 (19.0)	0.0631
1 Symptomatic but ambulatory	168 (16.0)	25 (2.4)		50 (8.4)	118 (19.8)	
2 Symptomatic, <50% of time in bed during the day	115 (11.0)	21 (2.0)		27 (4.5)	88 (14.8)	
3 Symptomatic, >50% of time in bed, not bed bound	135 (12.9)	8 (0.8)		21 (3.5)	114 (19.1)	
4 Bed bound	22 (2.2)	1 (0.1)		4 (0.7)	18 (3.0)	
Unknown	5 (0.6)	1 (0.1)		1 (0.2)	4 (0.7)	

*p value for difference between disposition groups

**p value for difference between LOS <2 days and ≥2 days groups

Chi-square for difference in proportions and t-test for difference in means. P-values do not include unknown observations

ECOG = Eastern Cooperative Oncology Group

Table 2:

Most Common Primary CCS Discharge Diagnoses by Initial Disposition

Observation Unit (%)	Inpatient <2 days (%)	Inpatient ≥2 days (%)
Symptoms; signs; and ill-defined (21.1) fever, abdominal pain, nausea, vomiting, syncope, weakness	Symptoms; signs; and ill-defined (18.5) fever, abdominal pain, nausea, vomiting, syncope, weakness	Symptoms; signs; and ill-defined (19.3) fever, abdominal pain, nausea, vomiting, syncope, weakness
Diseases of the circulatory system (20.0%) chest pain, PE, PAF, TIA	Diseases of the circulatory system (11.7) chest pain, PE, PAF, TIA	Diseases of the circulatory system (11.5) chest pain, PE, PAF, TIA
Diseases of the blood and blood-forming (8.6) anemia, neutropenia, thrombocytopenia	Diseases of the digestive system (11.2) diarrhea, GI bleed, constipation, bowel obstruction	Diseases of the respiratory system (10.3) pneumonia, dyspnea, hypoxia, COPD
Diseases of the digestive system (7.1) diarrhea, GI bleed, constipation, bowel obstruction	Diseases of the respiratory system (11.2) pneumonia, dyspnea, hypoxia, COPD	Diseases of the digestive system (10.1) diarrhea, GI bleed, constipation, bowel obstruction

CCS= Clinical Classifications Software; PE= Pulmonary Embolus, PAF= Paroxysmal Atrial Fibrillation, TIA= Transient Ischemic Attack; COPD= Chronic Obstructive Pulmonary Disease; AKI= Acute Kidney Injury, GI Bleed= Gastrointestinal Bleeding

Table 3:

Predictors of Inpatient Admission LOS ≤2 days

Characteristic	Adjusted Odds Ratio (OR)	95% Confidence Interval (CI)
Demographics		
Female (Male=ref)	0.97	(0.66–1.40)
Age ≥65 (<65=ref)	0.81	(0.55–1.18)
African-American (White=ref)	0.86	(0.48–1.56)
Other race (White=ref)	1.92	(0.77–4.75)
Clinical factors		
Solid tumor (liquid tumor=ref)	0.87	(0.54–1.40)
No chemotherapy within prior 30 days (ref=yes)	1.12	(0.77–1.63)
No surgery within 30 days (ref=yes)	2.23	(0.997–5.01)
No radiation within 30 days (ref=yes)	0.63	(0.35–1.13)
Cancer-related hospital admissions within prior 30 days = 1 (ref=0 visits)	0.98	(0.63–1.54)
2 admissions	0.63	(0.22–1.78)
3+ admissions	0.18	(0.12–1.96)
No hospice care (ref=yes)	0.96	(0.23–4.04)
Charlson comorbidity weight ≥2 (ref=<2)	0.72	(0.49–1.05)
ECOG score <2 (ref=≥2)	1.89	(1.15–3.03)

Compared to LOS >2 days, model is adjusted for all variables shown here

ECOG = Eastern Cooperative Oncology Group

Table 4:

Characteristics of Observation Unit Programs at Participating Sites

Site ID	Annual Patient Volume	ED Admit Rate	ED Active Cancer Patients	# of ED beds/OU beds	% of overall ED volume managed in OU	Provider model (EM or IM), APP use	Patient: RN staffing ratio	Proximity of OU to ED	Overall ALOS	Overall OU conversion to inpatient rate (%)	ED revisit rate at 14 and 30 days after OU stay and discharge home	Number Subjects Enrolled
Site 1 *	72,000	30%	15%	66/20	8.3	EM	5:1	Contiguous	13.7h	23.5	16.8% at 30d	70
Site 3	125,100	34%	5–10%	127/17	8.6	EM	4:1	Contiguous	16.8h	20	-	70
Site 4 *	60,050	29%	10%	49/20	12.6	EM	5:1	1 Contiguous and 1 Distant	16.7h	19.1	9.2% at 14d, 13.1% at 30d	71
Site 7 *	65,000	30%	4%	35/35	11.6	EM	-	Distant	22.9h	18.	2.2% at 14d, 2.5% at 30d	69
Site 9 *	90,000	40%	6%	62/14	5.0	EM	4:1	Contiguous	19.0h	15.0%	3.0% at 14d, 5.0% at 30d	72
Site 10 *	20,000	40%	100%	43/16	12.0	EM	4:1	Distant	30.0h	31.0	16.2% at 14d, 23.1% at 30d	70
Site 11 *	85,000	34%	5–10%	53/12	9.0	EM	5:1	Contiguous	-	-	-	42
Site 13	55,000	24%	1.5%	36/25	7.4	EM	4:1	Distant	21.3h	13.2	9.8% at 14d, 14.8% at 30d	60
Site 15 *	24,000	47%	95%	30/15	12.1	EM	4:1	Continuous	20.4h	34.1	9.1% at 14d, 19.0% at 30d	71
Site 17 *	55,000	30%	15%	37/22	-	IM	5:1	Distant	34.0h	-	-	60
Site 20	116,000	26%	4%	80/24	4.5	EM	5:1	Contiguous	21.0h	5.9	-	71
Site 21	76,800	20%	1.5%	55/16	3.0	EM	4:1	Contiguous	17.8h	23.0	9.8% at 14d, 14.8% at 30d	70
Site 22 *	50,000	30%	5%	46/9	5.1	EM	5:1	Contiguous	5.9h	18.0	6.0% at 14d, 6.0% at 30d	66
Ave				55/19	8.3				17.9h	20.1		

Note: sites without any enrollments or dedicated observation unit excluded from this table.

* denotes sites affiliated with NCI Comprehensive Cancer Network, ED = emergency department, OU = observation unit, EM = emergency medicine, IM = internal medicine, ALOS = average length of stay, - = data unavailable