Avoidable and Unavoidable ER Utilization by Cancer Patients on Systemic Therapy

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Emergency room (ER) utilization is common among patients with cancer and is associated with higher acuity visits and increased resource utilization.[1] Prior studies suggest rates of ER utilization between 6 and 83 percent, and up to 37 percent of people make multiple visits while on treatment.[2-7] This utilization exceeds that for the underlying population and also exceeds the rates of patients with cancer who are not on systemic therapy.[3,4,8] In addition, patients with cancer and those who are on treatment are frequently admitted to the hospital,[6] and the ER is a common mechanism used for admission. Population-based studies regarding patients within the first year of a cancer diagnosis demonstrate that as many as 50 to 70 percent of patients seen in the ER are admitted to the hospital.[5,9] ER evaluations add costs to care and more than 50 percent of ER visits by patients with cancer may be avoidable.[10-12]

In the current transition to value-based care, avoidable ER utilization represents an opportunity for healthcare system cost savings, but difficulties remain in determining what visits are and are not avoidable based on coding and billing data alone.[13-16] Recently, the Centers for Medicare & Medicaid Services (CMS) implemented the quality measure CMS OP-35, which measures one or more ER visits or inpatient admissions for anemia, dehydration, diarrhea, emesis, fever, nausea, neutropenia, pain, pneumonia, or sepsis within 30 days of chemotherapy treatment.[17] Data will be available to the public on the CMS hospital compare website for review.[18]

In all, ER utilization among patients with cancer and who are on systemic therapy remains understudied and a variable with regard to data source, design, patient populations, and intention.[8] Population-based studies or those obtained solely with administrative data—for example, coding and billing data—may lack granular detail and sometimes accuracy regarding the potential myriad of factors affecting both patients and providers, including those patients presenting to an ER or elsewhere for care.[14,15] Furthermore, most institution-specific observational studies are from academic or tertiary referral centers, whose patients may have potentially significant differences compared to patients receiving care in a community cancer center.[19,20]

In this study, we sought to comprehensively evaluate both avoidable and unavoidable ER utilization among patients receiving care in a comprehensive community cancer center.

Twenty-four-hour access to nurse communication regarding toxicity management is available via a phone triage system staffed with cancer center nurses after hours and former ER nurses during the regular workday.

Our Methods

The Goshen Center for Cancer Care is a community-based comprehensive cancer program staffed with subspecialty physicians in surgical, radiation, and medical oncology. In addition, support personnel form an integrated care team and include naturopathic physicians, dietitians, mind and body counselors, and financial counselors who are available to patients throughout their cancer treatment and beyond. Patients starting systemic therapy are discussed in a multidisciplinary conference aimed to coordinate care and identify support needs. Patients also are encouraged to attend a chemotherapy orientation class where they receive educational materials and contact information for various services. Many patients receive specific regimen-based education regarding toxicities of treatment from dedicated advanced care practitioners within medical oncology. Twenty-four-hour access to nurse communication regarding toxicity management is available via a phone triage system staffed with cancer center nurses after hours and former ER nurses during the regular workday.

For this study, we identified sequential patients on systemic therapy (exclusive of endocrine therapy) through our electronic health record between April 1 and June 30, 2019. Retrospective data collection included demographic variables, education status, pre-treatment education and support, cancer type, and treatment variables, as well as performance status and presence of the comorbidities of interest (see Table 1, page 45). We documented patient complaints while on systemic therapy, as well as recommendations from cancer center staff. ER utilization was identified from the electronic health record for that same time period (April 1-July 31, 2019). Independent physicians conducted a clinical review of medical records to assess whether these ER visits would be considered avoidable or unavoidable in accordance with the classification proposed by Billings et al.[21]:

- Non-emergent
- Emergent but amenable to primary care management
- Emergent but preventable with prior management (all avoidable visits)
- Emergent and not preventable (unavoidable visits).

Dates of death (where applicable) were identified up to April 30, 2020.

We compared groups with and without ER utilization during the specified time interval and groups of avoidable ER utilization to the remainder of the cohort inclusive of all variables listed in Table 1. In an exploratory analysis conducted due to small numbers, we evaluated groups with avoidable versus unavoidable ER utilization. Where appropriate, we conducted univariate analyses with Fisher's exact test, Pearson's chi-square test, two-sided *t* tests, and the Goodman-Kruskal's gamma test. Independent variables of significance between the comparison groups ($p < 0.05$) or those approaching significance ($p = 0.05$-0.10) were submitted to multivariate analysis utilizing a stepwise logistic regression technique. For all tests, the threshold for significance was a p value of 0.05.

The study was approved by the Goshen Health institutional review board.

Our Results

There were 240 sequential patients under the management of three medical oncologists during the time interval of the study. The cohort characteristics, including patient, payer, cancer type, and treatment variables are summarized in Table 2, page 46. The majority were married women with either commercial insurance or Medicare as their primary health coverage. Approximately one-half had documentation of at least one of the five pre-specified comorbidities of interest with a median performance status of 1. Of the cohort, 211 (88 percent) had pre-treatment education documented via either a chemotherapy orientation series routinely offered to patients starting systemic therapy or one-on-one education with a nurse practitioner or physician assistant in the medical oncology division. The cancer center's integrative care team, which consists of dedicated naturopathic physicians, dietitians, and counselors, provided support to 89 percent of patients at the time of their treatment. Tumor site groupings, chemotherapy administration prior to the study period (yes or no), infused agent type, number of agents, and median infusions per patient are provided in Table 2. The treatment was non-curative in intent for 142 patients (59 percent) in the cohort.

One hundred and twenty-one patients (50.4 percent) had 249 documented contacts with the cancer center concerning treatment-related side effects (range of contacts, 0-11). Of these patients, 51 (21 percent) ultimately made 58 ER visits during the specified study time (median days between infusion and ER usage was 6 days, range 0-70 days); 31 (53 percent) of these incidents had documented prior cancer center contact related to the complaint and 24 resulted in patients being directed to proceed to the ER. The remaining 27 ER visits were either patients who self-referred to the ER, patients who were referred by parties outside of the cancer center, or patients who ignored advice given by cancer center staff and went to the ER. Thirty-two of the 58 visits (55 percent) occurred outside of normal working hours. Independent physician review concluded that, in total, 44 of the 58 visits (76 percent) were avoidable. With the understanding that patients often have multiple complaints when presenting at the ER, the most common presenting complaints in avoidable ER visits included gastrointestinal (GI) complaints (21 instances), pulmonary complaints (8 instances), musculoskeletal complaints (8 instances), and those related to fever and chills (6 instances). The most common presenting complaints among those whose ER visit was assessed as unavoidable included concerns for sepsis (5 instances), severe pulmonary complaints (3 instances), severe GI symptoms (3 instances), paclitaxel reactions (2 instances), and suicidality (2 instances). Overall, 29 of the 58 ER visits (50 percent) resulted in hospital admissions—18 of the 44 (41 percent) were avoidable ER visits and 11 of the 14 (79 percent) were unavoidable.

As of April 30, 2020, 55 of the 240 patients in the study have died. This includes 21 of the 51 patients (41.2 percent) with ER visits during the specified study interval and 34 of the 189 (17.9 percent) patients who did not have an ER visit during the study interval ($p < 0.005$).

Table 1. Independent Variables Assessed for Impact on ER Utilization

Demographic	Health Literacy and Education	Health and Functional Status	Financial, Access, and Convenience	Provider and Cancer Variables	Treatment Variables
Age	Highest education	DM	Payer	Medical oncologist	Treatment intent
Gender	Chemotherapy orientation class	CHF	Distance from cancer center	Cancer type	Integrated care support
Marital status	One-on-one chemotherapy education	COPD CKD	Toxicity complaint	Complaint contact person	Treatment prior to second quarter 2019
		HTN	Day of contact	Number of complaints	Number of infusions
		Number of comorbidities	Interval infusion to ER visit		Number of agents
		ECOG PS	Interval clinic visit to ER visit		Type of agent(s)

ER = emergency room; DM = diabetes mellitus; CHF = history of congestive heart failure; COPD = chronic obstructive pulmonary disease; CKD = chronic kidney disease; HTN = hypertension; PS = performance status.

In comparing patients with ER utilization versus those without (Table 3, page 47), significant factors associated with ER utilization, included:

- Increasing Eastern Cooperative Oncology Group (ECOG) performance status
- Cancer type (with patients with upper GI cancer, more than one type of cancer, and hematologic malignancies all having greater than 30 percent prevalence of ER utilization)
- Increasing number of systemic therapy agents utilized
- The application of cytotoxic agents (as compared to targeted or immunotherapy agents)
- Payer status (Medicaid status had the highest rate of ER utilization, and commercial payer status had the lowest).

In the multivariate logistical regression model, ECOG performance status, the number of agents utilized, and payer status (Medicare) remained significant (Table 3, page 47 and Figure 1, page 48).

In comparing groups with avoidable ER visits versus the remainder of the patient cohort (Table 4, page 49), univariate analysis revealed that, again, increasing ECOG performance status was associated with increased risk of avoidable ER utilization. In addition, the increasing number of systemic agents utilized and the addition of at least one cytotoxic agent were associated with increased avoidable ER utilization. Of patients receiving cytotoxic therapy, 20 percent were assessed to have an avoidable ER visit versus only 7 percent of those receiving only targeted therapy or immunotherapy. Avoidable ER utilization was also associated with fewer triage calls to the cancer center. After a multivariate analysis, only ECOG status and number of agents used remained significantly associated with avoidable ER utilization. However, additional covariate factors in the model (which were not significant on univariate analysis) became significant in the multivariate model. These included histories of congestive heart failure, which had the highest odds of avoidable ER utilization at 9.12, and payer status, particularly Medicare as compared to commercial or Medicaid, which was associated with increased odds of avoidable ER utilization. Two factors were found to mitigate avoidable ER utilization. These included the number of triage contacts to the cancer center and attendance in a chemotherapy orientation class. Triage contact showed a 38 percent reduction in odds of avoidable ER utilization. Attendance of a chemotherapy orientation class was associated with an approximately 50 percent reduction in the odds of avoidable ER utilization, but this apparent trend did not reach statistical significance.

An exploratory univariate analysis (Table 4, page 49 and Figure 2, page 48) of patients assessed as having avoidable versus unavoidable ER utilization demonstrated that the absence of contact with cancer center staff regarding patient symptom complaints and higher educational status increased the probabilities of avoidable ER visits. Of the 51 patients with ER visits during the study time interval, 24 contacted the cancer center

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Table 2. Background Cohort Description

	Median (Range)	Variable	N (%)	Variable	N (%)
Demographic Data					
Age	64 (28-92)	Gender Male Female	 96 (40%) 144 (60%)	Highest educational level Did not graduate HS HS graduate College graduate Advanced degree Unknown	 31 (13%) 91 (38%) 32 (13%) 9 (4%) 77 (32%)
Distance to cancer center	12.1 (0-102.4)	Marital status Married Divorced Widowed Single	 153 (63.8%) 30 (12.5%) 27 (11.3%) 28 (11.7%)	Payer Commercial Medicare Medicaid Uninsured	 99 (42%) 102 (43%) 30 (12.5%) 9 (3.8%)
Comorbidity and Functional Assessment					
Comorbid condition/patient	1 (0-4)	Comorbid conditions DM CKD COPD CHF HTN	 45 (18.8%) 13 (5.4%) 30 (12.5%) 6 (2.5%) 86 (35.8%)	Comorbid conditions/patient 0 1 2 3 4	 119 (49.6%) 80 (33.3%) 31 (12.9%) 9 (3.8%) 1 (0.4%)
ECOG performance status	1 (0-3)				
Tumor Site Grouping				**Patient Education and Support**	
		Breast Hematologic Lung Lower GI Gynecologic Hepatopancreatobiliary	51 (21%) 47 (20%) 41 (17%) 30 (13%) 23 (10%) 10 (4%)	Chemotherapy orientation class Yes No	 112 (46.7%) 128 (53.3 %)
		Genitourinary Upper GI Head and neck Sarcoma Skin More than one cancer	8 (3%) 9 (4%) 5 (2%) 3 (1%) 7 (3%) 6 (3%)	NP or PA education Yes No Integrated care team support Yes No	 180 (75%) 60 (25%) 214 (89.2%) 26 (10.8%)
Systemic Therapy					
Infusions per patient	4.5 (1-27)	Chemotherapy prior to study period Yes No	 162 (67.5%) 78 (32.5%)	Treatment intent Curative Non-curative	 98 (41%) 142 (59%)
Number of agents	2 (1-4)	Drug type Cytotoxic Targeted agent Immunotherapy Study drug	 167 (69.6%) 92 (38.3%) 46 (19.2%) 4 (1.7%)		

HS = high school; DM = diabetes mellitus; CKD = chronic kidney disease; COPD = chronic obstructive pulmonary disease; CHF = congestive heart failure; HTN = hypertension; NP = medical oncologist nurse practitioner; PA = physician assistant.

Table 3. Univariate and Multivariate Analysis of Significant Factors Associated with ER Utilization Compared with No ER Utilization

Univariate Analysis ER Visit Yes Versus No (Non-significant Variables Not Shown)		ER No	ER Yes	*p* Value	Multivariate Analysis Odds Ratio (95% Confidence Interval)	*p* Value
ECOG PS	0 1 2 3	99 (91%) 69 (76%) 13 (57%) 5 (50%)	10 (9%) 22 (24%) 10 (43%) 5 (50%)	0.005	2.56 (1.65-4.13)	0.005
Cancer group	Breast Genitourinary Gynecologic Head and neck Hematologic Hepatopancreatobiliary Lower gastrointestinal Lung More than one cancer Sarcoma Skin Upper gastrointestinal	42 (82%) 8 (100%) 19 (83%) 5 (100%) 32 (68%) 9 (90%) 24 (80%) 34 (83%) 3 (50%) 3 (100%) 7 (100%) 3 (33%)	9 (18%) 0 (0%) 4 (17%) 0 (0%) 15 (32%) 1 (10%) 6 (20%) 7 (17%) 3 (50%) 0 (0%) 0 (0%) 6 (67%)	0.008		NS
Number of agents	1 2 3 4	82 (90%) 63 (76%) 32 (76%) 12 (50%)	9 (10%) 20 (24%) 10 (24%) 12 (50%)	0.005	2.30 (1.62-3.34)	0.005
Cytotoxic agent	No Yes	64 (89%) 125 (74%)	8 (11%) 43 (26%)	0.015		NS
Payer	Commercial Medicare Medicaid Uninsured	87 (88%) 23 (77%) 72 (71%) 7 (78%)	12 (12%) 7 (23%) 30 (29%) 2 (22%)	0.028	2.89 (1.3-6.85) 2.67 (0.72-10.65)	0.01 0.09

NS = not significant.

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prior to the ER utilization: 14 (58 percent) of these visits were assessed by the independent review as avoidable. On the contrary, of the 27 patients with ER utilization who did not contact the cancer program with symptom complaint prior to ER utilization, 24 (89 percent) were assessed as avoidable ($p = 0.023$). Data showing patients' highest educational status were available for 31 of the 51 patients who used the ER. Avoidable ER utilization correlated with increased levels of patient education status. Of the 31 patients with available educational status data, 4 of 7 (57 percent) who did not graduate high school and 11 of 15 (73 percent) high school graduates had ER utilization assessed as avoidable, whereas 9 of 9 (100 percent) patients with a college degree or higher had ER utilization assessed as avoidable ($p < 0.005$).

What Does This Mean?

For most healthcare industry stakeholders (patients, payers, and providers), the reduction of unnecessary ER utilization for patients on systemic therapy is advantageous. ER utilization is associated with increased costs and patient inconvenience, and it presents a threat to value-based reimbursement, which would include measures of ER utilization and costs of care associated with systemic therapy.[14] In this study, we have rigorously evaluated a sequential cohort of patients on systemic therapy in a comprehensive community-based cancer center. Despite significant programmatic efforts, 21 percent of our patients presented to the ER with complaints within the study time frame (4 months), with 55 of the 58 visits occurring less than 30 days after initiation of systemic therapy administration. Of these visits, 75 percent were

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Figure 1. Forest Plot of Significant Factors Associated with ER Utilization

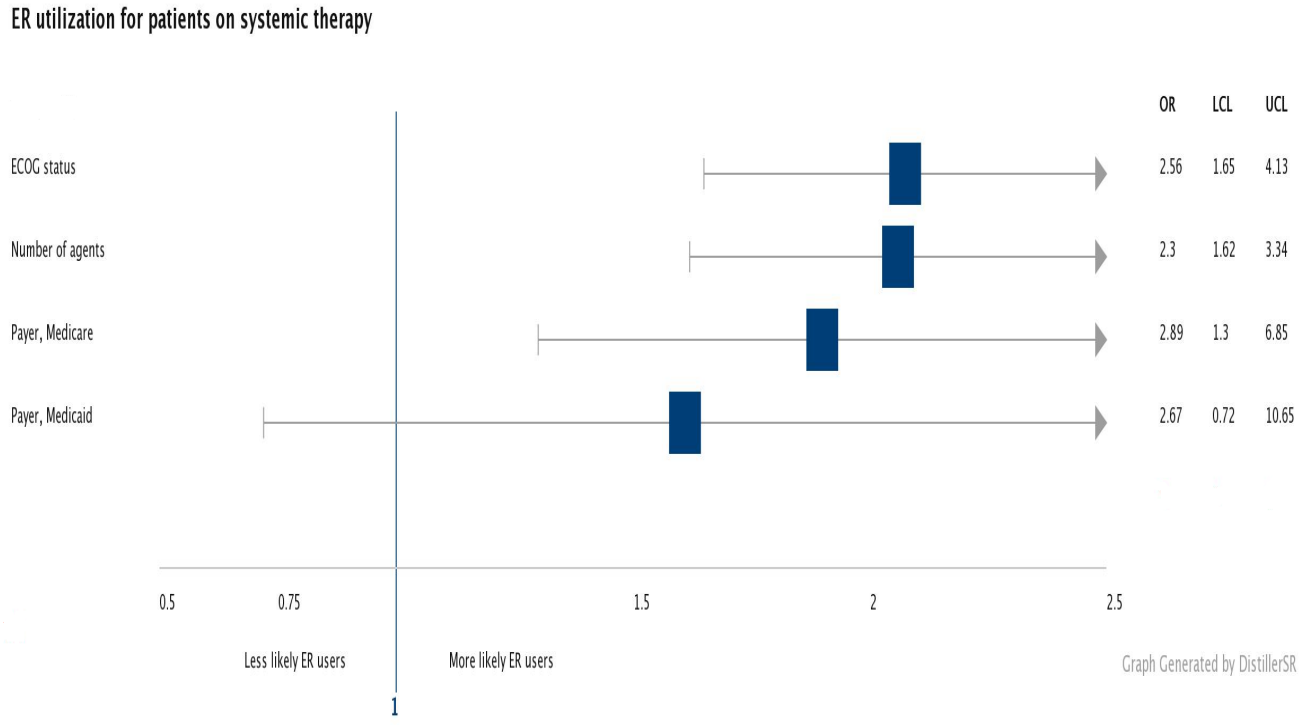

Figure 2. Forest Plot of Factors Associated with Avoidable ER Utilization and Factors Associated with Reduced Avoidable ER Utilization

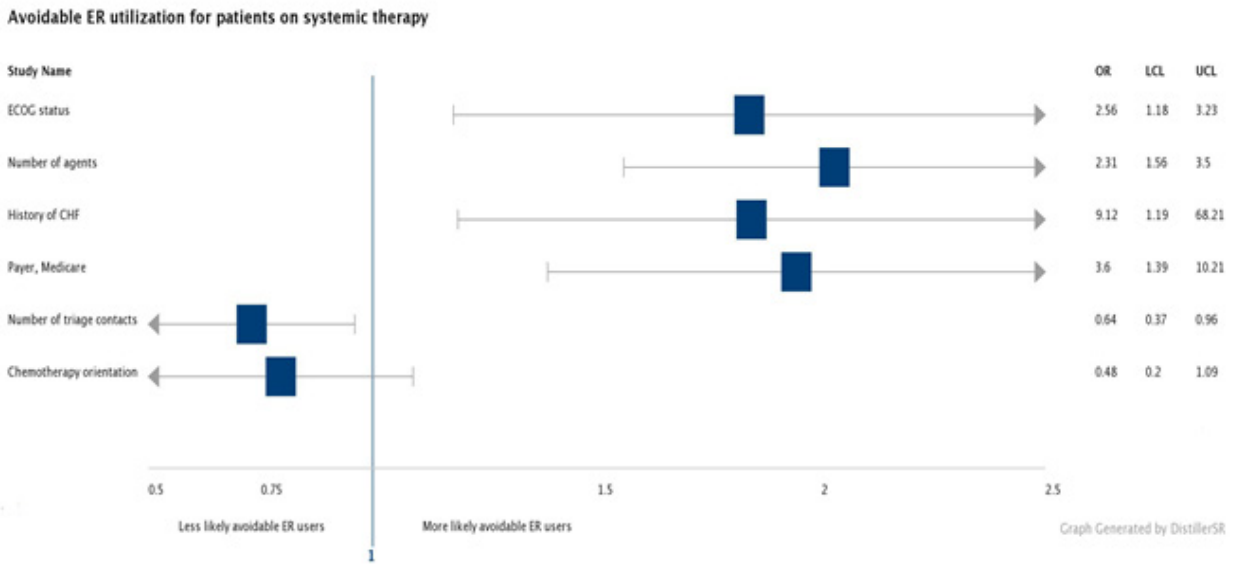

Table 4. Univariate and Multivariate Analysis of Significant Factors Associated with Avoidable ER Utilization Versus All Others

Univariate Analysis: Avoidable ER Visit Versus All Others (Non-significant Variables Not Shown)		No ER Visit or Not Avoidable ER visit	Avoidable ER Visit	*p* Value	Multivariate Analysis Odds Ratio (95% Confidence Interval)	*p* Value
ECOG PS	0 1 2 3	103 (95%) 72 (81%) 17 (74%) 7 (70%)	6 (5%) 19 (19%) 6 (26%) 3 (30%)	0.005	1.93 (1.18-3.23)	0.01
Number of agents	1 2 3 4	85 (93%) 67 (81%) 35 (83%) 15 (63%)	6 (7%) 16 (19%) 7 (17%) 9 (37%)	0.005	2.31(1.56-3.50)	0.005
History of CHF	No Yes	199 (85%) 3 (50%)	35 (15%) 3 (50%)	0.05	9.12 (1.19-68.21)	0.03
Cytotoxic agent	No Yes	67 (93%) 135 (80%)	5 (7%) 33 (20%)	0.01		NS
Payer	Commercial Medicaid Medicare Uninsured	90 (91%) 25 (83%) 79 (77%) 8 (89%)	9 (9%) 5 (17%) 23 (23%) 1 (11%)	0.07	3.60 (1.39-10.21)	0.01
Number of triage contacts	Mean triage calls	2.25	1.41	0.02	0.62 (0.37-0.96)	0.05
Chemotherapy orientation class	No Yes	102 (80%) 100 (89%)	26 (20%) 12 (11%)	0.05	0.48 (0.20-1.09)	0.09

PS = performance status; CHF = congestive heart failure.

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felt to be avoidable based on independent physician review. Half of the ER visits resulted in hospital admission, and ER utilization was associated with earlier death compared to non-users.

Despite full-time availability of skilled nursing symptom assessment and triage, many patients presented for ER evaluation without contacting the cancer center or their treating physician. These patients present real challenges for cancer centers that will be held accountable on payer-based quality assessment.[22] Clearly, payers expect more proactive than reactive patient management strategies from physicians. Therefore, identification of high-risk patients is essential.

We found that both ER utilization and avoidable ER utilization are strongly related to patient performance status and the number of different agents to which the patient was exposed during the study time frame. These study findings are unique but validate clinical common sense. It is also important to understand that the odds ratios reported in the results represent incremental risk between consecutive values. For example, the odds ratio between a performance status of zero and one is 2.56, but the odds ratio between a performance status of zero and two would be the square of that value. Therefore, the impact of these factors on the risk of ER utilization is substantial. It would be advisable for cancer centers wishing to limit ER utilization to closely monitor patients' performance status on an ongoing basis, as well as during periods of agent addition to a regimen or transitions of regimens, because these are periods of heightened risk of ER utilization, which includes avoidable visits.

A history of congestive heart failure was the only pre-defined comorbid condition that predicted avoidable ER utilization. Surprisingly, other comorbid conditions were not individually identified as predictive, nor was the total of comorbidities present in each patient predictive of ER utilization. Congestive heart failure is a known comorbid condition associated with frequent hospital admission and readmission.[23] Our study corroborates

these findings. Although the number of patients with this diagnosis who also received cancer treatment was very small, half of these patients had avoidable ER visits during the study period. This is a difficult patient population in general and likely even more so when on systemic therapy. For this specific patient population, aggressive monitoring and short cycled visits may help avoid unwanted medical events.

In our study, payer status is related to ER utilization, which has also been previously demonstrated by others.[5] However, in this study, Medicare status holds significance in a multivariate model. Patient age was factored in the multivariate model, and the remaining significance of Medicare did not reflect the age of the population. Interestingly, patients with commercial insurance had the lowest rate of ER utilization. It is plausible that out-of-pocket expenses (which may not be present with Medicare or Medicaid) may influence patients with commercial insurance to avoid visiting the ER.

Programmatic and operational changes at the cancer center level can impact avoidable ER utilization among patients with cancer.[13,24,25] We identified that avoidable ER utilization can be alleviated with an effective phone triage program. In our cancer center, the phone triage system is staffed during working hours by former ER nurses, who may have proven effective in reducing unnecessary ER utilization, which is a rational construct for other cancer centers to consider. The chemotherapy orientation class (during which patients are given structured educational content, including information about the phone triage system) was associated with a reduction in avoidable ER visits but was not statistically significant. In our study, less than half of our patients had documented attendance at this orientation. (Typically, this education was delivered one-on-one with an advanced care practitioner.) Our data suggest that structured and standardized educational content for patients embarking on systemic therapy may reduce ER visits.

A comparison of the 51 patients with ER utilization was made between those who had avoidable and unavoidable ER visits. Small numbers precluded definitive conclusions, so this comparison was done in an exploratory fashion. Patients who contacted the cancer center with a complaint had an association with decreased avoidable visits. This is intuitive and reassuring that programmatic support can impact avoidable ER utilization. Interestingly, patients with higher educational status appeared to present to the ER for avoidable reasons. One might surmise that this has to do with access, because those with advanced degrees may be limited by work schedules. However, in this study, the mean age of patients with advanced degrees in this cohort was 71 years, compared to 64 for the entire cohort, and many patients were well past retirement age. There may be additional unidentified factors involved with this finding. Regardless, because most ER utilization in this study occurred outside regular working hours, cancer centers seeking avenues to reduce ER utilization should make efforts to expand non-ER access during those times.

This study rigorously documented potential factors associated with ER utilization, including demographic information, patient level of education, cancer program education delivered, and cancer- and treatment-related factors, as well as patient performance status and an assessment of comorbidity. Despite this, there are limitations that deserve consideration. Only documented data could be collected. Missing data or data entered in error could be translated into the study results. The study is retrospective and, as such, predisposed to multiple forms of bias. Although data collection was thorough, the number of patients in the study is relatively small. As such, differences may exist among the comparisons that were undetected due to statistical power. In addition, the multivariate models suggested explanations for only approximately 20 percent of the data variability in each model. This suggests that even though the data collection was thorough, there remain other unidentified significant factors that could explain variability in the comparisons.

ER utilization (both avoidable and unavoidable) is common for patients undergoing systemic therapy for cancer. The data from this study may prove useful for programs in identifying patients at highest risk and for implementing mitigation strategies against avoidable ER utilization in this patient population. OI

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Statement of Contributions

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Data collection: Henry, Coil Griffin, Deardorff, and Davis.

Statistical analysis and interpretation: Li and Henry.

Manuscript creation and revisions: Henry, Deardorff, Li, Kelty, Kio, and von Holzen.

Final approval of manuscript: All authors.

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