

## QUALITY IMPROVEMENT

# Evaluation of Emergency Department Visits by Oncology Patients: A Running Comparison to Admissions and ED Visits Under the CMS OP-35 Ruling

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Authors' disclosures of conflicts of interest are found at the end of this article.

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## Abstract

**Background:** Cancer is the second leading cause of death in the United States. The incidence of emergency department (ED) visits by oncology patients has grown over the past years. Some ED visits are medically unnecessary and could be prevented with improved prevention measures. **Objectives:** To evaluate the incidence and causes of ED visits by cancer patients and evaluate outcomes and disposition of ED visits. **Methods:** This single-center, retrospective chart review was conducted in a tertiary medical hospital. We collected data using an electronic medical record and included oncology patients with active cancer who had ED visits from January 1, 2018, to December 31, 2018. Key data collection included baseline demographics; type of malignancy; main chief complaint; clinic visit history; current and past ED visits; treatment and supportive care data; and disposition status if admitted. Pregnant patients, patients without active cancer, and patients who received outpatient care at clinics other than the University of Arizona Cancer Center were excluded. **Results:** This chart review study screened 1,659 encounters and included 205 encounters. Approximately 70% of the encounters were solid tumor patients and 30% were hematologic malignancies. Nearly 50% of the patients with hematologic malignancies had preventable ED visits while 32.8% of solid tumor patients had preventable ED visits. The most common preventable ED visit reasons in both groups were pain, fever, nausea, vomiting, and dehydration. Almost 50% of the patients in both groups were hospitalized with a median length of stay of 3 days. The majority of admitted patients were discharged home in both the solid tumor (82.3%) and hematologic malignancy (83.8%) groups. **Conclusion:** This study showed that the rate of preventable visits was numerically higher in the

hematologic cancer group compared with the solid tumor group. These findings highlight the potential need for implementing prevention measures in the future.

**M**alignancy is the second leading cause of death in the United States and was attributed to 44.9% of all mortality in 2016 (Heron, 2016). The incidence of emergency department (ED) visits by cancer patients has grown over the past years and continues to do so (Delgado-Guay et al., 2015). In addition, multiple ED visits are considered a potential indicator of low quality of care. Some ED visits are medically unnecessary and could be avoided with improved preventable measures and patient education (Ko et al., 2015). Understanding why cancer patients use ED services is essential to optimize their care (Brown et al., 2016; Rivera et al., 2017). This will help develop cancer-related ED interventions, improve quality of care, and implement efforts to reduce ED visits in the oncology setting. Previous research demonstrated approximately 25% of oncology visits could have been avoided with increased patient support and communication (Delgado-Guay et al., 2015).

The Centers for Medicare & Medicaid Services (CMS) added an oncology measure set to its Hospital Outpatient Quality Reporting (OQR) Program (Advisory Board, 2016; CMS, 2020). OP-35 is a core measure of the admissions and ED visits for 10 potentially preventable conditions within 30 days of receiving outpatient chemotherapy. The ten conditions are anemia, nausea, vomiting, dehydration, neutropenia, diarrhea, pain, pneumonia, fever, and sepsis. This measure was established in 2018 and has been proposed to be used for payment determination beginning in the calendar year of 2021.

It is known that cancer overall generates a substantial economic burden on health-care systems and on society as a whole (Mariotto et al., 2011). The National Cancer Institute estimates that cancer costs will rise to almost \$174 billion by the year 2020. While overall costs are well-estimated, there is little literature regarding costs specifically of oncology patients visiting emergency departments, especially on a health-system level. Estimating these costs could demonstrate the magnitude of cost-minimization that could be attained by identifying avoidable reasons for these visits and determining ways to prevent them.

The purpose of this study was to evaluate the incidence of ED visits by The University of Arizona Cancer Center patients. This study evaluated reasons for ED visits by these patients with the goal of discovering possible interventions to prevent future visits.

## METHODS

This was a retrospective chart review study of 205 hematologic and solid tumor encounters. Systematic sampling of encounters by patients with hematologic malignancy was applied through organizing all encounters for patients in alphabetical order by patient last name and then analyzing every other encounter. Encounters for patients with solid tumor malignancies were sampled similarly, except that these encounters were ordered by date of encounter before random sampling. Given that both groups were randomly sampled by choosing alternating patients within the list and that the samples were both taken from all available patients in each group, this difference in sampling method between researchers was deemed to not impact study outcome and was thus employed for this evaluation. Data were collected relative to the characteristics of The University of Arizona Cancer Center patients who visited the ED at Banner - University Medical Center Tucson between the dates of January 1, 2018, and December 31, 2018.

Key data points collected included chief reasons for the ED visit demographics, insurance information, chief complaint, clinic visit history, current and past ED visits, admission history, recent cancer treatment data, supportive care measures in the setting of recent chemotherapy, and outcome of the ED visit. Visit reasons were then allocated into general categories first based on the 10 preventable visit reasons per OP-35, then into other non-preventable reason categories. To note, The University of Arizona Cancer Center is a part of the Oncology Care Model; however, this process was approved before the model was implemented.

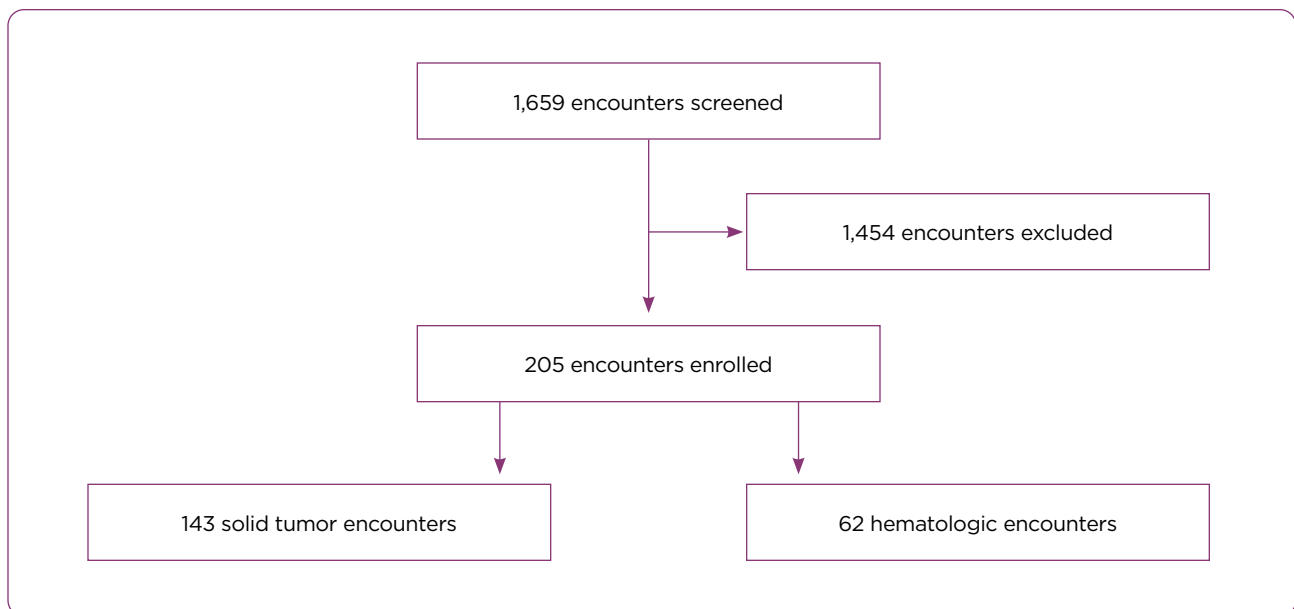
Adequate supportive care and prophylaxis measures were determined through comparison to National Comprehensive Cancer Network

(NCCN) guidelines for hematopoietic growth factors, antiemesis, and prevention and treatment of cancer-related infections (NCCN 2020a, 2020b, 2020c). If patients received chemotherapy within the month prior to the ED encounter, this chemotherapy regimen was recorded, as well as supportive care and prophylactic regimens that were administered or prescribed along with the chemotherapy. These regimens were then evaluated using the applicable guidelines listed previously and as follows. If the chemotherapy regimen had high risk of febrile neutropenia (> 20% risk), then granulocyte colony-stimulating factors (G-CSF) should have been administered (NCCN, 2020b). For the purposes of this evaluation, patients receiving a chemotherapy regimen with intermediate risk of febrile neutropenia (10%–20%) were not considered as requiring G-CSF, and additional risk factors were not collected. If the chemotherapy regimen was associated with high emetogenic risk (90%), then an appropriate antiemetic regimen should have been used, often including three agents involving an NK-1 receptor antagonist, a 5-HT<sub>3</sub> receptor antagonist, and dexamethasone (NCCN, 2020a). If the regimen was associated with moderate emetogenicity risk (30%–90%), then a recommended regimen should have been implemented, often involving a 5-HT<sub>3</sub> antagonist and dexamethasone. Regard-

less of level of emetogenicity, if any risk of nausea and vomiting was present, patients should also have had a documented prescription for an oral as-needed antiemetic agent for breakthrough symptoms. Patients with intermediate or high risk of infection should have been receiving anti-infective prophylaxis as recommended in the guidelines; if not, it was recorded that patients did not receive adequate anti-infective supportive care.

## RESULTS

A total of 1,659 encounters were screened and 205 patient encounters were enrolled during the year 2018 (Figure 1). Patients with solid tumor malignancies accounted for 143 encounters while 62 encounters were attributed to patients with hematologic malignancies. Table 1 shows demographic characteristics of both solid tumor and hematologic malignancy ED visits. Overall, 83% of patients had at least one comorbidity defined as any of the following chronic conditions: hypertension, heart failure, diabetes, chronic obstructive pulmonary disorder, coronary artery disease, cirrhosis, chronic kidney disease, psychiatric disorder, peripheral vascular disease, an autoimmune disorder, stroke history, or history of organ transplant (average of 2 in solid tumor group vs. 1.3 in hematologic malignancy group). Hyperten-



**Figure 1.** Flowsheet of the study screening and inclusion.

**Table 1. Baseline Characteristics**

	ST (n = 143)	HM (n = 62)	Total (n = 205)
Sex, n (%)			
Male	92 (64)	34 (54.8)	128 (62.4)
Age, years			
Range	35–93	38–89	35–93
Median (IQR)	73 (70 to 80)	73 (69 to 75)	73 (69–79)
Race, n (%)			
White	134 (94)	57 (91.9)	191 (93.7)
American Indian	5 (3.5)	0 (0)	5 (2.4)
Asian	1 (0.69)	0 (0)	1 (0.5)
Black	2 (1.39)	4 (6.45)	6 (2.9)
Two or more races	0 (0)	1 (1.61)	1 (0.5)
Smoking status, n (%)			
Current	4 (2.8)	1 (1.61)	5 (2.4)
Former	49 (34)	4 (6.45)	53 (25.8)
Never	90 (63)	57 (92)	147 (73.7)
Other chronic conditions			
Patients with any condition, n (%)	124 (60.4)	47 (75.8)	171 (83.4)
Mean number chronic conditions ± STD	2.0 ± 1.4	1.3 ± 1.1	1.8 ± 1.3
Patients with hypertension, n (%)	105 (73.4)	37 (59.6)	142 (69.3)
Patients with diabetes, n (%)	50 (35)	11 (17.7)	61 (29.8)
Patients with CAD, n (%)	42 (29.3)	6 (9.6)	48 (23.4)
Other chronic conditions, n (%)	90 (63)	23 (37)	113 (55.1)
Primary health insurance provider, n (%)			
Medicare	141 (98.6)	60 (96.7)	201 (98)
Commercial	2 (1.3)	1 (1.6)	2 (0.97)
Uninsured	2 (1.3)	1 (1.6)	2 (0.97)

sion was the most common comorbidity, followed by diabetes, then coronary artery disease (CAD). All but three patients had insurance at the time of their ED visit, and almost all patients (98%) were insured by Medicare.

The most common solid tumors were prostate, gastrointestinal, lung, and breast cancers. The most prevalent hematologic malignancies were acute leukemia, multiple myeloma, and lymphoma, respectively. The majority of patients were receiving treatment with a goal of cancer cure or life prolongation, and about one third of patients were on treatment with solely palliative intent. Approximately one third of patients were on their

first line of cancer treatment, but the majority of patients were on their second, third, or fourth line of treatment.

Both the number of ED visits and hospital admissions within the year before the current ED encounter, as well as whether patients had an encounter within the prior 30 days were assessed (Table 2, Figures 2 and 3). Approximately 50% of patients had an admission within the prior 30 days. The average number of admissions in the prior year was 1.6. Most patients were not admitted to the hospital in the year prior, but about 10% of patients were admitted five or more times, with a maximum of 11 admissions in the past year. The

**Table 1. Baseline Characteristics (cont.)**

	ST (n = 143)	HM (n = 62)	Total (n = 205)
<i>Cancer type</i>			
Solid tumor, n (%)			
Prostate	39 (27.3)	-	-
GI	28 (19.6)	-	-
Lung	17 (11.9)	-	-
Breast	17 (11.9)	-	-
Pancreatic	13 (4.9)	-	-
Renal	7 (4.9)	-	-
Other solid tumor	22 (15.4)	-	-
Hematologic, n (%)			
Acute leukemia	-	19 (30.6)	-
Multiple myeloma	-	18 (29)	-
Lymphoma	-	17 (27.4)	-
Chronic leukemia	-	6 (9.6)	-
Other	-	7 (11.2)	-
<i>Oncologic treatment goals/history</i>			
Goals of cancer care, n (%)			
Curative/Life-prolonging	77 (53.8)	45 (72.5)	122 (59.5)
Palliative	55 (38.4)	14 (22.5)	69 (33.7)
New diagnosis	10 (7)	2 (3.2)	12 (5.9)
Cancer treatment line, n (%)			
New diagnosis	12 (7)	4 (6.45)	16 (7.8)
1st line	50 (35)	12 (19.3)	62 (30.2)
2nd-4th	62 (43.4)	37 (59.6)	99 (48.3)
5th and beyond	21 (14.7)	7 (11.2)	28 (13.7)
Stage of solid tumor cancer			
Stage I-III	26 (18.1)	-	-
Stage IV	106 (74.1)	-	-
Not stated/not yet staged	11 (7.7)	-	-

Note. ST = solid tumor; HM = hematologic malignancy.

average number of ED visits during the year prior to the current encounter was 1.7 overall.

In the solid tumor group, 28.7% of patients had undergone non-cancer-related procedures in the past month (Table 2), while no patients in the hematologic group had history of a recent procedure. In the solid tumor group, 17.5% of patients underwent a cancer-related procedure within a month before the ED visit. In terms of recent cancer treatment, 69.8% of patients had chemotherapy in the

prior 30 days, with 21.5% of patients receiving oral chemotherapy, 49.8% of patients receiving IV chemotherapy, and 3.4% receiving combination IV and po chemotherapy. Only patients with solid tumors underwent radiation recently before the ED visit, with this occurring in 10.5% of these patients. Conversely, 4.8% of patients with hematologic malignancy had a history of a stem cell transplant.

The primary reasons for ED visits are shown in Table 3. The most common visit reasons across

**Table 2. General Patient History Between Solid and Hematologic Malignancies**

History, n (%)	ST (n = 143)	HM (n = 62)	Total (n = 205)
<i>Health-care history</i>			
Recent admission within the past 30 days, n (%)	35 (24.5)	18 (29)	53 (25.8)
Procedure in past 30 days (non-cancer related), n (%)	41 (28.7)	0 (0)	41 (20.0)
Average no. of admissions in the past year	2 ± 1.7	1.8 ± 2.2	1.6 ± 1.9
Average no. of ED visits in the past year	1.9 ± 2.2	1.3 ± 1.6	1.7 ± 2.0
<i>Recent oncologic history</i>			
Cancer-related procedure in past 30 days, n (%)	25 (17.5)	2 (3.2)	27 (13)
Recent clinic visit within the past 30 days, n (%)	104 (72.7)	48 (77.4)	152 (74.1)
Chemotherapy in past 30 days, n (%)	104 (72.7)	39 (62.9)	143 (69.8)
Radiation in past 30 days, n (%)	15 (10.5)	0 (0)	15 (7.3)
Status post SCT, n (%)	0 (0)	3 (4.8)	3 (1.5)
<i>Treatment characteristics</i>			
Oral chemotherapy, n (%)	29 (20.2)	15 (24.2)	44 (21.5)
IV chemotherapy, n (%)	69 (48.2)	32 (51.6)	102 (49.8)
Combination IV/po chemotherapy, n (%)	2 (1.4)	6 (9.6)	7 (3.4)
Nonchemotherapy cancer drug, n (%)	14 (11.2)	0 (0)	14 (6.8)
Not on treatment (new diagnosis/on-hold), n (%)	27 (18.9)	3 (4.8)	30 (14.6)

Note. ST = solid tumor; HM = hematologic malignancy; ED = emergency department; SCT = stem cell transplant.

both groups that may have been preventable per CMS were pain (20 of the total 205 patients, 9.8%), fever (15 of 205; 7.3%), nausea/vomiting/dehydration (15 of 205; 7.3%), and sepsis (9 of 205; 4.3%). Overall, a total of 37.5% of all 205 patients presented for a potentially preventable reason; and when evaluating each cancer-type group, nearly half of the patients with hematologic malignancies presented for possible preventable conditions (48.3%) while approximately one third of solid tumor patients had potentially preventable chief complaints (32.8%). The top three non-preventable visits were fall (8.2%), bleeding (5.3%), and recent procedure complication (3.4%). Overall, the rate at which patients presented to the ED for likely non-preventable reasons was 62.4% across all groups.

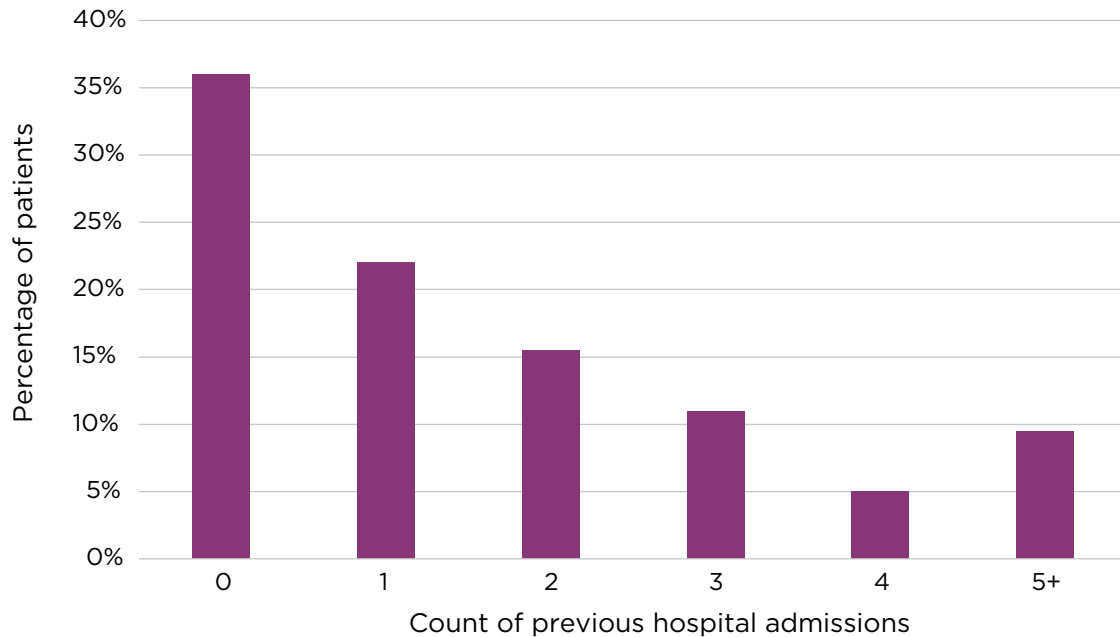
The characteristics of ED visits, outcomes, and disposition status are reported in Table 4. Approximately 33% and 48% of solid tumor and hematologic malignancy encounters were preventable per CMS criteria, respectively. Almost half of the visits were during clinic hours, and approxi-

mately 18% of encounters were referred from the clinic. Almost half of the patients in both groups were hospitalized with a median length of stay of 3 days. Patients with hematologic malignancies had a longer median of stay of 6 days. The majority of admitted patients were discharged home in both the solid tumor (82.3%) and hematologic malignancy (83.8%) groups.

## SUPPORTIVE CARE PROPHYLAXIS

The use of prophylactic antiemetic regimens and G-CSF with recent chemotherapy was evaluated for patients with solid tumors and hematologic malignancies (Figures 4A and 4B). Overall, based on chemotherapy regimen received in the solid tumor group, most patients received antiemetic regimens (95%) and G-CSF (91%) as indicated per NCCN Guidelines for Antiemesis and NCCN Guidelines for Growth Factors.

Further evaluation of the solid tumor group was performed to assess adequate supportive care prophylaxis measures for patients presenting with nausea and vomiting, fever, neutropenia, and sep-



**Figure 2.** Hospital admissions in past year.

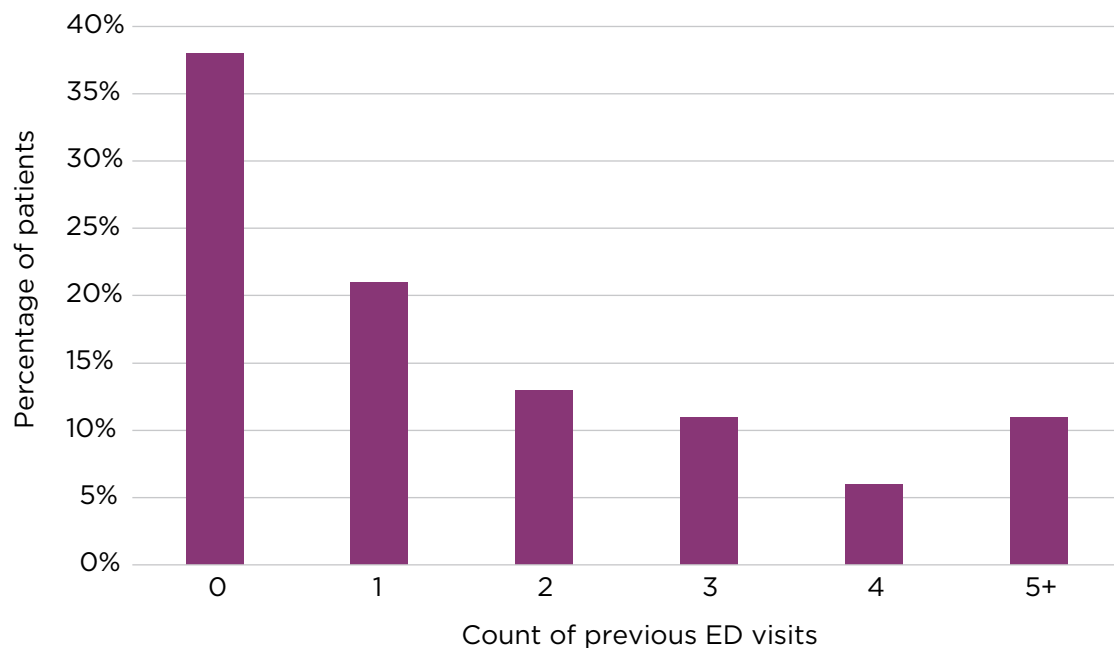
sis. In patients with solid tumor malignancies, 11 patients presented with nausea or vomiting. Of these patients, 7 had received chemotherapy in the past 30 days prior to the ED visit. Two encounters for nausea and vomiting occurred in patients who received chemotherapy with low to zero emetogenicity risk. Four patients had received chemotherapy with moderate emetogenicity risk and had received indicated emesis prophylaxis with palonosetron and dexamethasone on the day of chemotherapy; all four patients also had prescriptions for oral breakthrough agents. Lastly, one patient had received chemotherapy with high emetogenic potential; this patient also received the recommended emesis prophylaxis and had a prescription for agents to treat breakthrough nausea and vomiting. In summary, all patients presenting with nausea and vomiting had received appropriate prophylaxis for their chemotherapy regimen.

Patients with solid tumors presenting with fever, neutropenia, or sepsis were evaluated to determine if adequate primary prophylaxis was implemented with G-CSF when indicated. In patients presenting with fever or sepsis, laboratory results were collected at time of presentation, and patients were further evaluated if they were neu-

tropenic upon presentation (absolute neutrophil count [ANC]  $< 1,000/\text{mm}^3$ ). This resulted in two patients with possible preventable neutropenia and resulting sepsis or fever. However, based on febrile neutropenia risk of the chemotherapy regimen received, both patients were not indicated to receive primary prophylaxis with G-CSF. One patient presented with fever and low ANC of  $2,500/\text{mm}^3$  (but not technically neutropenic); this patient had received a regimen with intermediate febrile neutropenia risk, indicating G-CSF could have been considered as prophylaxis. This patient also did not receive G-CSF, which was likely a clinical decision made by the oncology team. Overall, it appears that in patients presenting with neutropenia alone or neutropenia in the setting of fever or sepsis, guidelines for G-CSF prophylaxis were 100% adherent.

The use of supportive care in patients with hematologic malignancies (Figure 4B) was evaluated to assess for the risk factor of ED visits. In patients with hematologic malignancies, 93.5% of patients (29/31) were on appropriate antiemetic therapy based on the emetogenic risk of chemotherapy. Two of the encounters were receiving only one antiemetic that the patients failed while receiving





**Figure 3.** ED visits in past year.

moderate emetogenic chemotherapy. Granulocyte colony-stimulating factor was given to the majority of patients (16/17) when indicated except for one because the patient refused to receive G-CSF while on chemotherapy with a high probability (> 20%) of febrile neutropenia risk due to past allergic reaction to G-CSF. However, the patient came to the ED visit due to a fall injury and not neutropenia or infection. All patients received appropriate anti-infective regimens when indicated based on their chemotherapy risk of infection. Patients who came with infections to the ED either failed outpatient antibiotic regimens or anti-infective prophylaxis was not indicated.

## DISCUSSION

Chemotherapy agents are known to cause a plethora of adverse effects based on the combination of their mechanism of action and disease state (Advisory Board, 2016; Brown et al., 2016; CMS, 2020; Ko et al., 2015; Rivera et al., 2017).

We analyzed our patients to address the CMS OP-35 core measures in the setting of ED admissions in our patient population to evaluate if correct prophylaxis was provided. The application of our evaluation for future patients in the setting

of COVID has also helped align our evaluation of supportive guidelines for treatment and preventive chemotherapy prophylaxis in the outpatient setting for both parenteral and/or oral chemotherapy (Richards et al., 2020; Williams, 2020)

There are commonalities across the literature regarding reasons for oncology patient visits to the ED, which are similar to the findings of this study (Brown et al., 2016; Ko et al., 2015; Mayer et al., 2011; Rivera et al., 2017; Vandyk et al., 2012; Yang et al., 2018). In our study, the top preventable reasons for ED visits were pain, fever, nausea, and vomiting. However, two thirds of the patients had non-preventable visits. In a retrospective study evaluating reasons for ED visits in cancer patients, the most common chief complaint was pain followed by infection (Delgado-Guay et al., 2015). A systematic review exploring the prevalence of cancer treatment-related symptoms in the ED found similar results regarding most frequent diagnoses in these patients (Vandyk et al., 2012). However, this review had a much higher estimate of preventable visits, concluding that approximately 42% of visits did not need hospitalization and, thus, could have possibly been managed in a different setting outside of the ED.



**Table 3. ED Visits Main Chief Complaints**

Chief complaint	ST (n = 143)	HM (n = 62)	Total (n = 205)
<i>Potentially preventable ED visits per CMS, n (%)</i>			
Pain (chronic/cancer-related)	11 (7.7)	9 (14.5)	20 (9.8)
Nausea/Vomiting/Dehydration	11 (7.7)	4 (6.45)	15 (7.3)
Fever	8 (5.6)	7 (11.3)	15 (7.3)
Sepsis	6 (4.2)	3 (4.8)	9 (4.3)
Diarrhea	6 (4.2)	1 (1.6)	7 (3.4)
Pneumonia	2 (1.4)	3 (4.8)	5 (2.4)
Neutropenia	2 (1.4)	1 (1.6)	3 (1.4)
Anemia	1 (0.7)	2 (3.2)	3 (1.4)
Total preventable ED visits	47 (32.8)	30 (48.3)	77 (37.5)
<i>Other visit reasons (not preventable per CMS), n (%)</i>			
Bleeding	11 (7.7)	0 (0)	11 (5.3)
Fall	10 (7)	7 (11.3)	17 (8.2)
Complications of recent procedure	5 (3.5)	2 (3.2)	7 (3.4)
Chemotherapy side effects	2 (1.5)	4 (6.4)	6 (2.9)
Other non-preventable ED visits	68 (49.7)	19 (30.6)	87 (42.4) <sup>a</sup>
Total non-preventable ED visits	96 (67.1)	32 (51.6)	128 (62.4)

Note. <sup>a</sup>Reasons for other non-preventable ED visits (percentage of total; n = 205): acute pain (7.3%), other infections (5.3%), cardiac problem (3.9%), weakness (3.9%), venous thromboembolism (2.9%), and other non-categorized reasons (19.1%).

Additionally, our study showed that almost 45% of the patients visited the ED during clinic hours, which is similar to the findings of two published studies where the patients came to the ED during office hours (Mayer et al., 2011; Yang et al., 2018). The timing of ED visits with respect to clinic hours was collected in this study as another avenue to explore for prevention of unnecessary ED cost and time. Patients should have access to their care team by telephone during these hours and it is possible that many conditions leading to ED visits could have been managed instead through a same-day clinic visit. Although consistent with previous studies, this percentage of emergency visits during clinic hours could indicate that improvements in patient counseling and communication can be made.

Based on previous studies, the most frequent cancer diagnoses present in patients presenting to emergency departments were lung, prostate, breast, hematologic, and gastrointestinal cancers, which is consistent with our findings (Mayer et al., 2011; Rivera et al., 2017; Sadik et al., 2014; Vandyk

et al., 2012; Yang et al. 2018). Nearly half of the ED visits in this study (53.6%) resulted in a hospital admission, which could mean that these patients presented with more severe symptoms and that the ED visit was likely warranted. In one study by Yang and colleagues (2018), the authors showed that cancer patients were more likely to be hospitalized compared with non-cancer patients, as they are more likely to be immunosuppressed and prone to infections. Moreover, a study conducted by Sadik and colleagues (2014) showed that solid tumor patients in later cancer stages are at greater risk of having ED visits and being hospitalized. Our data showed that the majority of ED visits (75%) consisted of solid tumor patients diagnosed with stage IV cancer.

The supportive care findings in our study indicate that the vast majority of patients in both groups received all indicated prophylactic measures with recent chemotherapy. More importantly, when considering preventable visits, this study found that guideline-recommended prophylactic G-CSF

had been implemented with recent chemotherapy in all patients presenting to the ED for neutropenia-related conditions (sepsis, fever, neutropenia), and appropriate antiemetic prophylaxis had been implemented in patients presenting with nausea and vomiting. This indicates that even when available guidelines for prophylactic measures were followed, patients still presented to the ED for these conditions, which shows that neutropenia-related conditions are inevitable, especially in patients with hematologic malignancies such as acute leukemias.

A study by Gilmore and colleagues (2013) also demonstrated the importance of adherence to antiemetic guidelines, showing the incidence of chemotherapy-induced nausea and vomiting was significantly higher in patients who received guideline-consistent prophylaxis (53.4% vs. 43.8%;  $p < .001$ ). Like our study, this also illustrates that, despite adequate emesis prophylaxis, a proportion of patients still experienced nausea and vomiting. Moreover, at The University of Arizona Cancer Center, our preferred CINV prophylaxis includes palonosetron as a 5-HT<sub>3</sub> receptor antagonist, which in the past has led to decreased nausea and vomiting in patients during therapy (Broder et al., 2014; Faria et al., 2014). This present study also found higher than expected rates of complete adherence to emesis prophylaxis regimens compared with a previous study (Gilmore et al., 2013). Of note, the patient population and chemotherapy

regimens received were quite different than in that study; however, this shows that efforts to follow prophylaxis guidelines have been successful at The University of Arizona Cancer Center. The G-CSF findings in our study exceeded rates of use in previous studies, which have shown that G-CSF is often underutilized when indicated but may also be overutilized at times (Barnes et al., 2014). This study did not assess overutilization of G-CSF, however, so this could be a measure assessed in future studies, especially when considering cost implications of G-CSF prophylaxis and the limitation that this study did not evaluate G-CSF use with chemotherapy associated with intermediate risk of febrile neutropenia. In addition, we implemented same-day pegfilgrastim administration concurrently with chemotherapy, which had decreased unnecessary patient visits as seen in our patient population for febrile neutropenia prophylaxis (Burris et al., 2010; Eckstrom et al., 2019).

## LIMITATIONS

As a result of its retrospective nature, this study has several limitations. First, this was a small study, with a sample size of 205 patients. The number of patients with hematologic malignancies was less than half of the number of solid tumor encounters. Second, this was not a comprehensive representation of all cancer-related ED visits at the medical center during the study year, as this was focused

**Table 4. Characteristics of ED Visits**

	<b>ST (n = 143)</b>	<b>HM (n = 62)</b>	<b>Total (n = 205)</b>
Preventable visits, n (%)	47 (32.9)	30 (48.3)	77 (37.5)
ED visits during clinic hours, n (%)	64 (44.8)	27 (43.5)	91 (44.3)
Referred from the clinic, n (%)	27 (18.9)	11 (17.7)	38 (18.5)
<i>Inpatient admission from ED visits</i>			
Inpatient admissions from ED visit, n (%)	79 (55.2)	31 (50)	110 (53.6)
Inpatient admissions from preventable ED visit, n (%)	27 (18.9)	12 (19.3)	39 (19.0)
Length of stay for admitted patients, median no. of days (IQR)	3 (2–6)	6 (3.5–8)	3 (1–6)
<i>Disposition status after admission</i>			
Home, n (%)	65 (82.3)	52 (83.8)	117 (57)
Facility, n (%)	7 (8.9)	7 (11.2)	14 (6.8)
Death, n (%)	3 (3.8)	2 (3.2)	5 (2.4)
Hospice, n (%)	3 (3.8)	1 (1.6)	4 (1.9)

on Medicare patients. Third, the use of systematic sampling was used, which is less random than a simple random sampling method and offers more risk of bias (Vassar & Matthew, 2013). Another limitation is that information on pain regimens or pain clinic visits was not collected, even though this could likely be an etiology or risk factor contributing to ED visits. It was deemed by the investigators that the subjectivity of pain and variability in patient treatment needs would cause this subject to reach beyond the scope of this current study and would instead warrant separate study to adequately assess this aspect of cancer patient care. Lastly, this study only included patients from one specific cancer center who had ED visits at one specific hospital which could affect generalizability of this study.

## CONCLUSION

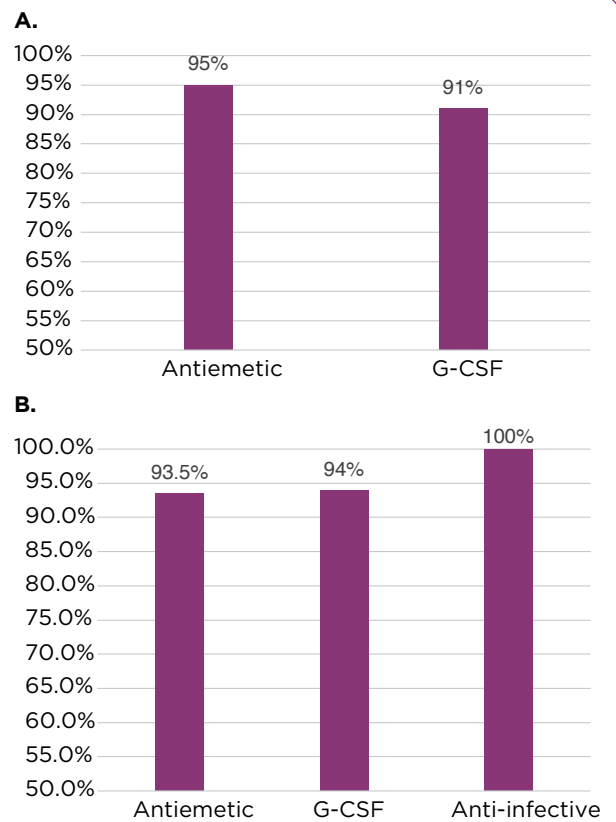
Our study demonstrates the importance of appropriate care and prophylaxis for cancer patients to prevent ER visits when applicable. Unfortunately, OP-35 does not take into account appropriate care as demonstrated in this study. Even in our case, appropriate, evidence-based management still led to ED admissions for chemotherapy-induced nausea and vomiting and febrile neutropenia. There were also noted differences based on disease states. Notably, the rate of preventable visits was numerically higher in the hematologic cancer group compared with the solid tumor group. Further evaluation of ED visits based on disease states and institutional management needs to first be addressed before future payment models can be implemented based on our assessments for causes of cancer patients' diagnoses in the ED. ●

## Disclosure

Dr. McBride has served on the advisory board for Bristol Myers Squibb and speakers bureau for Sanofi. The other authors have no conflicts of interest to disclose.

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**Figure 4.** (A) Use of supportive care in patients with solid tumors. (B) Use of supportive care in patients with hematologic malignancies. G-CSF = granulocyte colony-stimulating factor.

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