

Title: Emergency Department Chief Complaints Among Children with Cancer

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Abstract

Children with cancer have high emergency department (ED) utilization, but little is known about their chief complaints. A retrospective chart review of ED chief complaints for children with cancer (actively receiving therapy) at Riley Hospital for Children from January 2014 to December 2015 was performed. Proportions of visits and disposition for top 5 chief complaints were determined. Multivariate logistic regression analyzed factors associated with admission. There were 598 encounters by 231 children with cancer. About half (49%) had more than one complaint. The five most common primary chief complaints were: fever (60.2%), pain (6.5%), nausea/vomiting (5.0%), bleeding (3.9%), and abnormal lab (3.3%). Admission rates varied, with the highest rates being for nausea/vomiting (66.7%). Risk factors for admission were: hospitalization in prior 4 weeks (OR=2.67, CI 1.77-4.02), chief complaint of fever (OR=1.90, CI 1.16-3.09). For each increase in chief complaints, odds increased by 1.45 (CI 1.14-1.83). Black, non-Hispanic (OR=0.44, CI 0.22-0.88) as compared to white, non-Hispanic, younger age (OR=0.53, CI 0.29-0.99) or complaint of abnormal lab (OR=0.20, CI 0.06-0.68) had lower odds of admission. Children with cancer present to the ED with multiple and varied complaints. Future interventions could aim to improve caregiver anticipatory guidance and ED visit preparedness.

Background

Emergency department utilization is higher among children with cancer than the general pediatric population.^{1,2} Children with cancer represent a unique population in terms of the reasons for seeking care in the ED. Previous publications have evaluated the reasons for ED visits by children with cancer via assessment of International Classification of Diseases, Ninth Revision, Clinical Modification discharge diagnoses.^{3,4} Unfortunately, discharge diagnoses are not necessarily representative of the chief complaints that brought the child with cancer to the ED. A classic example of the difference between chief complaints and discharge diagnoses is if an adult presents with a complaint of chest pain, they may be diagnosed with a potentially fatal heart attack or a benign condition such as gastro-esophageal reflux.⁵ None of the currently available databases of ED utilization among children with cancer contain chief complaints, only discharge diagnoses, leading to a gap in our understanding of the complaints that prompt children with cancer to seek care in the ED.

Therefore, the purpose of this study is to identify the spectrum of chief complaints among children with cancer presenting to a free-standing children's hospital ED and evaluate factors associated with admission among this population. Our hypotheses were that children with cancer present to the ED with more than one chief complaint, with fever being the most common complaint and most associated with admission. Our investigation will lead to a better understanding of the signs and symptoms that cause children with cancer to seek care in the ED.

Methods

Study Design and Setting

We performed a retrospective chart review of ED encounters for children with cancer at the Riley Hospital for Children Emergency Department at Indiana University Health from January 1, 2014 to December 31, 2015. The Riley Hematology-Oncology Clinic at Indiana University Health treats 80 percent of all new pediatric cancer diagnoses in Indiana and sees an average of 200 new cancer patients each year. The Riley Hospital's Emergency Medicine and Trauma Center is a Level 1 Pediatric Trauma Center that provides care for over 34,000 children annually.

Study Population/Database Development

In order to create a database of all children with cancer seen at the Riley ED, we first obtained ED visit logs for all ED visits to the Riley Hospital for Children from the electronic medical record. Second, children with cancer were extracted using a clinical patient database maintained by the pediatric oncology clinical research office. Inclusion criteria for this study required an ED visit by a child with cancer actively receiving treatment, including either chemotherapy and/or radiation. ED encounters were excluded if the visit was for a new diagnosis of cancer, a relapse of cancer, or occurred prior to the cancer diagnosis. We then created a database of ED visits by children with cancer by extracting patient characteristics and ED encounter information from the clinical patient database and the electronic medical record.

Patient demographic characteristics included gender, age category, race/ethnicity (White, Non-Hispanic; Black, Non-Hispanic; Hispanic; and Other), primary payer (Public/governmental, Private, Self-pay). Patients were classified into one of the following types of cancer based on electronic medical record data: acute lymphoblastic leukemia (ALL), acute myelogenous leukemia (AML), central nervous system tumors (CNS), solid tumors (non-CNS), Hodgkin lymphoma, and non-Hodgkin lymphoma. Patients with non-specified malignancies or rare cancers were placed into an “Other” category. Encounter characteristics included chief complaints (including a primary chief complaint and then all secondary complaints), whether or not there was an inpatient encounter within the prior 4 weeks, ED disposition (admit vs discharge), and which unit the patient was admitted to (floor status versus pediatric intensive care unit). We chose to include an inpatient encounter within the prior 4 weeks because readmissions have been the focus of quality improvement and cost containment in the era of the Patient Protection and Affordable Care Act.⁶ We chose not to evaluate the reason for the previous inpatient visit since our focus was primarily on the reasons for ED visits.

There were 41 encounters with missing primary payer information, which accounted for about 7% of encounters, these were included in all analyses except the logistic regression.

Outcome and Exploratory Variables

We reviewed all listed chief complaints and those with a similar clinical focus were condensed into chief complaint categories. Each encounter could have more than

one complaint associated with it, the highest number of complaints found on chart review were five complaints so that was the maximum we collected for each encounter. For the logistic regression, the primary outcome of interest was whether an ED visit resulted in admission to Riley Hospital for Children versus discharged to home (patient treated then released from the ED).

Statistical Analyses

We summarized encounter characteristics using frequencies and percentages. We compared characteristics of those who were admitted versus discharged using chi-square analyses. We evaluated the number of ED visits per patient and the number of total chief complaints per visit. We separated primary chief complaints from secondary complaints and generated a rank list for each. Then, the top 5 primary chief complaints were presented as proportion of visits, both overall and by type of cancer. Proportions of hospitalization rates were calculated, both overall and by the top 5 primary chief complaints.

A multivariate logistic regression model was used to estimate factors associated with admission for children with cancer. Variables were included based on our defined model: patient's gender, age category, race/ethnicity, primary expected payer, whether there was an inpatient visit in the prior 4 weeks, the number of chief complaints as a continuous variable, and dichotomous variables for the presence or absence of each of the top 5 most common primary chief complaints. All analyses were performed using SAS 9.4 (Carey, NC), and p-values <0.05 were considered statistically significant.

Results

Overall, there were 598 encounters by 231 children with cancer during the two-year time frame investigated. Only 40.3% of children had just 1 ED visit, 23.8% had 2 visits, 12.1% had 3 visits, and 23.8% had 4 or more visits. We present the encounter level characteristics of the ED visits among children with cancer in Table 1, both overall and by ED disposition status. There were significant differences between age groups who were admitted compared to discharge with higher proportions of younger patients discharged. Similarly, a higher proportion of black, non-Hispanic patients were discharged. About half of visits were by children with public/governmental primary insurance payer (51.9%). Other common characteristics included a diagnosis of ALL (41.3%) and been hospitalized in the prior 4 weeks (53.2%). Of these encounters, 43.5% resulted in discharge to home and 56.5% were admitted to the hospital. Among the admissions, 93.8% were admitted to the inpatient floor and 6.2% were admitted to the pediatric intensive care unit.

Emergency department chief complaints

About half of children with cancer (51%) had only one chief complaint while 30.9% had 2 complaints (Figure 1). The five most common primary chief complaints prompting an ED visit for children with cancer are presented in Table 2. Fever was the most common primary chief complaint (60.4%); followed by pain (6.1%), nausea/vomiting (5.1%), bleeding (3.9%) and abnormal lab (3.4%). When we evaluated the chief complaints by type of cancer, fever remained the most common ED visit chief

complaint for all types of patients; ALL (66.0%), solid tumor (60.2%), CNS tumor (44.8%), NHL (70.0%), Hodgkin lymphoma (57.9%), and AML (60.0%). The top 5 secondary complaints included: cough (16.4%), nausea/vomiting (11.9%), pain (8.2%), rhinorrhea (6.9%), and headache (4.2%).

Admission rates by chief complaint

Overall, 56.5% (N=338) of ED encounters resulted in an inpatient admission. Admission rates varied by the top 5 primary chief complaints with nausea and vomiting having the highest (66.7%) and abnormal lab with the lowest (20%) (Figure 2).

Factors Affecting Admission from the ED Among Children with Cancer

In a multivariate analysis, factors associated with significantly increased odds of admission included having a chief complaint of fever (OR=1.90, CI 1.16-3.09) and having been hospitalized in the prior 4 weeks (OR=2.67, 95% CI 1.77-4.02) compared with not having a recent admission. For each increase in the number of chief complaints, the likelihood of admission increased by 1.45 (95% CI 1.14-1.83). Younger patients (ages 0-4 years) had lower odds of admission (OR=0.53, CI 0.29-0.99) than older children (ages 15-20+ years). Black, non-Hispanic patients were less likely to be admitted (OR=0.44, CI 0.22-0.88) as compared to white, non-Hispanic. Patients with a primary chief complaint of abnormal lab also had significant decreased odds of admission (OR=0.20, CI 0.06-0.68).

Discussion

In this retrospective study, children with cancer who are actively receiving therapy not only present to the ED with a wide range of complaints, but also tend to have more than one complaint. The most common ED chief complaint was fever, followed by pain, nausea/vomiting, bleeding and abnormal lab. Importantly, the majority of ED visits resulted in admission, with the highest rates of admission for a chief complaint of nausea/vomiting or fever. Factors associated with increased odds of admission included a chief complaint of fever, having a recent hospitalization, and having more than one complaint. This analysis highlights the undesired, but not unexpected side effects of the cancer therapies leading to ED visits for children with cancer. This information provides specific focus areas for future interventions aimed at providing caregivers of children with cancer improved anticipatory guidance and preparedness when an ED visit is necessary.

Fever is a significant ED complaint and discharge diagnosis for children with cancer with increased odds of admission.^{3,4} Unfortunately, in the field of pediatric oncology we lack agreement on the exact definition of a fever.^{7,8} This leads to difficulties in creating evidence-based clinical practice guidelines and differences in triaging and management practices, as demonstrated in a previous study of pediatric oncology providers in Michigan.⁹ In order to unify our approach and move towards implementation of validated risk prediction models to evaluate the risk of serious infection in the setting of fevers,^{10,11} a consensus on the definition of fever among children with cancer would be beneficial. At a minimum, it would be prudent for each institution to develop a clinical

practice guideline with an agreed upon definition of fever in order to decrease confusion among patients, caregivers, providers, and staff.

Chemotherapy-induced nausea and vomiting (CINV) was the third major chief complaint that brought children with cancer to the emergency department. Inadequate control of CINV are among the most severe and bothersome side effects experienced by children with cancer according to their parents.¹² Several recent updates on guidelines for CINV outline key changes in recommendations for both acute, anticipatory, breakthrough and refractory CINV.^{13,14} An important consideration for CINV is to understand whether these new evidence-based recommendations are being implemented by oncologists in the clinical setting. Also, attention should focus on the ability of caregivers of children with cancer to manage CINV in the home setting. A lack of caregiver education or appropriate at-home medications for breakthrough nausea will inhibit optimal supportive care.

Pain is not only an unfortunately common experience for children with cancer,^{15,16} but one which leads to ED visits. Pain can come from a variety of sources for this unique population; from complications of their malignancy (i.e. bone pain, tumor compression), post-operative pain, and the pain experienced during their treatment (i.e. central line accessing, mucositis, neuropathy). Therefore, pain assessment has been identified as an important quality measure for the outpatient care of children with cancer.¹⁷ It is essential that we not only assess pain in this unique population, but also provide sufficient anticipatory guidance for caregivers along with at-home prescription medications.

Improved at-home pain management strategies could decrease ED reliance and improve quality of life.

Secondary complaints of cough and rhinorrhea could represent a simple viral upper respiratory infection or be signs of a more serious bacterial or fungal infection such as sinusitis or pneumonia. Recently published guidelines for management of fevers in children with cancer highlight that further research is needed to evaluate if viral processes increase the risk for serious infections in this population.⁸ Of note, in a previous analysis of discharges for fever and neutropenia, encounters with a short length of stay (less than or equal to 3 days) were associated with a discharge diagnosis of a viral illness.^{18,19} This suggests that if patients with cough or rhinorrhea are admitted for evaluation and no serious bacterial infection is found, they are more likely to be discharged after only a few days. Further evaluation could investigate if there are associated signs or symptoms with rhinorrhea and cough that could aid in outpatient triaging and decrease ED visits.

Limitations

There are several important limitations to our study. First, this was a single institution study, but we have approximately 200 new diagnoses of childhood cancer per year at Riley Hospital for Children and are similar to many other large, quaternary, free-standing children's hospitals. Second, due to the large geographical spread of our patient population across the entire state of Indiana, this analysis may not represent all ED visits by our patient population as those who live far from Riley Hospital and may have received care at local hospitals. Third, our goal was to explore chief complaints as

documented in the medical record and we did not evaluate the highest documented or observed temperatures, thus the definition of “fever” was based on chief complaint report only. Also, we appreciate that admissions to the intensive care unit represent a higher level of clinical severity, but we did not have a large enough sample to evaluate differences in factors of admission to the intensive care unit versus the inpatient floor. Also, we did not explore factors associated with whether the admissions were considered “unplanned,” but this line of quality improvement could be the focus of future investigations. Nevertheless, this study represented a large number of ED visits to our institution from a wide variety of cancer types over a two-year time period.

Conclusion

In this retrospective review of ED visits among children with cancer who are actively receiving therapy, we revealed that children with cancer not only present to the ED with a wide range of complaints, but also tend to have more than one complaint. The five most common complaints for ED visits were fever, pain, nausea/vomiting, bleeding and abnormal lab. Factors associated with increased odds of admission included a chief complaint of fever and having more than one complaint. Future evaluations should focus on the adequacy of current management strategies through incorporation of patient and caregiver perspectives.

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Legends

Figure 1. Number of Chief Complaints for Children with Cancer per Emergency Department Encounter

Figure 2. Emergency Department Admission Rates Among Children with Cancer, Overall and by Top 5 Primary Chief Complaints

TABLE 1. Encounter Level Characteristics of Emergency Department Visits for Children with Cancer

	Overall	Admitted	Discharged	p-value
	N=598	N=338 (56.5)	N=260 (43.5)	
	N (%)			
Gender				
Female	240 (40.1)	138 (40.8)	102 (39.2)	0.69
Male	358 (59.9)	200 (59.2)	158 (60.8)	
Age Category				
0-4 years	223 (37.3)	118 (34.9)	105 (40.4)	0.040
5-9 years	172 (28.8)	89 (26.3)	83 (31.9)	
10-14 years	108 (18.1)	68 (20.1)	40 (15.4)	
15-20+ years	95 (15.9)	63 (18.6)	32 (12.3)	
Race/Ethnicity				
White, Non-Hispanic	450 (75.3)	258 (76.3)	192 (73.9)	0.003
Hispanic	77 (12.9)	47 (13.9)	30 (11.5)	
Black, Non-Hispanic	55 (9.2)	20 (5.9)	35 (13.5)	
Other	16 (2.7)	13 (3.9)	3 (1.2)	
Primary Payer*				
Public/ Governmental	289 (51.9)	153 (49.2)	136 (55.3)	0.30
Private	258 (46.3)	153 (49.2)	105 (42.7)	
Self-pay	10 (1.8)	5 (1.6)	5 (2.0)	
Type of Cancer				
Acute Lymphoblastic Leukemia	247 (41.3)	130 (38.5)	117 (45.0)	0.37
Solid Tumor	206 (34.5)	127 (37.6)	79 (30.4)	
Central Nervous System Tumor	96 (16.1)	53 (15.7)	43 (16.5)	
Non-Hodgkin Lymphoma	20 (3.3)	14 (4.1)	6 (2.3)	
Hodgkin Lymphoma	19 (3.2)	10 (3.0)	9 (3.5)	
Acute Myelogenous Leukemia	5 (0.8)	2 (0.6)	3 (1.2)	
Other	5 (0.8)	2 (0.6)	3 (1.2)	
Inpatient Encounter in Prior 4 Weeks				
Yes	318 (53.2)	207 (61.2)	111 (42.7)	<0.001
No	280 (46.8)	131 (38.8)	149 (57.3)	
Admit Unit				
Floor		317 (93.8)		
Pediatric ICU		21 (6.2)		

*There were 41 encounters with missing primary payer information. The remainder of the variables were complete for each encounter.

TABLE 2. Top Primary Chief Complaints Prompting ED Visits Among Children with Cancer – Overall and by Cancer Type

		Overall	By cancer type					
		N=598	ALL N=247	Solid tumor N=206	CNS N=96	NHL N=20	HL N=19	AML N=5
Rank		% by column						
1	Fever	60.2	66.0	60.2	44.8	70.0	57.9	60.0
2	Pain	6.5	6.1	6.8	4.2	5.0	10.5	0
3	Nausea/Vomiting	5.0	4.1	5.3	8.3	5.0	0	0
4	Bleeding	3.9	3.2	5.3	4.2	0	0	0
5	Abnormal Lab	3.3	2.8	2.4	6.3	10.0	0	0

ALL=Acute lymphoblastic leukemia, CNS=Central nervous system, NHL=Non-Hodgkin lymphoma, HL=Hodgkin lymphoma, AML=Acute myelogenous leukemia

TABLE 3. Multivariate Logistic Regression to Evaluate Factors Associated with Admission Versus Discharge from the ED Among Pediatric Cancer Patients

Factors	Adj. Odds Ratio (OR)	95% CI	p-value
Patient Characteristics			
Gender			
Female	1.04	0.70-1.56	0.84
Age			
15-20+ years	Ref		
10-14 years	1.01	0.50-2.0	0.99
5-9 years	0.55	0.29-1.06	0.07
0-4 years	0.53	0.29-0.99	0.046
Race/Ethnicity			
White, Non-Hispanic	Ref		
Black, Non-Hispanic	0.44	0.22-0.88	0.021
Hispanic	1.76	0.97-3.21	0.07
Other	2.87	0.73-11.28	0.13
Type of cancer			
Acute Lymphoblastic Leukemia	Ref		
Acute Myelogenous Leukemia	0.52	0.07-4.02	0.53
Solid Tumors	1.31	0.81-2.12	0.28
Central Nervous System Tumor	1.51	0.81-2.81	0.20
Hodgkin Lymphoma	0.69	0.22-2.14	0.52
Non-Hodgkin Lymphoma	1.74	0.56-5.45	0.34
Other	0.53	0.07-4.06	0.54
Primary Payer			
Public/ Governmental	Ref		
Private	1.07	0.69-1.64	0.77
Self	0.71	0.17-2.86	0.63
ED Visit Characteristics			
Number of Chief Complaints			
	1.45	1.14-1.83	0.002
Top 5 Primary Chief Complaint Categories (in rank order)			
Fever	1.90	1.16-3.09	0.010
Pain	1.78	0.78-4.05	0.17
Nausea or vomiting	1.88	0.72-4.91	0.20
Bleeding	0.49	0.17-1.41	0.19
Abnormal Lab	0.20	0.06-0.68	0.010
Inpatient in the last 4 weeks			
Yes	2.67	1.77-4.02	<0.001

ED=Emergency Department

Bold indicates significant factors associated with admission versus discharge