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Trends in Adult Cancer-Related Emergency Department Utilization

An Analysis of Data From the Nationwide Emergency Department Sample

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IMPORTANCE The emergency department (ED) is used to manage cancer-related complications among the 15.5 million people living with cancer in the United States. However, ED utilization patterns by the population of US adults with cancer have not been previously evaluated or described in published literature.

OBJECTIVE To estimate the proportion of US ED visits made by adults with a cancer diagnosis, understand the clinical presentation of adult patients with cancer in the ED, and examine factors related to inpatient admission within this population.

DESIGN, SETTING, AND PARTICIPANTS Nationally representative data comprised of 7 survey cycles (January 2006-December 2012) from the Nationwide Emergency Department Sample were analyzed. Identification of adult (age ≥ 18 years) cancer-related visits was based on Clinical Classifications Software diagnoses documented during the ED visit. Weighted frequencies and proportions of ED visits among adult patients with cancer by demographic, geographic, and clinical characteristics were calculated. Weighted multivariable logistic regression was used to examine the associations between inpatient admission and key demographic and clinical variables for adult cancer-related ED visits.

MAIN OUTCOMES AND MEASURES Adult cancer-related ED utilization patterns; identification of primary reason for ED visit; patient-related factors associated with inpatient admission from the ED.

RESULTS Among an estimated 696 million weighted adult ED visits from January 2006 to December 2012, 29.5 million (4.2%) were made by a patient with a cancer diagnosis. The most common cancers associated with an ED visit were breast, prostate, and lung cancer, and most common primary reasons for visit were pneumonia (4.5%), nonspecific chest pain (3.7%), and urinary tract infection (3.2%). Adult cancer-related ED visits resulted in inpatient admissions more frequently (59.7%) than non-cancer-related visits (16.3%) ($P < .001$). Septicemia (odds ratio [OR], 91.2; 95% CI, 81.2-102.3) and intestinal obstruction (OR, 10.94; 95% CI, 10.6-11.4) were associated with the highest odds of inpatient admission.

CONCLUSIONS AND RELEVANCE Consistent with national prevalence statistics among adults, breast, prostate, and lung cancer were the most common cancer diagnoses presenting to the ED. Pneumonia was the most common reason for adult cancer-related ED visits with an associated high inpatient admission rate. This analysis highlights cancer-specific ED clinical presentations and the opportunity to inform patient and system-directed prevention and management strategies.

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There are currently an estimated 15.5 million people living with cancer or a history of cancer in the United States, and this number is expected to rise to 26.1 million by 2040.^{1,2} The burden of cancer is associated with substantial health care resource utilization and cost. One measure of health care utilization is emergency department (ED) visits. According to the US Nationwide Emergency Department Sample (NEDS) data from 2006 to 2012, there were an estimated 696 million total ED visits among adults 18 years or older in the general population, with an increase from 87 million visits in 2006 to 106 million visits in 2012.³ A 2006 to 2010 NEDS analysis of ED use among pediatric individuals (age 0-19 years) reported 294 289 cancer-related visits (0.2%) across the 5-year study period, with febrile neutropenia as the most common primary reason for visit.⁴ Unlike the US population with pediatric cancer, there is a paucity of information about ED use among adult individuals with a cancer diagnosis.

Caring for patients with cancer in the ED comprises 2 health care specialties, oncology and emergency medicine, frequently operating in independent health care locations without well-defined communication processes between them. Potential adverse effects of treatment or disease may be managed through regular oncology outpatient visits; however, a visit to the ED may at times be unavoidable. The current practice of treating and managing cancer in outpatient settings and the subsequent use of ED services for treating acute symptoms underscores evidence gaps in: (1) understanding the clinical needs of patients with cancer in the ED; (2) developing cancer-specific evidence-based ED interventions; (3) improving the quality of cancer care delivery in the ED; and (4) implementing efforts to reduce emergency care use the oncology setting.^{5,6} Some initial steps in filling this knowledge gap are to identify the characteristics and clinical presentation of patients with cancer visiting the ED and factors related to subsequent inpatient admission.

The objectives of this study were: (1) to estimate the overall utilization and proportion of ED patient visits in the US made by adults with a cancer diagnosis; (2) to describe the clinical presentation of adult patients with cancer in the ED setting; and (3) to examine factors associated with inpatient admission in this population. This study provides national estimates of the utilization, clinical presentation, and disposition of visits among US adult patients with cancer in the ED setting.

Methods

Study Design and Sample

This study examined ED visits among adult patients using 2006 to 2012 data from the NEDS, Healthcare Cost and Utilization Project (HCUP), Agency for Healthcare Research and Quality.⁷ NEDS is the largest nationally representative ED database, providing a 20% stratified sample of community, nonrehabilitation hospital-based EDs reporting to the American Hospital Association (AHA) Annual Survey Database. This sampling strategy covers approximately 951 to 980 hospital-based EDs in 24 to 30 states, representing between 120 to 131 million

Key Points

Question What proportion of adult US emergency department visits are for a cancer-related complication?

Findings In this cross-sectional analysis of Nationwide Emergency Department Sample data from 2006 to 2012, 29.5 million adult US emergency department visits were for a cancer-related complication, representing 4.2% of all visits.

Meaning The emergency department is a care setting used for adult cancer-related complication management representing an opportunity to inform patient and system-directed prevention and management strategies.

weighted visits to the ED annually; HCUP state and partner participation varies by year. The following hospital characteristics were used for sample stratification: US census region, trauma designation, urban-rural location, hospital ownership, and teaching status. The databases used are consistent with the definition of limited data sets under the HIPAA (Health Insurance Portability and Accountability Act) Privacy Rule and contain no direct patient identifiers. The investigators completed the required data use agreement training and documentation. Institutional review board approval and patient written informed were not required for use of data from these publicly available deidentified databases.

Variables of Interest

Adult (≥ 18 years of age) cancer-related visits were identified in NEDS using the Clinical Classifications Software (CCS) diagnosis codes reported for each ED visit. The CCS is built on the *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)* system, the accepted clinical mechanism for identification of diagnosis and for claim submission tied to insurance reimbursement. The CCS maps ICD-9 codes (extracted from the clinical ED encounter discharge abstract) to nearly 260 clinically meaningful diagnosis categories.³ The CCS diagnosis code was selected as the preferred variable to identify cancer-related ED visits for this analysis based on clinical application and analytical feasibility. The NEDS dataset reports up to 15 CCS diagnosis codes for each ED visit. For the purposes of this study, the visit was considered cancer-related if any of the 15 CCS diagnosis codes were a neoplasm (s)-related CCS code (11 to 45) indicating cancer type, active cancer treatment, or potential disease recurrence.

Cancer type was identified using CCS codes. A visit where more than 1 cancer type was recorded (excluding secondary malignancies or active treatment codes) was coded as multiple cancers. The CCS code for secondary malignancies includes site specific secondary malignancies, malignant neoplasms of lymph nodes, malignant pleural effusion, and malignant ascites.

The primary reason for ED visit was identified as the first listed noncancer CCS code among the possible 15 reported CCS codes. There were 32 062 unweighted ED visits with only cancer-specific diagnoses (CCS 11-45) and no noncancer CSS codes used to determine the reason for visit; these were excluded

from the analyses examining primary reason for ED visit. Disposition status was also examined; the disposition categories associated with each visit were: discharged (patient treated and released from the ED), admitted (patient admitted to the same institution), or other (transferred, left against medical advice, died in the ED).

Other patient demographic characteristics available in NEDS and examined in this study were age, sex, metropolitan area, median household income of the patient zip code, expected primary payer, and day of visit (weekday or weekend).

Data Analysis

To calculate nationally representative estimates, sample weights were incorporated in all analyses.⁸ All results are presented as weighted estimates, and the associated variances were estimated using Taylor Series linearization method⁹ unless otherwise specified.

To compare the cancer-related and non-cancer-related ED visits by demographic characteristics and disposition status, χ^2 tests were conducted. Among cancer-related ED visits, the proportions of visits by disposition status for specific cancer types and for each of the top 10 primary reasons for ED visit were estimated. Furthermore, among the cancer-related ED visits only, a weighted multivariable logistic regression model was used to examine demographic and clinical factors associated with inpatient admission. Analyses were conducted using the PROC SURVEY procedures in SAS version 9.3 (SAS Institute) and SUDAAN 11.0.0 (Research Triangle Institute).

Results

Characteristics of the Study Sample

There were 695 841 124 weighted ED visits by adult members of the general population between January 2006 and December 2012, of which 4.2% were identified as cancer-related. The mean number of adult cancer-related visits to US EDs per year during the 7-year survey period was 4.2 million (range, 3.3 million in 2006 to 4.8 million in 2012). **Table 1** shows a comparison of demographic characteristics and disposition status of the cancer-related and non-cancer-related ED visits. Adult patients with a cancer-related visit were more likely to be older, male, and have Medicare insurance than adult patients with a non-cancer-related visit. Distribution of metropolitan area and day of visit (weekday or weekend) did not differ substantially between the 2 groups. Cancer-related visits were more likely to result in inpatient admission (59.7%) than non-cancer-related visits (16.3%).

Cancer-Related ED Visits

Cancer-related ED visits by cancer type and disposition status are reported in **Table 2**. The most commonly reported cancer types were breast (14.9%), prostate (11.3%), lung (10.3%), and multiple cancers (10.2%). Cancer types associated with the highest percentage of inpatient admissions were secondary malignancy (74.4%), multiple myeloma (72.4%), pancreatic cancer (72.1%), rectal cancer (70.8%), and multiple cancers (68.9%).

The top 10 most common primary reasons for a cancer-related ED visit and associated disposition status are shown in **Table 3**. The most common primary reasons for a cancer-related ED visit were pneumonia (excluding tuberculosis) (4.5%), nonspecific chest pain (3.7%), urinary tract infection (3.2%), septicemia (3.1%), and chronic obstructive pulmonary disease (3.0%). The conditions most often resulting in inpatient admission included septicemia (98.0%), intestinal obstruction without hernia (91.2%), congestive heart failure (nonhypertensive) (90.8%), and pneumonia (excluding tuberculosis) (88.6%). Other primary reasons for a cancer-related ED visit associated with a 90% inpatient admission rate or greater not included in the top 10 most common reasons and a primary reason for visit in at least 1% of the cancer-related ED visits were aspiration pneumonitis (98.5%); acute and unspecified renal failure (96.9%); fracture of neck of femur (hip) (95.2%); pulmonary heart disease (94.9%); acute myocardial infarction (93.5%); intestinal infection (90.9%); respiratory failure, insufficiency, arrest (90.9%); acute cerebrovascular disease (90.7%); and pathological fracture (90.6%).

The primary reasons for a cancer-related ED visit were also examined by cancer type (eTable 1 in the **Supplement**). The top 2 primary reasons for ED visits among breast cancer were nonspecific chest pain and urinary tract infections; among prostate cancer, genitourinary symptoms and urinary tract infections; among lung cancer, pneumonia and chronic obstructive pulmonary disease and bronchiectasis; among multiple cancers, pneumonia and urinary tract infections; and among colon cancer, intestinal obstruction without hernia and abdominal pain. Among visits where maintenance chemotherapy or radiotherapy was reported (CCS 45), primary reasons for an ED visit included deficiency and other anemia (5.7%), fluid and electrolyte disorders (4.7%), nausea and vomiting (4.3%), diseases of white blood cells (3.3%), and fever of unknown origin (3.1%) (eTable 2 in the **Supplement**).

Factors Associated With Inpatient Admission Among Cancer-Related ED Visits

Results of the multivariable logistic regression examining the associations between demographic and clinical characteristics with inpatient admission among the cancer-related visits are shown on **Table 4**. Significantly increased odds of admission were observed for the top 10 primary reasons for a cancer-related ED visit, with the exception of nonspecific chest pain, urinary tract infection, and abdominal pain. The greatest odds for inpatient admission were associated with septicemia (odds ratio [OR], 91.16; 95% CI, 81.23-102.30), intestinal obstruction without hernia (OR, 10.94; 95% CI, 10.55-11.35), congestive heart failure (nonhypertensive) (OR, 7.75; 95% CI, 7.46-8.05), and pneumonia (excluding tuberculosis) (OR, 7.16; 95% CI, 6.96-7.37).

Demographic variables significantly associated with increased odds of admission were increasing age and ED visit on a weekday vs a weekend (OR, 1.16; 95% CI, 1.15-1.17). Females had statistically significant decreased odds of inpatient admission compared with males (OR, 0.88; 95% CI, 0.88-0.89), as did all insurance types (with the exception of no charge) compared with Medicare (OR range, 0.49 [self-pay] to 0.88 [Medicaid]).

Table 1. Comparison of Cancer-Related and Non-Cancer-Related ED Visits in the United States, 2006 to 2012

Characteristics ^a	Weighted Frequency (%)	
	Cancer-Related ED Visits (n = 29 546 023)	Non-Cancer-Related ED Visits (n = 666 295 101)
Age, y		
18-24	279 872 (0.95)	105 480 826 (15.8)
25-44	2 232 305 (7.6)	244 975 183 (36.8)
45-64	8 564 792 (29.0)	184 026 554 (27.6)
65-74	6 670 278 (22.6)	53 423 005 (8.0)
≥75	11 798 776 (39.9)	78 389 533 (11.8)
Sex		
Male	13 810 749 (46.7)	284 015 744 (42.6)
Female	15 731 239 (53.2)	382 084 734 (57.3)
Missing	4034 (0.0)	194 623 (0.0)
Metropolitan area		
Central metro counties with population ≥1 million	7 621 433 (25.8)	171 582 936 (25.8)
Fringe metro counties with population ≥1 million	7 473 210 (25.3)	144 765 349 (21.7)
Medium metro counties ^b	6 429 970 (21.8)	145 786 127 (21.9)
Small metro counties ^c	2 796 701 (9.5)	66 002 899 (9.9)
Micropolitan counties	3 173 601 (10.7)	81 617 859 (12.2)
Not metropolitan or micropolitan counties	1 925 935 (6.5)	51 881 106 (7.8)
Missing	125 173 (0.4)	4 658 826 (0.7)
Median household income per zip code, \$		
Quartile 1 (<32 794)	7 414 542 (25.1)	213 138 725 (32.0)
Quartile 2 (32 794-40 626)	7 473 672 (25.3)	179 629 098 (27.0)
Quartile 3 (40 627-52 387)	7 140 097 (24.2)	146 506 940 (22.0)
Quartile 4 (>52 387)	6 880 336 (23.3)	110 659 285 (16.6)
Missing	637 376 (2.2)	16 361 053 (2.5)
Primary payer		
Medicare	18 651 028 (63.1)	163 663 203 (24.6)
Medicaid	2 676 337 (9.1)	121 161 948 (18.2)
Private insurance	6 346 733 (21.5)	207 696 073 (31.2)
Self-pay	1 093 880 (3.7)	129 890 476 (19.5)
No charge ^d	94 129 (0.3)	6 139 987 (0.9)
Other ^e	639 754 (2.2)	35 146 791 (5.3)
Missing	44 160 (0.1)	2 596 622 (0.4)
Day of visit		
Week day	21 519 984 (72.8)	477 220 771 (71.6)
Weekend	8 018 331 (27.1)	188 591 044 (28.3)
Missing	7708 (0.0)	483 286 (0.1)
Disposition status		
Admitted	17 649 303 (59.7)	108 544 463 (16.3)
Discharged	10 574 160 (35.8)	519 753 746 (78.0)
Other ^f	1 322 559 (4.5)	37 996 892 (5.7)

Abbreviations: ED, emergency department; metro, metropolitan.

^a P < .001 for all characteristic comparisons.

^b Medium metro counties are counties in metro areas with a population of 250 000 to 999 999.

^c Small metro counties are counties in metro areas with a population 50 000 to 249 999.

^d Care provided as charity, courtesy, or free of charge.

^e This category includes Worker's Compensation, Civilian Health and Medical Program of the Uniformed Services, The Civilian Health and Medical Program of the Department of Veterans Affairs, Title V, and other government programs.

^f This category includes transfer to other type of facility, home health care, against medical advice, died in the ED, discharge and/or transferred to court and/or law enforcement, not admitted to this hospital (destination unknown), or missing.

Discussion

Findings from this study indicate that there are over 4 million adult cancer-related ED visits each year in the United States with an observed increase each year over the study period (3.3 million in 2006 to 4.8 million in 2012). Cancer-related ED visits are different in many respects from non-cancer-related ED visits in that they are represented by patients who are older, more likely to be male, and more likely to be insured by Medicare than patients without cancer

presenting to the ED. Importantly, cancer-related ED visits are associated with a significantly higher inpatient admission rate than non-cancer-related ED visits. Cancer is a complex disease, often requiring management of conditions caused by the cancer itself (eg, pain, bowel blockage), the cancer treatment (eg, risk of infection, nausea, and vomiting) and concurrent comorbidities (eg, diabetes, cardiovascular disease). These complexities and significant differences in population characteristics require an understanding of cancer-related complications to improve care delivery and outcomes in the ED.

Table 2. Adult Cancer-Related Emergency Department Visits by Cancer Type and Disposition Status

Cancer Type	Overall	Disposition Status, % ^a	
	Weighted Frequency (%)	Admitted	Discharged
Breast	4 406 721 (14.9)	51.7	44.2
Prostate (and other male genital cancers)	3 339 362 (11.3)	56.1	39.5
Lung (and other respiratory cancers)	3 037 570 (10.3)	65.8	28.9
Multiple ^b	3 024 943 (10.2)	68.9	27.0
Colon	2 283 316 (7.7)	59.7	35.1
Cancer of unknown or unspecified origin	2 265 317 (7.7)	62.0	33.4
Female reproductive	1 842 809 (6.2)	50.1	46.1
Melanoma (and other skin cancers)	1 349 695 (4.6)	53.7	42.5
Non-Hodgkin lymphoma	1 162 405 (3.9)	61.8	34.1
Leukemia(s)	927 183 (3.1)	62.9	32.0
Bladder (and other urinary organ cancers)	886 265 (3.0)	61.6	33.9
Gastrointestinal	831 941 (2.8)	63.5	31.8
Head and neck	675 363 (2.3)	56.1	38.5
Kidney and renal	645 550 (2.2)	62.7	33.4
Multiple myeloma	455 685 (1.5)	72.4	23.9
Rectal	419 273 (1.4)	70.8	25.7
Pancreatic	382 180 (1.3)	72.1	23.3
Brain and nervous system	345 838 (1.2)	56.6	36.3
Secondary malignancies ^c	324 243 (1.1)	74.4	20.6
Liver	318 793 (1.1)	65.5	29.5
Thyroid	306 415 (1.0)	43.8	53.0
Hodgkin's disease	201 510 (0.7)	48.8	47.2
Cancer of bone and connective tissue	106 964 (0.4)	56.6	37.4
Active chemotherapy treatment (not associated with a specific cancer site)	6680 (0.0)	9.8	82.1

^a Visits associated with transfer, other (transferred, left against medical advice, died in the emergency department), or that were missing are not presented.

^b Multiple cancers include visits associated with more than 1 primary site coded (excluding secondary malignancies or active treatment codes).

^c Secondary malignancies consist of site-specific malignancies, malignant neoplasms of lymph nodes, malignant pleural effusion, and malignant ascites (*International Classification of Diseases, Ninth Revision* codes 196.00 to 198.89, 209.7x, 511.81, and 789.51).

Table 3. Top 10 Primary Reasons for Cancer-Related Emergency Department Visits and Associated Disposition Status

Diagnoses	Overall	Disposition Status, % ^a	
	Weighted Frequency (%)	Admitted	Discharged
Pneumonia ^b	1 330 447 (4.5)	88.6	8.4
Nonspecific chest pain	1 084 104 (3.7)	29.9	62.6
Urinary tract infections	928 514 (3.2)	58.3	38.4
Septicemia ^c	906 814 (3.1)	98.0	0.7
Chronic obstructive pulmonary disease	880 545 (3.0)	72.6	24.8
Abdominal pain	837 624 (2.8)	12.0	82.0
Fluid and electrolyte disorders	783 274 (2.7)	71.4	24.2
Congestive heart failure ^d	748 222 (2.5)	90.8	6.7
Cardiac dysrhythmia	739 992 (2.5)	73.6	23.2
Intestinal obstruction without hernia	610 297 (2.1)	91.2	5.9

^a Visits associated with transfer, other (transferred, left against medical advice, died in the emergency department), or which were missing are not presented.

^b Except pneumonia caused by tuberculosis or sexually transmitted diseases.

^c Except septicemia experienced in labor.

^d Nonhypertensive congestive heart failure.

Reflecting the adult cancer burden in the United States,¹⁰ breast, prostate, and lung cancer were the most common cancer types associated with a cancer-related ED visits. Of note is the volume of adult ED visits associated with secondary malignancies and multiple cancers, which may reflect the aging population as well as the growing cancer survivor population.

Infectious concerns represented 3 of the top 5 primary reasons for a cancer-related ED visit; respiratory and gastrointestinal causes were each reflected in 2 of the top 10 primary reasons. Similar primary reasons for a cancer-related

ED visit were identified in a study conducted using 2008 data from the North Carolina Disease Event Tracking and Epidemiologic Collection Tool system, a mandated statewide population-based database of ED visits.¹¹ Reported infectious presentations are consistent with the immune-altering effects of cancer and its treatments, while respiratory (eg, pneumothorax for lung cancer) and gastrointestinal (eg, hemorrhage for colon cancer) presentations can be attributed to tumor involvement in the related organ or complications of cancer treatment.

Table 4. Multivariable Logistic Regression Analysis to Examine Selected Demographic and Clinical Characteristics Associated With Inpatient Admission Among Adult Cancer-Related Emergency Department Visits

Characteristic	Odds Ratio (95% CI)
Age, y	
18-24	0.47 (0.45-0.49)
25-44	0.59 (0.58-0.6)
45-64	1 [Reference]
65-74	1.15 (1.13-1.17)
≥75	1.51 (1.48-1.55)
Sex	
Male	1 [Reference]
Female	0.88 ^a (0.88-0.89)
Metropolitan area	
Central metro counties ≥1 million population	1 [Reference]
Fringe metro counties ≥1 million population	1.10 (1.00-1.19)
Medium metro counties ^b	0.75 (0.68-0.83)
Small metro counties ^c	0.71 (0.63-0.81)
Micropolitan counties	0.62 (0.56-0.68)
Not metropolitan or micropolitan counties	0.5 (0.46-0.56)
Median household income per zip code, \$	
Quartile 1 (<32 793)	1 [Reference]
Quartile 2 (32 794-40 626)	0.92 (0.89-0.96)
Quartile 3 (40 627-52 387)	0.91 (0.87-0.96)
Quartile 4 (>52 387)	0.91 (0.85-0.97)
Primary payer	
Medicare	1 [Reference]
Medicaid	0.88 (0.85-0.91)
Private insurance	0.81 (0.79-0.83)
Self-pay	0.49 (0.46-0.53)
No charge ^d	0.92 (0.75-1.13)
Other ^e	0.78 (0.73-0.84)
Day of visit	
Week day	1 [Reference]
Weekend	1.16 (1.15-1.17)
Top 10 primary diagnoses (excluding cancer-specific diagnoses)^f	
Pneumonia ^g	7.16 (6.96-7.37)
Nonspecific chest pain	0.33 (0.32-0.34)
Urinary tract infections	0.99 (0.97-1.01)
Septicemia ^h	91.16 (81.23-102.3)
Chronic obstructive pulmonary disease	1.93 (1.88-1.98)
Abdominal pain	0.11 ^a (0.11-0.12)
Fluid and electrolyte disorders	2.02 (1.97-2.07)
Congestive heart failure ⁱ	7.75 (7.46-8.05)
Cardiac dysrhythmia	1.92 (1.87-1.97)
Intestinal obstruction without hernia	10.94 (10.55-11.35)

Abbreviation: metro, metropolitan.

^a For these odds ratios, the lower bounds of the 95% CI overlap with the point estimates when rounded to 2 digits after the decimal place. The odds ratios are significant at $\alpha = .05$.

^b Medium metro counties are counties in metro areas with a population of 250 000 to 999 999.

^c Small metro counties are counties in metro areas with a population 50 000 to 249 999.

^d Care provided as charity, courtesy, or free of charge.

^e This category includes Worker's Compensation, Civilian Health and Medical Program of the Uniformed Services, The Civilian Health and Medical Program of the Department of Veterans Affairs, Title V, and other government programs.

^f Estimates reflect having the diagnosis vs the reference category of not having the diagnosis.

^g Except pneumonia caused by tuberculosis or sexually transmitted diseases.

^h Except septicemia experienced in labor.

ⁱ Nonhypertensive congestive heart failure.

Cancer is primarily a disease of older individuals who are more likely to have 1 or more chronic diseases requiring monitoring and management during cancer treatment.² Age-related comorbidities, including congestive heart failure, cardiac dysrhythmias, and chronic obstructive pulmonary disease, were in the top 10 reasons for cancer-related ED visits for both overall and cancer-specific visits. These comorbidities can be preexisting and exacerbated or directly caused by cancer treatment, potentially complicating the clinical picture during a visit

to the ED. Assessment and medical management of both cancer-related complications and chronic diseases are required during a cancer-related ED visit because they may exacerbate presenting symptoms.

Clinical Classifications Software neoplasm codes could identify ED visits occurring during any stage of the cancer care continuum. While the treatment code for maintenance chemotherapy or radiotherapy (CCS 45) was not required to specifically indicate a treatment-related event, the primary

reasons for associated visits included fluid and electrolyte imbalances, uncontrolled nausea and/or vomiting, abnormal white and red blood cell counts, and fever, which are directly indicative of adverse events resulting from active treatment. The treatment code was most commonly associated with visits for lung cancer, Non-Hodgkin lymphoma, secondary malignancies, breast cancer, leukemias, and colon cancer.

This study found that 59.7% of cancer-related ED visits resulted in an inpatient admission, a rate 3.5 times that of the non-cancer-related visits and consistent with previously published estimates for cancer-related ED visits.^{11,12} Patients with secondary malignancies, which included indicators of advanced disease, were admitted 74.4% of the time. All cancer types were associated with a greater than 50% admission rate except for thyroid cancer and Hodgkin disease (both 43.8%). This could mean that patients with cancer who present to the ED are sicker, have complex presentations, or are more commonly admitted as an added precaution.

Seven of the top 10 primary reasons for a cancer-related ED visit resulted in an inpatient admission more than 50% of the time the diagnosis was reported. Septicemia and intestinal obstruction resulted in the highest percentage of admissions, both requiring emergent medical attention and monitoring. Presenting to the ED under suspicion of sepsis and with positive blood culture test results has been found to be a significant factor for death within 1 month of visit.¹³ Congestive heart failure, pneumonia, and fluid and electrolyte disorders were each associated with significantly higher odds of admission as well, although it is plausible that a subset of these visits could have been discharged after ED assessment and initial treatment and with outpatient follow-up by oncology. Further analysis is needed to build evidence-based risk stratification for inpatient admissions related to ED visits for adult patients with cancer.

Limitations

While this study, to our knowledge, is one of the first to examine the use of EDs among adult patients with cancer across the United States, several limitations inherent to the data set should be noted. First, identification of a cancer-related visit was based on the 15 CCS codes reported in NEDS for each study visit; if a patient with a history of cancer visited the ED and a CCS neoplasm code was not documented, that patient would have been misclassified into the noncancer visit group. However, if a neoplasm CCS code was not included in the 15 CCS codes, it is unlikely that the reason for visit would have been related to a cancer diagnosis. Second, there are no separate cancer staging or treatment codes in the NEDS dataset other than the maintenance chemotherapy or radiotherapy CCS code; thus, it was not possible to distinguish the type of cancer treatment (eg, chemotherapy, radiation, surgery, immunotherapy) or whether patients were receiving active treatment, had already completed treatment, or had advanced disease. This lack of detailed staging and treatment informa-

tion precluded our ability to examine the reasons for cancer-related visits at different points along the cancer continuum (eg, acute- vs late-onset toxic effects; new cancer diagnosis vs relapsed disease; metastatic vs nonmetastatic disease). Finally, similar to the methodology for identifying cancer-related visits and cancer type, primary reason for the ED visit was determined using CCS codes, which do not provide detailed data on the specific primary reason the cancer patient sought care in the ED. Nevertheless, using CCS codes in the context of this large, nationally representative dataset provides an overall picture of what types of patients with cancer are seeking care and for what reasons. Priority areas for future epidemiologic research in the area of cancer care in the ED should include the collection of more detailed data on reason for visits to the ED, as well as those related to the patient's cancer, including date of diagnosis, cancer type and stage, previous treatments, and clinical outcomes.

To begin to build the evidence base, this study provides the first nationwide description of adult patients with cancer seeking emergency treatment because of cancer-related, treatment-related, or comorbidity-related symptom manifestations. These data identify pulmonary, cardiac, and infectious clinical presentations that should be the focus of future prevention and intervention research, as well as significantly increased admission rates over the general population requiring further cancer care delivery research. Emerging data on the cancer population presenting to the ED inform the need for focused, rapid assessment including presenting cancer type and treatment history.^{4,11,12} The Comprehensive Oncologic Emergencies Research Network (CONCERN) seeks to accelerate knowledge generation, synthesis, and translation of oncologic emergency medicine research through multicenter collaborations.¹⁴ A long-term goal of efficient coordination of care for patients with cancer includes improved prevention and management of treatment-related adverse events to reduce emergency care utilization while optimizing emergency care when unavoidable complications arise.

Conclusions

The ED setting is a significant component of the cancer care delivery system with over 4 million adult patients with cancer admitted annually. Adult cancer-related ED visits are representative of the adult solid tumor cancer burden. Pneumonia, nonspecific chest pain, urinary tract infections, septicemia, and chronic obstructive pulmonary disease are all primary reasons for visit in at least 3% of cancer-related ED visits. Cancer care delivery research should focus on the significantly higher inpatient admission rate of cancer-related ED visits (59.7%) compared with noncancer ED visits. Further study is needed to better describe cancer-related ED visits and to identify subpopulations in which ED physicians and oncologists can work together to improve patient care.

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