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A Systematic Review of Emergency Department Use Among Cancer Patients

Dr Rebecca S. Lash, PhD, MPP, RN, Dr Janice F. Bell, PhD, MN, MPH, Ms Sarah C. Reed, MSW, MPH, Dr Hermine Poghosyan, PHD, MPH, Mr James Rodgers, MA, Dr Katherine K. Kim, PhD, MPH, MBA, Dr Richard J. Bold, MD, and Dr Jill G. Joseph, MD, PhD

Collaborative Cancer Care Research Group (3CRG), Betty Irene Moore School of Nursing, University of California, Davis, Sacramento (Drs Lash, Bell, Kim, Bold, and Joseph; Ms Reed; and Mr Rodgers); Department of Nursing Research and Education, UCLA Health, Los Angeles, California, (Dr Lash); and College of Nursing and Health Sciences University of Massachusetts, Boston (Dr Poghosyan).

Abstract

Background—Recent reports call for reductions in costly and potentially avoidable services such as emergency department (ED) visits. Providing high-quality and safe care for oncology patients remains challenging for ED providers given the diversity of patients seeking care and the unpredictable clinical environment. While ED use by oncology patients is appropriate for acute health concerns, some ED visits may be preventable with well-coordinated care and adequate symptom management.

Objective—The aim of this study was to summarize available evidence regarding the incidence, predictors of, and reasons for ED visits among oncology patients.

Methods—Keyword/MeSH term searches were conducted using 4 online databases. Inclusion criteria were publication date between April 1, 2003, and December 5, 2014; sample size of 50 or more; and report of the incidence or predictors of ED use among oncology patients.

Results—The 15 studies that met criteria varied in study aim, design, and time frames for calculating ED utilization rates. The incidence of ED visits among oncology patients ranged from 1% to 83%. The 30-day standardized visit rate incidence ranged from 1% to 12%. Collectively, the studies lack population-based estimates for all cancers combined.

Conclusions—The studies included in this review suggest that rates of ED use among cancer patients exceed those of the general population. However, the extent of ED use by oncology patients and the reasons for ED visits remain understudied.

Implications for Practice—Nurses are involved in the treatment of cancer, patient education, and symptom management. Nurses are well positioned to develop patient-centered treatment and care coordination plans to improve quality of care and reduce ED visits.

Keywords

Avoidable; Cancer patients; Emergency department; Emergency department use; Oncology patients; Potentially avoidable; Potentially preventable

Cancer is the second leading cause of death in the United States, with more than 1.6 million new cases and nearly 600 000 cancer-related deaths estimated to occur in 2015.^{1–2} A recent Institute of Medicine report, *Delivering High-Quality Cancer Care: Charting a New Course for a System in Crisis*, estimates that the annual cost of cancer treatment is estimated to reach \$173 billion by the year 2020.⁴ This report highlights problems with the high costs, fragmentation, and quality of cancer care in the United States.⁴ Fragmentation of healthcare services can occur when patients seek or are referred to care from multiple providers, including primary care providers and specialists. For patients with cancer, oncologists generally manage cancer treatments; however, patients may also require services from other providers or from the emergency department (ED) for unexpected health concerns. Although ED use by oncology patients is appropriate for acute health concerns, some ED visits may be preventable with well-coordinated care, appropriate treatment regimens, and adequate symptom management.⁵ Furthermore, providing high-quality and safe care for oncology patients, who often require specialized care, is challenging for ED providers given the diversity of patients seeking care and the complex and fast-paced clinical environment.

Previous literature offers little guidance on how to define preventable ED use among oncology patients. Yet, as cancer is increasingly recognized as a chronic illness, it is important to understand the extent to which preventable healthcare use—including unnecessary ED visits—occurs in this population.^{6–2} Two general approaches to identifying potentially preventable or avoidable ED visits both use discharge diagnoses and include the Agency for Healthcare Research and Quality's definition of ambulatory care-sensitive conditions (ACSCs)^{10,11} and the New York University's Billings algorithm.¹² The ACSC identifies 16 conditions that are considered potentially preventable with proper primary or ambulatory care. The Billings algorithm categorizes visits into 4 groups: nonemergent, emergent but primary care treatable, emergent with ED care needed but potentially avoidable if timely and effective ambulatory care had been available, and emergent when ED care was truly needed and the visit was not preventable.¹² Using such definitions, it is estimated that approximately 12% of ED visits overall are considered nonemergent,¹³ and up to 56% of visits can be considered avoidable.^{13,14} However, it is important to consider that neither the ACSC nor Billings classifications are oncology specific; for instance, the Billings algorithm does not classify oral or digestive cancers, and febrile neutropenia is not included in either method.

With the phased implementation of the Patient Protection and Affordable Care Act, which emphasizes the accountable provision of healthcare and bundled payments, there are increasing calls to improve quality of care and to reduce preventable health service use for patients with chronic conditions.^{6–2,15,16} In light of these policy changes, some medical specialties, including oncology, are expanding care models to include care coordination, with the aim of reducing unnecessary health service use.^{4,15,17,18} In fact, the Centers for

Medicare & Medicaid Services has recently announced the development of a new payment model designed specifically for oncology practices.^{19,20} This model is anticipated to introduce overall cost savings, in part through improved care coordination, resulting in fewer avoidable ED visits.¹⁹

These policy changes have direct implications for oncology nursing practice, as nurses are often responsible for patient education and symptom management during cancer treatment. Furthermore, given that demand for oncology services is expected to rise by nearly 50%, a rate 3 times faster than supply,²¹ nurses are increasingly engaged as integral team members in care management and care coordination roles. Such nursing roles further support progress toward the Institute for Healthcare Improvement's "Triple Aim" by contributing to improved patient experiences, better patient outcomes, and reducing preventable healthcare use, thereby reducing costs of care.²²

Despite the increasing interest in more efficient health systems use by oncology patients, many aspects of healthcare utilization, including ED visits, are not well understood for this population.²³ This information is crucial to nurses and other healthcare providers in order to identify oncology patients with unmet health needs that may benefit from patient education, higher levels of assistance with symptom management, and/or increased care coordination efforts. Therefore, the purpose of this systematic review is to summarize available evidence regarding the incidence and predictors of, and reasons for, ED visits among oncology patients. In addition, we examine the extent to which studies classify ED visits as potentially preventable among oncology patients.

Methods

Search Strategy

Following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses) guidelines,²⁴ we conducted a search of 3 electronic library databases (PubMed, CINAHL, EconLit) and the online bibliography of the National Cancer Institute's Surveillance Epidemiology and End Results (SEER) Program. As we were interested in health system use and the incidence of ED use in particular, we opted not to search the Cochrane Library, which primarily identifies evidence for medical interventions and clinical trials. Medical Subject Heading (MeSH) and keyword searches were used to identify existing evidence regarding health service use by oncology patients. In PubMed, articles were examined if they included health service use (MeSH terms were "patient readmission," "emergency medical services," or "emergency treatment") and cancer (MeSH terms were "neoplasms," "neoplasm metastasis," or "carcinoma"). This initial search strategy was purposefully broad so as to include health service outcomes other than ED use, because information regarding ED use is often included as an aspect of broader analyses of healthcare utilization by cancer patients, rather than as a primary study outcome. Key words in the searches of the other databases included patient readmission, emergency, emergencies, readmission(s), rehospitalization(s), neoplasms, metastasis, and carcinoma. The SEER bibliography search focused on abstracts and titles using the health services key words; the CINAHL search used subject headings.

Inclusion and Exclusion Criteria

The review inclusion criteria were (1) peer-reviewed research; (2) publication date April 1, 2003, through December 5, 2014; (3) sample size 50 or more; and (4) report of either the proportion of the sample with ED visits or predictors of ED use. Articles were excluded if they (1) were not available in English; (2) were literature reviews, meta-analyses, commentaries, or case studies; (3) reported estimates of ED use that were not exclusive to cancer patients; (4) reported unplanned clinic visits in conjunction with ED use or were otherwise not restricted to ED use; or (5) focused only on ED use at the end of life, as healthcare use and its predictors may be very different during this stage of illness. Studies with samples composed entirely of patients with ED visits, for instance, those focused specifically on pain or febrile neutropenia, were also excluded because these studies do not provide estimates of the incidence of ED use because there is no comparison group without ED visits. Because of differences in international health systems, structures, and policies, only United States-based studies were included in this review.

Screening Process

All citations were managed in Endnote X6, and duplicates were discarded. A 4-stage screening process was applied to assess whether articles met inclusion criteria. In the first stage, we searched all Endnote fields including titles and abstracts for the singular or plural key words “readmission,” “rehospitalization,” “emergency department,” or “emergency room.” In the second stage, abstracts were reviewed to determine if the studies presented information on ED use. In the third stage of the review, the full-text data extraction of all included articles was completed independently, with all articles screened by the lead author (R.S.L.) and at least one other investigator (J.F.B., S.C.R., H.P.). Papers were excluded at this stage if they did not meet inclusion criteria. In the final stage, bibliographies of relevant meta-analyses, review articles, and all included studies were examined; the titles of the references were reviewed for inclusion; and potential articles pulled for review. There were few discrepancies between reviewers regarding decisions to include or exclude articles. All discrepancies were resolved with a majority consensus of the 4 reviewers.

Data Abstraction

A standardized abstraction form was used to systematically collect and summarize the following elements from each article: author; publication year; study design (categorized as retrospective cohort, prospective consecutive cohort, randomized controlled trial, or other); percentage of the sample with an ED visit; data source; sample size; age (mean, median or range); percentage of the sample that was male; cancer case definition; time frame of surveillance for ED use; predominant cancer(s) studied; reasons for ED visits; and significant predictors of ED visits. Predictors of ED use were categorized according to Andersen Behavioral Model of Health Service Use, a widely used conceptual framework to understand health system use.^{25,26} Specifically, the Andersen model posits that health system use is driven by predisposing factors (ie, demographic characteristics and health beliefs), enabling factors (ie, resources and support), and need factors (ie, perceived or evaluated health status).

In addition, studies were categorized into 1 of 3 groups according to the focus of the study population: single site, multiple institution, or population based (ie, based on statewide or national data sources). Importantly, population-based studies capture ED visits to any institution within the state or national catchment area, whereas single- and multiple-institution studies may be unable to capture visits made to other hospitals.

Identifying Incidence

Because of differences in the time frames reported for ED visit rates, we adjusted visit rates to create a consistent metric for comparison. For instance, a 1% ED visit rate within 7 days is not directly comparable to a 54% annual ED visit rate. To address this inconsistency, we recalculated ED visit rates for each study using a 30-day time frame assuming a constant visit rate over time. A per-day visit rate was tabulated from the time frame provided in each study, and this rate was then multiplied by 30.

Results

Of the 1274 unduplicated articles screened, 185 studies were retained for full-text review, and 15 met the inclusion criteria (Figure). The collective characteristics and findings of these studies, including the adjusted 30-day visit rates, are summarized in Table 1. Ten studies used a retrospective cohort design, 4 analyzed data from prospective cohorts, and 1 study was a randomized controlled trial. Sample sizes ranged from 60 to more than 60 000 participants. Five studies were conducted at a single site, 1 was conducted at multiple sites, and 9 studies were population based. All of the included studies examined ED use with the patient (rather than the visit) as the unit of analysis.

Ten studies focused on ED use among patients with 1 specific cancer type, 4 considered more than 1 type but not all cancers, and 1 study included all cancers. Prostate cancer was the most often studied cancer (n = 5), followed by colon cancer (n = 3), breast cancer (n = 3), gynecologic cancers (n = 2), lung cancer (n = 1), and all cancers (n = 1).

Percentage of Oncology Patients With ED Visits

Eleven studies presented the percentage of the sample that made ED visits (Table 1). Time frames of interest and the event after which ED visits were examined varied across these studies. Five studies examined ED use after surgery, with follow-up time ranging from 30 days to 61 months.^{27–2} Three studies quantified ED use during a specific postdiagnosis period ranging from 6 to 12 months.^{32–2} Two studies examined ED visits within 7 to 30 days from any treatment such as chemotherapy, radiation, hormone, and/or surgery,^{35,36} and 1 study used a 1-year study period but did not specify any related clinical event or phase of treatment.³⁷ All studies reporting ED visit incidence used “at least 1 visit” as the definition of ED use and did not quantify the extent to which patients visit the ED more than once. Five studies reported the mean number of visits for the whole sample or used ED visit counts in Poisson regression models, but again did not report the percentage of the sample that made more than 1 visit.^{36,38–2}

In the original reports, the percentage of cancer patients with ED visits ranged from 1% to 83% (Table 1). After recalculating these rates to permit comparison across studies, 7% to

12% of the patients in the study evaluating all cancers had an ED visit,³³ followed by 5% to 12% of gynecological cancer patients,^{29,35} 2% to 10% of colon cancer patients,^{27,31,37} 3% to 5% of prostate cancer patients,^{28,41} 4% of lung cancer patients,³⁷ and 1% to 2% of breast cancer patients.^{32,34,37} Using the 30-day visit rate, studies that examined postsurgical periods demonstrated 2% to 12% of the sample visited an ED within 30 days after surgery,^{27–2,31} and the study that examined only chemotherapy showed a 5% 30-day visit rate.³⁵ Those that examined the period after diagnosis had between 1% and 12% 30-day ED visit rates.^{32,33}

Significant Predictors of ED Use

Predictors of ED use were assessed in 8 of the reviewed studies (Table 2), collectively identifying 14 significant predictors ($P < .05$) and 1 predictor with conflicting results across studies. Predisposing factors found to be predictors of increased ED use were African American race/ethnicity compared with white,^{36,41} older age,^{36,41} and male gender.^{38,40} Enabling factors associated with increased ED use were urban compared with rural residence,³⁶ residing in a state in which Medicaid copayments increased and prescription drug and other benefits were reduced,³³ and being unmarried compared with married.³⁶ Need factors that predicted increased ED use were having a radical prostatectomy compared with no treatment,³⁶ surviving at least 1 year from diagnosis,⁴⁰ having more severe symptoms,³⁹ having a greater number of comorbidities,^{34,39,41} being eligible for Medicaid due to blindness or disability,³⁴ receiving chemotherapy versus no chemotherapy,³⁴ residing in a census tract with low median income,³⁶ and having no treatment compared with radiation therapy.³⁶ Cancer stage is also considered a need factor that could influence ED use; however, results for the impact of cancer stage were less consistent. For instance, Tumor Node Metastasis (TNM) stage T2b and T2c predicted less ED use, and TNM stage T3 predicted more ED use when compared with stage T2a or below.^{36,41}

Reasons for ED Visits

Five studies presented reasons for ED visits; each study focused on a single cancer: colon ($n = 1$), breast ($n = 2$), and prostate ($n = 2$). These reasons included conditions such as fever, urinary complaints, malnutrition, neutropenia, gastrointestinal complaints, postoperative complications, and fractures.^{27,30,32,34,35} Although all studies used “diagnosis” to establish reason for ED visits, the studies used different criteria for characterizing these diagnoses. For instance, 2 studies focused on surgical complications,^{27,30} whereas 3 studies identified reasons for ED use related to complications from chemotherapy.^{32,34,35} Two of the studies used diagnoses to develop a binary measure of having a chemotherapy-related serious adverse event (SAE), reporting, respectively, that 6%³² and 25%³⁴ of those receiving chemotherapy had an SAE. Other methods used to operationalize “reasons for ED visits” include presenting the top 5 discharge diagnoses for postsurgical patients who are discharged from the ED and comparing them by surgical technique²⁷ and reporting “reasons documented in the medical record” to classify visits as chemotherapy-induced nausea vomiting.³⁵ Finally, 1 study reported 11 “main indications” for an ED visit, but did not report how these indications were identified.³⁰

Potentially Preventable ED Use

Few of the included studies address what may constitute preventable ED utilization. Three studies discuss ED use as potentially preventable, yet only 1 study addressed what percentage of patient visits to the ED could be considered potentially preventable. Himelhoch et al³⁷ utilized the Agency for Healthcare Research and Quality's ACSC classification system to classify 8% of visits made by prostate cancer patients, 7% of breast, 19% of lung, and 10% of visits by colon cancer patients as potentially preventable. One study used ED utilization as a measure of health system use for a symptom control intervention,³⁹ and another specifically outlined ED use as measure of preventable health system use in a medical home model for chemotherapy-related adverse events.³⁴ These authors suggested many of the symptoms associated with chemotherapy can be proactively monitored and managed; however, the degree to which the visits in these studies are preventable or how to identify what can be considered potentially preventable is unclear.

Of the studies that did not specifically address ED use as potentially preventable, 5 studies present ED utilization as a measure of adverse quality of care following surgery,^{27,29,30,36,41} Five others present it as a measure of general health system use for a variety of reasons (ie, comparing nausea medication regimens, residing in a state with Medicaid copayment changes compared with residing in a state with no payment increases, or examining survival and physical functioning during active and follow-up cancer treatment periods).^{31,33,35,38,40} One study suggested that ED use is an indicator of higher patient suffering and costs than previously considered based on clinical trials.³² However, none of these studies specifically addressed what aspect of ED use is potentially preventable among the study populations.

Discussion

Studies of ED use among oncology patients are sparse and vary greatly in aim, population of interest, and sample size. Moreover, they vary in their estimates of ED utilization and predictors of ED use. The incidence of ED use was higher for those with all cancers, gynecological or colon cancers, compared with those with breast, prostate, or lung cancers. Using standardized visit rates within 30 days of diagnosis or treatment, ED visit rates are approximately 10% to 12% among individuals with all cancers, and specifically gynecological cancers or colon cancers, and approximately 1% to 5% among those with prostate or breast cancers.

Some of the variation in ED use reported in extant studies is undoubtedly attributable to differences in cancer diagnoses and to differences in the time frame over which use was examined. Ultimately, these differences make it difficult to draw definitive conclusions about the percentage of oncology patients with ED visits, predictors of ED visits, or reasons for ED visits. However, this information is essential to provide benchmarks against which high and low users of ED services can be identified in order to identify potential unmet health need in this population, identify targets for interventions to reduce ED use, and evaluate the outcomes of such interventions.

It is likely that the ED visit rates identified in this review are underestimates of the true incidence of ED use. For example, 2 studies relied solely on patient recall, which can result

in underreporting of events such as ED visits, particularly over longer periods.^{38,39,42} At least 2 studies included only those ED visits that did not result in admission to the hospital,^{27,31} and 1 study counted only ED visits that were considered chemotherapy SAEs, thereby excluding all other ED visits.³⁴ Single and multicenter studies that use electronic health records (EHRs) to identify ED visits are not able to account for ED visits that occur at other institutions.^{29,35} While one of the single center studies included in this review indicated that visits to other facilities were identified in the EHR, the ability to accurately capture visits made at other facilities is unclear.³⁰ Greater accuracy in estimating ED visits may require inclusion of data from administrative claims or health information exchanges.

Despite the fact that the estimates in this review may be underestimates of true ED visit rates, it should be noted that the estimates of ED visits by cancer patients identified appear to exceed the annual rate of 20% (or 30-day rate of 1.64%) reported for the US general population.⁴³ While ED visits are known to increase as the number of comorbidities increases, and as cancer recognized as a chronic condition, further research is needed to establish more accurate descriptions of ED use across cancer types and by the presence of comorbid conditions.^{43,44}

It is challenging to draw conclusions about significant predictors of ED use from the available literature, although this information is required to identify high-risk populations. The current literature provides few population-based estimates of predictors of ED use among oncology patients. Of the 11 predictors of ED use reported, only 3 were found in more than 1 study, and only the number of comorbidities was identified as a significant predictor in more than 2 studies ($n = 3$). Among the 8 studies that examined predictors, 3 were single- or multiple-site rather than population-based studies, which raises concerns about the sample size and generalizability of the findings in those studies. Furthermore, only 1 study examined all cancers, limiting our ability to identify predictors of ED use across cancer types. In addition, more than half of the studies ($n = 8$) examined gender-specific cancers and therefore are unable to contribute to the assessment of gender as a predictor of ED use, whereas gender may be an important and relevant predictor for other cancers. Not all studies present odds ratios for all covariates controlled for in the analysis, and therefore, estimates of the magnitude and significance of these predictors could not be compared across all studies.^{33,37} Even among studies that reported such estimates, differences in the covariates and model-building strategies make comparisons difficult.

Although the evidence is weak, there is some indication that African American race, higher age, male gender, and cancer stage may impact ED use. However, because of the small number and limited scope of these studies, a more thorough analysis of predictors of ED use is required before conclusions can be drawn, and potential interventions developed for these subgroups of patients. Consistent with other literature, patients with cancer and covered by Medicaid have higher ED utilization, and interventions to address this ongoing healthcare disparity could be explored.⁴⁵ In addition, further attention should be given to the apparent nonlinear effect of cancer stage for patients in early and late TNM stages, considering the studies that demonstrated these results focused solely on prostate cancer.^{36,41}

Only 5 of the studies in this review presented reasons for ED visits, each using different approaches—making it difficult to draw conclusions from the collective results. Cumulatively, the included studies provide little information regarding why cancer patients visit EDs. A recent review highlighted the evidence regarding the symptoms experienced by oncology patients who visit the ED⁴⁶; however, the studies in this review largely focused on specific symptoms such as febrile neutropenia or provided vague definitions for reported symptoms, making comparisons across studies difficult. Furthermore, it is not clear if a reported symptom is considered either a reason or a diagnosis for an ED visit. All studies in this review used diagnosis as a reason for an ED visit, making comparisons with previous literature even more challenging.

Two studies in this review examined reasons for ED visits according to whether they were chemotherapy-related adverse events; however, this broad categorization does not account for the range in severity of condition among these diagnoses.^{32,34} For instance, nausea and septicemia are both considered chemotherapy-related adverse events, yet they have significantly different clinical implications and in fact are not mutually exclusive. The study evaluating chemotherapy-induced nausea and vomiting found no visits classified as such and reported only 1 visit, for a fracture—and it is unclear if this fracture is cancer related. One of the studies that focused on surgical complications used discharge data, and the other used EHR data to determine reasons for ED visits, with little information provided on how the determination was made for what constituted a diagnosis.^{27,30} Given the various methods for establishing reasons for ED visits, it is difficult to determine the primary reasons oncology patients visit the ED. Further research is needed to examine why oncology patients utilize the ED, using consistent methodologies and time frames and examining multiple or all cancers. Such research would be strengthened by identifying specific cancer treatment regimens received by cancer patients and the timing of such treatments in relation to ED use.

Nursing Practice Implications

Given the paucity of data regarding the incidence and predictors of ED use and definitions of preventable ED use, there are numerous opportunities for nurses in different specialties and service areas to address gaps in research and patient care. Nurses are involved in the treatment of cancer and coordination of care both in inpatient and outpatient settings. Therefore, establishing patient education and symptom management plans that include available resources other than EDs, as well as the proper time to present to an ED for true medical emergencies, falls directly under the scope of nurses in oncology practices. Furthermore, as nurses are increasingly involved in the development of patient-centered healthcare delivery models, nurse leaders are well positioned to design and evaluate systems that improve the quality of cancer care and reduce potentially avoidable ED visits.

Limitations

The limitations outlined in this review also inhibit our ability to identify preventable ED use—and in fact, what constitutes potentially preventable ED use remains unclear for oncology patients. Systematic approaches to identifying reasons for and the potential to prevent ED visits should be explored in this population. This information would be valuable to policy

makers and healthcare providers and could also be used to inform ED providers about the care required by cancer patients in the ED.

Some important limitations should be considered when evaluating the collective evidence from this review. First, while our standardized 30-day time frame of reference allows comparison of rates across studies, it assumes a constant rate of visits over time, which may not accurately capture visit patterns among oncology patients with complicated, periodically intense, or lengthy treatment regimens.

In addition, the results from the reviewed studies must be evaluated, taking into consideration the limitations in their underlying data sources. For instance, the focus on specific subpopulation—for example, older adults^{28,36,41} or commercially-insured individuals³²—limits the generalizability of the findings in this review. One study used Centers for Medicare & Medicaid Services Standard Analytic files from the year 1999, and these findings are now more than 15 years out of date.³⁷ Moreover, most studies did not account for the effect of mortality on ED visit rate.^{38,40} The impact of this limitation on reported estimates is unclear, as patients may have more frequent visits toward the end of life, yet patients who die during the surveillance period have a shorter exposure time in which to visit the ED.

Finally, given the unique attributes of the US healthcare environment and the dramatic recent healthcare policy changes, this review aimed to capture the incidence and predictors of ED use in the United States, thereby excluding international studies. Future systematic reviews are recommended to compare ED utilization among oncology patients internationally and to identify key health system similarities or differences associated with ED use across countries. For instance, studies are needed to examine whether specific health system features result in more or less ED use by oncology patients. Future research could explore national payment systems, models of care, and the role of nurses within each healthcare system as potential influences on preventable health service use, including ED visits, among oncology patients.

Conclusion

Collectively, the studies included in this review suggest that rates of ED use among cancer patients exceed those of the general population. However, this evidence is hampered by differences in study populations by cancer type, treatment, and health insurance status. Extant studies also use different designs and measure ED use within different time frames. Future efforts are needed to develop standardized methods for measuring ED visits, categorizing their underlying reasons, and differentiating between presenting complaints and diagnosis established after evaluation. From a public health perspective, well-designed population-based studies are needed to examine ED use for all cancer patients and to establish the full burden of ED use in this population. Furthermore, as nurses are involved in the treatment of cancer, patient education, and symptom management, nurses are well positioned to develop patient-centered treatment and care coordination plans to improve the quality of care and reduce potentially avoidable ED visits.

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Selection of Studies Examining Emergency Department Use among Oncology Patients using the 2009 PRISMA format. Adapted from "Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement" by Moher, Liberati, Tetzlaff, Altman, and Group, 2009, *Journal of Clinical Epidemiology*, 62(10), 1006-1012.

Figure.

Selection of studies examining emergency department use among oncology patients.

Table 1

Summary of Emergency Department (ED) Use by Cancer Patients

Author (Year)	Population	Design	Data Source	Sample Size	Age (Mean)	% Male	Cancers Studied	Definition of ED Use	% ED Visit	30-d Visit Rate
Single Center and Multicenter (n = 6)										
Doll et al ²⁹ (2014)	Gynecologic cancers with surgery 18 y	Prospective cohort	Interview Survey Medical record	152	59	0	Uterine Ovarian Cervical Vulvar	30 d after surgery	12.1	12.1
Kurtz et al ⁴⁰ (2005)	Breast, prostate, lung or colon cancer 65 y	Prospective cohort	Interview Survey Medical record	909	65–75 ^a	54	Breast Prostate Lung Colon	1 y after diagnosis ^b	NS	NC
Kurtz et al ³⁸ (2006)	Lung cancer 65 y	Prospective cohort ^c	Interview Survey Medical record	277	65–75 ^a	33	Lung	1 y after diagnosis ^b	NS	NC
Kurtz et al ³⁹ (2006)	Chemotherapy patients 21 y	Randomized controlled trial	Interview Survey Medical record	222	59	26	Breast Lung Other	Prior 3 mo	NS	NC
Rabbani et al ³⁰ (2010)	Prostate cancer undergoing RP/LP 18 y	Retrospective cohort	Medical record Billing	4592	60 (median)	100	Prostate	NS ^d	14.2	NC
Yeh et al ³⁵ (2011)	Ovarian cancer received cisplatin (44–79 y)	Prospective cohort	Medical record	60	59	0	Ovarian	7 d after chemotherapy cycle	1.1	4.7
Population Based (n = 9)										
Goyal et al ³⁴ (2014)	Early-stage breast cancer in North Carolina (18–64 y)	Retrospective cohort	Cancer Registry and NC Medicaid	570	48	0	Breast	15 mo after diagnosis for chemotherapy related AE	24.9	1.7
Hansen et al ²⁷ (2013)	Surgical colon cancer patients 18 y	Retrospective cohort	California Healthcare Cost and Utilization Project Database	6760	65–79 ^a	47 ^e	Colon	30 d after surgery ^f	7.9 ^e	7.9
Hassett et al ³² (2006)	Breast cancer patients 64 y	Retrospective cohort matched	MarketScan Commercial Claims Data	12 239	52 ^e	0	Breast	12 mo after diagnosis	15.0–21.0	1.2–1.7
Himelhoch et al ³⁷ (2004)	Medicare recipients with chronic illness 65 y	Retrospective cohort	CMS Standard Analytic Files	60 382 ^e	76	40	Breast Colon Lung Prostate	During 1 y study period (1999)	27.0 42.0 54.0 31.0	2.2 2.4 4.4 2.6
Huang et al ²⁸ (2014)	Prostate cancer with RP 66 y	Retrospective cohort	Surveillance Epidemiology and	7534	66–69 ^a	100	Prostate	90 d after RP surgery	12.8–14.8 ^g	4.3–4.9

Author (Year)	Population	Design	Data Source	Sample Size	Age (Mean)	% Male	Cancers Studied	Definition of ED Use	% ED Visit	30-d Visit Rate
Jayadevappa et al ³⁶ (2010)	Prostate cancer 66 y	Retrospective cohort	End Results (SEER) Medicare	36 046	73 ^e	100	Prostate	30 d after treatment ^b	3.4–5.0 ⁱ	3.4–5.0
Jayadevappa et al ⁴¹ (2011)	Prostate cancer 66 y	Retrospective case control	SEER Medicare	57 128	74 ^e	100	Prostate	5 y after diagnosis	NS	NC
Sanoff et al ³¹ (2012)	Stage III Colon cancer patients all ages	Retrospective cohort	SEER/NY Medicare and Medicaid	17 365	NS	41–46	Colon	All cause visit within 8 mo of surgery	18.0–35.0 ^j	2.0–10.4
Subramanian ³³ (2011)	FFS Medicaid enrollees 21–64 y	Retrospective cohort / quasi-experimental	Medicaid linked to Cancer Registry	10 241	51–65 ^a	33–45 ^{c,k}	All	6 mo of diagnosis	44.0–69.3	7.3–12.0

Abbreviations: AE, adverse event; diagnosis; FFS, fee for service; LP, laparoscopic radical prostatectomy; NC, not calculated; NS, not specified; RP, retropubic prostatectomy.

^a Largest age group reported.

^b Patient recall for previous 4 weeks, 4 interviews over 1 year.

^c Secondary data analysis of Kurtz et al⁴⁰ (2005).

^d Participants had differing follow-up times.

^e Estimate calculated from presented data.

^f Represents only those discharged from ED, that is, not admitted to hospital.

^g Range depends on time of surgery.

^h Treatments include surgery, radiation, and/or hormone.

ⁱ Range depends on race.

^j Range depends on insurance group SEER Medicare 35%, NYCR Medicare 18%, NY Medicaid 31%.

^k Range depends on changes in state-level copayment structure, that is, higher rates where benefits were reduced.

Table 2

Predictors of Emergency Department (ED) Use by Cancer Patients

Author (Year)	Significant Predictors of ED Use	
	More ED Use	Less ED Use
Kurtz et al ⁴⁰ (2005)	Survival group	
	Male gender	
	Interaction between physical function and survival	
Kurtz et al ³⁸ (2006)	Male gender	
	Physical function	
Kurtz et al ³⁹ (2006)	Intervention, comorbid conditions	
	Symptom severity	
Goyal et al ³⁴ (2014)	Chemotherapy	
	Higher no. of comorbidities	
	Blind/disabled	
Himelhoch et al ³⁷ (2004)	Comorbid depressive syndrome	
Jayadevappa et al ³⁶ (2010)	African American race/ethnicity	TNM stage ^a
	Higher age	
	Higher no. of comorbidities	
Jayadevappa et al ⁴¹ (2011)	African American race/ethnicity	Higher income
	Higher age	Married
	Urban residence	Radiation
	Retropubic prostatectomy TNM stage ^b	TNM stage ^a
Subramanian ³³ (2011)	State with Medicaid copayment changes	

^aTumor Node Metastasis staging T2b and T2c compared with T2a or less.^bTumor Node Metastasis stage T3 compared with T2a or less.